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# BASIS OF DESIGN - PLUMBING

## CSI Division 22

### Pryor Data Center - PACHYDERM GLOBAL

**Parent Document:** [[Saga Pryor DC/Basis of Design/Erik\_BOD\_Updated/\_BOD - Exec Summary and TOC]]

## OVERVIEW

Plumbing systems provide domestic water service, fire protection water supply, sanitary/storm drainage, and chilled water makeup for closed-loop glycol systems. Zero water consumption for cooling operations (air-cooled chillers eliminate evaporative losses).

**Design Philosophy:** - **Zero cooling water:** Air-cooled chillers, closed-loop glycol (WUE <0.5 L/kWh) - **Minimal domestic use:** Staff amenities only (~10-20 occupants) - **Leak detection:** Comprehensive system protecting IT equipment - **Sustainable design:** Stormwater management, low-flow fixtures

## DOMESTIC WATER SERVICE

### Water Demand Analysis

**Domestic Use:** - Restrooms: 6-8 fixtures (staff + visitors) - Break rooms: Sinks, dishwasher, ice maker - Showers/lockers: 2-4 shower stalls (24/7 operations support) - **Estimated demand:** 500-1,000 gallons/day (10-20 occupants)

**One-Time Fill Requirements:** - Fire sprinkler system: 8,000-15,000 gallons (wet pipe areas) - Chilled water loops: 15,000-25,000 gallons total - Loops 1+2: ~5,000 gallons (Phase 1) - Loop 3: ~15,000 gallons (Phase 2) - **Total initial fill:** ~25,000-40,000 gallons

**Annual Makeup (Closed-Loop Systems):** - Chilled water makeup: <1% volume/year (leak replacement only) - Glycol concentration maintenance: Minimal (~100-200 gallons/year)

### Service Specifications

**Municipal Connection:** - **Service size:** 3-4” water main - **Pressure required:** 60-80 psi at building entry - **Meter:** 3” compound meter with remote reading - **Backflow prevention:** Reduced pressure zone (RPZ) backflow preventer per IPC

**If Municipal Service Unavailable:** - On-site well system (capacity: 50-100 GPM) - Pressure tank and booster pumps - Water quality testing and treatment as required - Backup well for redundancy (if mission-critical)

**Water Quality:** - Filtration: 5-micron cartridge filters at building entry - Softening: If hardness >150 ppm (protects fixtures, humidifiers) - Testing: Annual water quality analysis

## SANITARY SEWER & WASTEWATER

### Wastewater Generation

**Domestic Wastewater:** - Restrooms, showers, break room sinks - **Flow:** 500-1,000 gallons/day average - **Peak:** 2,000 gallons/day (shift change, events)

**No Process Wastewater:** - Closed-loop cooling (no blowdown or discharge) - No cooling tower makeup or bleed-off - No industrial processes

### Service Requirements

**Municipal Sewer Connection:** - **Pipe size:** 6” sanitary sewer lateral - **Invert depth:** Per local utility requirements - **Cleanouts:** Every 100 ft, at direction changes

**If Municipal Sewer Unavailable:** - On-site septic system per Oklahoma DEQ - Sized for 2,000 gallons/day peak flow - Leach field area: ~5,000-8,000 SF - Permitting: Oklahoma DEQ approval required

**Grease Management:** - No grease trap required (no commercial kitchen) - Break room sink only (minimal grease load)

## STORM DRAINAGE

### Roof Drainage

**System Type:** Interior roof drains with overflow scuppers

**Sizing:** - Design storm: 100-year, 1-hour duration (Oklahoma) - Rainfall intensity: [ROM] 5-6 inches/hour - Roof area: 50,000 SF - Primary drains: [ROM] 8-12 × 6” drains - Overflow: Scuppers at roof edge (backup)

**Routing:** - Interior storm leaders (insulated in conditioned spaces) - Discharge to site storm system (away from building) - No discharge into sanitary sewer

### Site Stormwater Management

**Detention/Retention:** - Detention pond(s) sized per Oklahoma DEQ stormwater permit - Capacity: [ROM] 50,000-100,000 CF (varies by site grading) - Outlet control structure (restricts discharge to pre-development rates)

**Low-Impact Development (LID):** - Permeable paving in parking areas (if feasible) - Bioswales and rain gardens for water quality treatment - Native landscaping reduces irrigation demand

**Erosion Control:** - During construction: Silt fences, sediment basins per SWPPP - Permanent: Vegetated slopes, riprap at outfalls

## CHILLED WATER MAKEUP & TREATMENT

### Glycol System Fill (Closed-Loop)

**System Volumes:** - **Loops 1+2 (Phase 1):** ~5,000 gallons (30% glycol = 1,500 gal glycol + 3,500 gal water) - **Loop 3 (Phase 2):** ~15,000 gallons (30% glycol = 4,500 gal glycol + 10,500 gal water) - **Total (Phase 2):** ~20,000 gallons (6,000 gal glycol + 14,000 gal water)

**Initial Fill Procedure:** - Deionized or softened water only (no raw municipal water) - Pre-mix glycol to 30% concentration in fill tanks - Pump into system via fill stations (one per loop) - Purge air via high-point vents, circulation - Test concentration via refractometer (target: -15°F freeze point)

### Makeup Water System

**Equipment:** - 3 × 500-gallon glycol mix tanks (one per loop) - Circulation pumps for mixing - Fill connections at each chiller plant - Totalizing flow meters (track makeup volume)

**Annual Makeup Requirements:** - Target: <1% of system volume per year - Typical: 100-200 gallons/year (leak replacement, expansion tank overflow) - Alarm if makeup exceeds threshold (indicates leak)

### Water Treatment

**Chemical Treatment Program:** - **Corrosion inhibitors:** Protect steel, copper, aluminum components - **Biological inhibitors:** Prevent algae/bacteria growth - **pH buffers:** Maintain pH 7.5-8.5 - **Supplier:** [TBD - e.g., Nalco, ChemTreat, Kurita]

**Monitoring:** - Quarterly testing: pH, conductivity, inhibitor concentration, glycol % - Annual full analysis: Metals, biological activity, fluid degradation - BMS integration: Conductivity sensors provide continuous monitoring

**Chemical Dosing:** - Manual dosing via chemical dosing pots (CDPs) - 2 × 8-liter CDPs per loop - Replenish every 6-12 months based on testing

### Filtration

**Side-Stream Filtration:** - 2 × dirt and air separators (DAS) per loop - Removes particulates, deaerates fluid - 5-micron cartridge filters (replaceable)

## GLYCOL STORAGE & HANDLING

### Bulk Glycol Storage

**Phase 1 Initial Fill:** - 1,500 gallons propylene glycol (30% of 5,000 gal system) - Delivered in 55-gallon drums or 275-gallon totes - Storage: Outdoor chemical storage shed with secondary containment

**Phase 2 Additional:** - 4,500 gallons propylene glycol (Loop 3) - Bulk delivery via tanker truck (if available) - Temporary storage in totes during fill operation

**Safety:** - Propylene glycol: Non-toxic, food-grade (safe for data center environment) - SDS (Safety Data Sheets) on-site - Spill kit and containment equipment

### Fill Stations

**One Fill Station per Loop (3 Total):** - Location: Near each chiller plant - Equipment: Hose connection, isolation valves, drain - Pump: Portable transfer pump (200-300 GPM) - Venting: High-point manual air vents during fill

## WATER LEAK DETECTION SYSTEM

Critical for protecting IT equipment from water damage.

### Detection Zones

**Data Hall Coverage:** - Under all overhead chilled water piping - At all cabinet D2C manifold connections (Phase 2) - Under CDU units (Phase 2) - At mechanical room penetrations

**Mechanical Room Coverage:** - Under pumps, valves, heat exchangers - At chiller connections - Near expansion tanks, fill stations

### Detection Technology

**Sensing Cable:** - Conductive fluid detection cable (continuous sensing) - Detects water, glycol, or other conductive fluids - Length: [ROM] 1,000-2,000 ft per data hall

**Spot Detectors:** - Discrete leak detectors at high-risk points - Under each CDU (60 detectors in Phase 2) - At quick-disconnect fittings - Response time: <1 second

**Control Panels:** - 2 × leak detection control panels (redundant) - BACnet/IP integration to BMS - Audible/visual local alarms

### Alarm Response

**Automatic Actions:** 1. BMS alarm (visual + audible in NOC) 2. Email/SMS to on-call engineer 3. DCIM integration (log event, track location) 4. Optional: Close isolation valves if leak zone can be isolated

**Manual Response:** 1. Maintenance team dispatched within 15 minutes 2. Locate leak via sensing cable zone indication 3. Isolate affected loop/cabinet if possible 4. Repair and refill system

## PLUMBING FIXTURES & EQUIPMENT

### Restrooms

**Fixtures:** - Water closets: Low-flow (1.28 GPF), ADA-compliant - Urinals: 0.5 GPF or waterless - Lavatories: 0.5 GPM sensor-activated faucets - Janitor sinks: 1 per floor (utility sink)

**Configuration:** - 2 × restroom groups (men’s + women’s + unisex/ADA) - Capacity: ~10-15 simultaneous occupants

### Break Rooms

**Equipment:** - Sinks: 2-3 sinks, 1.5 GPM faucets - Dishwasher: Residential-grade (low-flow) - Ice maker: Self-contained (30-50 lb/day) - Coffee/beverage: Point-of-use water filter

### Showers & Lockers

**Purpose:** Support 24/7 operations, on-call engineers

**Facilities:** - 2-4 shower stalls (private, ADA-accessible) - 10-15 lockers - Changing area with benches - **Flow:** 2.0 GPM low-flow showerheads

**Drainage:** Dedicated drain line to sanitary sewer

### Emergency Fixtures

**Eyewash/Safety Showers:** - Required at chemical storage area (glycol, water treatment chemicals) - Required in mechanical rooms (per OSHA 1910.151) - **Flow:** 3 GPM eyewash, 20 GPM safety shower (ANSI Z358.1)

## DOMESTIC HOT WATER

### System Configuration

**Heat Source:** Electric water heaters (no gas available)

**Equipment:** - 2 × 80-gallon electric water heaters (N+1 redundancy) - 120°F setpoint (tempered to 110°F at fixtures) - Recirculation pumps for instant hot water

**Distribution:** - Insulated copper piping (Type L) - Recirculation loop with thermostatic controls - Expansion tank

**Energy Efficiency:** - Heat pump water heaters (if suitable) - Timer controls (reduce standby losses during low-occupancy)

## NATURAL GAS (IF AVAILABLE)

**Potential Uses:** - Emergency generator fuel (if dual-fuel capability desired) - Space heating (if needed for office areas)

**Service:** - Coordinate with local gas utility for availability - If unavailable: All-electric building design

## CODES AND STANDARDS

* **IPC 2021** (International Plumbing Code), Oklahoma amendments
* **UPC** (Uniform Plumbing Code) if adopted locally
* **ASHRAE 188** (Legionella risk management for building water systems)
* **EPA SPCC** (Spill Prevention, Control, and Countermeasure) for glycol storage >1,320 gallons
* **ANSI Z358.1** (Emergency eyewash and shower equipment)
* **Oklahoma DEQ** (Stormwater, septic system regulations)

## SUSTAINABILITY & EFFICIENCY

### Water Usage Effectiveness (WUE)

**Target: <0.5 L/kWh** - Air-cooled chillers: Zero evaporative cooling water - Closed-loop glycol: Minimal makeup (<200 gal/year) - Domestic water only: Staff use (~500-1,000 gal/day)

**Comparison:** - Traditional data centers: 1.8 L/kWh (cooling towers) - Pryor DC: <0.5 L/kWh (air-cooled) ✓

### Low-Flow Fixtures

**Water Savings:** - Low-flow toilets: 1.28 GPF vs. 3.5 GPF (63% reduction) - Low-flow faucets: 0.5 GPM vs. 2.2 GPM (77% reduction) - Low-flow showers: 2.0 GPM vs. 2.5 GPM (20% reduction)

**Annual Savings:** [ROM] 30-40% vs. standard fixtures

## EQUIPMENT SUMMARY

| System | Equipment | Quantity | Notes |
| --- | --- | --- | --- |
| **Domestic Water** | 3-4” service connection | 1 | Municipal or well |
| **Backflow Prevention** | RPZ backflow preventer | 1 | Required by code |
| **Sanitary Sewer** | 6” lateral connection | 1 | Municipal or septic |
| **Glycol Mix Tanks** | 500-gallon tanks | 3 | One per loop (1, 2, 3) |
| **Fill Pumps** | Transfer pumps | 3 | 200-300 GPM portable |
| **Water Heaters** | 80-gallon electric | 2 | N+1 redundancy |
| **Leak Detection Cable** | Conductive sensing cable | 2,000-3,000 ft | Data halls + mech rooms |
| **Leak Spot Detectors** | Discrete detectors | 100+ | CDUs, valves, pumps |
| **Emergency Fixtures** | Eyewash/shower stations | 2-3 | Chemical storage, mech rooms |

**Tags:** #pryor-dc #plumbing #domestic-water #glycol-systems #leak-detection #wue

**Next Steps:** 1. Confirm municipal water/sewer availability via utility coordination 2. Design glycol mix stations and bulk storage 3. Detail leak detection routing and zones 4. Coordinate eyewash/safety shower locations with OSHA compliance review 5. Stormwater permit application (Oklahoma DEQ)

**Document Control:** - **Source:** Pryor\_Bod\_EVS\_Rev01.md and Erik\_BOD reference - **Date Updated:** October 29, 2025 - **Prepared by:** EVS / PGCIS Team - **Key Updates:** Glycol system details, leak detection expansion for D2C