

**BORELOGIX**

Waterwell IQ™ · Well condition report

VALLE VERDE MUNICIPAL WATER DISTRICT

Well 7 — Alder Bench

Well #7 · Prepared Oct 6, 2026 · Report WCR-7-20261006 · Engine 1.8.1

D**69** WELL IQ

Intervene

SPECIFIC
CAPACITY**23.2** gpm/ft

99% of baseline

WIRE-TO-WATER

52%

target 75%

ENERGY
INTENSITY**1,000** kWh/AF

1,228 AF/yr

ANNUAL ENERGY
COST**\$194,690**\$60,556/yr
recoverableREMAINING
LIFE, NO
ACTION**5.1** years64% chance of
failing band in 5 yrsRECOMMENDED
NOW**Replace
pump**

budget \$175,000

Economics: At \$0.1585/kWh, the district blend and 1,228 AF/yr (WY2025 meter total).

EXECUTIVE SUMMARY

Well 7 — Alder Bench scores 69 of 100 (grade D — intervene: loss is now costing real money each year. Plan work into this budget). It is producing 23.2 gpm per foot of drawdown, 99% of its baseline, at 52% wire-to-water efficiency, and costs \$194,690 a year to run.

The engine's diagnosis is pump wear (confidence 80%): The pump has worn. The well is fine.

Capacity is falling 0.4% a year in the current segment, which does not reach the 15% rehabilitation trigger inside the 25-year horizon.

\$60,556 of the annual energy bill is recoverable by bringing the pumping plant back to the district's target efficiency.

The lifecycle policy recommends replace pump now (budget \$175,000). Holding the decision for one more budget cycle adds an expected \$71,540 to the lifetime cost of this well. If nothing is done at all, expected remaining life is 5.1 years and the chance of reaching a failing band within five is 64%.

THE DECISION BEFORE THE BOARD

Replace pump — \$175,000

EXPECTED LIFETIME COST,
ACTING NOW**\$1,645,306**EXPECTED LIFETIME COST,
DEFERRING ONE YEAR**\$1,716,847**COST OF DEFERRING ONE
YEAR**\$71,540**

BUDGET APPROVED NOW

\$175,000

Costs are expected discounted costs over the well's remaining life, not a fixed window, discounted at 4%, using the district's own unit costs (rehabilitation \$165,000, pump replacement \$175,000, marginal replacement water \$650/AF, unplanned failure \$450,000). Replacement water is priced at the cost of making the volume up from the rest of the fleet, not at the imported retail rate. **Deferring one year** means holding the decision for a single budget cycle and then acting on whatever the record says next year — not leaving the well alone indefinitely; the cost of deferring is the difference between those two columns. The policy is recomputed from the record every time the report is opened.

CONDITION NOW

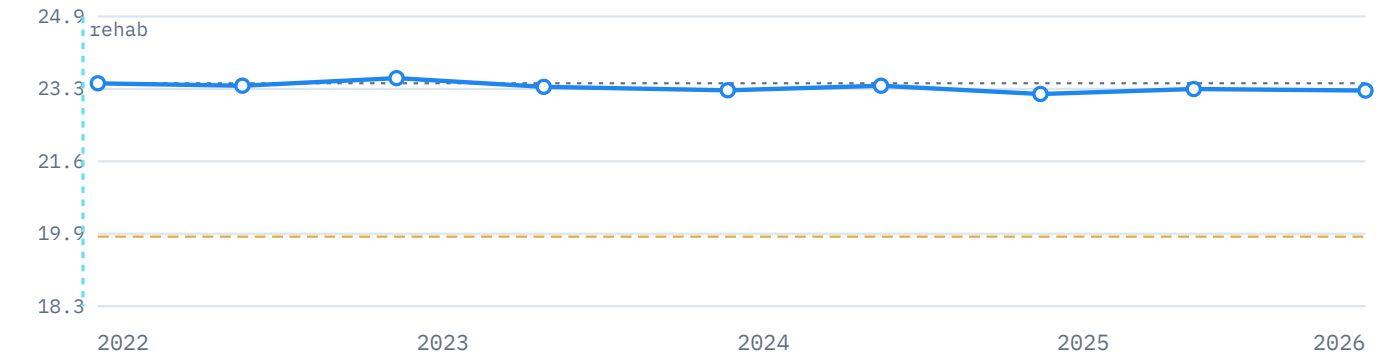
MEASURE	NOW	BASELINE	OF BASELINE
Specific capacity gpm/ft	23.2	23.4	99%
Wire-to-water efficiency	52%	72%	72%
Energy intensity kWh/AF	1,000	—	—
Annual energy cost	\$194,690	\$134,134	at target
Last test	May 19, 2026		
Baseline test	Jun 2, 2022 · segment from May 16, 2022		
Capacity band	C0 · At baseline		
Efficiency band	E3 · Badly worn		
Decline, current segment	0.4% a year — the 15% trigger is beyond the 25-year horizon at this rate		

SCORE	COMPONENT	SCORE	WEIGHT Well IQ™ weighting v1.0
	Well capacity How freely the well still passes water compared with its condition after the last rehabilitation.	97	30%
	Plant efficiency The share of the electricity entering the motor that ends up as water lifted. This is what the energy bill responds to.	29	28%
	Operating region How close the pump runs to its best efficiency point. Away from it, radial load rises and bearing life falls with the cube of that load.	94	14%
	Vibration Measured against the limit that applies to the region this pump is actually operating in, not one blanket threshold.	27	12%
	Screen headroom How much water still stands above the screen while pumping. This is the number that tells you when the well goes dry.	100	10%
	Record completeness How much of what this well should have on file it actually has.	86	6%
Well IQ		69 · D	confidence 100%

THE RECORD

Specific capacity, gpm per foot of drawdown

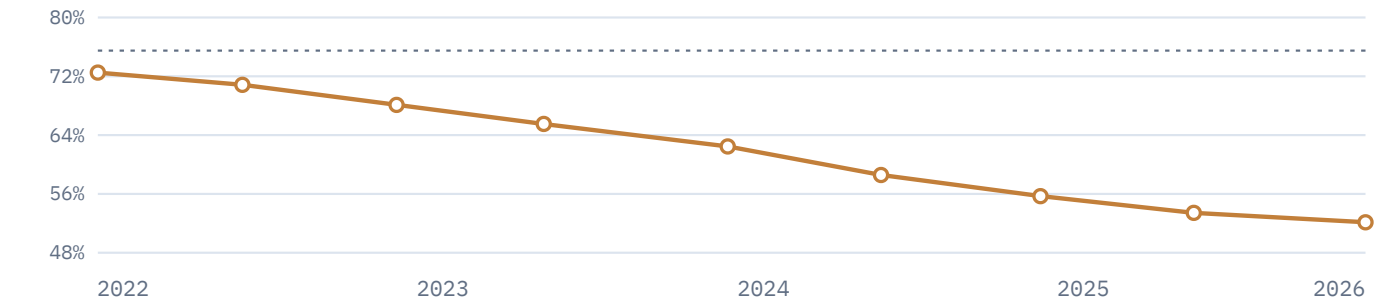
baselines and the 15% rehabilitation trigger; events marked



Corrected to 1251 gpm using $C = 0.00000225 \text{ ft/gpm}^2$ from the step test; the reading itself was taken at 1119 gpm.

Wire-to-water efficiency

target 75%; a rebuild usually pays for itself below 55–60%



DIAGNOSIS

PUMP WEAR confidence 80% · severity alarm

The pump has worn. The well is fine.

Evidence

- Flow differs by 11% between the two readings, so the water-level comparison is only indicative. Specific capacity is used instead, with the latest reading corrected to the baseline rate (1251 gpm) using the step test's well-loss coefficient — the same figure the well's capacity index shows.
- Specific capacity is flat and the static level has not moved, so neither the screen nor the aquifer accounts for the loss.
- The static water level is 4.7 ft from baseline — within the range a season moves it.

What to do, in order

1. Check the lateral setting first. Semi-open impellers sitting a few hundredths of an inch high can cost around ten percent of flow, and that is a shim rather than a pump pull.
2. Compare the current field curve against the factory curve at two or three flows to size the loss.
3. If the deficit survives the lateral check, schedule a pump pull and inspect bowls, wear rings and the lineshaft.

Next best test: A three-point field curve at design speed, plus a lateral setting check.

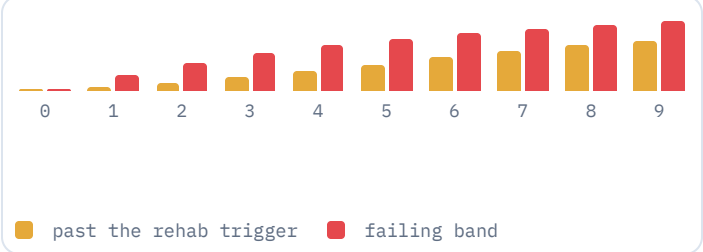
LIFECYCLE FORECAST

Expected lifetime cost by action taken now

ACTION	BUDGET NOW	EXPECTED LIFETIME COST
Replace pump RECOMMENDED	\$175,000	\$1,645,306
Defer one year	\$0	\$1,716,847
Rehabilitate + replace pump	\$292,000	\$1,762,306
Rehabilitate	\$165,000	\$1,881,847
Replace well	\$3,200,000	\$4,844,043

Every row above defers for one year and then follows the policy. For contrast, running the well to failure over the horizon without ever intervening carries \$1,340,044 of energy, lost-capacity and failure cost, and leaves the district with the capital still to spend. Policy converged.

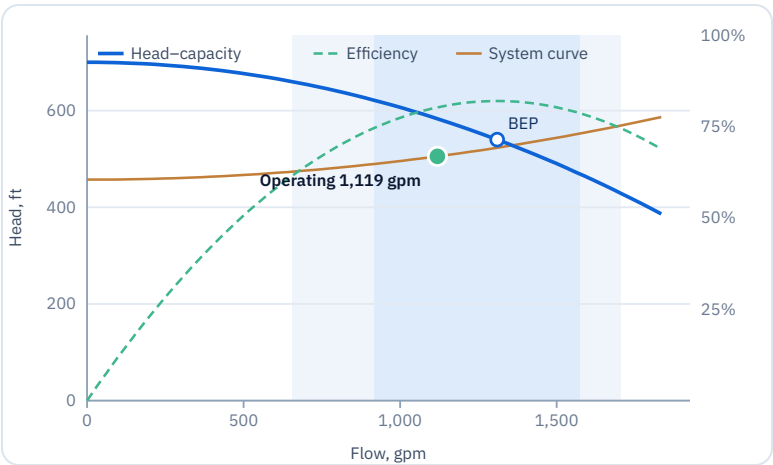
If nothing is done — probability by year



Median year of reaching a failing band: 4. Model: Capacity and efficiency deteriorate independently over a one-year step; A well never improves without an intervention.

PUMP AND OPERATING POINT

Pump	14 in vertical turbine · 7 stages · open lineshaft
Motor	300 hp · 1,770 rpm · across-the-line
Rated point	1,310 gpm at 540 ft
Best efficiency point	1,310 gpm at 540 ft · 82%
Shut-off head	700 ft
Setting depth	300 ft · installed Sep 3, 2018
Operating point	1,119 gpm at 505 ft 85% of BEP · inside the preferred range
Head against curve	13.3% below measured TDH versus the fit curve at that flow



Measured head is 13.3% below the curve at this flow — impeller wear, a slipped lateral, or the motor not making rated speed.

CRITICAL SPEED AND RESONANCE

Lineshaft first critical	not above 641 rpm (21.7 Hz) 1.938" shaft on 10 ft bearing spacing
Avoid band	16.3–27.2 Hz
Maker's skip band	none recorded
Running speed	60 Hz · 1,770 rpm (no speed on record — full speed assumed)
Drive	fixed speed
Excitations at 60 Hz	29.5 Hz (1×) · 59.0 Hz (2×) · 177.0 Hz (vane pass, 6 vanes)
Motor reed frequency	not on record — never derived

Across the line this is crossed in the seconds it takes the pump to come up to speed, not dwelt in.

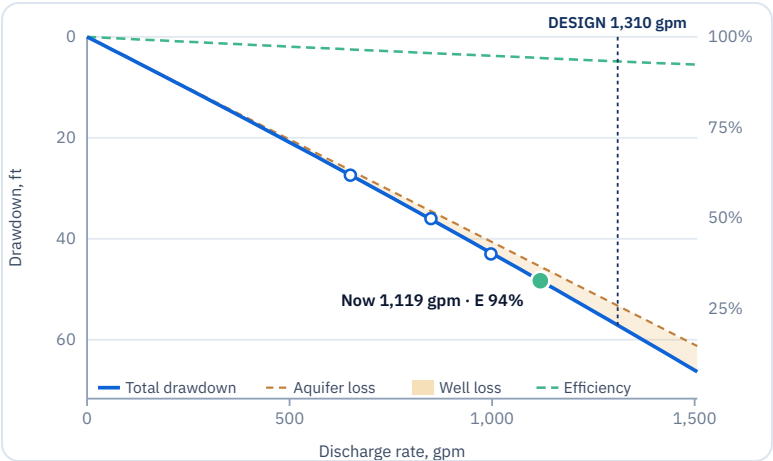
The critical is solved as a dry shaft on simple supports. Entrained water and axial down-thrust both push the true critical lower, so it is a ceiling, not a value. A maker's own figure outranks it wherever one exists.

Still missing: the motor's reed frequency — published by the motor maker, and not derivable from anything else on this record.

WELL EFFICIENCY FROM THE STEP TEST

Jacob: $s = BQ + CQ^2$ from the May 19, 2026 step test · B 4.066e-2 ft/gpm · C 2.250e-6 ft/gpm² · 4 steps · R² 1.000. Well efficiency is the aquifer loss over the total drawdown, E = $BQ \div (BQ + CQ^2)$; the well loss delivers nothing but a power bill.

Efficiency at the operating rate	94% 1,119 gpm · 45.5 ft aquifer + 2.8 ft well loss = 48.3 ft · 23.2 gpm/ft
When new, at the same rate	needs a second usable step test in this segment
At the design rate	93% 1,310 gpm (rated duty) · drawdown 57.1 ft · 22.9 gpm/ft · 70% at the design rate is the usual acceptance figure
Lost capacity, as replacement water	needs; no earlier step test to set the design drawdown (the well as new)



TRANSMISSIVITY — THE AQUIFER AND THE WELL

From the 2026-05-19 step test: the drawdown that grows in step with the rate is the aquifer's (B), the part that grows with its square is the well's (C), $s = BQ + CQ^2$. Aquifer type not on record, worked as confined. Well radius 0.667 ft: casing radius: no screen diameter on record.

Transmissivity	46,200 gpd/ft 43,400–64,400 gpd/ft · 6,170 ft²/day · step test of May 2026
Floor from specific capacity	43,400 gpd/ft 23.2 gpm/ft on 2026-05-19; the measured value clears it
Well efficiency against the aquifer	94% 23.2 of the 24.6 gpm/ft a fully efficient well in this aquifer would reach at the same rate, both at 60 minutes (2026-05-19)
Aquifer or well	Needs a second step test One step test or none: T and well loss cannot be tracked apart until a second step test is run. Next: A step test at the next efficiency test, same step lengths as the last one.

Flow by layer: no lithology on record, so the split across the screen cannot be given.

The steps fit $s/Q = B + CQ$ loosely (R^2 0.872): read B, C and this T with care, and check the step readings. Storativity not measured: confined typical 0.0001 used; the band shows 0.00001 to 0.001.

THE WATER — OVER THE BOWLS AND THE SCREEN

Pumping level the margins are read from	227 ft live SCADA sample, Oct 6, 2026, 4:45 AM	Right now	pump off · newest reading 22 min ago
Water over the bowls	73 ft OK Pump set at 300 ft · more than 30 years at the static trend	Flow · level	0 gpm · 183 ft · 0.0 Hz
Water over the screen	153 ft OK Screen top at 380 ft · more than 30 years at the static trend	Specific capacity now	the pump is off
Static level trend	falling 1.3 ft/yr fitted through 9 tests, Jun 2, 2022 to May 19, 2026 (4.0 years)	Wire-to-water now	the pump is off
		Both margins are read from the most recent <i>pumping</i> level, because the bowls and the screen are uncovered while the pump runs, not while it rests. Watch under 20 ft; alarm at or below zero. Years are a straight line at the fitted static trend and stop at 30.	

CONSTRUCTION INTEGRITY — THE DRAWING, CHECKED

No casing, screen or pack on record for this well, so none of the five construction checks — screen exposed while pumping, casing collapse margin, annular seal, pack against slot, entrance velocity — can be run. The as-built or the driller’s report, read in on Ingest, is what they need.

BOREHOLE LOG — THE DRILLER’S WORDS, READ

No borehole log on record. The driller’s log places the screen against the formation and is the basis for the USCS reading of each layer; it is usually on the well completion report.

CONSTRUCTION AND PRODUCTION

Total depth	720 ft	Screened interval	380–690 ft
Rated motor	300 hp	Design flow	1,310 gpm
Annual production	1,228 AF · WY2025 meter total	Power rate	\$0.1585/kWh · district blend
Documents on file	7		

TESTS ON FILE

DATE	KIND	FLOW GPM	STATIC FT	PUMPING FT	DRAWDOWN FT	TDH FT	INPUT KW	SC GPM/FT	WIRE-TO-WATER
Jun 2, 2022	efficiency	1,251	173.9	227.4	53.5	510	167	23.4	72%
Nov 14, 2022	efficiency	1,255	179.3	233.1	53.8	514	173	23.3	70%
May 9, 2023	efficiency	1,222	175.3	227.3	52.0	508	173	23.5	68%
Oct 24, 2023	efficiency	1,214	182.1	234.2	52.1	514	181	23.3	65%
May 21, 2024	efficiency	1,189	176.9	228.1	51.2	507	183	23.2	62%
Nov 12, 2024	efficiency	1,171	183.1	233.3	50.2	512	194	23.3	58%
May 13, 2025	efficiency	1,150	178.1	227.8	49.7	506	199	23.1	55%
Nov 4, 2025	efficiency	1,123	183.7	232.0	48.3	511	204	23.3	53%
May 19, 2026	step drawdown	1,119	178.6	226.8	48.2	505	206	23.2	52%

EVENTS AND INTERVENTIONS

DATE	EVENT	METHOD	EFFECT ON RECORD	COST
Apr 12, 2011	Rehabilitation	Wire brush and dual-phase chemical treatment; 42 hours of development.	Resets the capacity baseline	\$78,400
Sep 3, 2018	Pump replacement	New bowl assembly, 7-stage; column and shaft reused.	—	\$141,200
May 16, 2022	Rehabilitation	Chemical treatment and redevelopment following a 19% capacity loss.	Resets the capacity baseline	\$96,750

DOCUMENTS ON FILE

TITLE	KIND	DATE
Driller's log and well completion report	well completion report	Aug 2, 1994
Electric and gamma log, 0–720 ft	geophysical log	Jul 21, 1994
As-built casing, screen and gravel pack detail	construction detail	Sep 14, 1994
Rehabilitation report and cost breakdown	rehabilitation report	Jun 1, 2022
Downhole video survey, post-rehabilitation	video survey	May 30, 2022
Pump design sheet and factory curve	pump design	Aug 10, 2018
Pump efficiency test — May 2026	efficiency test	May 19, 2026

HOW THESE NUMBERS ARE PRODUCED

Every figure in this report is computed by the Waterwell IQ™ engine 1.8.1 from the raw measurements listed above; derived values are never stored, so the report can always be reproduced from the record. **Specific capacity** = flow ÷ (pumping level – static level). Specific capacity is *not* normalized for pumping rate by that division: drawdown follows $s = BQ + CQ^2$, so $SC = 1/(B + CQ)$ and falls as rate rises on an unchanged well. Where a step-drawdown test gives C, readings are restated at one reference rate; where it does not, the report compares only tests at comparable rates and states how much of the comparison the rate difference could account for. **Wire-to-water efficiency** = water horsepower (gpm × TDH ÷ 3,960) ÷ motor input (kW × 1.341). **Energy intensity** = kW ÷ (gpm × 60 ÷ 325,851). Indices are measured against the first test after the most recent baseline-resetting event. The **diagnosis** separates aquifer decline (static level), well loss (specific capacity at stable static) and pump wear (efficiency at stable specific capacity). The **lifecycle forecast** is a probabilistic condition-state model, fitted to this district's own history of tests and completed work, that carries capacity and efficiency as separate deteriorating modes; the recommended action is the one with the lowest expected discounted cost over an indefinite horizon — the standard formulation for a decision that comes round again every year, and the reason the columns can be compared at all when the actions happen at different times. The **probability-by-year chart** and the **10-year run-to-failure figure** beneath it are the finite-horizon views, and are the only figures here bounded to a fixed number of years.

The weighting is published. The six component weights above are the **Well IQ™ weighting v1.0**, a versioned standard applied identically to every well in every district on the platform, so two wells can be compared and a score can be reproduced years later from the same record. A score nobody can take apart is a score nobody should act on, and this report is written to be checked. What produces each component score from the underlying measurement — the scales, the operating-region vibration limits, the confidence model and the deterioration chains — is proprietary to BoreLogix and is not disclosed here.

- Band midpoints stand in for the index when costing a state.
- Lost capacity costs energy through extra lift; volume is lost only below 70% of baseline capacity.
- Routine O&M is equal under every action and is omitted.
- Discount rate 4.0%; the annual chance of an unplanned failure rises with each condition band, from negligible at baseline to material in the worst band.

PREPARED BY	REVIEWED BY (DISTRICT ENGINEER)	PRESENTED TO THE BOARD ON
_____	_____	_____