

**BORELOGIX**

Waterwell IQ™ · Well condition report

VALLE VERDE MUNICIPAL WATER DISTRICT

Well 12 — Coyote Wash

Well #12 · Prepared Oct 6, 2026 · Report WCR-12-20261006 · Engine 1.8.1

F**60** WELL IQ

Act

SPECIFIC
CAPACITY**20.6** gpm/ft

49% of baseline

WIRE-TO-WATER

65%

target 75%

ENERGY
INTENSITY**700** kWh/AF

940 AF/yr

ANNUAL ENERGY
COST**\$104,247**\$14,452/yr
recoverableREMAINING
LIFE, NO
ACTION**None**already in a failing
bandRECOMMENDED
NOW**Rehabilitate**

budget \$165,000

Economics: At \$0.1585/kWh, the district blend and 940 AF/yr (WY2025 meter total).

EXECUTIVE SUMMARY

Well 12 — Coyote Wash scores 60 of 100 (grade F — act: performance has fallen far enough that rehabilitation may not fully recover it). It is producing 20.6 gpm per foot of drawdown, 49% of its baseline, at 65% wire-to-water efficiency, and costs \$104,247 a year to run.

The engine's diagnosis is screen fouling (confidence 90%): The well is plugging.

Capacity is falling 11.8% a year in the current segment, and the well is already past the 15% rehabilitation trigger.

\$14,452 of the annual energy bill is recoverable by bringing the pumping plant back to the district's target efficiency.

The lifecycle policy recommends rehabilitate now (budget \$165,000). Holding the decision for one more budget cycle adds an expected \$193,889 to the lifetime cost of this well. The well is already in a failing band.

THE DECISION BEFORE THE BOARD

Rehabilitate — \$165,000

EXPECTED LIFETIME COST,
ACTING NOW**\$1,748,884**EXPECTED LIFETIME COST,
DEFERRING ONE YEAR**\$1,942,773**COST OF DEFERRING ONE
YEAR**\$193,889**

BUDGET APPROVED NOW

\$165,000

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

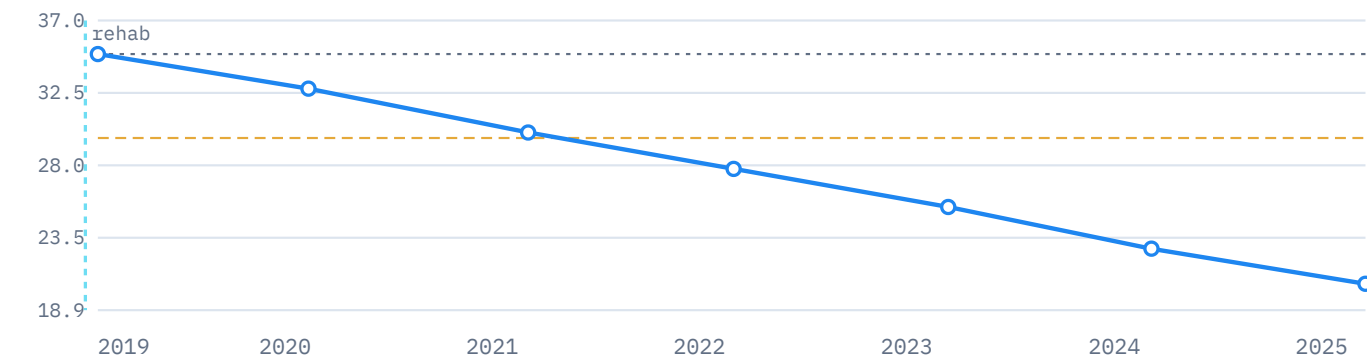
MEASURE	NOW	BASELINE	OF BASELINE
Specific capacity gpm/ft	20.6	34.9	49%
Wire-to-water efficiency	65%	69%	94%
Energy intensity kWh/AF	700	—	—
Annual energy cost	\$104,247	\$89,796	at target
Last test	Sep 16, 2025		
Baseline test	Aug 6, 2019 · segment from Jul 15, 2019		
Capacity band	C4 · Severe — recovery uncertain		
Efficiency band	E1 · Normal wear		
Decline, current segment	11.8% a year — already past the 15% trigger		

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.	 0	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.	 85	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.	 82	14%
	Vibration Measured against the limit that applies to the region this pump is actually operating in, not one blanket threshold.	 74	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.	 91	6%
Well IQ		60 · F	confidence 100%

THE RECORD

Specific capacity, gpm per foot of drawdown

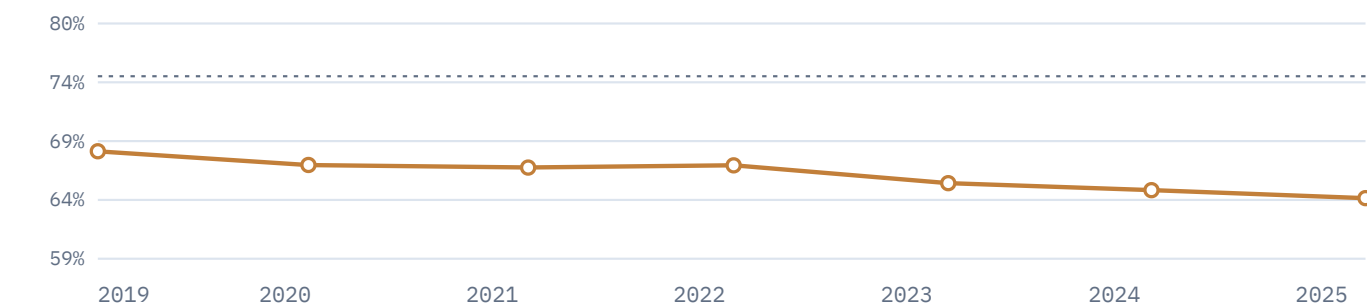
baselines and the 15% rehabilitation trigger; events marked



Corrected to 1463 gpm using $C = 0.0000236 \text{ ft/gpm}^2$ from the step test; the reading itself was taken at 1023 gpm.

Wire-to-water efficiency

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



DIAGNOSIS

SCREEN FOULING confidence 90% · severity alarm

The well is plugging.

Evidence

- Flow differs by 30% 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 (1463 gpm) using the step test's well-loss coefficient — the same figure the well's capacity index shows.
- Specific capacity is down 51% from the current baseline (at the baseline rate of 1463 gpm), so the well is passing water less freely than it did.
- The Jacob well-loss coefficient C has risen 461% between step tests. That is loss through the screen and gravel pack specifically, not loss in the aquifer.
- The static level is essentially unchanged, so the aquifer is not the driver.

What to do, in order

1. Run a downhole video survey to see whether the deposit is mineral incrustation, biofouling or sand, because the treatment differs.
2. Run a step-drawdown test and track the well-loss coefficient; it is the number that will tell you whether the rehabilitation worked.
3. Model rehabilitation against replacement on equivalent annual cost before committing capital.

Next best test: Downhole video survey and a step-drawdown test.

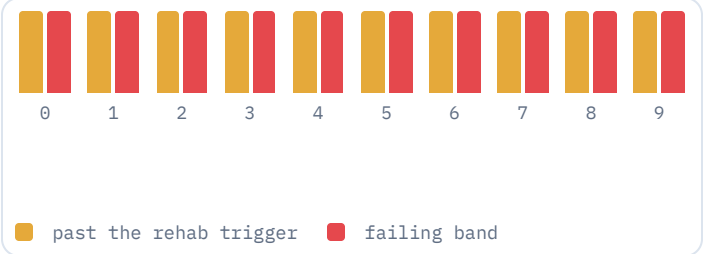
LIFECYCLE FORECAST

Expected lifetime cost by action taken now

ACTION	BUDGET NOW	EXPECTED LIFETIME COST
Rehabilitate RECOMMENDED	\$165,000	\$1,748,884
Rehabilitate + replace pump	\$292,000	\$1,783,800
Defer one year	\$0	\$1,942,773
Replace pump	\$175,000	\$2,030,764
Replace well	\$3,200,000	\$4,764,158

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 \$2,242,696 of energy, lost-capacity and failure cost, and leaves the district with the capital still to spend. Policy converged.

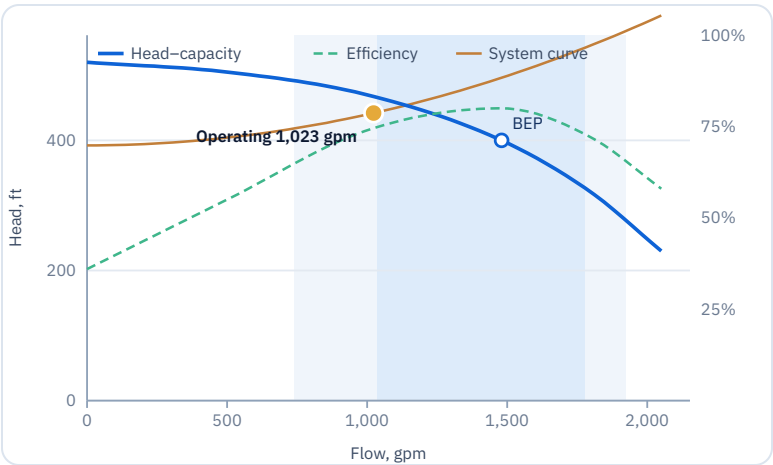
If nothing is done – probability by year



The well is already in a failing band. Model: Capacity and efficiency deteriorate independently over a one-year step; A well never improves without an intervention.

PUMP AND OPERATING POINT

Pump	12 in vertical turbine · 6 stages · open lineshaft
Motor	250 hp · 1,770 rpm · across-the-line
Rated point	1,450 gpm at 405 ft
Best efficiency point	1,480 gpm at 400 ft · 80%
Shut-off head	520 ft
Setting depth	340 ft · installed Mar 2, 2016
Operating point	1,023 gpm at 442 ft 69% of BEP · inside the allowable range
Head against curve	5.5% below measured TDH versus the catalogue curve at that flow



CRITICAL SPEED AND RESONANCE

Lineshaft first critical	not above 559 rpm (18.9 Hz) 1.688" shaft on 10 ft bearing spacing
Avoid band	14.2–23.7 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	21.5 Hz (published by the maker)

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

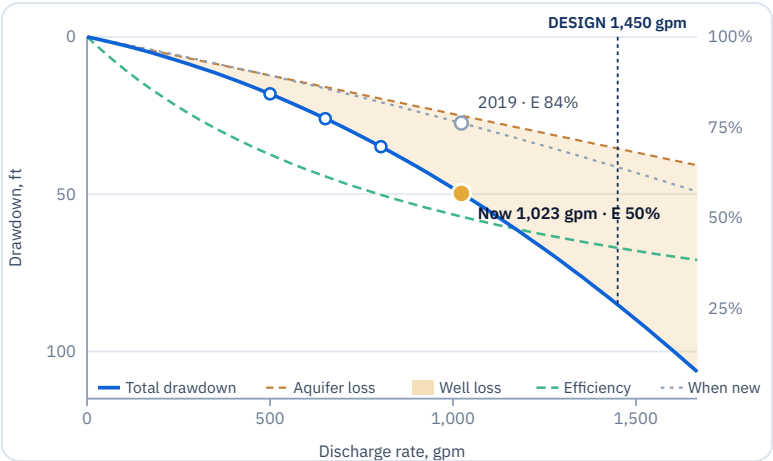
The critical is solved as a dry shaft on simple supports. Entrained water and axial down-thrust both push the true critical lower, so it is a ceiling, not a value. A maker's own figure outranks it wherever one exists.

Where an excitation meets the reed frequency: 1× running speed meets the motor's reed frequency at 43.7 Hz; 2× (misalignment) meets the motor's reed frequency at 21.9 Hz; vane pass (6 vanes) meets the motor's reed frequency at 7.3 Hz.

WELL EFFICIENCY FROM THE STEP TEST

Jacob: $s = BQ + CQ^2$ from the Sep 16, 2025 step test · B 2.447e-2 ft/gpm · C 2.361e-5 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	50% 1,023 gpm · 25.0 ft aquifer + 24.7 ft well loss = 49.7 ft · 20.6 gpm/ft
When new, at the same rate	84% Aug 6, 2019 → Sep 16, 2025: -40% · +22.3 ft of drawdown at 1,023 gpm · reads as screen or pack fouling (well loss rose)
At the design rate	42% 1,450 gpm (rated duty) · drawdown 85.1 ft · 17.0 gpm/ft · 70% at the design rate is the usual acceptance figure
Lost capacity, as replacement water	\$325,926/yr 546 gpm of the 1,450 gpm design rate (38%) · 501 AF/yr at \$650/AF · a rehabilitation pays back in about 6 months



- Design rate 1450 gpm from the pump's rated duty.
- Design drawdown 41.4 ft from the 2019-08-06 step test at that rate.
- The well now delivers 904 gpm within that drawdown, from the 2025-09-16 step test.
- 4,990 hours a year, from 940 AF/yr on record at the latest test's 1023 gpm.
- Replacement water at \$650/AF from Settings.

TRANSMISSIVITY — THE AQUIFER AND THE WELL

From the 2025-09-16 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 0.531 ft: screen radius (conservative: the filter pack makes the effective radius larger).

Transmissivity	81,500 gpd/ft 58,500–113,000 gpd/ft · 10,900 ft²/day · step test of Sep 2025
Floor from specific capacity	39,300 gpd/ft 20.6 gpm/ft on 2025-09-16; the measured value clears it
Well efficiency against the aquifer	50% 20.6 of the 40.9 gpm/ft a fully efficient well in this aquifer would reach at the same rate, both at 60 minutes (2025-09-16)
Since the first step test	T -9% · well loss C +461% 2019-08-06 → 2025-09-16: 89,200 → 81,500 gpd/ft; efficiency 79% → 50% at test rates; static level deeper by 4.7 ft
Aquifer or well	The well, not the aquifer The aquifer held (T -9%) while well loss rose +461%: the drop in specific capacity is at the well, not in the formation. This indicates screen or filter-pack fouling. Confirm with: A downhole video survey of the screen, then a step test after rehabilitation: C should fall back toward its earlier value while T stays put.

Share of the flow by screened layer

DEPTH, FT	LAYER	CONDUCTIVITY CLASS	OPEN FT	K, FT/DAY (CALIBRATED)	SHARE OF FLOW
320–420	SP · poorly graded sand, medium to coarse	Medium sand	40	0.63	0.2%
420–498	GW · well-graded gravel with sand	Gravel	78	89.1	64%
498–516	ML · silt, low plasticity	Silt	18	0.004	under 0.1%
516–560	GP · poorly graded gravel, clean	Gravel	44	89.1	36%

Shares follow the starting ratios between soil classes, scaled to the measured value: an indication. A spinner or dynamic flowmeter log measures them. From the log alone, published ranges would put this well at 778,000 gpd/ft; the tests govern.

The textbook lithology estimate is 9.5 times the measured value; the measurement governs, and the ratio is kept to calibrate the district's conductivity table. 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	264 ft live SCADA sample, Oct 6, 2026, 4:45 AM	Right now	pump off · newest reading 22 min ago
Water over the bowls	76 ft OK Pump set at 340 ft · more than 30 years at the static trend	Flow · level	0 gpm · 220 ft · 0.0 Hz
Water over the screen	116 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 0.7 ft/yr fitted through 7 tests, Aug 6, 2019 to Sep 16, 2025 (6.1 years)	Wire-to-water now	the pump is off

Both margins are read from the most recent *pumping* 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

Screening from the record, not a design: each check names its basis and what it could not compute. Levels and flow from the test of Sep 16, 2025 (1,023 gpm, static 215 ft, pumping 264 ft).

CHECK	STATE	RESULT	BASIS, OR WHAT IT NEEDS
Screen exposed while pumping	OK	0 ft · 0% of 180 ft	every screen stands below the 264 ft pumping level
Casing collapse margin	OK	16.0× on the 18 in casing	345 psi elastic collapse at 0.3125 in wall against 21.5 psi at its foot (50 ft of drawdown); 2× is the usual design margin
Annular seal	SHORT	48 ft sealed	short of the 50 ft minimum (DWR Bulletin 74-90, community supply well)
Pack held by the slot	ALARM	1.19 slot ÷ finest grain	6 x 10 against 0.09375 in / 0.06 in slots — the finest grain passes the slot
Entrance velocity	OK	0.018 ft/s	1,023 gpm through 127.5 sq ft of submerged open area; 0.1 ft/s is the rule of thumb

Every string, checked

STRING	DEPTH, FT	D/T	COLLAPSE, PSI	LOAD, PSI	MARGIN
30 in conductor · Mild Steel	-0.5–48	80	129	0.0	ends above the water table — not loaded
18 in casing · Low-carbon Steel	-1.5–320	58	345	21.5	16.0×
12.75 in casing · Low-carbon Steel	320–380	51	497	21.5	23.1×
12.75 in blank · Low-carbon Steel	560–640	51	497	21.5	23.1×

Timoshenko long-tube elastic collapse on the nominal wall of an ideal round tube — a ceiling. Out-of-roundness, corrosion and perforations all lower it.

CASING, SCREEN AND PACK — AS RECORDED, WITH SOURCES

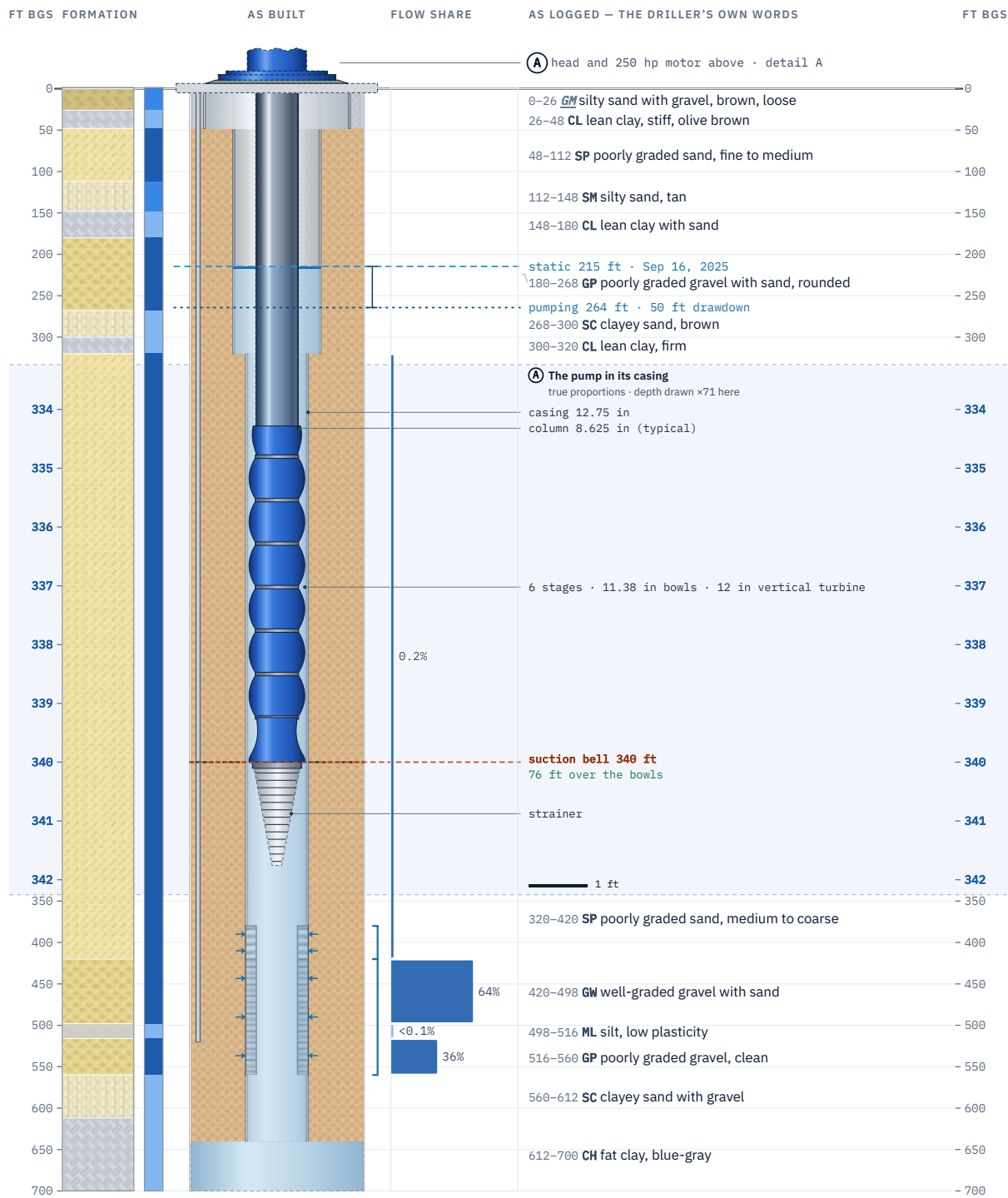
KIND	FROM, FT	TO, FT	DIA, IN	MATERIAL	WALL, IN	SLOT, IN	OPEN AREA	GRADATION	SOURCE
casing	-1.5	320	18	Low-carbon Steel	0.3125	—	—	—	entered by hand
conductor	-0.5	48	30	Mild Steel	0.375	—	—	—	entered by hand
annular seal	0	48	—	Neat cement grout	—	—	—	—	entered by hand
sounding tube	0	520	2	PVC	—	—	—	—	entered by hand
filter pack	48	640	—	Washed gravel pack	—	—	—	6 x 10	entered by hand
casing	320	380	12.75	Low-carbon Steel	0.25	—	—	—	entered by hand
louver	380	420	12.75	Louvred, mill-slotted	0.25	0.09375	8%	—	entered by hand
screen	420	560	12.75	304 Stainless, wire-wrap	0.25	0.06	25%	—	entered by hand
blank	560	640	12.75	Low-carbon Steel	0.25	—	—	—	entered by hand

Every row was entered by hand; none cites a filed document.

THE WELL AS BUILT – THE SECTION

WELL SECTION – CONSTRUCTION, FORMATION, WATER AND PUMP

Well 12 – Coyote Wash · Valle Verde Municipal Water District · drilled to 700 ft bgs



- FORMATION**
- Gravel (GP, GW)
 - Gravel with fines (GM, GC)

-  Sand (SP, SW)
-  Sand with fines (SM, SC)
-  Silt (ML, MH)
-  Clay (CL, CH)

AS BUILT

-  Filter pack
-  Annular seal / concrete
-  Perforated — louvred
-  Screen — continuous slot

-  Pump: every width on the casing's scale and the bowl assembly at its true depth, its suction bell on the exact setting depth; around the pump the depth axis opens (tinted, with its own feet) so the pump stands in its casing at its true proportions; the head and motor are broken off at the surface. Detail A, below, draws the whole pump and every bowl at one scale. Dashed: a size not on record, drawn at a typical proportion
-  Water in the casing, to the latest level known

SCREEN SUITABILITY — screening only, from the district's USCS conductivity matrix

-  Screen target — clean sand or gravel
-  Conditional — fines raise well loss and sanding risk
-  Not a production interval — confining or poor

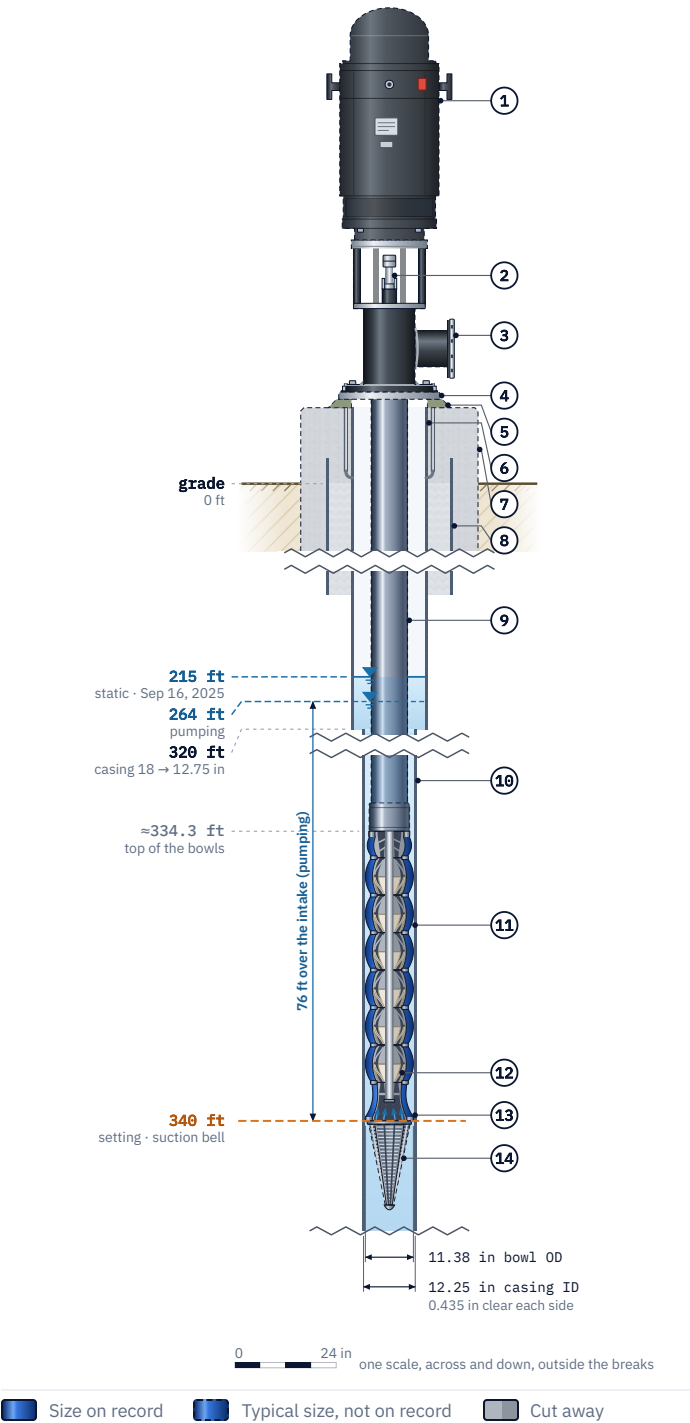
FLOW SHARE — each screened layer's share of the well's water, from the transmissivity split; an indication, not a measurement

Shares follow the starting ratios between soil classes, scaled to the measured value: an indication. A spinner or dynamic flowmeter log measures them.

Depths are feet below ground surface; a negative depth is casing above grade. A group symbol shown like this was read from the driller's wording by Waterwell IQ, not taken off a log — USCS classification needs a sieve analysis and plasticity limits, and neither is on a driller's report. Treat it as a reading to check, not a determination. Screen suitability is a preliminary screening aid and never a substitute for grain-size analysis, geophysical logs or a pumping test.

A DETAIL A · PUMP ASSEMBLY — AS INSTALLED, AT ONE SCALE

12 in vertical turbine · open lineshaft · every part drawn to the same inch scale as the casing it hangs in; the bowl assembly cut open on the shaft; the column shortened between the breaks



#	PART	SIZE	BASIS
1	Motor Vertical hollow shaft. Frame drawn ≈23.5 in across × 55 in to the top of the drip cover — a published frame size for the horsepower; the frame is not on record	250 hp · 1,770 rpm	Record
2	Head shaft and lineshaft Seen in the head's window; the lineshaft runs on inside the column to the bowls. About 33 lineshaft bearings between the head and the bowls.	1-11/16 in · bearings every 10 ft	Record
3	Discharge head Base flange, barrel with the flanged side outlet, top plate with the stuffing box, motor stand and the ring the motor bolts to. Not on record — drawn at a typical proportion to the column and motor it carries	fabricated · 8 in outlet	Typical
4	Sole plate Not on record — sized to carry the head and motor; held by anchor bolts cast in the pedestal	≈24 in	Typical
5	Grout Non-shrink grout under the sole plate, angled edges — not on record	2 in	Typical
6	Casing at the head Top 1.5 ft above grade, flush with the pedestal; down to 320 ft	18 in OD · 0.3125 in wall	Record
7	Well pedestal Concrete, drawn with its top flush with the casing's top on record. Not itself on record: width drawn ≈42 in, depth not shown	top 1.5 ft above grade	Typical
8	Conductor Mild Steel · Neat cement grout between it and the casing	30 in to 48 ft	Record
9	Column Not on record — drawn at a typical size for the bowl assembly. Threaded couplings drawn at the 10 ft bearing spacing on record (typical proportions); shortened between the breaks	8 in · 8.625 in OD	Typical
10	Casing at the bowls 320 ft to 380 ft, 0.25 in wall	12.75 in OD · 12.25 in ID	Record
11	Bowl assembly One bowl drawn per recorded stage; bowl height is typical of the type.	6 stages · 11.38 in OD	Record
	Clearance to the casing Against the tightest bore above the setting: the 12.75 in casing from 320 ft, 12.25 in inside	0.435 in each side	Computed
12	Impellers Drawn as enclosed mixed-flow impellers; the impeller type is not on record	6 · one per stage	Record
13	Suction bell The setting depth on record, drawn at the suction bell	at 340 ft	Record
	Water over the intake At the pumping level of 264 ft	76 ft	Computed
14	Strainer Not on record — a slotted cone strainer drawn at a typical size, about twice its diameter long	cone	Typical

Every width and height outside the breaks is drawn at the scale bar's one scale, so the motor, head, column and bowls stand in their true proportion to the casing. Solid outlines are sizes on record; dashed outlines are drawn at a typical proportion because the record

does not carry the size. The setting depth is drawn at the suction bell; if your record measures it to the top of the bowls, they sit about 5.7 ft deeper. Typical sizes are for the drawing only — no figure on this page is computed from them.

BOREHOLE LOG — THE DRILLER’S WORDS, READ

FROM, FT	TO, FT	AS WRITTEN ON THE LOG	USCS	READING
0	26	silty sand with gravel, brown, loose	GM · read	conditional · confidence 60%
26	48	lean clay, stiff, olive brown	CL	avoid
48	112	poorly graded sand, fine to medium	SP	screen target
112	148	silty sand, tan	SM	conditional
148	180	lean clay with sand	CL	avoid
180	268	poorly graded gravel with sand, rounded	GP	screen target
268	300	clayey sand, brown	SC	avoid
300	320	lean clay, firm	CL	avoid
320	420	poorly graded sand, medium to coarse	SP	screen target
420	498	well-graded gravel with sand	GW	screen target
498	516	silt, low plasticity	ML	avoid
516	560	poorly graded gravel, clean	GP	screen target
560	612	clayey sand with gravel	SC	avoid
612	700	fat clay, blue-gray	CH	avoid

Descriptions are the driller’s words, never paraphrased. A USCS group marked “read” was inferred from those words by the engine and carries its confidence; a group without the mark was logged as such. The log was entered by hand; no filed document is cited.

CONSTRUCTION AND PRODUCTION

Total depth	700 ft	Screened interval	380–560 ft
Rated motor	250 hp	Design flow	1,480 gpm
Annual production	940 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
Aug 6, 2019	step drawdown	1,463	209.9	251.8	41.9	404	162	34.9	69%
Aug 11, 2020	efficiency	1,425	210.8	254.3	43.5	409	163	32.8	67%
Sep 2, 2021	efficiency	1,366	211.7	257.2	45.5	414	159	30.0	67%
Aug 30, 2022	efficiency	1,271	212.8	258.6	45.8	421	150	27.8	67%
Sep 12, 2023	step drawdown	1,185	212.8	259.5	46.7	427	145	25.4	66%
Sep 4, 2024	efficiency	1,100	213.2	261.5	48.3	434	138	22.8	65%
Sep 16, 2025	step drawdown	1,023	214.6	264.3	49.7	442	132	20.6	65%

EVENTS AND INTERVENTIONS

DATE	EVENT	METHOD	EFFECT ON RECORD	COST
Aug 20, 2009	Rehabilitation	Acidization and surge block development.	Resets the capacity baseline	\$61,900
Jul 15, 2019	Rehabilitation	Chemical treatment; recovered 88% of original specific capacity.	Resets the capacity baseline	\$88,300

DOCUMENTS ON FILE

TITLE	KIND	DATE
Driller's log and well completion report	well completion report	Dec 18, 1976
Electric log, 0–840 ft	geophysical log	Nov 29, 1976
Acidization and surge-block rehabilitation report	rehabilitation report	Sep 11, 2009
Downhole video survey — incrustation on the upper screen	video survey	Jun 28, 2019
Rehabilitation report and cost breakdown	rehabilitation report	Aug 2, 2019
Step-drawdown test — well loss coefficient	step drawdown test	Sep 12, 2023
Pump efficiency test — September 2025	efficiency test	Sep 16, 2025

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.

