MONTARA WATER AND SANITARY DISTRICT AGENDA

For Meeting Of: November 2**, 2023**

TO: BOARD OF DIRECTORS

FROM: Clemens Heldmaier, General Manager

SUBJECT: Alta Vista Groundwater Monitoring Update

For the initial 5 years of operation of the District's Alta Vista Well, MWSD was charged with the implementation of a groundwater monitoring program. MWSD chose to extend the groundwater monitoring beyond the required term and expanded the program to include other scientific measures that increase the understanding of the aquifer.

The Alta Vista Well is drilled deep into solid bedrock of granitic type unlike most drinking water wells in California that are in non-consolidated sediments. Therefore, usual draw down and recovery tests are not suited to evaluate production rates and pumping sustainability.

Mark Woyshner with Balance Hydrologics will be available to present the most recent monitoring results. The attached slide show containing the information was presented at the most recent Groundwater Resources Association of California.

RECOMMENDATION:

Receive presentation about the District's management of the underlying granitic aquifer in Montara.

Attachment

TRACK 2 – GROUNDWATER QUALITY

Sustainable Management of a Fractured Granitic Aquifer in Coastal California

Sustainable Management of a Fractured Granitic Aquifer in Coastal California

Mark Woyshner, Clemens Heldmaier, Barry Hecht,
Emma Goodwin, and Jason Parke

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Methods to Evaluate Sustainability

- ✓ **Geologic framework** of aquifer: Fracture orientation and boundaries
- ✓ **Hydrologic monitoring** across a cycle of major recharge and drought years
- ✓ **General mineral**: Piper diagram
- ✓ **Groundwater age techniques**:
  - Modern water (Tritium-helium, CFCs, SF6)
  - Pre-modern water (Radiogenic helium, 14C)
  - Paleoclimate indicators (18O and 2H, Noble-gas recharge temperature)
- ✓ **Groundwater modeling:** Water balance and recharge area estimates
- ✓ **Historical records / Indigenous traditions**

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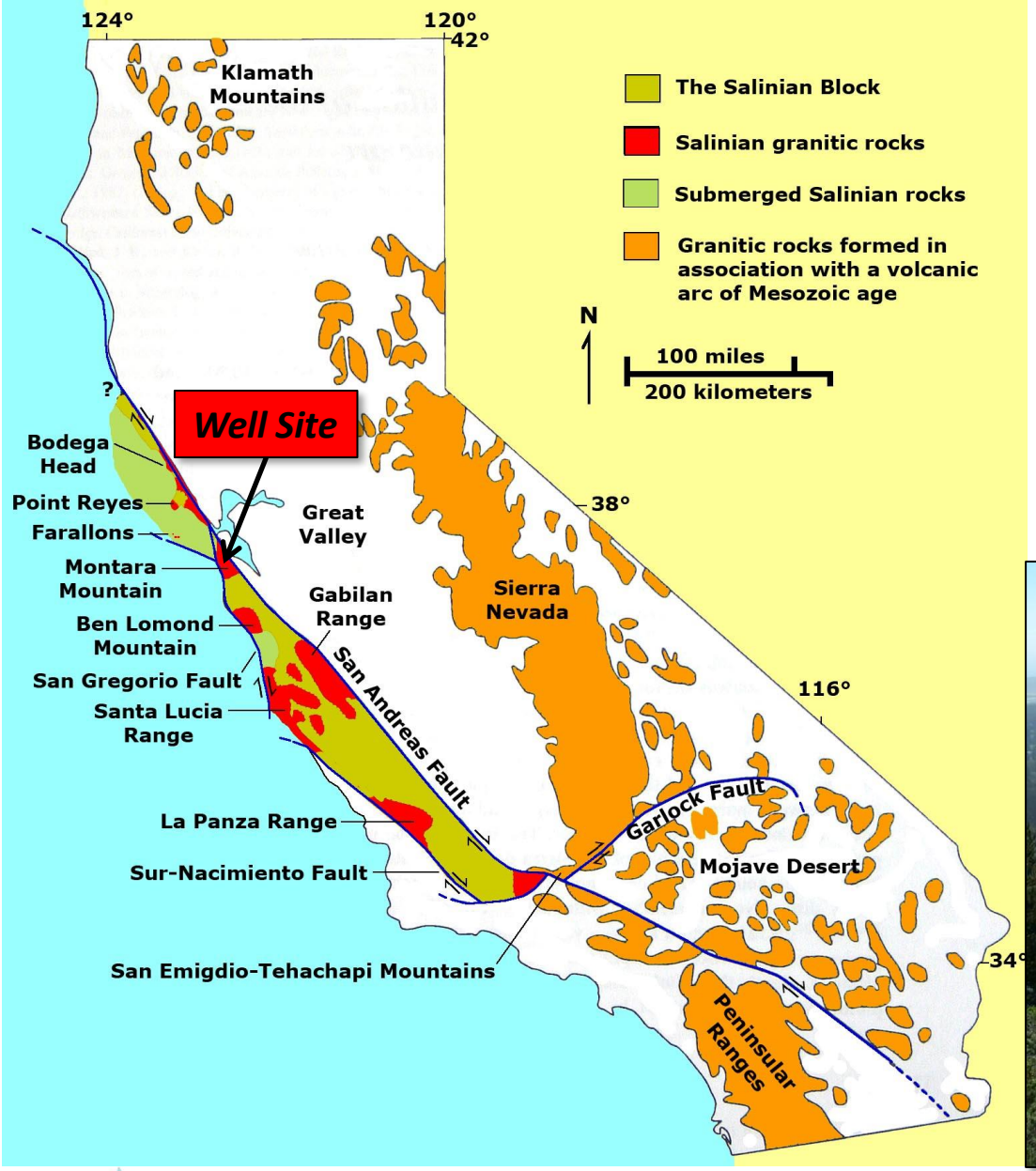
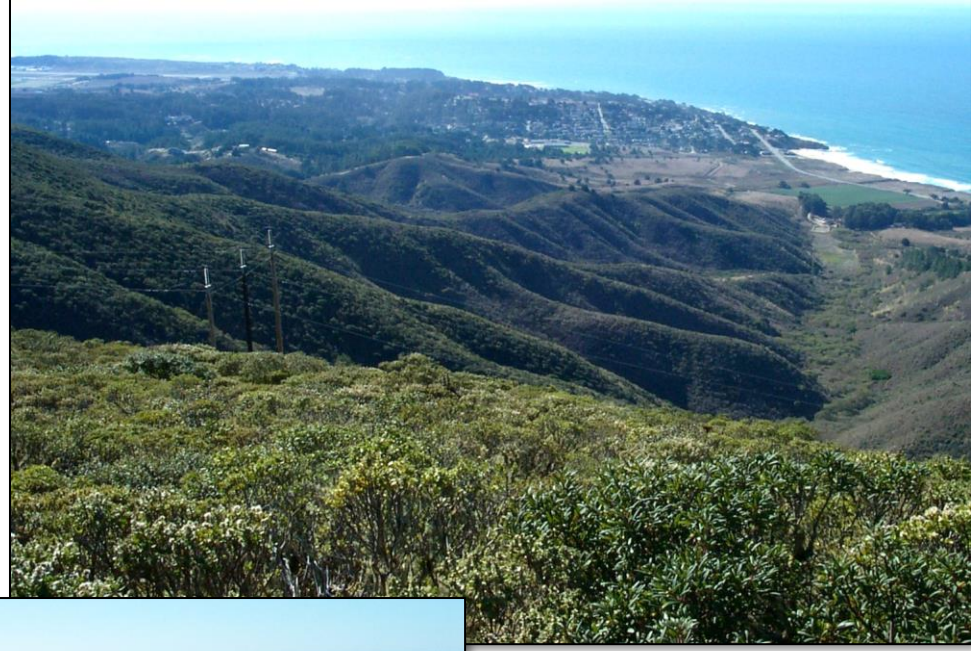


Non-glaciated, deeply weathered granitic rock promotes recharge, provides storage and sustains baseflows.



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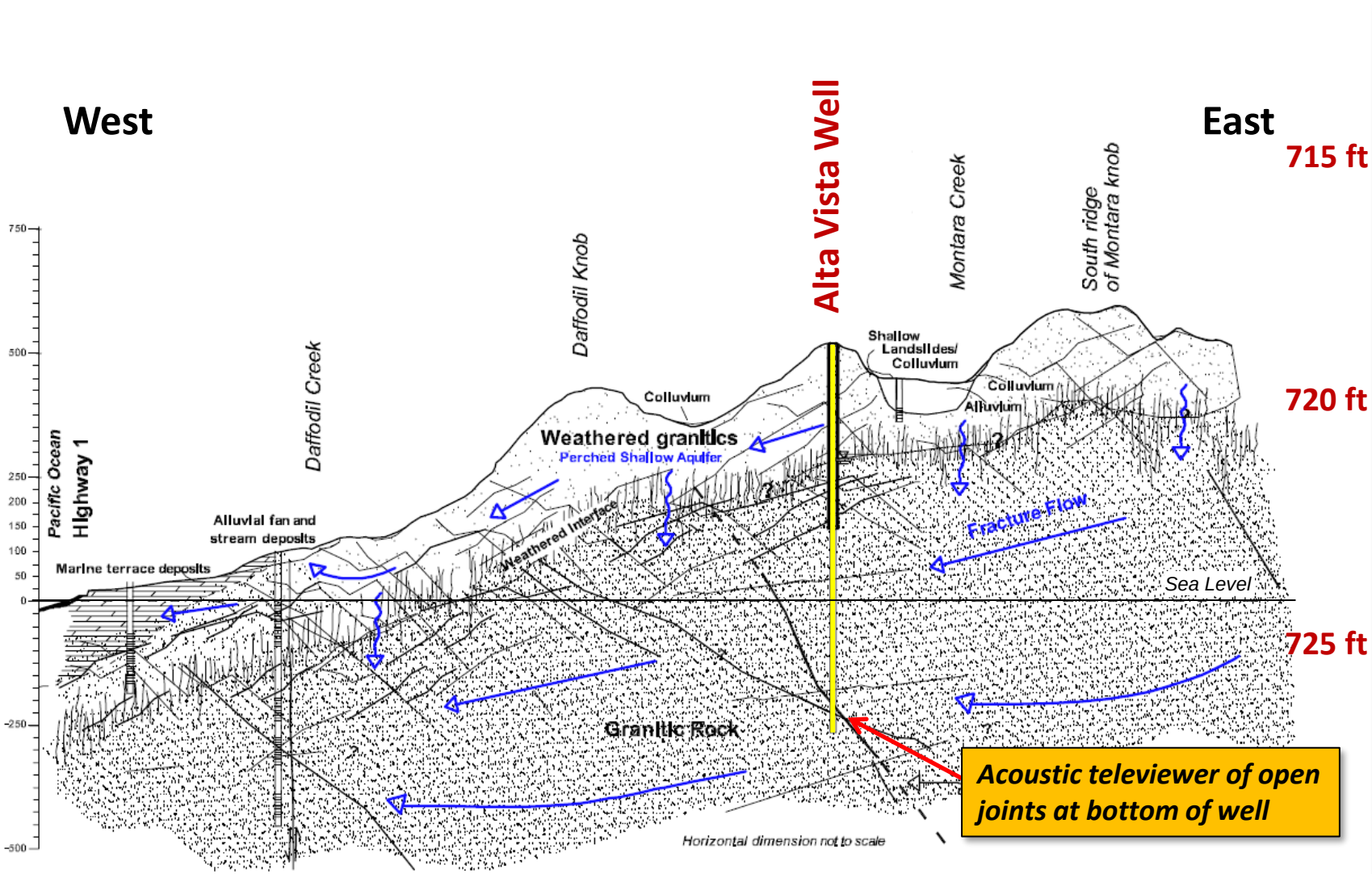

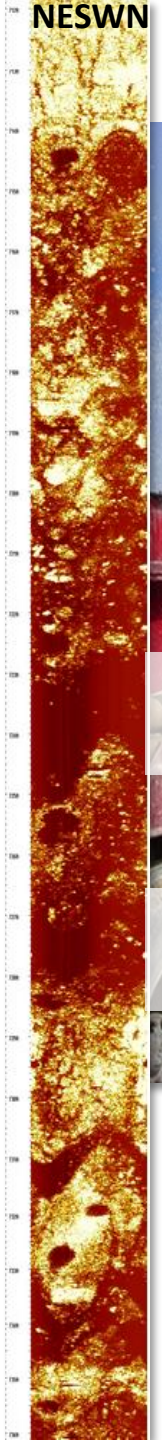

Air-rotary hammer drilling after intersecting open joints

Following well completion in 2004: a 5-day test at 300 gpm, a 60-day test at 40 gpm. Specific Capacity = 1.4 gpm/ft

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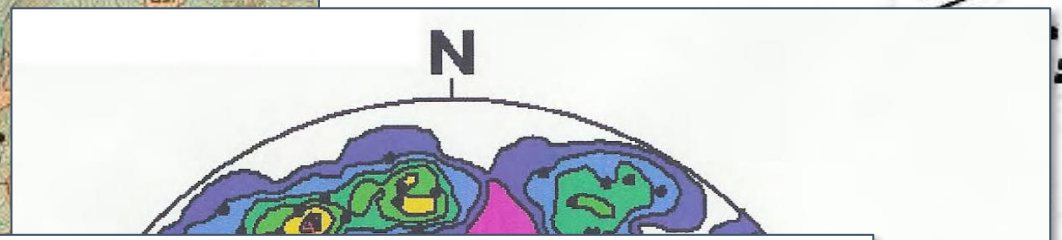
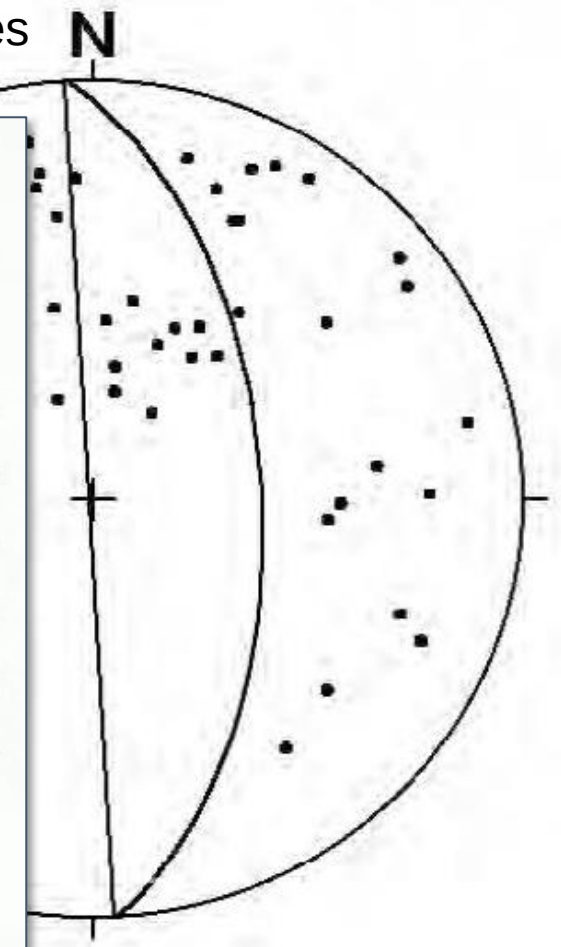
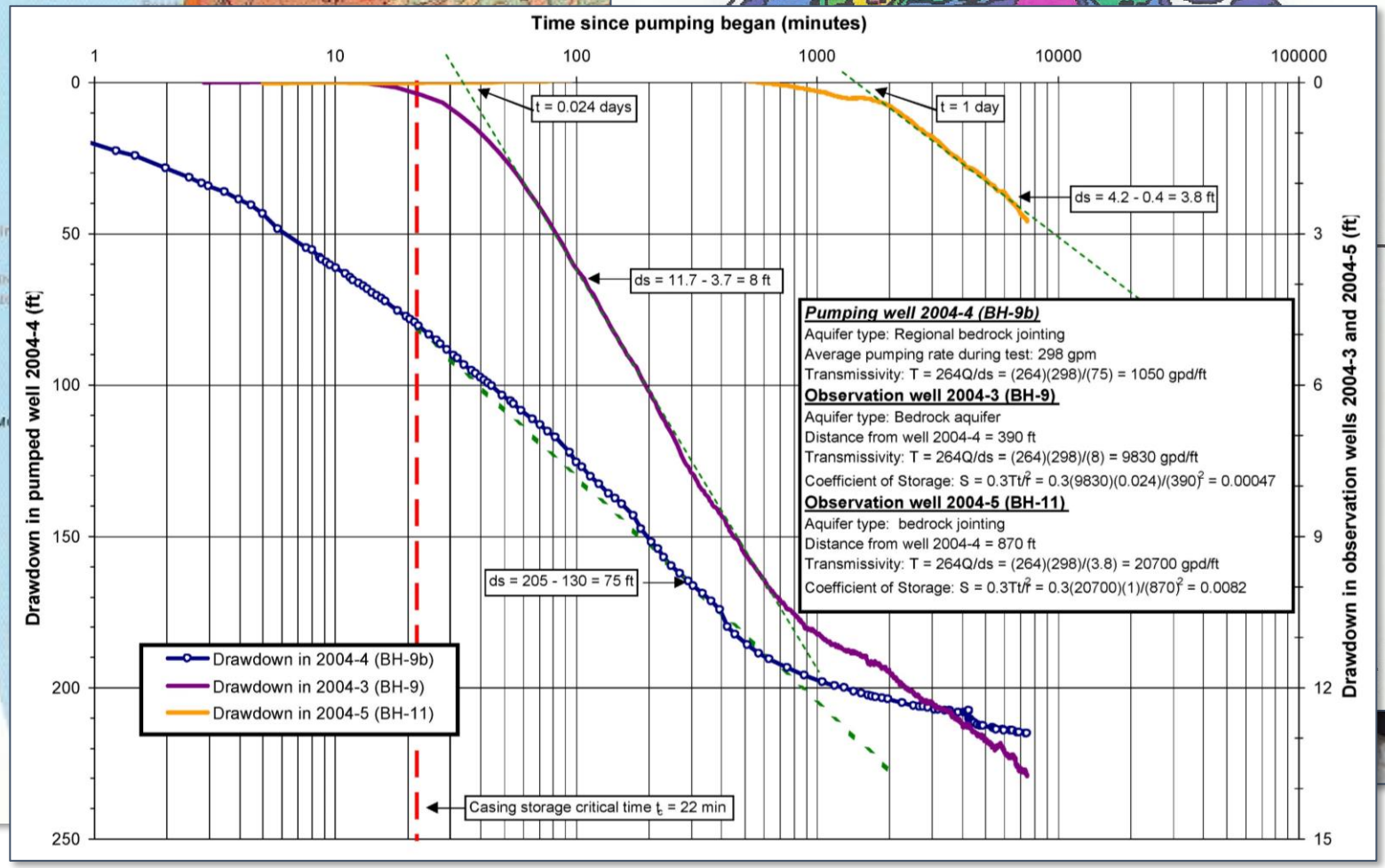
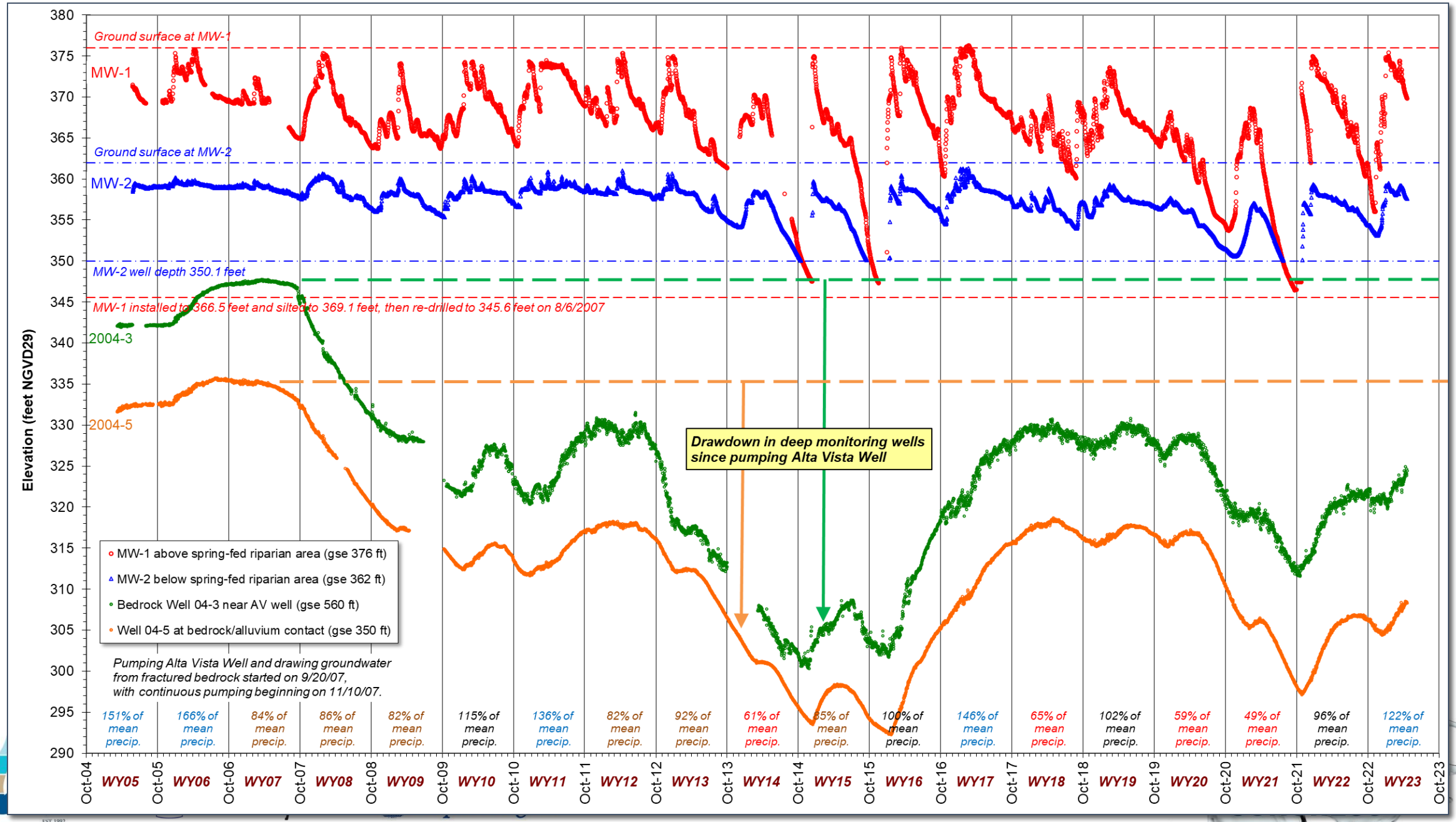
Schmidt-net plot of discontinuities








Ground surface at MW-1
MW-1
Ground surface at MW-2
MW-2
MW-2 well depth 350.1 feet
MW-1 installed to 366.5 feet and silted to 369.1 feet, then re-drilled to 345.6 feet on 8/6/2007
2004-3
2004-5
Drawdown in deep monitoring wells since pumping Alta Vista Well
MW-1 above spring-fed riparian area (gse 376 ft)
MW-2 below spring-fed riparian area (gse 362 ft)
Bedrock Well 04-3 near AV well (gse 560 ft)
Well 04-5 at bedrock/alluvium contact (gse 350 ft)
Pumping Alta Vista Well and drawing groundwater from fractured bedrock started on 9/20/07, with continuous pumping beginning on 11/10/07.
Elevation (feet NGVD29)
380
375
370
365
360
355
350
345
340
335
330
325
320
315
310
305
300
295
290
151% of mean precip.
166% of mean precip.
84% of mean precip.
86% of mean precip.
82% of mean precip.
115% of mean precip.
136% of mean precip.
82% of mean precip.
92% of mean precip.
61% of mean precip.
85% of mean precip.
100% of mean precip.
146% of mean precip.
65% of mean precip.
102% of mean precip.
59% of mean precip.
49% of mean precip.
96% of mean precip.
122% of mean precip.
Oct-04
WY05
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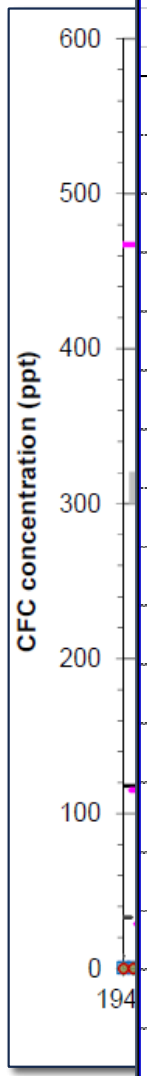
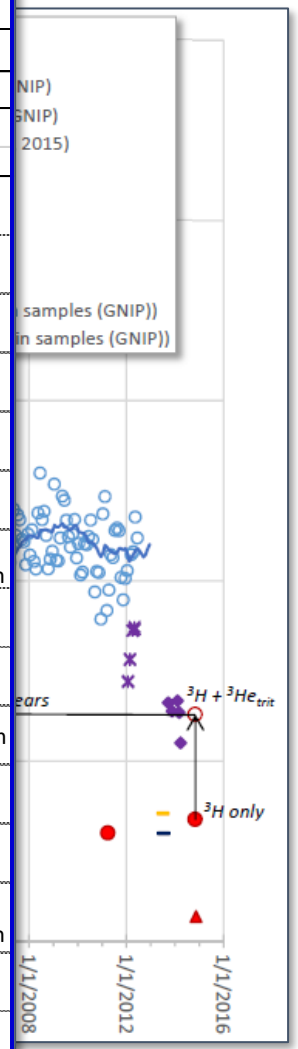


Water Year		CONDITIONS: Rainfall at Alta Vista Gage — Water Year Type [3]	Annual Total (inches)	Percent of Mean	AV Well Volume Pumped (ac-ft)	RESPONSES: Discharge at Stream Gages — Martini Cr (unimpaired) (ac-ft)	Daffodil Cyn (unimpaired) (ac-ft)	Montara Cr (impaired) (ac-ft)	Dry-Season Minimum [1] — MW-1 Elevation (ft NGVD29)	MW-2 Elevation (ft NGVD29)	INDICATORS: Alta Vista Well Groundwater Age [2] — Sample Date	Modern Water: Recharge Year [4]	Modern Water: Method	Pre-Modern Water: Result (P/A)	Pre-Modern Water: Methods
2005		Wet	43.9	152%	0	678	not gaged	not gaged	369	359	--	--	--	--	--
2006		Extremely Wet	48.5	168%	0	1116	not gaged	not gaged	369	359	--	--	--	--	--
2007	Drought	Dry	24.5	85%	0	411	not gaged	not gaged	365	358	--	--	--	--	--
2008	Drought	Dry	25.0	87%	87.5	361	not gaged	not gaged	364	356	--	--	--	--	--
2009	Drought	Dry	23.8	83%	112	partial record	15	1	364	355	--	--	--	--	--
2010		Above Average	33.6	117%	97.4	408	37	138	364	357	--	--	--	--	--
2011		Wet	39.6	138%	99.2	partial record	127	325	367	358	3/28/11	Inconclusive but present	^3H-^3He	Absent	Carbon-14 Radiogenic helium
2012	Drought	Dry	24.0	83%	84.7	partial record	27	71	366	358	--	--	--	--	--
2013	Drought	Dry	26.8	93%	151	356	50	40	361	354	--	--	--	--	--
2014	Drought	Extremely Dry	17.6	61%	186	226	30	0	347	< 350 (well dry)	10/30/14	1991 ± 4 yrs	^3H-^3He	Absent	Radiogenic helium
2015	Drought	Dry	24.7	86%	141	213	27	23	347	< 350 (well dry)	10/27/15	1966 to 1972	CFCs	Present	Carbon-14
2016		Average	29.2	102%	113	410	57	151	360	354	10/20/16	1975 to 1989	CFCs	Absent	Carbon-14
2017		Wet	42.5	148%	81.0	965	127	542	366	357	8/23/17	1975 to 1988	CFCs, SF_6 ^3H-^3He	Absent	Carbon-14 Radiogenic helium
2018		Extremely Dry	19.0	66%	99.1	352	30	77	360	354	--	--	--	--	--
2019		Average	29.7	103%	86.5	479	66	92	364	356	--	--	--	--	--
2020	Drought	Extremely Dry	17.1	59%	104	272	7.6	13	354	351	--	--	--	--	--
2021	Drought	Extremely Dry	14.2	49%	123	167	8.0	0.9	346	< 350 (well dry)	10/19/21	2011	^3H-^3He	Absent	Carbon-14
2022		Average	27.8	97%	90.4	419	107	163	356	354	--	--	--	--	--
2023		Wet	pending	pending	pending	pending	pending	pending	pending	pending	pending	pending	CFCs, SF6	pending	Carbon-14
Mean		--	28.8	100%	110	513	52	134	--	--	--	--	--	--	--



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Qualitative Check

- ✓ Since start of pumping in 2007, the Alta Vista well has been pumped at an average (continuous) rate of 68 gpm or 110 acre-feet per year.
- ✓ Recharge area estimates

Average annual recharge	8	6	4	inches
Average annual groundwater pumping	110	110	110	acre-feet
Estimated recharge area needed	165	221	331	acres
Percent of 360-acre topographic watershed upstream of the well	46%	61%	92%	percent

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The guidelines for the Honorable Harvest are not written down, or even consistently spoken of as a whole—they are reinforced in small acts of daily life. But if you were to list them, they might look something like this:

Know the ways of the ones who take care of you, so that you may take care of them.

Introduce yourself. Be accountable as the one who comes asking for life.

Ask permission before taking. Abide by the answer.

Never take the first. Never take the last.

Take only what you need.

Take only that which is given.

Never take more than half. Leave some for others.

Harvest in a way that minimizes harm.

Use it respectfully. Never waste what you have taken.

Share.

Give thanks for what you have been given.

Give a gift, in reciprocity for what you have taken.

Sustain the ones who sustain you and the earth will last forever.

ons

Geologic framework and monitoring across a cycle of wet and dry years

and a capacity for

Adaptive management

Master plan update

Recharge area estimate

CEQA compliance

Conservation programs

65th anniversary celebration

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Thank You!

We believe this is a successful habitat-responsible adaptive-management approach to managing a complex fractured bedrock aquifer.

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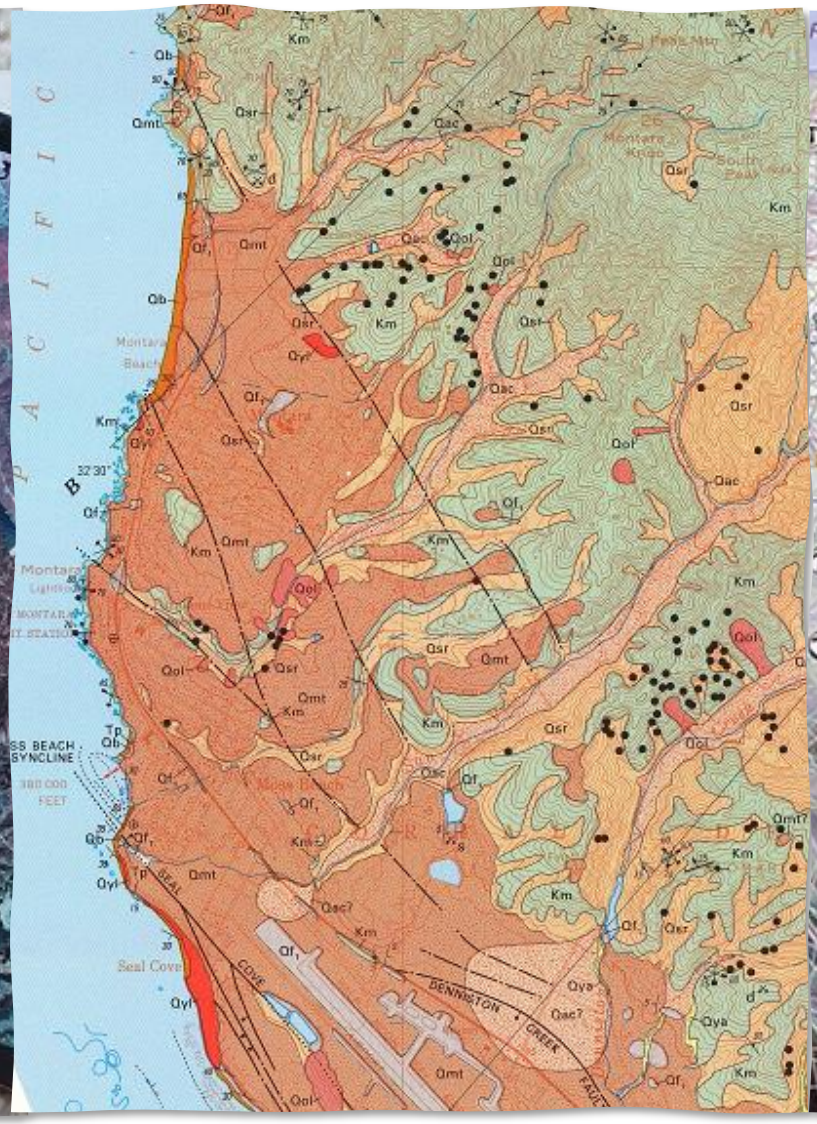

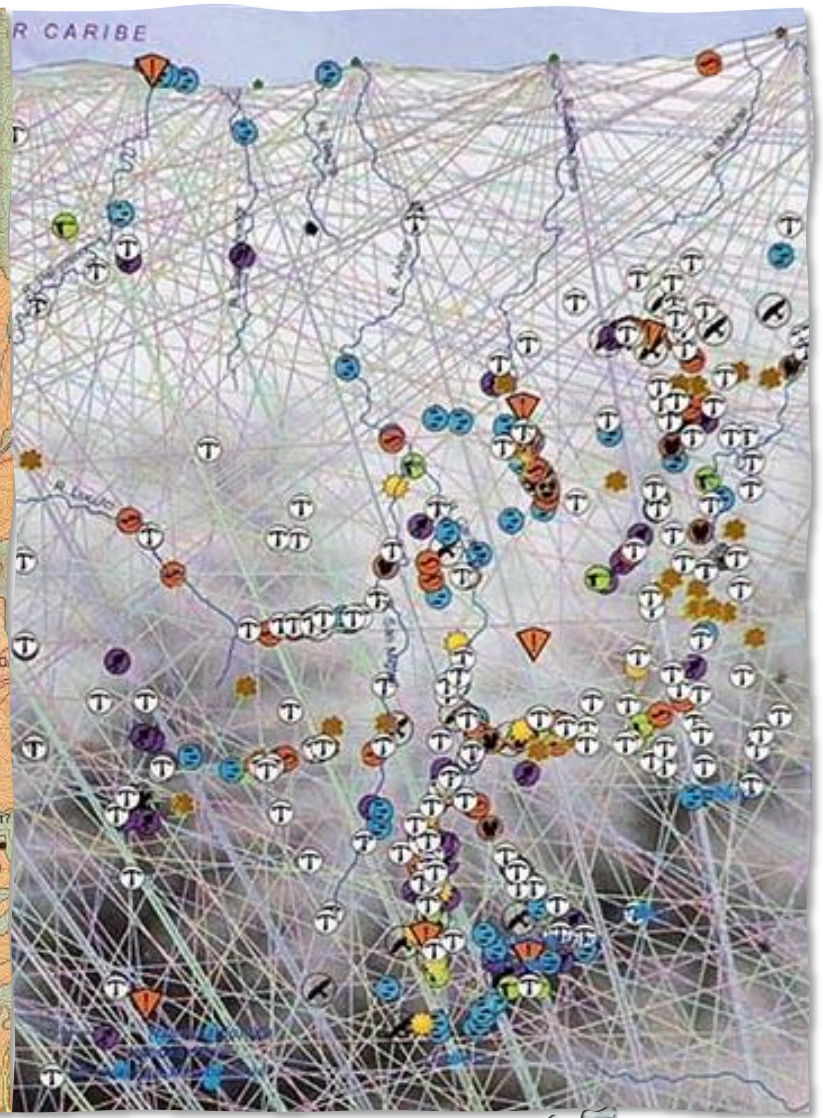

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