Exploring Modeled Management Scenarios and Adaptive Management

Harney GW RAC Discussion Groups – 01.27.24

Zoom: Link

Meeting Zoom Recording Link: https://media.pdx.edu/media/t/1_q0qtqiwp

Attendees:

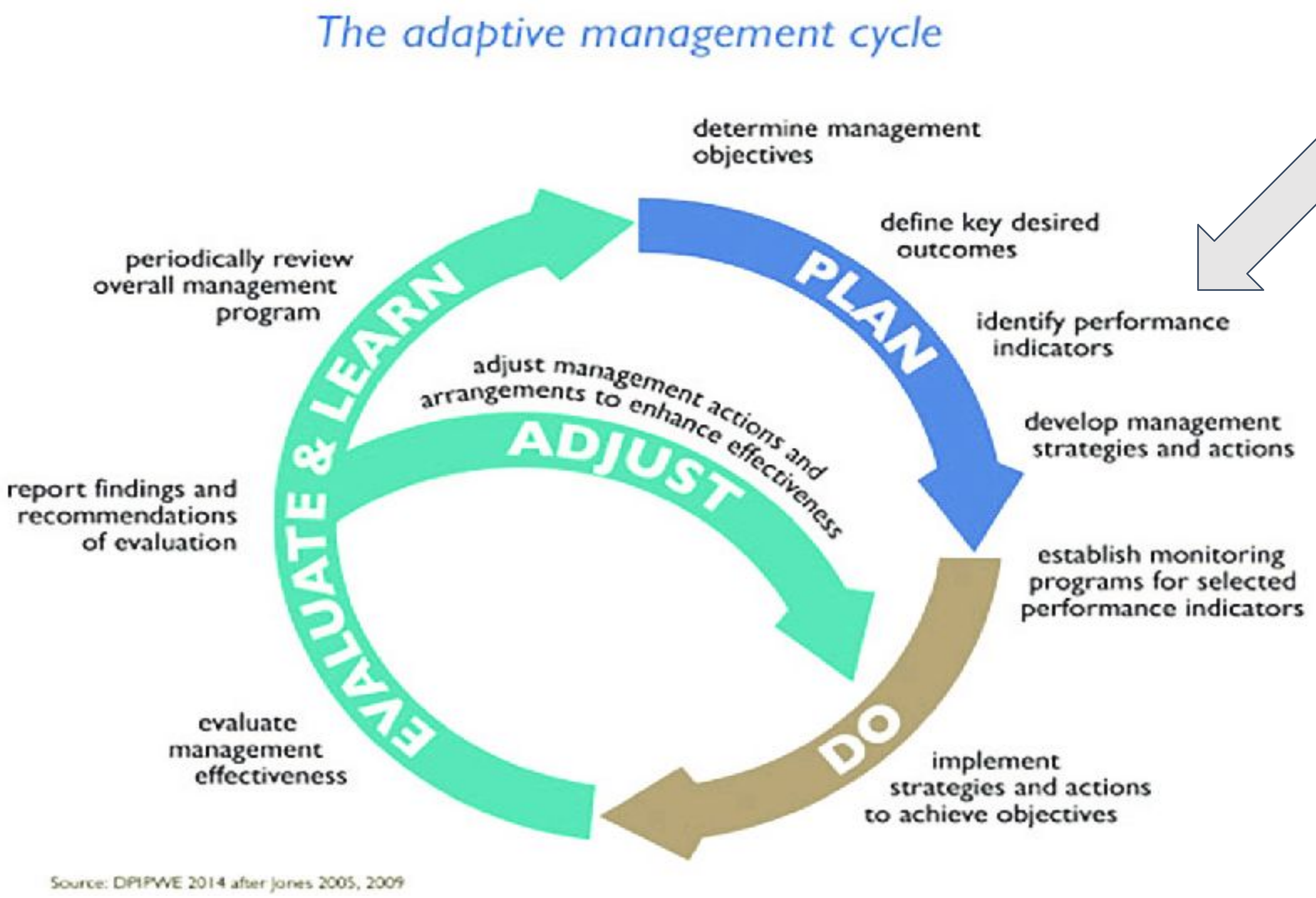
Bobby Cochran (Oregon Consensus), Harmony Burright (High Desert Partnership), Brenda Smith (High Desert Partnership), Chad Karges (HDP), Christopher Hall (Water League), Curt Blackburn (Real Estate Broker), Debbie Gouveia, Jason Spriet (OWRD), Ken Bierly, Ben Scandella (OWRD), Darrick Boschmann (OWRD), Mark Owens, Jerry Grondin, Sabrina Mackey, Rob Frank, Roger Sheley, Dally Swindlehurst (OWRD), Steve Rickman, Karen Moon, Fred Flippance, Fred Otley

Introductions

Bobby Cochran from Oregon Consensus and Harmony Burright from High Desert Partnership opened the meeting and asked participants to introduce themselves.

Members of the discussion group wanted clarity from OWRD on whether stability (zero rate of decline) is the goal or not, and the group discussed whether the three new model constraints should be used or not. There was interest in knowing the sensitivity of model results to increased recharge from uplands post fire. There was interest in more data from the Double O spring complexes.

Language of Adaptive Management



- Using language from this graphic

[*Discussion group language*] Dials for Designing or "Iterating" Model Scenarios

"Dial"						
Volume of pumping reductions	Least Reductions	Less Reductions	More reductions	Most reductions		
Management areas	15 subareas	7 subareas	6 subareas	0 subareas		
Management objective	Some decline (-0.X ft/yr)	Zero decline (0 ft/yr)	Some recovery (>0 ft/yr)	More recovery		
Performance indicator(s)	Median/50% of wells	80% of wells	90% of wells			
Date reductions begin/are fully implemented	Immediate	10 years	20 years	30 years		
Timeline to achieve objectives	ASAP	10 years	20 years	30 years	40 years	60 years

[*RAC 1/22 language*] Dials for Designing or "Iterating" Model Scenarios

"Dial"

Volume of pumping reductions [NA]	Least Reductions	Less Reductions	More reductions	Most reductions		
Management areas [spatial extent]	15 subareas	7 subareas	6 subareas	0 subareas		
Management objective [constraint parameters]	Some decline (-0.X ft/yr)	Zero decline (0 ft/yr)	Some recovery (>0 ft/yr)	More recovery		
Performance indicator(s) [stability success metric]	Median/50% of wells	80% of wells	90% of wells			
Date reductions begin/are fully implemented [phasing timeline]	Immediate	10 years	20 years	24 years	30 years	
Timeline to achieve objective[timeline to achieve goal]	ASAP	10 years	20 years	30 years	40 years	60 years

[*RAC 1/22 language*] Dials for Designing or "Iterating" Model Scenarios

"New Dials"

Key desired outcomes
[Constraint parameters]

Discharge to springs and streams

Natural evapotranspiration

Dry domestic wells

Dials for Iterative Model Runs

Pumping volume - what is the maximum amount of water that can be pumped (e.g., maximum permissible total withdrawal)?

Management areas: Optimized for X, Y, or Z number of subareas

Management objectives: Zero decline (0 ft/yr of decline)

Key desired outcomes: *NEW* - at what level should groundwater stabilize - consider native vegetation, discharge to streams/springs, impacts to domestic wells, impacts to ag production, economic impact

Performance indicator(s): Different thresholds or number of wells that must meet management objective (50% of wells, 80% of wells, 90% of wells)

Start date and phasing of reductions: Reductions phased in over X, Y, or Z years (2030-????)

Timeline to achieve objectives: X, Y, or Z years after reductions begin (????)

Different by subarea: Yes, no, maybe?

“Sensitivity” of Dials

- **Management areas**
  - one subarea has the highest reductions - most subareas has least reductions (larger difference between 1 subarea and 6/7 or 15, less difference between 15 and 6/7 subareas)
  - **Separating Weaver Springs from Dog Mountain** - different distribution of reductions (more pumping/less reductions in Dog Mountain) and Dog Mountain declines more
- **Performance indicator(s)**
  - more stringent metric (80th percentile) means higher final groundwater levels, more reductions needed
- **Phased reductions**
  - shorter timelines for implementing reductions means higher final groundwater levels, stabilize natural discharge sooner, less opportunity for adaptive management
- **Frequency of adaptation**
  - minimal differences between 3, 6, 9 years
- **Timeline to achieve success**
  - shorter timeline means higher final groundwater levels, more reductions needed, less opportunity for adaptive management
- **Recharge**
  - less recharge to groundwater (on average future conditions represent 10% less recharge) = more reductions in pumpage needed (if you don’t adjust pumping with less recharge, you get more declines)
  - more recharge (on average if future conditions were greater) = in principle with more recharge less reductions in pumpage would be needed
- **Variable Distribution of Impacts**
  - there are different impacts in different subareas (e.g., domestic wells and springs vary across areas) - can adjust model parameters for impacts

“Sensitivity” of Dials - clarifying questions and requests?

- What still seems unclear?
- Are there any other “what if” analyses you would like OWRD to think about
  - e.g., What if phasing reductions in Weaver Springs were sped up? And how would that impact Double O springs and needed reductions in Silver Creek?
  - e.g., If a 10 or 20% reduction in each subarea was achieved voluntarily by 2030, what would that mean for final water levels and needed reductions for each subarea?

“Sensitivity” of Dials

- Is the objective stable groundwater levels? The “new dials” are changing the objective (rising groundwater levels/recovery). I want to talk about the objectives, not the sensitivity of the dials. Do we even support the dials? Will there be new “dials” that affect the ultimate objective? We shouldn’t introduce new dials now - stay focused on original objective.
- Shouldn’t dry wells be directly correlated with groundwater levels? Shouldn’t we be able to predict the number of dry wells base don groundwater levels?
    - Estimated impacts can now be quantified - using the model to quantify the impacts and use them as constraints to set the permissible total withdrawal
- If you move the one well that is on the border between Weaver Springs and Dog Mt. How would that change things for Dog Mt. There are particular wells that should be in Weaver Springs not Dog Mt.

OWRD Proposed Management Scenario

Iterative Model Runs - A Review

- USGS study model runs (no change, no pumping)
- Initial Department developed model runs
    - A - 15 subareas - targeted reductions in 6 subareas
    - E - 1 subarea (entire GHVGAC) - reductions by priority back to 1990
- RAC developed model runs - reductions differ by 6 subareas to achieve different outcomes
    - B - Balanced and phased reductions, minimize impact to economy
    - C - Balanced and phased reductions, minimize impacts to springs and domestic wells, recover groundwater levels (minimal)
    - D - Balanced immediate reductions, minimize impacts to springs and domestic wells, recover groundwater levels, recover groundwater levels (more)
- Next iteration of Department developed model runs - “optimized” reductions based on different parameters
    - “Irrigation” - Phased reductions for the whole basin by priority across 1 subarea, minimize impact to economy, follow prior appropriation
    - “Conservation” - Immediate reductions by priority across subareas, minimize impacts to springs and domestic wells, recover groundwater levels
    - “Department Proposed” - Balanced and phased reductions, “optimize” final groundwater level for different impacts in each subarea

Department Proposed Management Scenario

Parameter	Proposed Management Scenario
Spatial extent	7 subareas
Stability success metric	Median (50th percentile) of well-cells
Timeline to achieve goal	30 years
Phasing timeline	24 years
Frequency of adaption	Every 6 years
Discharge to streams and springs	At least 50-70% of 2022 rates
Natural evapotranspiration	At least 60% of 2018 rates
Dry domestic wells	No more than 170% of 2018 counts

Clarifying questions about proposed management scenario?

- In the criteria for discharge to springs and streams were they talking about exceedance?
  - If GW levels in a particular cell rise to an elevation where they exceed the bottom of the spring or stream then they can discharge to the spring or stream (model does not differentiate between streams or springs)
  - In Silver Creek area cells of interest were clustered around Double O
  - What was the total discharge in lowland areas in 2098 vs. 2018
  - In the model we allowed a 30% reduction in spring/stream discharge by the end of the century (2098)
- How much water comes from surface water versus groundwater? What is the relationship with surface water and springs/stream discharge?
  - In late summer and fall, a significant portion of flow is from groundwater
- Too much variability and uncertainty with parameters - desire for data
  - Data contributing to the establishment of criteria? Observation - limited historical data for springs. Springs seem to be correlated with precipitation patterns. Is there data to support these parameters/thresholds? If those parameters are important (agree they are), then we ought to be focused on getting that data. Springs are importan. There is a significant economic impact to these parameters. Direct measurement is important.

Clarifying questions about proposed management scenario?

- Observations reflect different groundwater flow paths. Some recharge stays shallow and may be more precipitation/snow driven. Springs that are deeper and travel longer differences - depending on the depth it may collect heat on its way to the surface. Shallow vs. deep and short vs. long travel paths.
- Flow chart showing recharge and discharge in the groundwater study shows the movement of water and recharge along the margins of lowlands which becomes lowland groundwater.
- Do we have measured data of Double O springs? Can we measure the impact over time? Are there differences in the different springs or they all “the same” - share the same characteristics?
  - Over 20 years of data on the flow of those springs - some water quality data
  - Was this data included in the study?
- How does this get implemented exactly?
- How would all of this actually show up in the rules?
-

Clarifying questions about proposed management scenario?

- Concerns about the data and statements made at the previous meeting - e.g., there are springs in Weaver Springs - presence/absences of springs in different areas - how to model that.
- How and why did OWRD choose numbers for each: 170% of domestic wells, 60% of 2018 of natural ET, and 50-70% of discharge? Why not 120% or 200%? Why 60% and not 45%, etc.? There must be a reason that can be explained.
  - Selected as “intermediate” variables between “irrigation” and “conservation” scenarios.
- Thorough understanding of the rationale and reasoning behind the selection of various parameters. Are those placeholder numbers or will they move around? What is the rationale for selecting these numbers?
  - We want feedback on “how does this balance of impacts strike you?” - look at the variables and the relative impacts and give us feedback on these relationships/combination of various results
  - Minimize reductions in pumping, maximize PTW, while achieving these other desired outcomes

Clarifying questions about proposed management scenario?

- The economic impact statement seemed lacking. When you're looking at the new dials without the economic impact statement it's hard to analyze. Noone wants to see springs go dry, but we also don't want to see our community disappear. These should go hand in hand. All of these dials have a signifcant impact on the permissible total withdrawal and the individual/collective economic impacts.
- Add "economic impacts" as another dial.
- The only solution to this has to include all the larger ecosystem dynamics. My biggest issue has to do with recharge - management of uplands has a significant impact on this in my view. Overgrowth in forest happened at the same time as declines in groundwater level - interested in this relationship.

Balancing desired outcomes

Social, Economic, and Environment

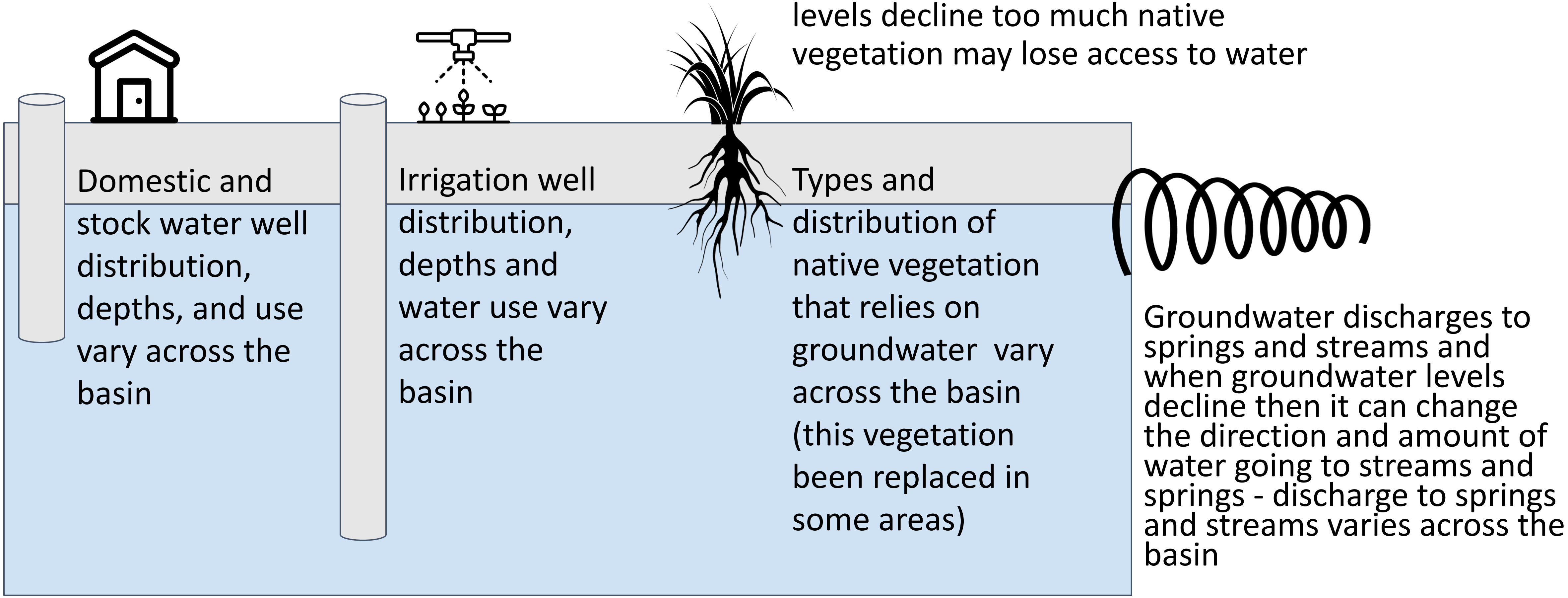
Balancing Social, Economic, Environmental Values/Desired Outcomes - What we've heard

- Social
  - People value the culture, economy, environment, way of life and quality of life in Harney County
  - People want to continue to live, work, and play in Harney County and want a promising future for themselves, their families, and neighbors
  - People want to ensure there is continued access to water for homes so they can continue to live in Harney County
- Economic
  - Groundwater irrigated agriculture is a major contributor to the economy - all reductions will have a roughly equivalent impact on the economy
  - There are ripple effects to other industries, the region, state, and nation
  - People want to ensure there are opportunities for economic transition as well as opportunities for future economic development
- Environmental
  - Some native vegetation relies on access to groundwater to continue to grow and this native vegetation is important ecologically to the basin
  - Groundwater is an important source of water for springs and streams that contribute to the Wildlife Refuge and other ecologically important features in the basin
  - Continued groundwater declines will have effects on the environment

Balancing Social, Economic, Environmental Tradeoffs/Desired Outcomes

Domestic and stockwater wells are generally shallower than irrigation wells - wells can be deepened as groundwater levels decline

Some native vegetation relies on root access to groundwater (the depth to groundwater varies) - if groundwater levels decline too much native vegetation may lose access to water



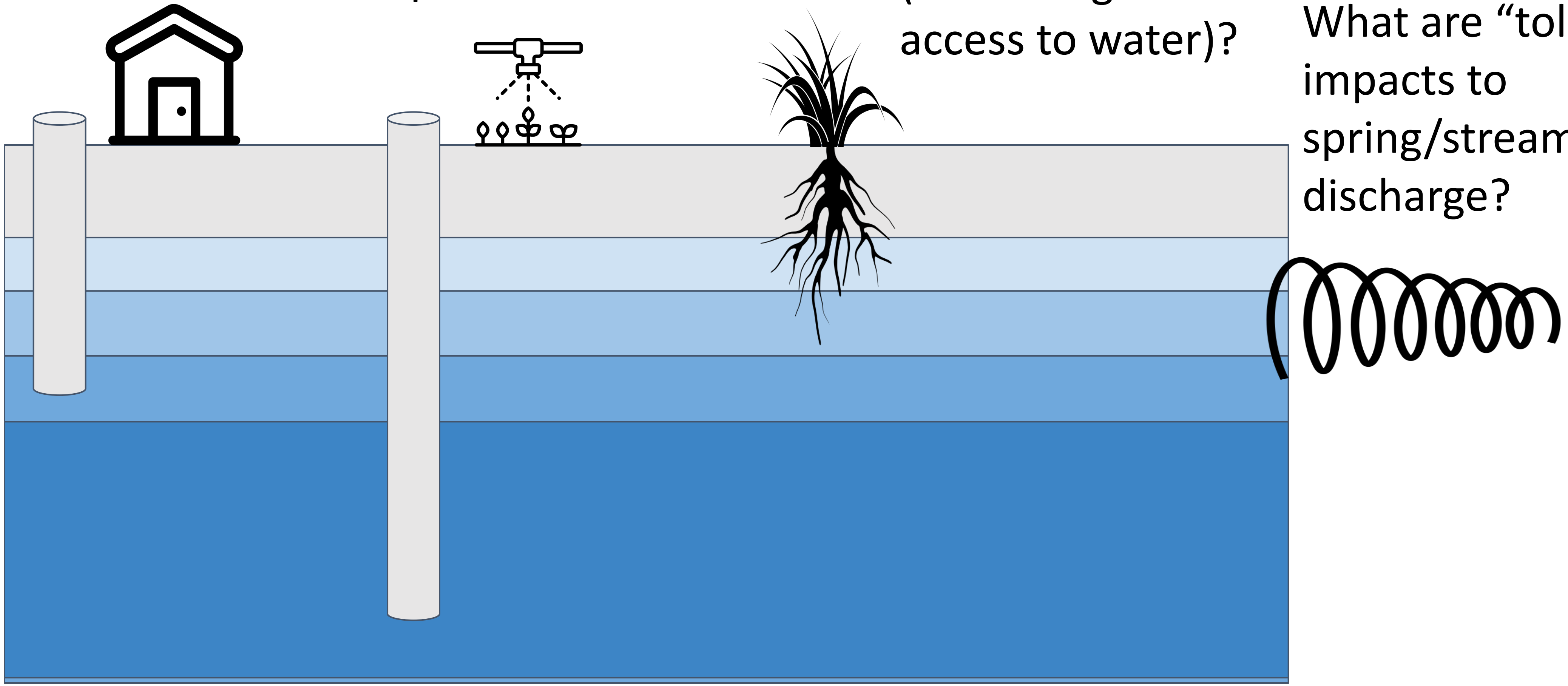
Balancing Social, Economic, Environmental Tradeoffs

What are "tolerable" impacts to domestic/ stock wells?

What are "tolerable" impacts to agricultural production?

What are "tolerable" impacts to natural ET (native vegetation access to water)?

What are "tolerable" impacts to spring/stream discharge?



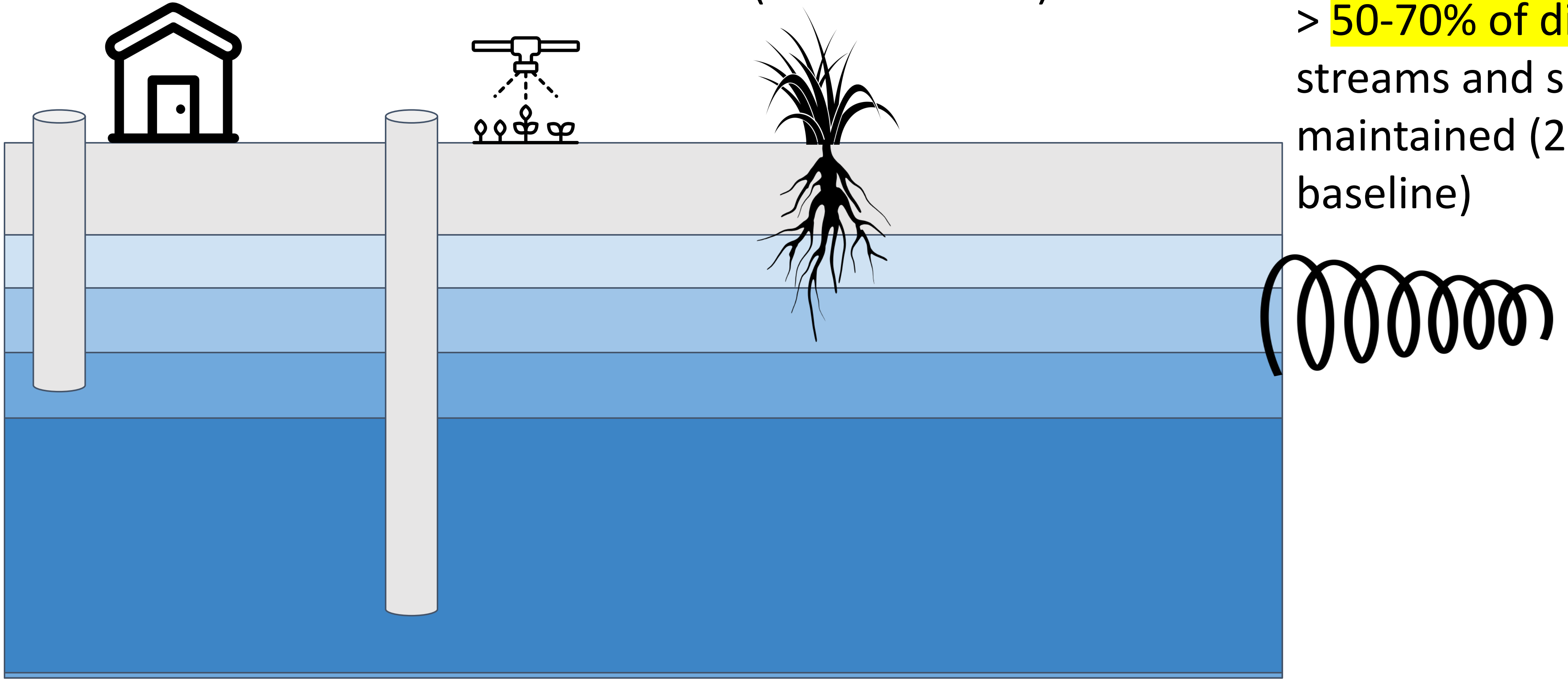
Balancing Tradeoffs - OWRD proposed “constraints”

< 170% of domestic wells lose access to water at current depth (2018 baseline)

Maximize within constraints

> 60% of native vegetation maintains access to groundwater (2018 baseline)

> 50-70% of discharge to streams and springs is maintained (2022 baseline)



Subarea Specific "Limiting Constraints"

Proposed Management Scenario Results: Percent Changes by Subarea

Subarea	Pumpage (% vs 2018)	Lowland Spring & Stream (% vs 2022)	Lowland Natural ET (% vs 2018)	Dry Wells (# vs 2018)
Dog Mountain	-55%	N/A	-27%	+3
Lower Blitzen - Voltage	-32%	-5%	-25%	+5
Northeast-Crane	-48%	+13%	-47%	+5
Silver Creek	-45%	-21%	-23%	0
Springs around Double O	N/A	-31%	N/A	+1
Silvies	0	0	-28%	0
Upper Blitzen	0	-7%	-7%	+5
Weaver Springs	-49%	N/A	-40%	+19
Overall	-38%	-11%	-26%	+3

Are there other ways to manage tradeoffs (outside of the model? and PTW?)

What happens if…?	**Current OWRD proposal for management**	**Other options for how these impacts can be managed for?**
…groundwater levels decline below the depth of domestic and stock wells?	PTW set so < 170% of domestic wells lose access to water at current depth (2018 baseline)	
…discharge to springs and streams is reduced?	PTW set so 50-70% of discharge to streams and springs is maintained (2022 baseline)	What are ecologically meaningful thresholds for spring discharge? Subarea specific considerations (look at ecologically important springs in each area)
…groundwater levels decline below the roots of native vegetation?	PTW set so >60% of native vegetation maintains access to groundwater (2018 baseline)	
…agricultural production is reduced?	After constraints and zero decline condition, PTW maximized; Phasing and adaptive	

Clarifying questions about “limiting constraints”? or proposed scenario?

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What information do you need to provide specific input on this proposal?

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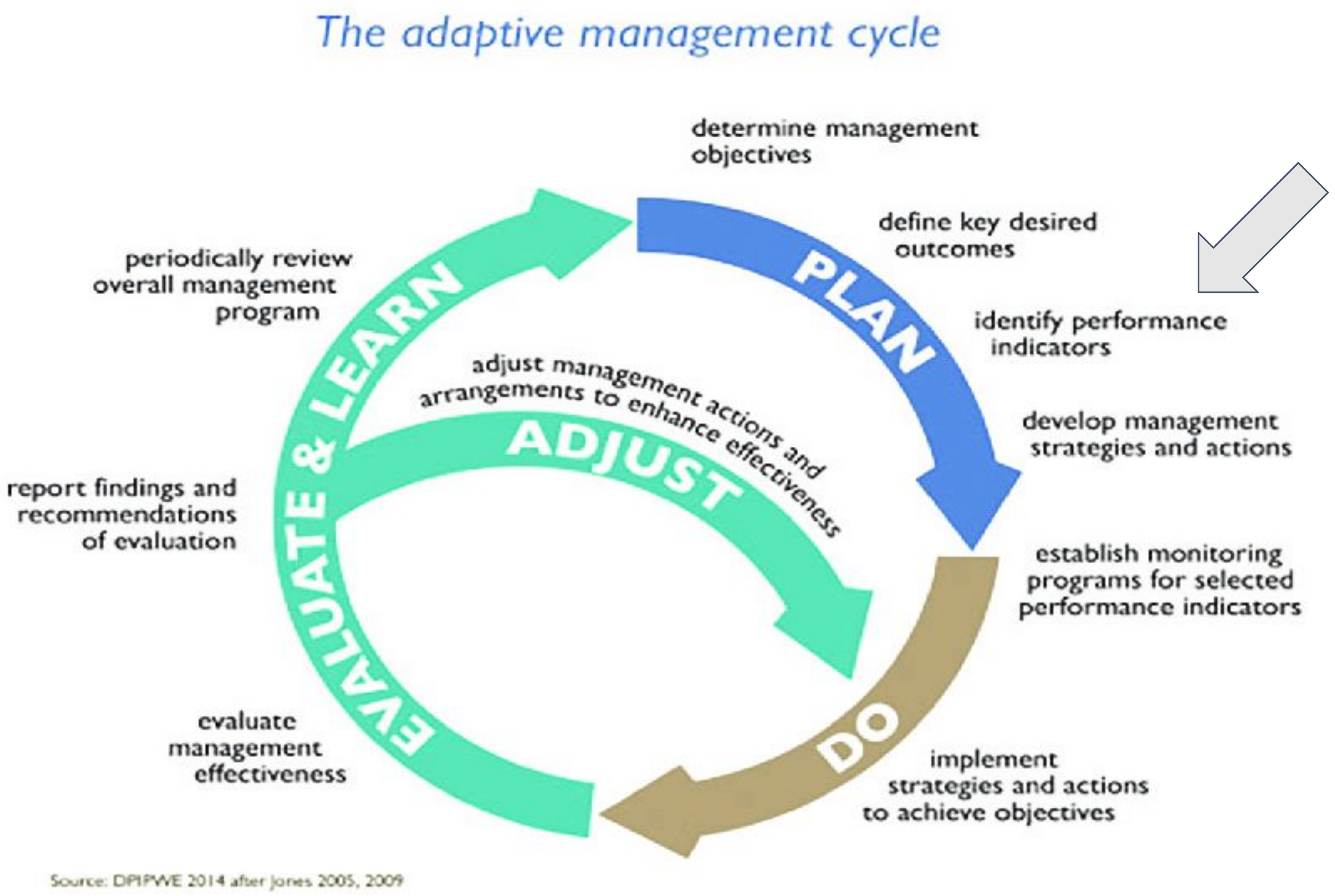
Next steps:

- WRD will review the input
- Make adjustments as appropriate
- March RAC: return with proposal in rule language and reasoning for each parameter and adjustments made

Adaptive Management

Adaptive Management - Overview



Adaptive management in the context of:

- Rules
- Contested Case
- Voluntary Agreements
- Groundwater management more generally

Previous Input and Discussion on Adaptive Management

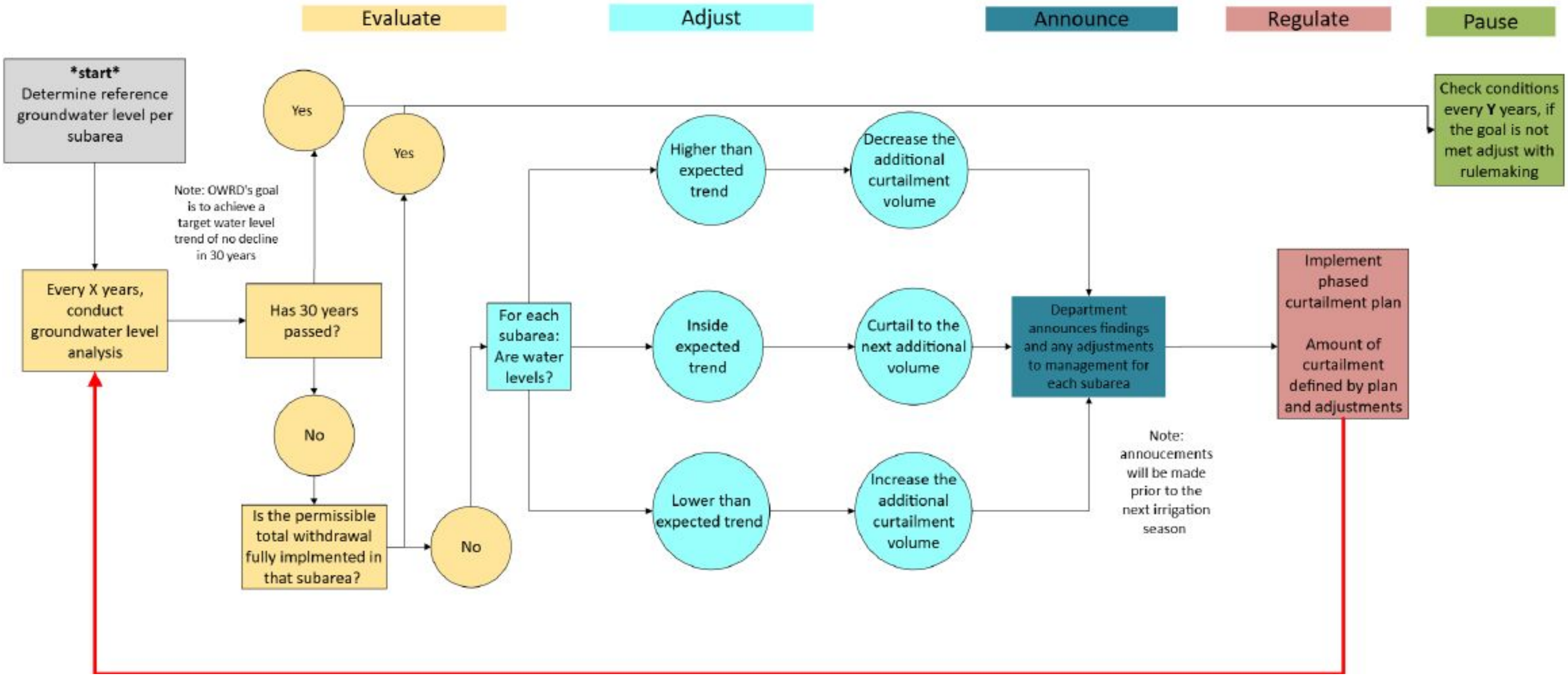
- Interest in exploring adaptive management approaches
- Desire to better understand what the Department can and can’t do
- Interest in exploring “phased” approach to reductions
- Interest in exploring “subarea” specific approach/considerations
- Explore balance between providing “certainty” and “flexibility”/discretion for adjustments
- Questions about what technical analyses that will be performed and when
- Questions about opportunities for public participation in adaptive management
- Interest in exploring “graduated rate of decline” and tracking success against established metrics
- Interest in exploring “triggers for action”
- Explore tradeoffs (benefits and drawbacks) with allowing more time
- Desire to better understand technical bases of proposals

Adaptive Management Opportunities and Constraints

What we can and can't do in rule

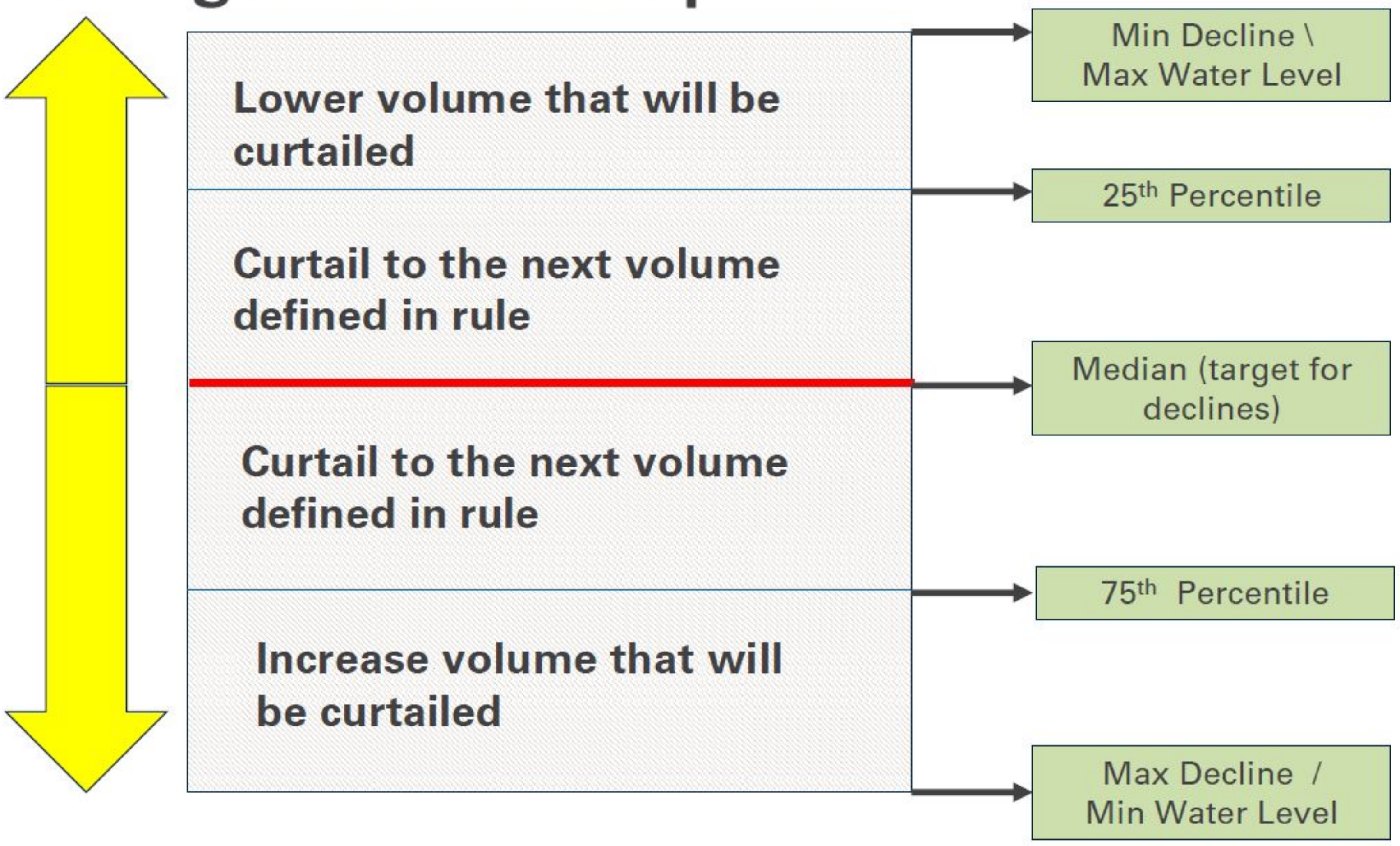
In Rule	In Order
Can • Set PTW by Subarea • Define timeline to achieve goal • Set timeline for evaluation of progress • Set timeline to adjust curtailment • Allocate PTW to achieve goal Cannot • Adjust overall PTW based on conditions • Make changes to subarea boundaries after rule adoption	Can • Modify amount of curtailment at each check in period based on conditions up to the allotted PTW defined in rule • Modify curtailment based on conditions • Issue orders for future expected curtailment Cannot • Curtail outside of priority date in the same subarea • Modify PTW

Proposed Adaptive Management Plan



Proposed Adaptive Management Plan

Decline magnitude envelope



EGON

Adjustment amounts at check-in points

Proposed Adaptation Plan

- Adapt every 6 years, adjusting the additional curtailment:
- If the current year's water level is:
  - Above the 90th percentile: -60%
  - Above the 75th percentile: -30%
  - Between 25th and 75th percentiles: no change
  - Below the 25th percentile: +30%
  - Below the 10th percentile: +60%
- And, if net (years above 75th) – (years below 25th) is:
  - 3 or more: -30%
  - -2 to 2: no change
  - -3 or less: +30%

Clarifying questions about what OWRD can and cannot do <u>in rule</u>? the overarching <u>framework</u>? decline magnitude <u>envelope</u>? proposed <u>adjustment amounts</u>?

- What are the assumed relationships between management actions and impacts? Desire to actually observe/measure impacts.
- Timing of when this change - so much of this deals with people's businesses. How long will we allow for change to be implemented? How long until the effect of the change shows up in the system?
  - e.g., Letters that just went out
  - Harney Electric has already contracted for 3 years of energy consumption - need to pay for power even if the power isn't used
  - How fast do we make changes and how long do we allow people to adapt?
- There's no "going back" once people pull out their systems they can't easily turn things back on
  - Need to be very careful/cautious - these are permanent changes that require time to implement - profound impacts on people's lives

Clarifying questions …

- How can we affect groundwater levels without reducing irrigation? Is there something innovative we could do with surface water (e.g., WA example).
  - We have to be more creative with how we solve these problems - from a positive, can-do perspective - what ideas are we bringing to the table
- What are the different time cycles to be cognizant of (business operations)
- In the decision chart, for the announce box, how are adjustments to the management made? Would like clarity on that.
- Why wasn’t upland recharge included in the model?

What information do you need to provide specific input on this proposal?

Next steps:

- WRD will review the input
- Make adjustments as appropriate
- March RAC: return with proposal in rule language and reasoning for each parameter and adjustments made

Future Discussions

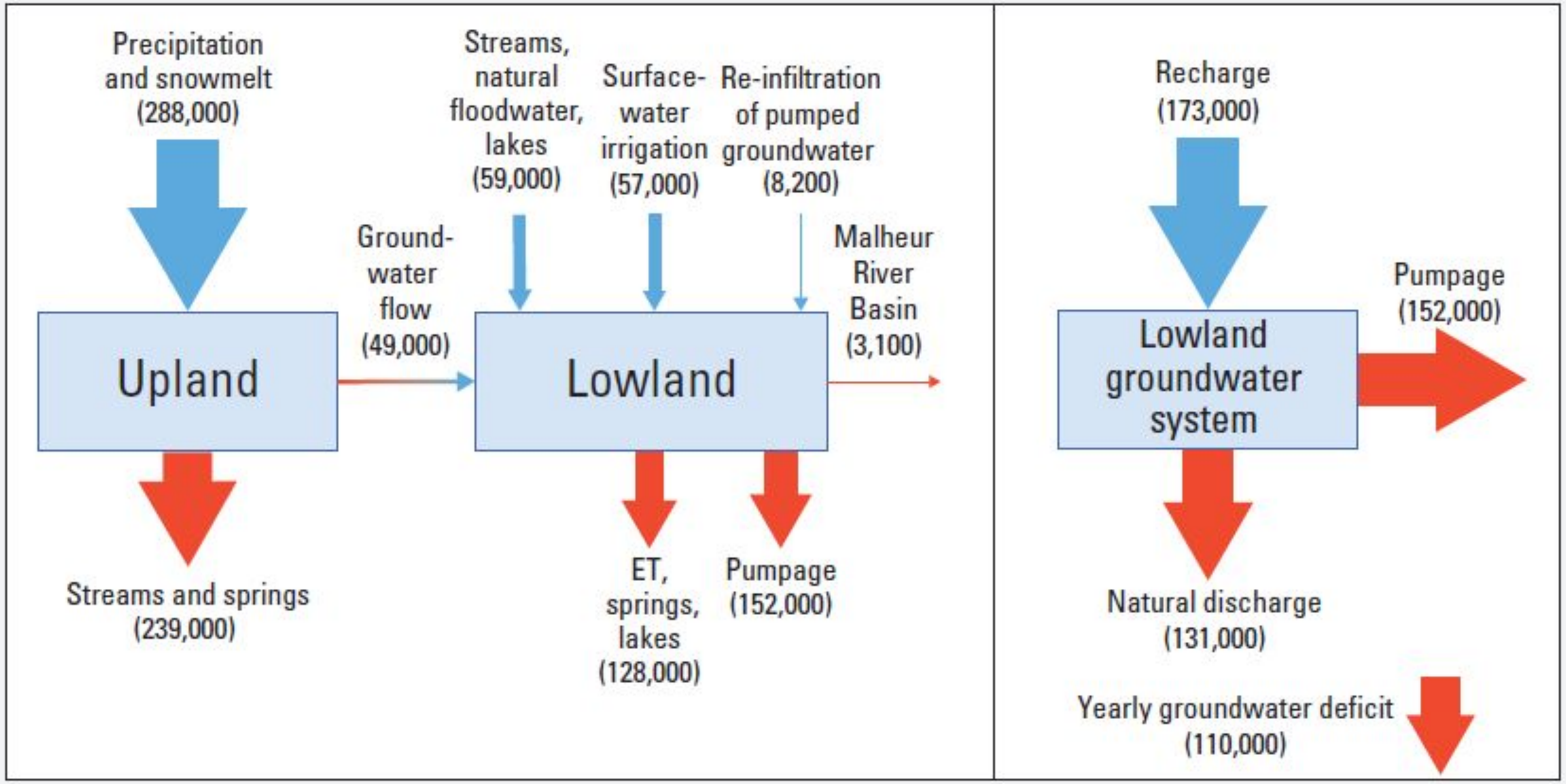
Discussion Group Topics - What is on the table?

- Further discuss proposed management scenario
- Further discuss adaptive management approach
- Examine and discuss subarea specific considerations/tradeoffs (balancing social, economic, environmental tradeoffs) and approaches

Future (if requested/needed - not currently scheduled)

- SWMPA rule language?
- Classification rule language?
- Critical groundwater area rule language?
- CREP/voluntary approaches?

Figure 3. Mean annual upland and lowland groundwater budgets, Harney Basin, southeastern Oregon, 1982–2018. Modified from Garcia and others, 2022. [ET, evapotranspiration.]



EXPLANATION

[Width of arrows indicates relative volume]

Recharge, in acre-feet (inflow)

Discharge, in acre-feet (outflow)

Table 7. Mean groundwater discharge to selected springs (1903–2017), Harney Basin, southeastern Oregon.

[**Discharge, July 2017**: Single measurements made by OWRD in July 2017. **Mean discharge**: Over period of record. **Range of measurement dates**: Unless otherwise noted, measurements collected 1902–32 from Piper and others (1939); 1939–40, 1984, 2017 from Oregon Water Resources Department (2020); 1968 from Leonard (1970); 1972–73 from Hubbard (1975); 1997–2016 by Timothy Mayer, U.S. Fish and Wildlife Service, written commun., 2017. **Latitude** and **Longitude:** Referenced to North American Datum of 1983. Elevation: in feet above North American Vertical Datum of 1988. Geographic position: position of water-bearing units from which discharge occurs. **Abbreviations**: ft^3/s, cubic feet per second; L, lowland; meas., measurements; N, no; number; OWRD, Oregon Water Resources Department; U, upland; USGS, U.S. Geological Survey; Y, yes; —, not measured

Local spring name or state spring number	Discharge, July 2017 (ft^3/s)	Mean discharge (ft^3/s)	No. of meas.	Measured discharge range (ft^3/s)	Range of measurement dates	OWRD spring number	USGS site number	Latitude (decimal degrees)	Longitude (decimal degrees)	Elevation (feet)	Geographic position/ discharge routed to stream, canal, or irrigated area
Northern region											
Goodman Spring	—	0.36	5	0.06–0.67	1930–31, 1968	SPRG0018713	433827118173801	43.528502	-119.081420	4,140	L/N
Cow Creek Spring	—	0.50	2	0.50–0.50	1930–31	SPRG0018717	433949118442401	43.663522	-118.739953	4,207	U/Y
Mill Pond Spring	—	0.57	4	0.02–1.11	1930–31, 1968	SPRG0018720	433224119045401	43.540296	-119.082092	4,147	U/Y
SPRG0018721	—	0.26	6	0.01–0.67	1930–31, 1968	SPRG0018721	433153119045001	43.530860	-119.077340	4,138	L/N
SPRG0018724	—	0.76	4	0.56–0.96	1930–31, 1968	SPRG0018724	433029119082301	43.508056	-119.139722	4,156	U/Y
SPRG0018725	—	0.11	2	0.01–0.17	1930–31	SPRG0018725	433008119070601	43.502222	-119.118333	4,139	U/Y
Roadland Spring	—	0.84	4	0.65–1.08	1930–31, 1968	SPRG0018726	433000119053001	43.500000	-119.092593	4,138	U/Y
SPRG0018728	—	0.11	2	0.11–0.11	1930–31	SPRG0018728	432849119043301	43.480278	-119.075833	4,131	L/N
Crane Hot Spring	[1]0.00	0.27	9	0.0–0.40	1903, 1907, 1930–31, 1968, 1984, 2017	SPRG0018279	432630118382601	43.441000	-118.639000	4,122	L/N
Western region											
Elliot Spring	—	0.002	1	0.002	[2]1980	SPRG0022260	433530119191301	43.591667	-119.320278	5,114	U/N
Weaver Spring	—	0.03	3	0.02–0.04	1907, 1930–31	SPRG0018730	432258119065201	43.382778	-119.114444	4,153	U/Y
Double O Cold Spring	—	0.85	2	0.70–1.00	1907, 1931	SPRG0018731	431649119190800	43.283850	-119.317240	4,126	L/Y
Double O Barnyard Spring	3.70	5.74	12	3.00–9.20	1916-19, 1931, 2017	SPRG0018733	431635119183601	43.276100	-119.310200	4,124	L/Y

Table 7. Mean groundwater discharge to selected springs (1903–2017), Harney Basin, southeastern Oregon.—Continued

[**Discharge, July 2017**: Single measurements made by OWRD in July 2017. **Mean discharge**: Over period of record. **Range of measurement dates**: Unless otherwise noted, measurements collected 1902–32 from Piper and others (1939); 1939–40, 1984, 2017 from Oregon Water Resources Department (2020); 1968 from Leonard (1970); 1972–73 from Hubbard (1975); 1997–2016 by Timothy Mayer, U.S. Fish and Wildlife Service, written commun., 2017. **Latitude** and **Longitude:** Referenced to North American Datum of 1983. Elevation: in feet above North American Vertical Datum of 1988. Geographic position: position of water-bearing units from which discharge occurs. **Abbreviations**: ft³/s, cubic feet per second; L, lowland; meas., measurements; N, no, number; OWRD, Oregon Water Resources Department; U, upland; USGS, U.S. Geological Survey; Y, yes; —, not measured

Local spring name or state spring number	Discharge, July 2017 (ft³/s)	Mean discharge (ft³/s)	No. of meas.	Measured discharge range (ft³/s)	Range of measurement dates	OWRD spring number	USGS site number	Latitude (decimal degrees)	Longitude (decimal degrees)	Elevation (feet)	Geographic position/ discharge routed to stream, canal, or irrigated area
Western region—continued											
Basque (East Double O) Spring	1.80	2.40	9	1.80–4.00	1907, 1916–17, 1931–32, 2017	SPRG0018734	431607119174201	43.268960	-119.294920	4,124	L/Y
Johnson Spring	1.60	1.71	7	1.30–2.00	1907, 1916–17, 1931, 2017	SPRG0018737	431542119165401	43.261600	-119.281700	4,122	L/Y
Hughet Spring	13.00	12.59	9	9.20–14.50	1916-17, 1931–32, 2017	SPRG0018738	431453119153101	43.247370	-119.258200	4,116	L/Y
Upper Sizemore Spring	1.40	2.15	7	1.20–3.50	1916-17, 1931–32, 2017	SPRG0018739	431423119142501	43.239730	-119.240120	4,123	L/Y
Lower Sizemore Spring	1.70	1.72	7	0.92–3.50	1916-17, 1931, 2017	SPRG0018740	431406119140201	43.235060	-119.233860	4,126	L/Y
Hibbard Spring	9.20	14.29	15	8.40–20.90	1907, 1913, 1916–19, 1921, 1932, 2017	SPRG0023236	431623119195001	43.273350	-119.330690	4,127	L/N
Soldier Spring	—	0.06	1	0.06	1931	SPRG0018814	431333119125901	43.225950	-119.216130	4,105	L/N
Unnamed Hot Spring	—	0.48	4	0.35–0.80	1902, 1907, 1930–31	SPRG0018745	431052119032701	43.181100	-119.057000	4,110	L/N
SPRG0018746	—	0.06	1	0.06	1931	SPRG0018746	431541119005201	43.261389	-119.014444	4,100	L/N
SPRG0018747	—	0.02	1	0.02	1931	SPRG0018747	431520119003601	43.255556	-119.010000	4,098	L/N
Lynch Spring	—	0.06	1	0.06	1931	SPRG0018748	431448119014001	43.246630	-119.027775	4,098	L/N

Table 7. Mean groundwater discharge to selected springs (1903–2017), Harney Basin, southeastern Oregon.—Continued

[**Discharge, July 2017**: Single measurements made by OWRD in July 2017. **Mean discharge**: Over period of record. **Range of measurement dates**: Unless otherwise noted, measurements collected 1902–32 from Piper and others (1939); 1939–40, 1984, 2017 from Oregon Water Resources Department (2020); 1968 from Leonard (1970); 1972–73 from Hubbard (1975); 1997–2016 by Timothy Mayer, U.S. Fish and Wildlife Service, written commun., 2017. **Latitude** and **Longitude:** Referenced to North American Datum of 1983. Elevation: in feet above North American Vertical Datum of 1988. Geographic position: position of water-bearing units from which discharge occurs. **Abbreviations**: ft³/s, cubic feet per second; L, lowland; meas., measurements; N, no, number; OWRD, Oregon Water Resources Department; U, upland; USGS, U.S. Geological Survey; Y, yes; —, not measured

Local spring name or state spring number	Discharge, July 2017 (ft³/s)	Mean discharge (ft³/s)	No. of meas.	Measured discharge range (ft³/s)	Range of measurement dates	OWRD spring number	USGS site number	Latitude (decimal degrees)	Longitude (decimal degrees)	Elevation (feet)	Geographic position/ discharge routed to stream, canal, or irrigated area
Southern region											
Fivemile (Hog House) Spring	—	3.00	2	2.00–4.00	1907, 1932	SPRG0018751	425321118535501	42.889167	-118.898611	4,165	U/Y
Knox Spring	—	1.25	2	1.00–1.50	1911, 1932	SPRG0018752	425210118502201	42.869444	-118.839444	4,282	U/Y
Warm Spring near Frenchglen	—	0.93	7	0.19–2.50	1907, 1916, 1932, 2003	SPRG0018753	424854118540201	42.815000	-118.900556	4,201	U/Y
SPRG0018754	—	0.13	2	0.04–0.22	1907, 1932	SPRG0018754	424927118514601	42.824167	-118.862778	4,201	U/Y
Page Springs	—	11.52	34	2.40–21.50	1997–98, 2003, 2005, 2007, 2009, 2011–16	SPRG0000055	424814118515801	42.803778	-118.866000	4,241	U/Y
Sodhouse Spring	—	12.27	20	4.50–19.0	1907, 1930–31, 1939–40, 1972–1973, [3]1978–80	SPRG0018735	431559118504001	43.266377	-118.845150	4,100	L/Y

[1]Spring is no longer flowing

[2]Townley (1980)

[3]U.S. Geological Survey (2021)

Discussion

February 3, 2025

Discussion: Feedback Form

February 3, 2025

[*Discussion group language*] Dials for Designing or "Iterating" Model Scenarios

"Dial"

Volume of pumping reductions

Least Reductions | Less Reductions | More reductions | Most reductions

Management areas

15 subareas | 7 subareas | 6 subareas | 0 subareas

Management objective

Some decline (-0.X ft/yr) | Zero decline (0 ft/yr) | Some recovery (>0 ft/yr) | More recovery

Performance indicator(s)

Median/50% of wells | 80% of wells | 90% of wells

Date reductions begin/are fully implemented

Immediate | 10 years | 20 years | 30 years

Timeline to achieve objectives

ASAP | 10 years | 20 years | 30 years | 40 years | 60 years

[*RAC 1/22 language*] Dials for Designing or "Iterating" Model Scenarios

"Dial"						
Volume of pumping reductions [NA]	Least Reductions	Less Reductions	More reductions	Most reductions		
Management areas [spatial extent]	15 subareas	7 subareas	6 subareas	0 subareas		
Management objective [constraint parameters]	Some decline (-0.X ft/yr)	Zero decline (0 ft/yr)	Some recovery (>0 ft/yr)	More recovery		
Performance indicator(s) [stability success metric]	Median/50% of wells	80% of wells	90% of wells			
Date reductions begin/are fully implemented [phasing timeline]	Immediate	10 years	20 years	24 years	30 years	
Timeline to achieve objective[timeline to achieve goal]	ASAP	10 years	20 years	30 years	40 years	60 years

[*RAC 1/22 language*] Dials for Designing or "Iterating" Model Scenarios

"New Dials"

Key desired outcomes
[Constraint parameters]

Discharge to springs and streams

Natural evapotranspiration

Dry domestic wells

“Dial”	
Management areas	7 (4 people, 1 wanted some Dog Mtn wells in Weaver) 15 (2 people)
Performance indicator	50th percentile (5 people)
Phasing timeline	3 years for Weaver and NE Crane, then less over time (1 person) 24 years (1 person) 30 years (1 person) 36 years (1 person)
Timeline to stability	30 years (1 person) 36 years (1 person) 40 years (1 person) Don’t like the goal at all (1 person)

“Dial”	
Streams and springs	Don’t use (5 people)
Natural ET	Don’t use (5 people)
Wells	Don’t use (5 people)
Ag production	Don’t use (addressed in subareas, phasing, overall PTW) (2 people) Lower the % reductions (3 people)
Economic impact	See Ag production

Other ways to deal with these:

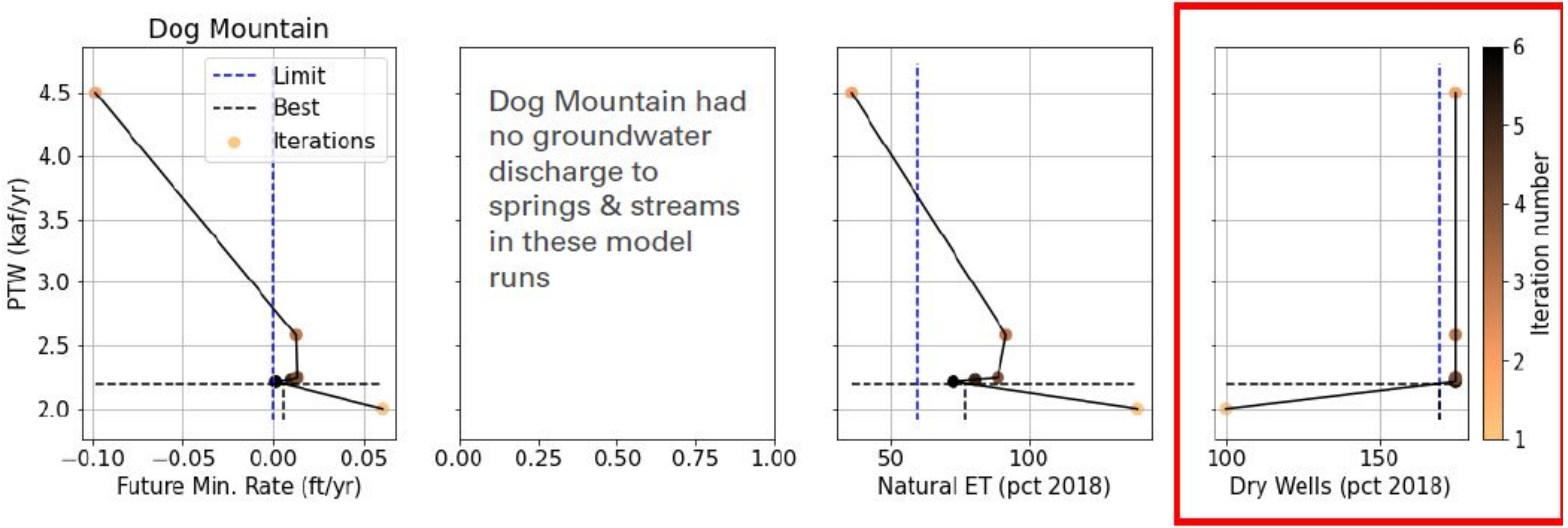
- Well mitigation (dry wells)
- Focus areas for CREP (Protection of streams, springs, GDEs)
- Earlier implementation of reductions (Protection of streams, springs, GDEs)
- Not all subareas in CGWA (ag production)
- Reduce all 2000-2016 water rights by 1AF and 1990-1999 water rights by 0.5AF across all subareas (simpler is better)

“Adaptive Management Element”	
Timing	Every 6 years (2 people; 1 person wanted more steps out to 36 years) Every 3 years based on most recent 6 years (1 person)
Who is involved	People most impacted

Other considerations:

- Use Open ET in adaptive management (in addition to well data)
- Share annual reporting of groundwater pumping and have an annual community conversation (experiences with curtailment, CREP, well fund)
- Change CREP so more users can participate

Dog Mountain
Limited by Dry Wells



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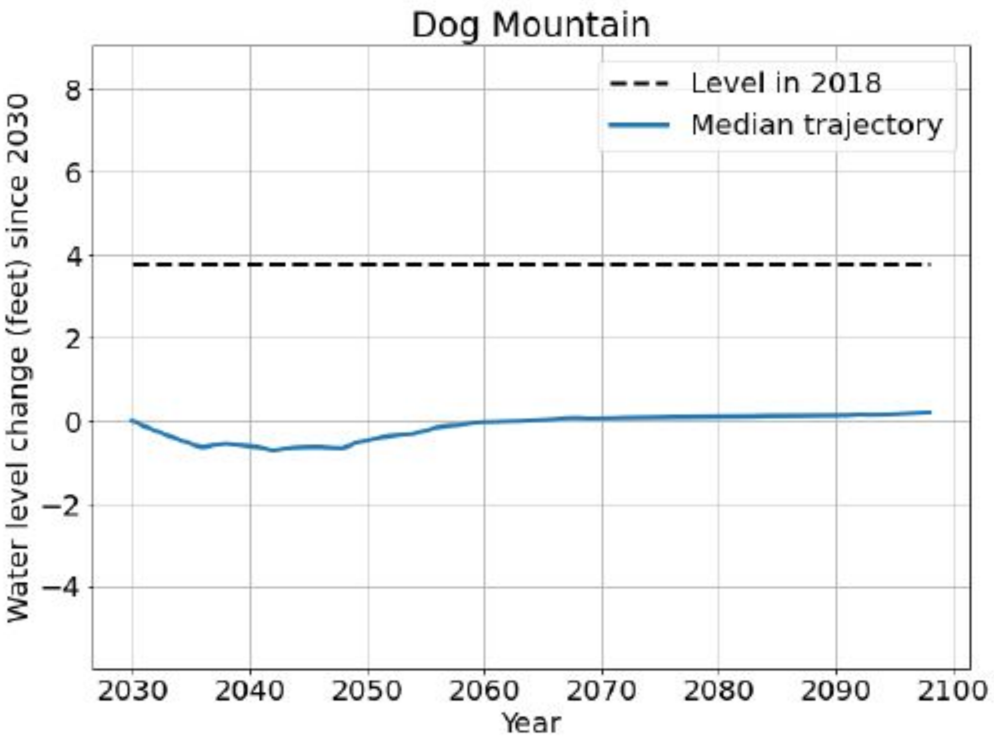
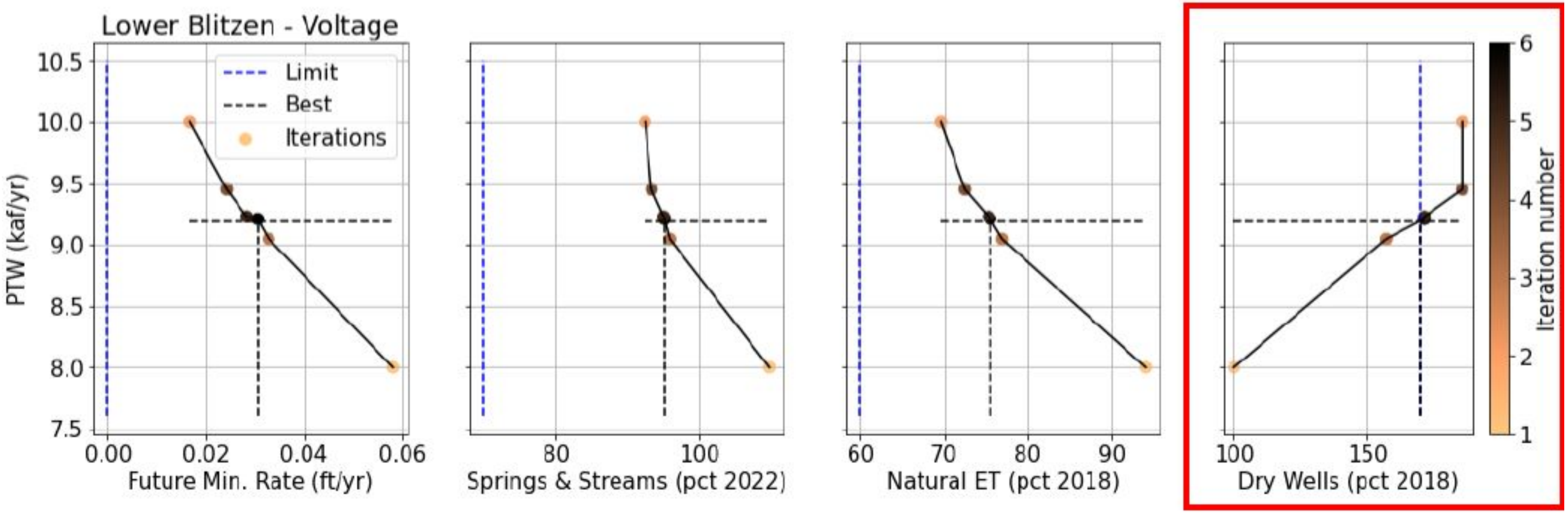
Dog Mountain



Lower Blitzen – Voltage Limited by Dry Wells



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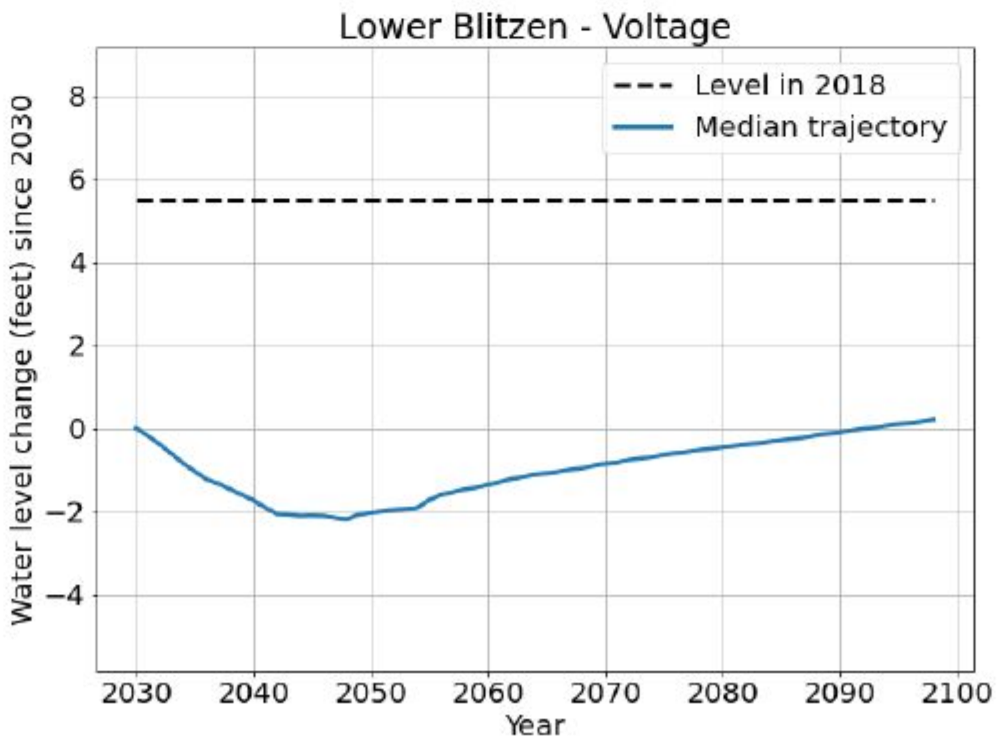
Lower Blitzen – Voltage



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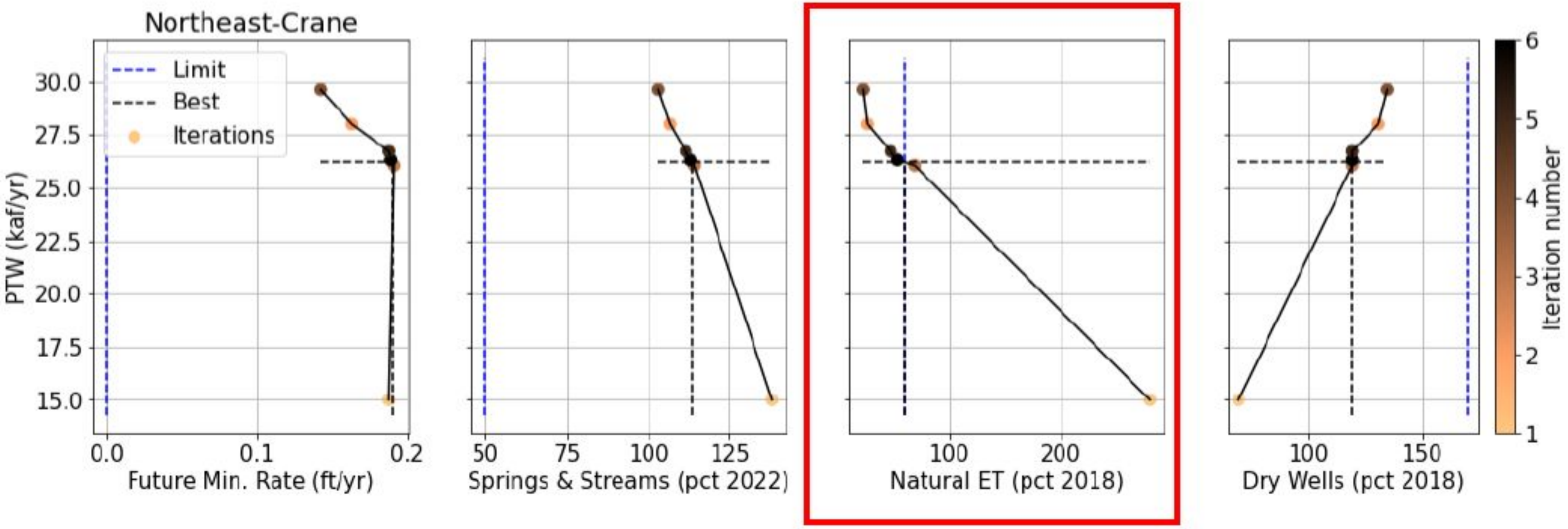
Northeast - Crane
Limited by Natural Evapotranspiration



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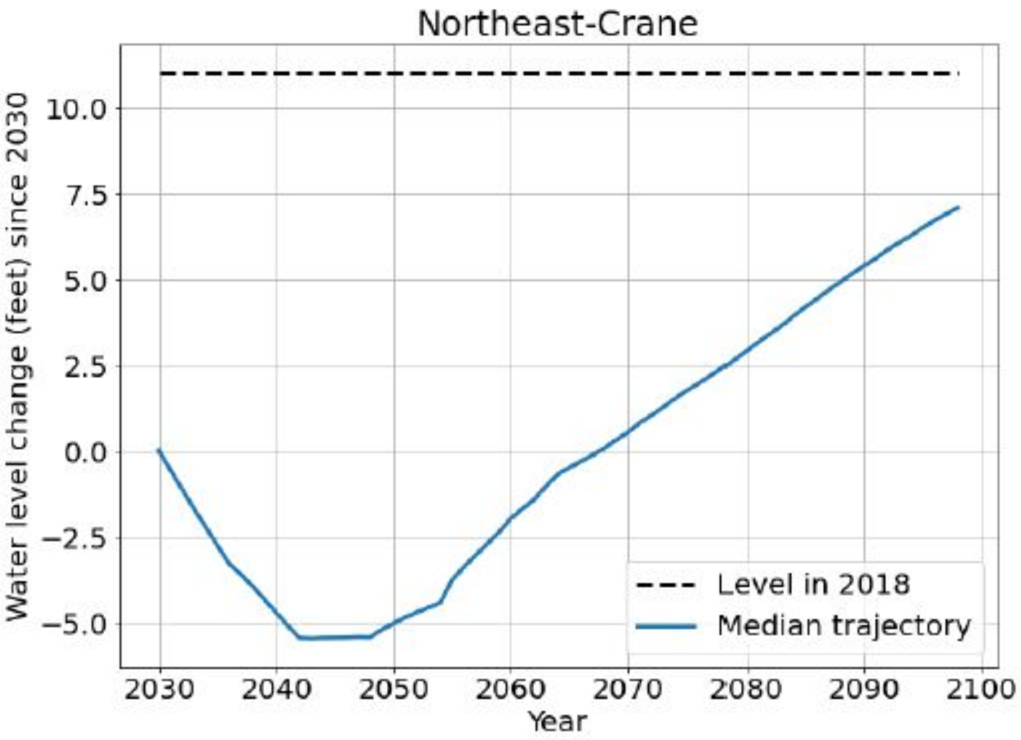
Northeast-Crane



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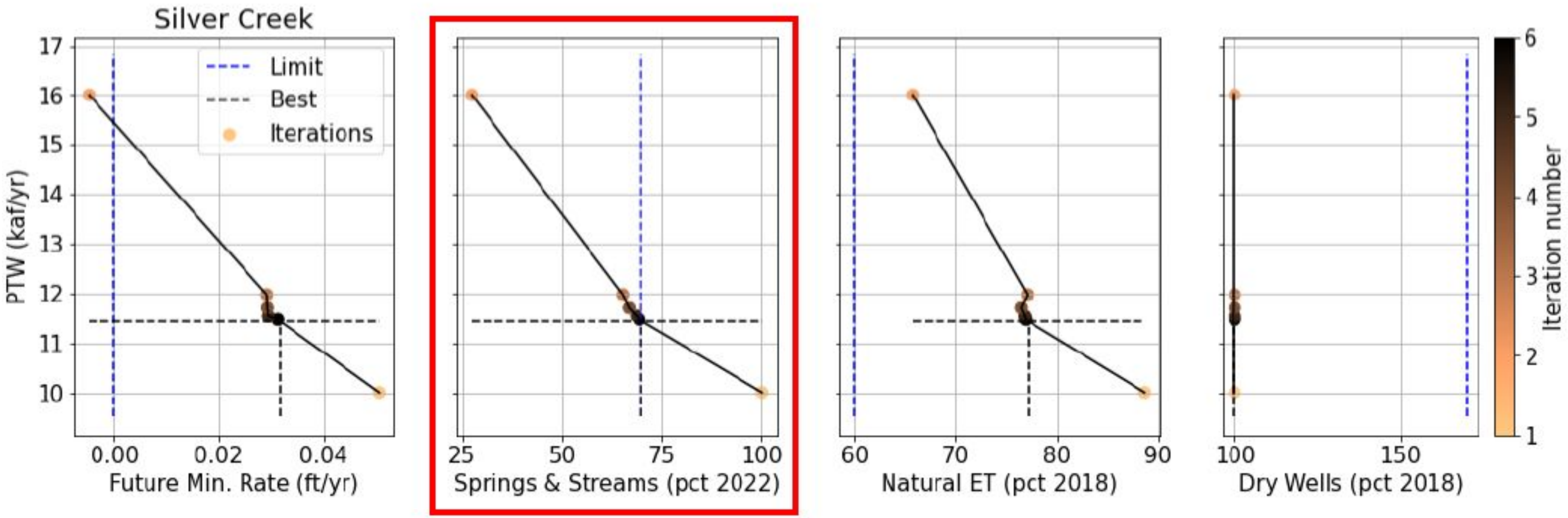
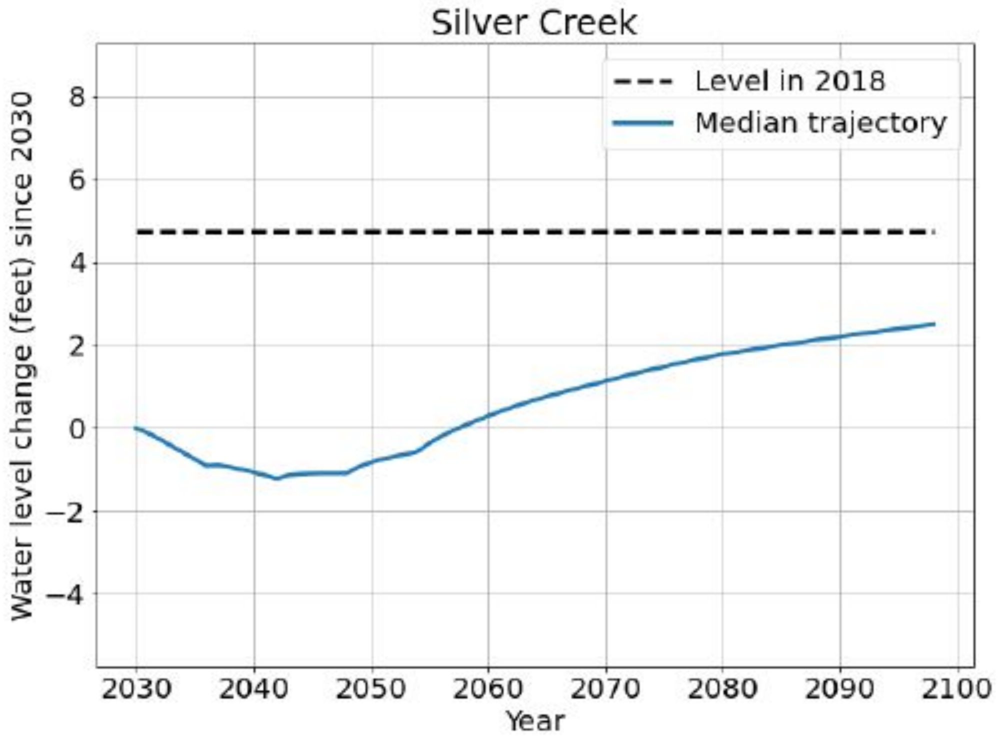
Silver Creek
Limited by Springs & Streams (Double O)

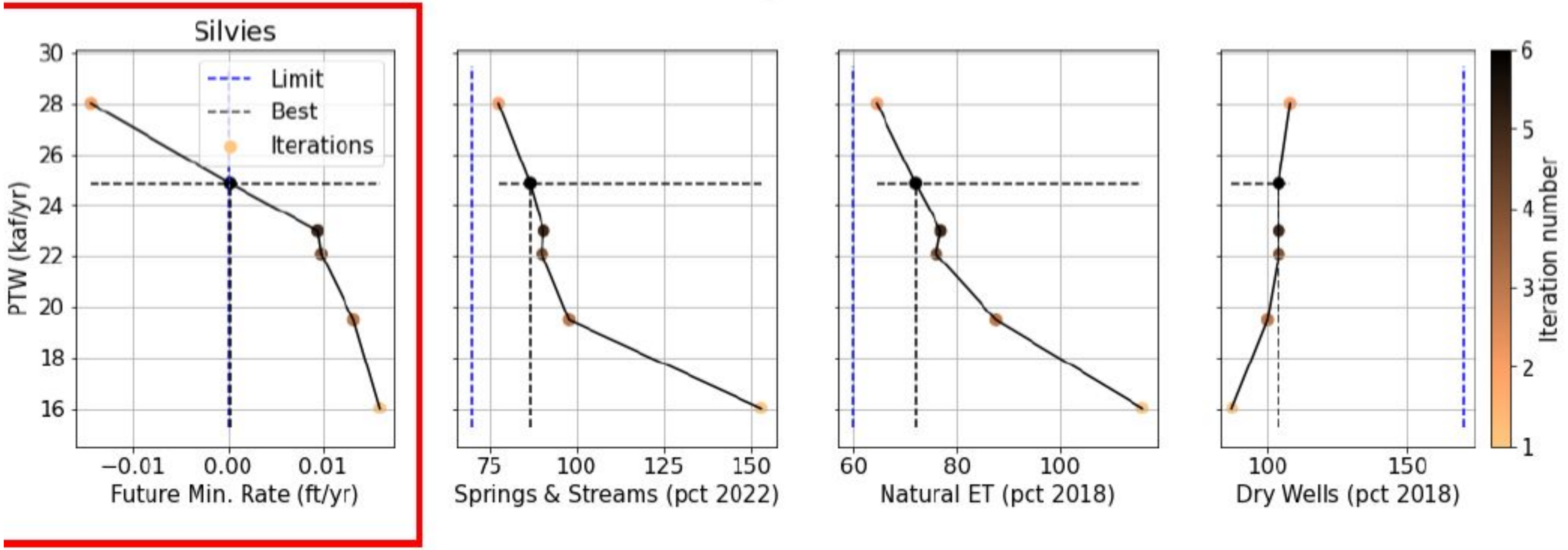


For Silver Creek, groundwater discharge to springs and streams was evaluated in the area around Double O Spring for the purposes of constraining PTW.

Silver Creek



Silvies
Limited by Stabilizing Rate of Decline



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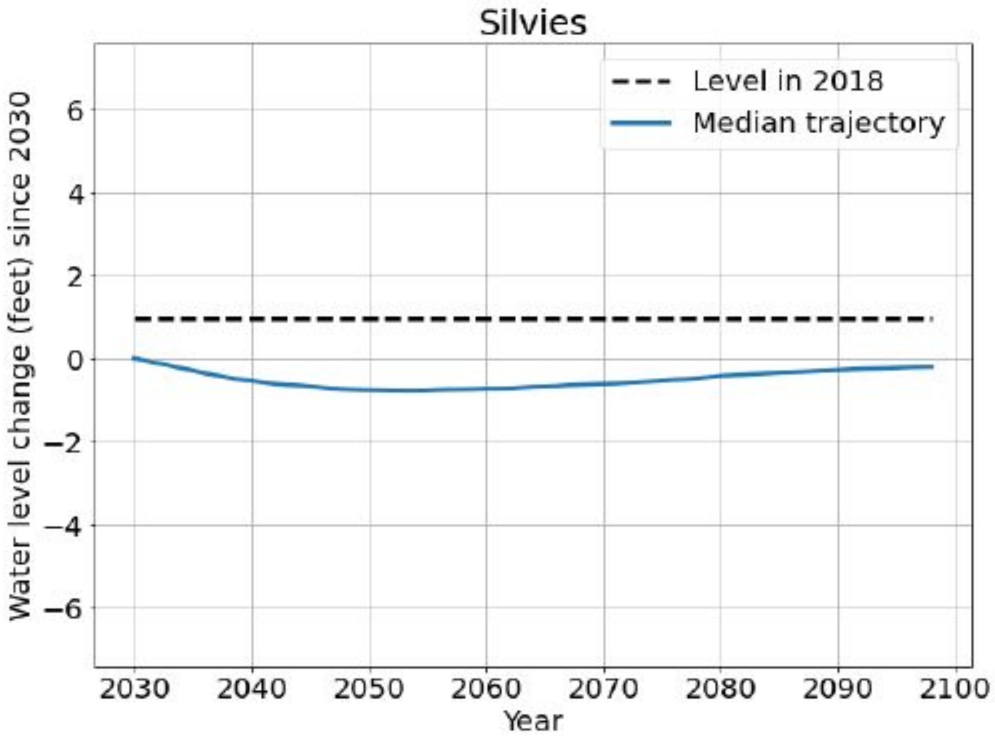
For Silvies, groundwater discharge to springs and streams was evaluated in the area south of highway 78 for the purposes of constraining PTW.

Silvies



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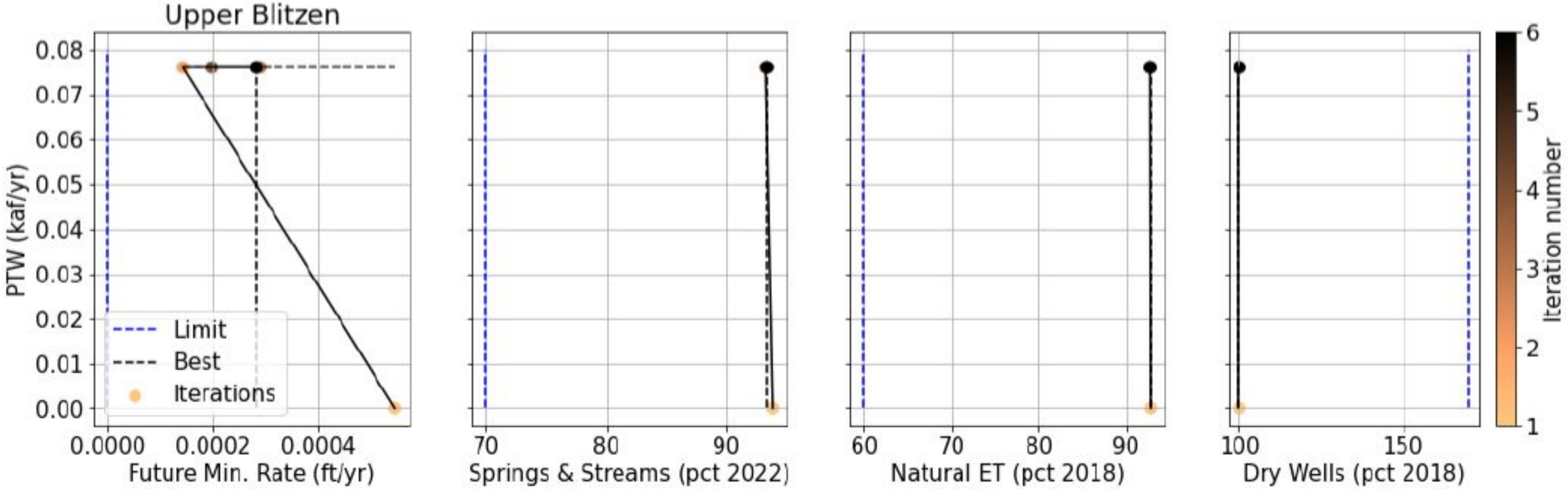
Upper Blizen
Limited by 2018 Pumpage



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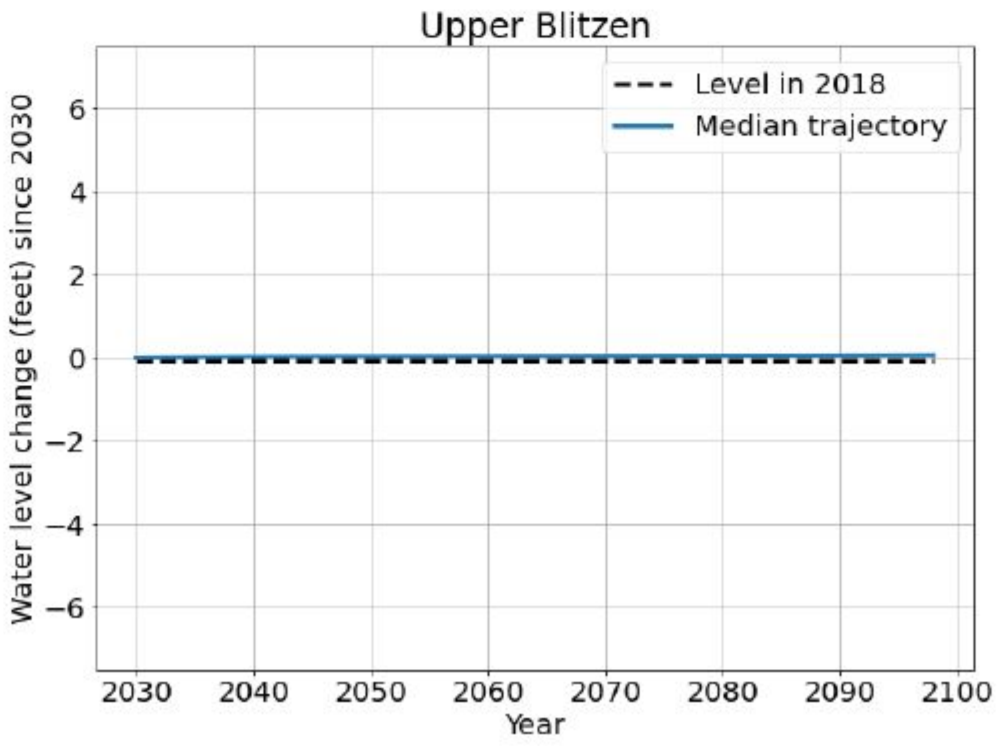
Upper Blitzen



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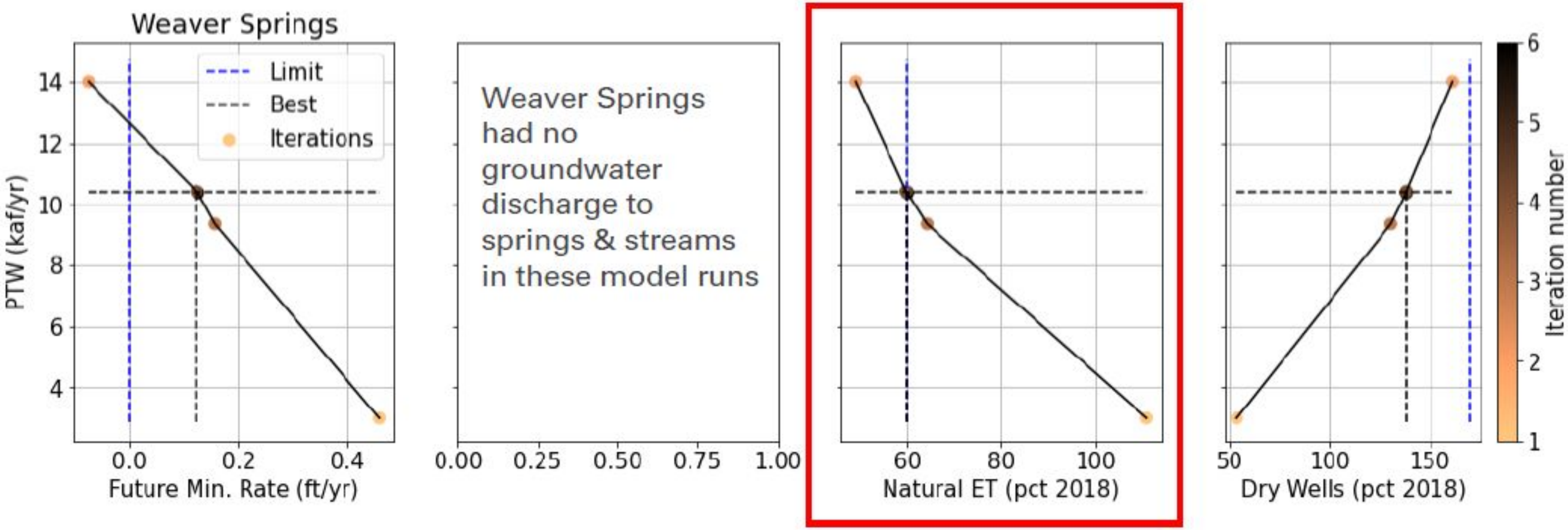
Weaver Springs
Limited by Natural Evapotranspiration



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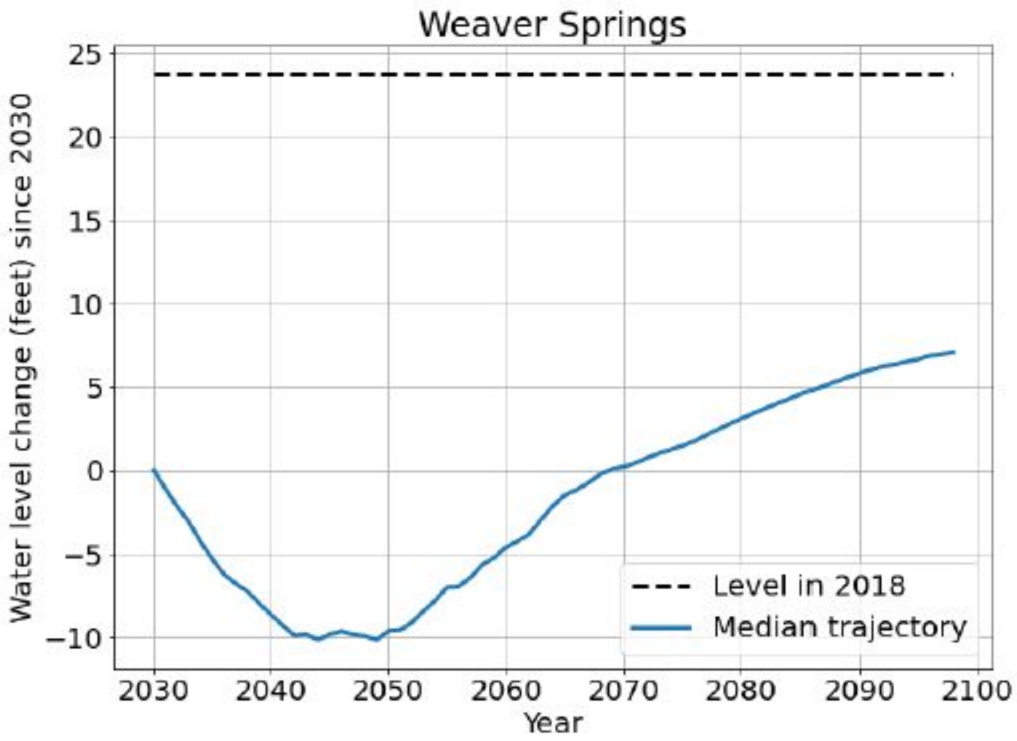
Weaver Springs



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