Harney Groundwater RAC: Discussion Group Materials

Adaptive Management Discussion Guide

Prepared for: Harney RAC Discussion Group
Prepared by: Harmony Burright, High Desert Partnership and Bobby Cochran, Oregon Consensus
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Prepared for Discussion Purposes Only

This discussion guide builds from conversations on Oct 7 and Oct 21, 2024 about indicators of success and adaptive management for groundwater in the Harney Basin. The guide starts putting some of those conversations within the context of "adaptive management" which is a structured decision-making process that involves learning and improving management practices over time. Some of adaptive management is relevant to the OWRD rulemaking, and some of it connect more broadly to groundwater management. The discussion guide has several parts:

- An example adaptive management framework and the relevant rules and statutes defining how OWRD looks at adopted rules on regular cycles;
- An indicators of success worksheet (Appendix A) which builds from the Oct 21 conversation;
- Examples for what "monitoring options" could look like for groundwater levels and trends (Appendix B) and groundwater pumpage and use (Appendix C); and
- A table of potential risks and uncertainties to "watch for" as part of adaptive management (Appendix D).

Relevant Statutes and Rules

ORS 537.780
(3) At least once every three years, the commission shall review any rule adopted under subsection (2) of this section that restricts ground water use in an area. The review process shall include public notice and an opportunity to comment on the rule.

OAR 690-010-0130
(2) A rule adopted by the Water Resources Commission shall:
(b) Contain a provision requiring a periodic review of conditions in the critical groundwater area. The review shall be in sufficient detail to evaluate the continuing need for the critical groundwater area designation and shall occur no less frequently than once every 10 years.

Guiding Questions:

- What are the benefits or drawbacks to an adaptive management approach? What would adaptive management allow us to do that we would not otherwise be able to do?

- What are the uncertainties/risks that we need to be aware of and potentially manage for?
- What if things don't work out the way we expect them too? How would we know? How can we proactively prepare to make adjustments?
- What ability does the Department have to support adaptive management? What are the Department's limitations?
- Are there existing examples of adaptive management in OWRD or other agency rules that we can draw from?
- What opportunities are possible at the 3 year and 10 year review periods to evaluate success and make adjustments? What information will be considered? How can the community be involved at these intervals?

Adaptive Management

Adaptive management is a cycle and process for adjusting management based on changing information, evaluation and learning. The steps of adaptive management include are described in Table 1 below.

Figure 1. Adaptive Management Cycle Example

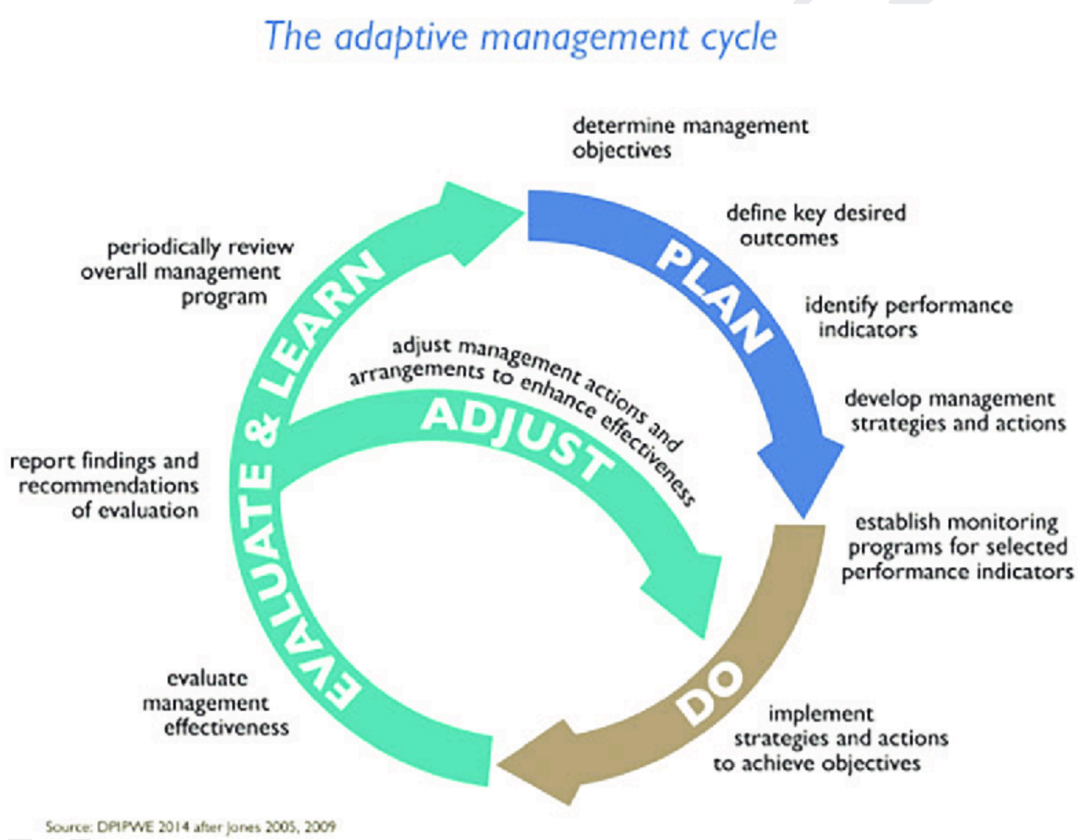
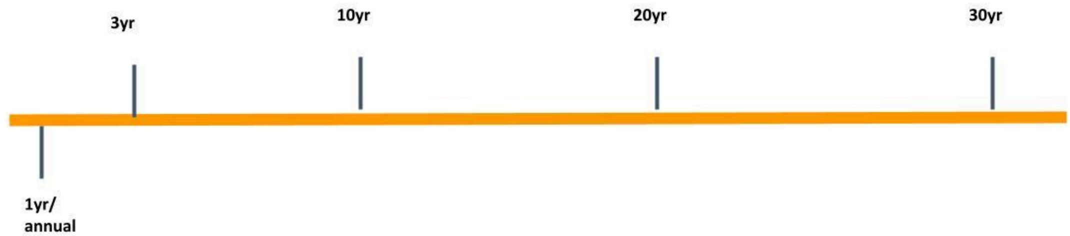


Figure 2. Adaptive Management Blank Timeline


3yr
10yr
20yr
30yr
1yr/
annual

Appendix A: Indicators of Success Worksheet

List of Potential Indicators of Success

"One overarching theme has remained; the Harney Community Based Water Planning Collaborative wants a sustainably managed supply of quality water for people, the economy, and the environment." Community Based Water Plan pg. 58

Table A. Includes a list of potential indicators of success that have been identified in various meetings. The highlighted indicators are those that are most likely within the scope of the rulemaking and may be addressed in rule language. Please review the list to identify any potential indicators. What is missing? What would you add? Add thoughts and considerations to the indicators. Mark 4-5 indicators that are the highest priority for you.

Table A. Potential Indicators of Success

Potential Indicators of Success	Considerations	Priority
Hydrology		
Rate of decline decreases and eventually stabilizes (rate of decline = 0) and/or recovers over a specified period of time (TBD) by geography		
Magnitude of decline does not exceed some groundwater elevation or level in a particular well or geography [from some start year X and measurement year Y]		
Prevalence and effect of "comingling" wells on groundwater quantity/movement of groundwater is understood and minimized		
Recharge to groundwater is maximized		
Groundwater Use/Users		
Groundwater pumping stays within authorized/"sustainable" limits (direct measurements)		
Groundwater pumping and use stays within authorized/"sustainable" limits (indirect measurements)		
Near-term and long-term impacts to exempt (domestic and stockwater) wells are understood and minimized		
Exempt well users (domestic and stockwater) have long-term water security		
Community water systems have long-term water security		
The footprint of groundwater irrigated agriculture is "sustainably" maximized relative to available supplies in different areas of the basin		
There is no unauthorized or illegal water use in the basin		
Additional groundwater development is limited		
Environment and Recreation		
Near-term and long-term impacts of groundwater declines to spring discharge are understood and minimized		

Near-term and long-term impacts of groundwater declines groundwater contributions to streams are understood and minimized		
Groundwater dependent ecosystems are protected, restored, and maintained		
Overall ecological health is maintained	What aspects of ecological health are specifically tied to groundwater?	
Thriving bird and wildlife habitat and populations are maintained	May be more closely tied to surface water	
Vibrant opportunities to hunt and fish are maintained	May be more closely tied to surface water	
A thriving recreation economy is maintained	May be more closely tied to surface water	
Groundwater Conditions/Quality		
Groundwater quality does not deteriorate due to groundwater level declines		
Thermal properties of groundwater are not negatively affected by groundwater declines		
Abandoned and poorly constructed wells are identified and addressed to reduce impacts to groundwater quality (including potential for comingling)		
Economy and Community		
Near-term and long-term impacts to the local economy are minimized		
Community cohesion and wellbeing are maintained		
System Dynamics Affecting Success		
Impacts of management actions between different geographies (how actions in one area have the potential to affect another area) are understood and accounted for		
Lag time of management actions on outcomes (when we “observe” impacts) are understood and accounted for		
Upland management and impacts to water budget (recharge and discharge) are understood and accounted for		
Changes in climate and impacts on water budget (recharge and discharge) are understood and accounted for		
Larger economic drivers of change (state, regional, national, international) are identified and considered		

Appendix B: Monitoring and Measuring Success –

Groundwater Level Trends (Rate and Magnitude of Change)

Dataset: Groundwater Level Measurements

DRAFT High-Level Indicator(s) of Success:

- Rate of decline decreases and eventually stabilizes (rate of decline = 0) and/or recovers over a specified period of time (TBD) by geography
- Magnitude of decline does not exceed some groundwater elevation or level in a particular well or geography

Use Considerations: Groundwater level data will be the primary indicator of whether management objectives are being achieved. Groundwater level may be used to curtail water use in individual wells that have exceeded decline conditions set in their permit.

Data Collection:

	OWRD groundwater level measurements	**OWRD observation wells**	**Permit condition groundwater level measurements**	**Other options?**
Overview	Wells primarily used for other purposes that are measured by OWRD as a part of ongoing monitoring	Wells drilled for the specific purpose of monitoring groundwater levels	Wells with permit conditions requiring annual measurements	
Who collects?	OWRD	OWRD	Water Professionals	
Who is responsible?	OWRD	OWRD	Water Professionals	
Number of wells measured/ monitored?	Available (filling in soon)	Available (filling in soon)		
Frequency of measurements?	Quarterly	Quarterly	Spring measurements (before pumping begins)	
Where is data stored?	OWRD Groundwater Information System (GWIS)	OWRD GWIS	Submitted annually to OWRD and stored in GWIS	
What is the quality assurance procedure?	Follows USGS procedures			

Monitoring Network Considerations

- What is OWRD’s current groundwater level monitoring network? What are the gaps in the existing network?
- What are the considerations for well selection (inclusion/exclusion criteria)?
- What are OWRD’s authorities/limitations for measuring groundwater levels in wells?
- Are there opportunities to expand the monitoring network beyond the existing network? How would this be accomplished?
- How should the different well depths be accounted for in the monitoring network?
- What is the optimal monitoring network for each geography/subarea?
- Should data from all wells be included in an analysis or data from a subset of wells (e.g., “sentinel wells” or “representative” monitoring sites)?
- How can we ensure that the monitoring network is sufficiently representative?
- Under what conditions would a well be dropped from the monitoring network?
- How can the monitoring network be adapted over time to make sure monitoring leads to effective management?

Analysis

- How should the different well depths be accounted for in analysis?
- How often should data be analysed?
- What summary statistics should be used? All wells show a particular result, some percentage of wells show a particular result, mean of wells show a particular result, or
- When calculating “rate of change” how much data is necessary to make this determination over time?
- When calculating “magnitude of change” what starting point should be used?
- Is it possible to set a groundwater level that cannot be exceeded in an individual well or geography?
- What time period should be used to assess whether groundwater levels in a well are “stable” (e.g., 3 years, 5 years, 10 years)?
- Is it possible to assess the relationship between groundwater levels and impacts to groundwater dependent ecosystems and exempt users?

Reporting and Communication

- When and how should analysis of data be publicly communicated?

Adaptive Management

- At what frequency should analyses be used to assess progress and inform potential adjustments?
- What are the mechanisms to change management actions based on monitoring results?

Rules

- What level of specificity needs to be captured in rule with regards to specifying the approach to monitoring? How is this handled in other basins?

Appendix C: Monitoring and Measuring Success – Groundwater Pumping and Use

Dataset: Groundwater Pumping and Use

DRAFT High-Level Indicator(s) of Success:

- Groundwater pumping levels stay within authorized/"sustainable" limits (direct measurements)
- Groundwater pumping and use stays within authorized/"sustainable" limits (indirect measurements)

Use Considerations: The relationship between groundwater pumping and use and changes in groundwater levels will inform what amount of groundwater use can be sustained while achieving the management objectives. Increasing accuracy of these assessments will improve the effectiveness of management actions over time. Measuring groundwater use can also improve individual management and be used to ensure that groundwater users do not use more than their legally entitled amount.

Data Collection

- OWRD has authority under ORS 540.435 to require measurement and reporting and the RAC has discussed and reached a preliminary recommendation to delineate the boundary for this requirement to the entire Harney Basin (known as a Serious Water Management Problem Area).
- Acceptable methods for collecting water use data are specified in OAR 690-085-0015.
- The Division 512 rules may specify who is required to install measuring devices, specifications for the types of measuring devices and annual reports, and timelines for implementation (see OAR 690-085-0020).
- How often should water use be measured and recorded by water users? How often should it be transmitted to the Department?
- What lessons have been learned or best practices have been gleaned from water use measurement and reporting in other basins (Walla Walla, Umatilla)?
- What are the requirements for individual water users? How will these requirements be enforced? What are the consequences of not meeting the requirements?
- What happens if a water user is unable to consistently meet the requirements? Can there be any flexiblity?
- What are the quality assurance/quality control measures for reported water use data?
- What is the estimated investment associated with any requirement to measure water use?
- Can OpenET be used to estimate groundwater use and pumping in addition to or in lieu of measurements of groundwater pumping?
- How can accuracy of OpenET be assessed and improved over time?

Monitoring Network Considerations

- Will all water users (including exempt users) be required to measure and report their water use?
- Will all geographies be required to measure and report their water use on the same timeline/timeframe? Will the same methods be required for each geography or will different methods be considered/allowed? Will certain areas be prioritized over other areas?

Analysis

- How does the Department propose to use reported groundwater use data for management purposes?
- How can groundwater pumping data be most useful and effective?
- What are the benefits and drawbacks of measured and reported groundwater use from individual users versus using a platform like OpenET?

Reporting and Communication

- When and how should analysis of reported water use data be publicly communicated?
- Will the Department analyze and present OpenET data? At what frequency?

Adaptive Management

- At what frequency should analyses be used to assess progress and inform potential adjustments?
- How can groundwater pumping and use data be used to inform management actions?

Rules

- What level of specificity needs to be captured in rule with regards to specifying water use measurement and reporting? How is this handled in other basins?
- How can OpenET be incorporated into rules?

Appendix D: Identifying and Managing for Risk and Uncertainty

Table D.1 below is designed to understand how some of the uncertainties in Harney groundwater management can be articulated in terms of risk. Not all uncertainties pose a risk. Risk is a probabilistic estimate of how likely an event or exposure will be (e.g., low, moderate, or high likelihood) and the impact of that event occurring.[1] As risk managers, one might pay attention to moderate and high likelihood events with significant impacts, but not worry as much about low likelihood and low impact events. Table D.1 is intended to guide discussions around A) what are the risks that are most important to manage for, and B) are there approaches to reduce or manage for those risks. Table D.2 is intended to guide discussions around uncertainties that, if they were reduced, could improve management actions but may not pose a risk..

Table D.1. Risk Matrix

Risk	Likelihood	Impacts	Potential Management Actions to Reduce or Manage Risk	Monitoring and Thresholds for Action
The amount of necessary reductions in groundwater pumping are underestimated and more significant pumping reductions are needed	Moderate?	It takes longer to achieve reasonably stable groundwater levels which may negatively affect some exempt users and groundwater dependent ecosystems	Monitor groundwater level conditions and groundwater use Consider adjustments to permissible total withdrawals in subareas at established intervals (allow for a “ramp up”)	
The amount of necessary reductions in groundwater pumping are overestimated in some places and pumping reductions are too aggressive	Moderate?	Negative economic ramifications to individuals and the local economy and community Difficult to “undo” or “reverse” impacts	Monitor groundwater level conditions and groundwater use Consider adjustments to permissible total withdrawals in subareas at established intervals (create an “off ramp”)	
The wells initially selected for the monitoring network	Moderate?			

[1] Available at https://web.pdx.edu/~rueterj/CCC/v7-Rueter-chap9.pdf.

are not sufficiently representative of conditions				
Fallowing irrigated acres without a transition plan in place can result in other environmental problems (weeds, reduced quantity and quality of habitat, erosion, dust, etc)	High?			
Declining groundwater levels continue to impact shallow exempt wells, including domestic and stockwater wells in some parts of the basin	High?		Understand the geographic distribution of impacts Estimate/track current and future impacts to domestic wells in each subarea	
Some parts of the basin do not stabilize or recover as quickly as other parts of the basin	High?			
Declining groundwater levels continue to impact springs and other groundwater fed ecosystems in some parts of the basin	High?			

Table D.2. Uncertainty Matrix

Uncertainty	Expected Condition	Potential Deviations	Impact(s) of Uncertainty	Information and Actions to Reduce Uncertainty
Factors affecting groundwater levels/supply in addition to pumping rates (precipitation/recharge, upland management, etc)				
Variability in precipitation patterns and the potential impacts to groundwater recharge over time	Precipitation patterns will not deviate significantly from historical patterns/averages	1. There is much more precipitation than average in the future 2. There is much less precipitation than average in the future	The amount of precipitation to the basin controls water available for groundwater recharge, and affects how much water is available for groundwater pumping	
Effect of upland management on surface water runoff and groundwater recharge in the near-term and long-term (effect of forest fires)				Monitor surface water flows over time (additional stream gauges?)
Effect of upland management on groundwater recharge in the near-term and long-term (juniper encroachment and management)				Monitor range and density of juniper over time

Effect of declining groundwater levels on native vegetation (phreatophytic communities)				
Effect of changing climate on groundwater use by crops				
Effect of changing climate on the growing season and types of crops				
Current and future extent of impacts to exempt wells				
Current and future extent of impacts to springs and other groundwater fed ecosystems				