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The Economic Impacts of Groundwater Management in Harney County, Oregon

Prepared for: Oregon Consensus, Oregon Water Resources Department, and Division 512 RAC

ECOnorthwest

920 SW 6th Ave • Suite 1400 • Portland, OR 97204 • 503-222-6060

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That assistance notwithstanding, ECOnorthwest is responsible for the content of this report. The staff at ECOnorthwest prepared this report based on their general knowledge of the economics of agriculture, recreation, amenities, and regional economies. ECOnorthwest staff contributing to this study included ***Nathanial Trull and Mark Buckley.*** ECOnorthwest also relied on information derived from government agencies, private statistical services, the reports of others, interviews of individuals living in and familiar with Harney County's economy, or other sources believed to be reliable. ECOnorthwest has not independently verified the accuracy of all such information and makes no representation regarding its accuracy or completeness. Any statements nonfactual in nature constitute the authors' current opinions, which may change as more information becomes available.

For more information about this report please contact:

Nathanial Trull
trull@econw.com
ECOnorthwest
503-222-6060

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Executive Summary

Why This Analysis Was Done

The Oregon Water Resources Department (OWRD) is evaluating new rules to reduce how much groundwater is pumped in Harney County and must consider fiscal impacts. The goal of the rules is to make sure that groundwater levels are sustainable for the future. The rules are being informed by a Rules Advisory Committee (RAC). RAC members requested that OWRD engage an economist to do a more robust fiscal impact analysis, especially to inform potential groundwater management scenarios. OWRD retained ECOnorthwest to do that work. ECOnorthwest's analysis looks at how proposed rules could affect farmers/ranchers, the local economy, government tax revenues, and ecosystem services over the next 30 years. ECOnorthwest paid particular attention to how groundwater management by subarea, or over time might or might not change estimated fiscal impacts.

Assumptions in the Proposed Rules

OWRD provided ECOnorthwest with their proposed groundwater management scenario, which would reduce groundwater pumping by 33.6 percent across seven subareas in Harney County. These cuts would happen in phased steps over a 24-year period and aim to achieve long-term groundwater stability in 30 years. The fiscal impact analysis compares what things are like now (called "pre-policy") with what things could look like after the full implementation of proposed groundwater use reductions (called "post-policy").

Key Takeaways from Analysis

Brief takeaways from each portion of the analysis are presented in the following sections.

Harney County's Economy is Dependent on Agriculture

ECOnorthwest's analysis found that Harney County's economy is reliant on agriculture within the county, but also fairly isolated from other economic opportunities. Today, agriculture represents 22 percent of total economic output.[1] The percent reduction in groundwater use, correlates strongly to a similar percent reduction in the value of agricultural production and total economic output. Different configurations of subareas, or different scenarios for timing implementation, did not significantly change this finding.

[1] IMPLAN (2025). https://implan.com/.

Agriculture

Groundwater is critical for growing crops like alfalfa and supporting livestock in Harney County. This analysis found:

- Based on groundwater data from 2018, about 133,000 acre-feet of water are pumped each year to support around 48,000 acres of irrigated alfalfa/hay and $123 million (in 2024 dollars) in total agricultural revenue (including livestock production) in the areas affected by the proposed groundwater management scenario.
- If the proposed rules are fully implemented, groundwater use would drop by 46,000 acre-feet per year at the end of 24 years, reducing irrigated land to 32,000 acres.
- As a result, total agricultural revenue could fall to $82 million per year—a $41 million decrease between today and 30 years from now (in 2024 dollars).
- Livestock operations would be hit hard too, since less locally grown alfalfa would be available for feed. Both crop and livestock sector impacts are included in the numbers above combined as "agriculture".
- The change in economic value would happen in steps as groundwater use reductions are phased in, with an estimated $8 million drop in agricultural value after each six-year reduction in groundwater use.

The Local Economy

Agriculture plays a big role in Harney County's economy. ECOnorthwest used an economic model called IMPLAN to estimate how changes in agriculture would ripple through the economy:

- Today, agriculture supports about 1,020 local jobs and generates $186 million in total economic activity each year.
- If the proposed rules are fully implemented, between 160 - 320 of those jobs could be lost and annual economic activity could shrink by $22 - $61 million (in 2024 dollars) at the end of 30 years.
- Jobs would be lost not only on farms and ranches, but also in businesses that supply goods and services to them (like equipment repair, feed suppliers, and fuel providers).
- Even local shops, grocery stores, and restaurants could feel the impact as families spend less because of reduced employment and labor income.

Local Government Revenue (Property Taxes)

Lower agricultural production means land is worth less for property tax purposes, especially land that loses access to irrigation water.

- Today, the affected land's assessed value across Harney County is worth about $57 million.

- If the proposed rules are fully implemented, the land's assessed value could drop to $45 million.
- That would mean $146,000 less in yearly property tax revenue for Harney County—a 1.3 percent decrease at the end of 30 years.
- Local schools could lose the most (about $66,000 less in yearly revenue), followed by the county's general fund ($55,000) and hospitals ($24,000).

Nature, Recreation, and other Ecosystem Services

Reduced groundwater use could benefit the streams and springs that create economic value by supporting wildlife and opportunities for outdoor recreation.

- Groundwater feeds important natural springs, such as Double-O Springs, which help keep the Malheur National Wildlife Refuge healthy.
- The Refuge supports birds, wildlife, and wetland habitats—and attracts visitors for birdwatching. In the broader region, there is also hunting and fishing.
- These outdoor activities support local businesses and bring significant economic activity to the region.[2]
- In this analysis, there was not enough information to quantify the likely changes in the economic value of ecosystems and recreation as a direct result of fully implementing the rules. However, the potential change in economic value is likely smaller than the proposed negative impacts on agriculture and associated businesses based on currently available data.

Final Thoughts

The proposed rules to reduce groundwater use are aimed at protecting water supplies for future generations of farmers, residents, and ecosystems. Significant reductions in groundwater use, either because of dwindling supplies or due to rules, will have economic effects on farmers, ranchers, small businesses, and local government revenues that rely on agriculture. Those economic impacts result from **A)** a close connection between viable agriculture and access to water, **B)** the reliance of the Harney County economy on agriculture, and **C)** the relative lack of other current, economic options for the community. On the other hand, the proposed rules should help protect local springs and ecosystems that are vital to Harney County's wildlife, recreation economy and quality of life.

Next Steps

For Harney County, given current scarcities and trends, less water means less alfalfa production. The economic future of Harney County will rely on how transitions from today to

[2] Earth Economics. "Economic Analysis of Outdoor Recreation in Oregon: 2022 Update." (2024).

the future are supported. Based on ECOnorthwest's analysis and past experience, some strategies policymakers and community leaders could explore include:

- Understanding how economic development can tie into the phased steps in groundwater use reductions (i.e., there is time to support transitions in the next 24-30 years).
- New types of farming that use less water (different crop rotations, dryland farming or deficit irrigation).
- Programs that pay landowners to use their land in new ways (like Conservation Reserve Enhancement Program, wildlife habitat or grazing/energy).
- Financial and other support for small businesses and workers affected by the changes.

1. Analysis Overview

Introduction

ECOnorthwest (ECO) was brought on to conduct an analysis to understand the potential economic impacts to agriculture (crop and livestock), the local economy, local government revenues, and local ecosystem services of a proposed groundwater management scenario. On March 5th, 2025, the Oregon Water Resources Department (OWRD) sent ECO a proposed groundwater management scenario that reduced groundwater pumping across seven subareas[3] by 33.6 percent to achieve durable groundwater level stability after 30 years. Using publicly available agricultural parcel data from Jaeger et. al., (2024), ECO analyzed changes to agricultural production, agricultural revenues, and local property tax revenues across a baseline scenario (hereafter "pre-policy") and policy implementation (hereafter "post-policy") scenario.[4] Agricultural revenues in both scenarios were used as inputs to IMPLAN to model the potential economic impacts to the Harney County economy. In addition to the economic effects on agriculture and local government, ECO conducted a qualitative analysis to understand the potential effects of groundwater management on local ecosystem services (especially springs, streams, and outdoor recreation). Working with Oregon Consensus, ECO conducted interviews with local farmers, agricultural businesses, local government agencies, wildlife managers, and other stakeholders to inform this analysis and ground truth assumptions.

Analytical Framework

The proposed groundwater management scenario that OWRD sent to ECO proposes a 33.6 percent reduction in groundwater pumping compared to 2018 modeling across seven subareas in Harney County. The proposed reductions are to be phased in across a 24-year period to achieve durable groundwater stability after 30 years. The groundwater pumping data was given to ECO for each well across the area of interest for 2018 pumping-levels (e.g., pre-policy scenario) and the end of 30-year implementation (e.g., post-policy scenario).

This analysis measures the potential effects of the proposed groundwater management scenario across a 30-year period (example: 2023 - 2052). The beginning of the 30-year period is referred to as "pre-policy" (e.g., the period before curtailment begins) and the end of the period is referred to as "post-policy" (e.g., full policy implementation). The quantitative portion of this analysis estimates the pre-policy conditions for agricultural production, local economic impacts, and local fiscal impacts (e.g., property tax revenues) and the post-policy

[3] Subarea names: Northeast-Crane, Silvies, Silver Creek, Weaver Springs, Lower Blitzen-Voltage, Dog Mountain, and Upper Blitzen.

[4] Jaeger, William K., J. Antle, Stephen B. Gingerich, and Daniel Bigelow. "Advancing sustainable groundwater management with a hydro-economic system model: Investigations in the Harney Basin, Oregon." *Water Resources Research* 60, no. 11 (2024): e2023WR036972.

conditions for the same three impact categories. The differences between these two conditions are the estimated impacts of the proposed groundwater management scenario. Details of each portion of the analysis are discussed in the following sections.

2. Agricultural Analysis

Assumptions

Agricultural production (specifically crop production) was estimated using agricultural parcel data from Jaeger et. al., (2024) that included wells, total parcel acres, water application rates, hay crop yields, crop price, and input costs. Crop yields and crop prices were informed by interviews with eight local farmers. All farmers on the RAC, and those on the RAC Discussion Group, were invited for an interview. Eight, representing a mix from different subareas and large and small farms, participated and provided feedback. Alfalfa was used as the representative hay crop for the area. Updated alfalfa yields (see Exhibit 1) were derived from self-reported averages from farmers across five of the seven subareas.[5] To update the alfalfa price, a five-year average (2019-2023) of Oregon alfalfa prices from the USDA-National Agricultural Statistics Service (NASS) was used and inflated to 2024-dollar values.[6] The alfalfa price used in the analysis was $273 per ton. The updated agricultural parcel information was joined with the groundwater pumping data to create a full dataset.[7]

Another component of measuring agricultural value in Harney County is the value of livestock production. Due to insufficient data specific to livestock production in each of the seven subareas, an average of livestock sales across Harney County—inflation-adjusted to 2024 dollars—from the 2017 and 2022 USDA Census of Agriculture is used and is separate from the crop production estimation.[8] [9] The pre-policy value of livestock production used in the analysis is approximately $65 million. To estimate the potential effect of the proposed groundwater management scenario, a simplifying assumption was used. Alfalfa/hay is an important input to livestock production and preliminary analyses revealed that groundwater reductions had approximately a 1:1 relationship with reductions in alfalfa/hay production (e.g., a 10% reduction in groundwater use would result in a 10% reduction in hay production). This 1:1 relationship is thus passed through to the livestock production value[10]. Dairy and

[5] There was not a representative farmer for Upper Blitzen, so an average yield of the other subareas was used. For the Weaver Springs subarea, the Dog Mountain average yield was used as Weaver Springs was a portion of the larger Dog Mountain subarea in a previous groundwater management iteration.

[6] U.S. Department of Agriculture, National Agricultural Statistics Service, *Quick Stats*, accessed [February 18, 2025], https://quickstats.nass.usda.gov/.

[7] After the join, 97 percent of the parcels matched to wells and 94 percent of wells matched to parcels. The unmatched data does not significantly impact results or conclusions of the analysis.

[8] U.S. Department of Agriculture, National Agricultural Statistics Service. *2017 Census of Agriculture: County Profile, Harney County, Oregon*. Washington, DC: USDA. https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Oregon/cp41025.pdf

[9] U.S. Department of Agriculture, National Agricultural Statistics Service. *2022 Census of Agriculture: County Profile, Harney County, Oregon*. Washington, DC: USDA. https://www.nass.usda.gov/Publications/AgCensus/2022/Online_Resources/County_Profiles/Oregon/cp41025.pdf

[10] During the April 15, 2025 RAC meeting, feedback was provided that this 1:1 may overestimate the impact to livestock production from groundwater reductions. It may be that some farmers transition from alfalfa to irrigated or dryland farming, increasing the total head of cattle in Harney County. Thus, groundwater reductions

livestock operations are the primary drivers of alfalfa demand in the US.[11] Reductions in local supplies of alfalfa made lead to producers purchasing alfalfa from external markets—increasing operating costs and reducing livestock production. The estimated value of livestock production after full implementation of the groundwater management scenario is $42 million. The $65 million and $42 million values of livestock production are used in conjunction with the crop production analysis. Another simplifying assumption is made to account for the portion of on-farm alfalfa/hay production that does not go to market and is instead used to feed livestock. According to local farmer interviews, between 5 and 35 percent of on-farm alfalfa production goes to the livestock operation. This analysis uses an average value of 20 percent that goes to livestock production and reduces the revenue from alfalfa production by that amount to account for the alfalfa that does not go to market.

Results

After joining the parcel dataset and groundwater modeling output, irrigated acreage was estimated for the pre-policy and post-policy conditions based on groundwater availability and an assumed water application rate of 2 acre-feet per acre. From those irrigated acres, total crop yield and crop value were calculated. Irrigated acres and crop revenue are shown in Exhibit 1 across the seven subareas for the pre-policy conditions. During pre-policy conditions, an estimated 133,000 acre-feet (AF) of water are pumped annually. There are an estimated 48,000 acres of irrigated alfalfa production for a total annual value of $58 million.[12] In addition to the alfalfa production, there is an additional $65 million of annual value that comes from livestock production. This brings the total annual value of agricultural production to $123 million under the pre-policy conditions. All values are in 2024 dollars (no inflation adjustments) for comparison purposes.

Exhibit 1. Crop and Livestock Production – (Pre-Policy)

Subarea	Groundwater Pumped (AF)	Irrigated Acres	Alfalfa Yield (ton/acre)	Total Value
Northeast-Crane	52,156	19,166	5.6	$23,463,793
Silvies	22,810	8,193	6.0	$10,715,224
Silver Creek	21,012	7,173	5.8	$9,178,460
Weaver Springs	19,246	6,633	5.0	$7,267,336
Lower Blitzen - Voltage	13,121	4,962	5.2	$5,501,485
Dog Mountain	4,504	1,853	5.0	$2,032,149
Upper Blitzen	69	23	6.1	$30,913
Alfalfa Production	**132,919**	**48,003**	**--**	**$58,189,361**
Livestock Production	**--**	**--**	**--**	**$64,830,693**
Total Annual Agricultural Value				**$123,020,054**

Source: Jaeger et. al., (2024), OWRD, and ECOnorthwest Analysis
NOTE: All dollar values are in 2024 dollars.

could increase livestock production. See ECOnorthwest's Sensitivity Analysis section below for the impact of changing this assumption.

[11] Putnam, Daniel H., Charles G. Summers, and Steve B. Orloff. 2007. *Alfalfa Production Systems in California.* In *Irrigated Alfalfa Management for Mediterranean and Desert Zones,* edited by C. G. Summers and D. H. Putnam, Chapter 1. Oakland: University of California Agriculture and Natural Resources, Publication 8287. http://alfalfa.ucdavis.edu/IrrigatedAlfalfa.

[12] All dollar values presented in the Results section are in 2024 dollars.

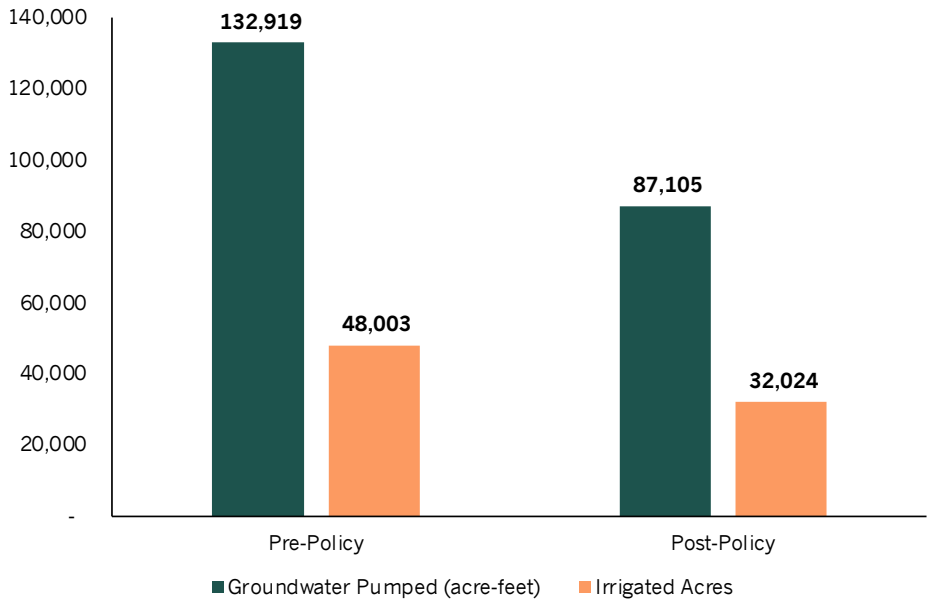
Changes in groundwater pumped, irrigated acres, and agricultural revenues under post-policy conditions are shown in Exhibit 2. Under post-policy conditions, 87,000 AF of groundwater is pumped (a reduction of 46,000 AF from pre-policy) and there are 32,000 acres of irrigated alfalfa production (a 16,000-acre reduction from pre-policy)—see Exhibit 3. Revenue from alfalfa production decreases by $19 million from pre-policy to an annual value of $39 million. Revenue from livestock production decreases by $22 million from pre-policy to $42 million annually. **Total annual agricultural value under post-policy conditions is $82 million which is a $42 million decrease from pre-policy conditions—**see Exhibit 4. The proposed groundwater management scenario is designed to be phased-in over six-year periods, thus agricultural value will decrease by $8 million at each of the six-year step downs until the policy is fully implemented. The annual agricultural values presented in Exhibit 1 and Exhibit 2 are used as inputs into IMPLAN to understand the impacts of changes in agricultural output on Harney County's economy.

Exhibit 2. Crop and Livestock Production – (Post-Policy)

Subarea	Groundwater Pumped (AF)	Irrigated Acres	Alfalfa Yield (ton/acre)	Total Value
Northeast-Crane	34,809	12,850	5.6	$15,733,840
Silvies	19,830	7,049	6.0	$9,248,028
Silver Creek	15,533	5,384	5.8	$6,899,295
Lower Blitzen - Voltage	8,002	2,745	5.2	$3,084,431
Weaver Springs	4,769	2,254	5.0	$2,482,020
Dog Mountain	4,093	1,718	5.0	$1,885,925
Upper Blitzen	69	23	6.1	$30,913
Alfalfa Production	**87,105**	**32,024**	**--**	**$39,364,453**
Livestock Production	**--**		**--**	**$42,464,104**
Total Annual Agricultural Value				**$81,828,556**

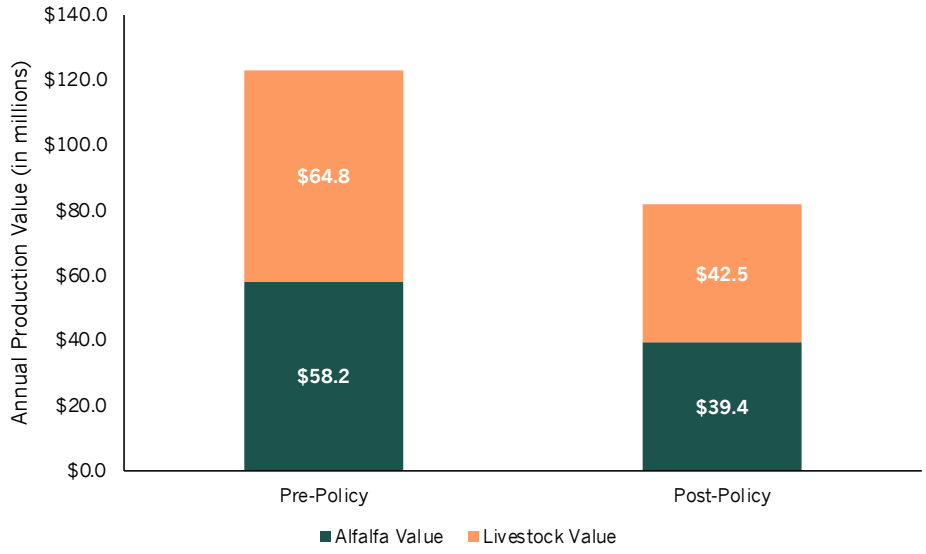
Source: Jaeger et. al., (2024), OWRD, and ECOnorthwest Analysis
NOTE: All dollar values are in 2024 dollars.

Exhibit 3. Groundwater Pumped and Irrigated Acres



Source: ECOnorthwest Analysis

Exhibit 4. Annual Agricultural Value - Pre & Post-Policy



Source: ECOnorthwest Analysis
NOTE: All dollar values are in 2024 dollars.

3. Economic Contributions Analysis

IMPLAN: Modeling Methodology

IMPLAN ("impact analysis for planning") is a regional input-output (I/O) model widely used to assess the economic impacts of changes in agricultural production and many other types of projects.[13] The IMPLAN model divides the economy into 528 sectors, and models the linkages between the various sectors, including accounting for government and household spending. Using national industry and county-level economic data from the U.S. Bureau of Economic Analysis, U.S. Census, and other government sources, IMPLAN models how spending in one sector of the economy is spent and re-spent in other sectors of the economy. The linkages are modeled through input-output tables that account for all dollar flows between different sectors of the economy.

The economic relationships modeled by IMPLAN allow the user to estimate the overall change in the economy that would result from industry expenditures (see Exhibit 5). The dollars spent by an agricultural operation are analyzed to determine the total economic impact within the selected geography. The direct expenditures by an agricultural operation trigger successive rounds of spending that result in an overall increase in employment, labor income, and value added in the local economy. The summation of these impacts is referred to as the economic output.

Exhibit 5. Overview of Economic Contributions Analysis Framework

Source: ECOnorthwest (2024)

[13] For more information on IMPLAN, please see https://implan.com/introduction-to-economic-impact-analysis/.

Impact Types

Economic multipliers derived from the model are used to estimate total economic impacts. Total economic impacts consist of three components: direct, indirect, and induced impacts.

- **Direct impacts** consist of expenditures made specifically by agricultural operations, such labor and inputs (seed, fertilizer, etc.). These direct impacts generate economic activity elsewhere in the local economy through the multiplier effect, as initial changes in demand "ripple" through the local economy and generate indirect and induced impacts.
- **Indirect impacts** are generated by expenditures on goods and services by suppliers who provide goods and services to agricultural operations. Indirect effects are often referred to as "supply-chain" impacts because they involve interactions among businesses.
- **Induced impacts** are generated by the spending of households associated either directly or indirectly with local agricultural operations. Workers employed by a farm, for example, will use their income to purchase groceries and other household goods and services. Workers at businesses that supply the agricultural operation will do the same. Induced effects are also referred to as "consumption-driven" impacts.

Impact Measures

Impacts are assessed using the following measures that are reported by the IMPLAN model:

- **Jobs** are measured as the average number of employees engaged in full-time, part-time, or seasonal work. IMPLAN employment estimates are a measure of head count and **not** FTEs.[14]
- **Labor income** is expressed as the sum of employee compensation and proprietary income.
  - Employee compensation (wages) includes workers' wages and salaries, as well as other benefits such as health, disability, and life insurance; retirement payments; and non-cash compensation; expressed as total cost to the employer.
  - Proprietary income (business income) represents the payments received by small-business owners or self-employed workers.
- **Value added** represents the value of all final goods and services produced (i.e. the sum of intermediate stages of production). Value added is a subset of Output and accounts for the increase in value that the producer adds to the inputs because of the production process. Value added can be conceptualized as the impact to Gross Regional Product (GRP) for the study area.

[14] IMPLAN. (2024). Employment in IMPLAN. https://support.implan.com/hc/en-us/articles/30779951167771-Employment-in-IMPLAN.

- **Output** is the total value of an industry's production and includes all components of the production function: labor income, taxes, profit, and intermediate inputs.

Limitations of Input-Output Models

Input-output models are static models used to measure an economy's inputs and outputs based on data that represents the relationships within an economy at a specific point in time. This analysis used data from the 2023 model year, which is the most recent year for which data is available. The model then estimates how specific changes in inputs to an economy result in changes throughout the economy. This approach—known as a "partial equilibrium analysis" works well when the modeled changes don't radically reshape the relationships within an economy or effect the fundamental characteristics of labor markets, prices, or property values. IMPLAN does not account for economic adjustments, transitions, or innovations that local communities and businesses might make in response to economic pressures or opportunities. *Given what we know of the area economy, the scale of agricultural production, and other considerations, the IMPLAN model is an appropriate tool to perform this analysis.*

Economic Contributions Results

Using annual agricultural values under pre- and post-policy conditions as well as production information from local farmer interviews, two IMPLAN models were run. Alfalfa production is modeled in *IMPLAN Sector 10 – All other crop farming* and livestock production is modeled in *IMPLAN Sector 11 - Beef cattle ranching and farming, including feedlots and dual-purpose ranching and farming* for both models. The economic contributions of both industries modeled will be displayed together in the analysis. Farmer interviews, conducted in person in Harney County, informed the percentage of inputs that are purchased in Harney County, which affects the indirect impacts.

The pre-policy economic contributions to Harney County's economy are shown in Exhibit 6 and represent economic conditions in 2023. Under pre-policy conditions, the annual agricultural value of $123 million supports 670 direct jobs and $36 million in direct labor income. There are 240 jobs supported along the supply-chain (indirect impact) for a labor income of $10.5 million and economic output of $47 million. There are 110 jobs with a labor income of $4 million and economic output of $15 million in the consumption-driven impacts (induced impacts). **In total, 1020 jobs, $51 million in labor income, and $186 million of annual economic output are supported by direct output of the agricultural production in the seven subareas.** For every $1 spent directly by agriculture, $0.51 is generated in additional economic activity. Using the 133,000 AF of groundwater pumped under pre-policy conditions, economic output per AF of groundwater pumped can be calculated. For every AF of groundwater pumped by agricultural producers, $1,400 of economic activity is generated — $926 direct output, $356 indirect output, and $119 of indirect output.

Exhibit 6. Annual Economic Contributions from Agriculture – (Pre-Policy)

IMPACT	EMPLOYMENT	LABOR INCOME	VALUE ADDED	OUTPUT
Direct	670	$35,890,000	$48,140,000	$123,020,000
Indirect	240	$10,460,000	$13,920,000	$47,300,000
Induced	110	$4,360,000	$9,860,000	$15,790,000
Totals	**1,020**	**$50,710,000**	**$71,920,000**	**$186,110,000**

Sources: IMPLAN (2025) and ECOnorthwest Analysis
NOTE: Employment is rounded to nearest tenth. Labor income, value added, and output is rounded to nearest thousand dollars. All dollar values are in 2024 dollars.

The proposed groundwater management scenario will phase curtailments in over six-year periods rather than all at once. The potential economic losses to Harney County over these six-year periods is shown in Exhibit 7. The values presented in Exhibit 7 represent the total difference in the pre- and post-policy economic contributions (Exhibit 6 and Exhibit 8) allocated in six-year steps across a thirty-year period. In each of these six-year policy step periods, it is estimated that Harney County could lose 64 total jobs, $3.5 million in labor income, and $12 million in economic output. Once curtailment has been fully implemented after 30 years (e.g., 2053), the economic contributions of agriculture to Harney County could look significantly different (see Exhibit 8).

Exhibit 7. Economic Losses – Total Over Each Six-Year Policy Step

IMPACT	EMPLOYMENT	LABOR INCOME	VALUE ADDED	OUTPUT
Direct	-40	-$2,580,000	-$3,540,000	-$8,220,000
Indirect	-16	-$600,000	-$840,000	-$2,820,000
Induced	-8	-$300,000	-$660,000	-$1,080,000
Totals	**-64**	**-$3,480,000**	**-$5,040,000**	**-$12,120,000**

Sources: IMPLAN (2025) and ECOnorthwest Analysis
NOTE: Employment is rounded to nearest tenth. Labor income, value added, and output is rounded to nearest thousand dollars. All dollar values are in 2024 dollars.

Using 2052 as an example year of when curtailment has been fully implemented, the annual economic contributions of agriculture to the local economy will be less than in the pre-policy condition (e.g., 2023). As shown in Exhibit 8, estimated economic output from agriculture (alfalfa and livestock production) could be $82 million and support 470 jobs within the industry (a 200 job decrease from pre-policy conditions) for a total labor income of $23 million (a $13 million decrease). Jobs along the supply-chain (indirect jobs) could decrease from 240 under pre-policy conditions to 160 jobs under post-policy conditions. Labor income could decrease to $7.5 million and annual indirect economic output could decrease to $33 million. In this new economic reality, induced jobs would decrease to 70 jobs, for $3 million in labor income, and $10.3 million in annual economic output. **In total, an estimated 320 jobs, $18 million in labor income, and $61 million in annual economic output could be lost between pre-policy and post-policy conditions**. It is important to note that these results assume the broader economic conditions in Harney County do not change over this 30-year period.

Exhibit 8. Annual Economic Contributions from Agriculture – (Post-Policy)

IMPACT	EMPLOYMENT	LABOR INCOME	VALUE ADDED	OUTPUT
Direct	470	$22,910,000	$30,470,000	$81,830,000
Indirect	160	$7,460,000	$9,770,000	$33,230,000
Induced	70	$2,840,000	$6,420,000	$10,280,000
Totals	**700**	**$33,210,000**	**$46,660,000**	**$125,340,000**

Sources: IMPLAN (2025) and ECOnorthwest Analysis

NOTE: Employment is rounded to nearest tenth. Labor income, value added, and output is rounded to nearest thousand dollars. All dollar values are in 2024 dollars.

Outside of the direct impacts to agriculture, there will impacts to local businesses and industries along the supply-chain and local consumptive businesses. The top 10 local industries affected by direct expenditures of agriculture in Harney County are shown in Exhibit 9 and represent the aggregate industries included within IMPLAN. Intuitively, the impacts would be things related to expenditures on farm labor, inputs for livestock production and crop production (i.e., seed, grain, hay, chemicals, livestock vaccinations, food additives, etc.), fuel purchases, paying rent on land being farmed, repaying debts related to operations, and insurance purchases. These are the industries/local businesses that would be indirectly impacted by curtailments affecting agriculture and represent the businesses along the supply chain that would experience job losses.

Exhibit 9. Top Indirect Industries Affected

IMPLAN INDUSTRY CODE & INDUSTRY NAME
19 – Support activities for agriculture and forestry
11 – Beef cattle ranching and farming, including feedlots and dual-purpose ranching and farming
429 – Other real estate
164 – Pharmaceutical preparation manufacturing
10 – All other crop farming
2 – Grain farming
20 – Oil and gas extraction
423 – Monetary authorities and depository credit intermediation
383 – Wholesale – Other nondurable goods merchant wholesalers
427 – Insurance agencies, brokerages, and related activities

Sources: IMPLAN (2025) and ECOnorthwest Analysis

NOTE: These industry names represent the aggregated industry type by which multiple businesses could exist under. For example, vaccinations and feed additive purchases would be located under IMPLAN Sector 164 – Pharmaceutical preparation manufacturing.

The top 10 induced industries that would be affected by the proposed groundwater management scenario are shown in Exhibit 10 and represent the aggregate industries included within IMPLAN. These impacts are consumptive driven meaning that employees of

farms or employees of businesses along the supply chain use their wages to buy local goods and services. The potential changes in employment and wages in these industries will impact local restaurants, grocery stores, merchandisers, automotive dealers, local real estate, and donations to religious institutions. These are other types of local businesses that could be impacted by the groundwater management scenario's effect on agricultural production in Harney County.

Exhibit 10. Top Induced Industries Affected

IMPLAN INDUSTRY CODE & INDUSTRY NAME
492 – Limited-service restaurants
475 – Individual and family services
389 – Retail – Food and beverage stores
503 – Religious organizations
394 – Retail – General merchandise stores
491 – Full-service restaurants
395 – Retail – Miscellaneous store retailers
385 – Retail – Miscellaneous store retailers
429 – Other real estate
494 – Automotive repair and maintenance, except car washes

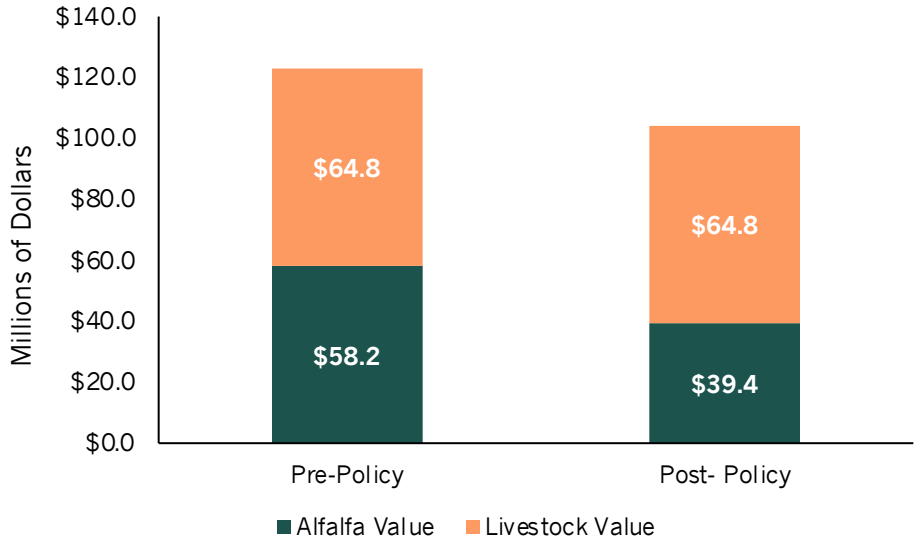
Sources: IMPLAN (2025) and ECOnorthwest Analysis

NOTE: These industries names represent the aggregated industry type by which multiple businesses could exist under.

Sensitivity Analysis

Due to the uncertainty around the potential effects of the proposed groundwater management scenario on local livestock production—a sensitivity analysis is conducted. The economic contributions of Harney County agriculture are recalculated by assuming that livestock production value does not decrease in the post-policy period (see footnote 10 above). This sensitivity analysis still assumes that annual alfalfa production value will decrease from $58.2 million to $39.4 million, however, annual livestock production value will remain constant at $65 million (see Exhibit 11). In this sensitivity analysis, total annual agricultural value goes from $123.0 million to $104.2 million. These values are used to re-run the IMPLAN analysis to see how the results might change based on this new assumption.

Exhibit 11. Annual Agricultural Production Value - Sensitivity Analysis



Source: ECOnorthwest Analysis

Under this new assumption, Harney's local economy does not contract as much as shown in Exhibit 8, but the losses in economic activity are still significant for a county of 7,000 people. Exhibit 12 shows the IMPLAN results of this sensitivity analysis. In a scenario where livestock production does not change as result of the proposed groundwater management scenario, total job losses could be 160, total labor income lost could be $8 million, and total economic output lost could be $22.4 million. While these losses are not as large as when livestock production is impacted, they are still significant.

Exhibit 12. Annual Economic Contributions from Agriculture - Sensitivity Analysis Assuming No Reduction in Livestock Production

IMPACT	EMPLOYMENT	LABOR INCOME	VALUE ADDED	OUTPUT
Direct	550	$28,470,000	$36,310,000	$104,200,000
Indirect	210	$10,620,000	$13,600,000	$46,200,000
Induced	100	$3,680,000	$8,320,000	$13,320,000
Totals	**860**	**$42,770,000**	**$58,230,000**	**$163,720,000**

Sources: IMPLAN (2025) and ECOnorthwest Analysis
NOTE: Employment is rounded to nearest tenth. Labor income, value added, and output is rounded to nearest thousand dollars. All dollar values are in 2024 dollars.

The sensitivity analysis allows for a range in the estimated economic impacts to Harney County. Assuming no adaptation by farmers or structural changes to the local economy, **estimated total job losses to the county could be between 160 - 320 total jobs and losses to total economic output are estimated to be between $22.4 - $60.8 million.** It is important to note that these losses will not occur in a single-year and will instead occur over the course of 30-years. Policymakers and local stakeholders should consider and research strategies to mitigate these losses over the course of the policy implementation.

4. Local Government Property Tax Analysis

The proposed groundwater management scenario will lead to agricultural land losing access to groundwater resources and being unable to irrigate. This loss of access to water will change the assessed value of the land and will affect the property taxes that can be collected by Harney County. Discussions with staff in Harney County's Assessor and Tax Collector's office led to the understanding that agricultural land in the county falls under two land class categories—Land Class 2 (LC2) and Land Class 5 (LC5).[15] LC2 is the higher valued land that has access to water resources for irrigation and LC5 is a lower value land that does not have access to water resources for irrigation.

Each of these land classes have a specially assessed value (SAV) that is used to determine the value of the property for the purposes of levying property taxes. The average SAV for LC2 in Harney County is $1,185 per acre and the average SAV for LC5 is $93 per acre.[16] These SAV values are used to estimate the total assessed value of the set of agricultural land that is impacted by the proposed groundwater management scenario. This analysis derives from the changes in irrigated land from the agricultural analysis. Under pre-policy conditions, it is assumed that all parcels with groundwater rights are irrigated and fall under LC2. When curtailment is fully implemented after 30 years, approximately 25 percent of parcels would then fall under LC5. The changes in assessed value are shown in Exhibit 13. Of the parcels potentially affected by the groundwater management scenario, the total assessed value is $57 million under pre-policy conditions and decreases to $45 million post-policy, after curtailment is fully implemented. This means that taxable assessed value of these parcels could decrease by $12 million. This will impact the property taxes that can be levied from these lands.

Exhibit 13. Taxable Assessed Value – Pre & Post-Policy

	PRE-POLICY	POST-POLICY
Land Class 2	$56,887,000	$43,527,000
Land Class 5	$0	$1,044,000
Total	**$56,887,000**	**$44,571,000**

Source: ECOnorthwest Analysis
NOTE: All dollar values are in 2024 dollars.

The average property tax levy for the affected taxing districts in Harney County is $11.84 per $1000 of assessed value. Property tax revenues are distributed into three distinct funds—general fund, hospitals, and local school districts—each fund represents a portion of the average property tax levy. These levies are $4.50 per $1000 for the general fund, $1.93 per

[15] These discussions occurred on November 12th, 2024, and January 9th, 2025.
[16] Harney County Assessor/Tax Collector, November 12th, 2024.

$1000 for the hospital fund, and $5.41 per $1000 for local school districts. Due to the changes in assessed value in Exhibit 13, property tax revenues will also decrease post-policy after the full implementation of curtailment (see Exhibit 14). **Post-policy at the end of curtailment, total property tax revenues for the county could see a $146,000 decrease in annual revenues—$55,000 for the general fund, $24,000 for hospitals, and $66,000 for local schools.** The total property tax revenue for Harney County was $11 million for fiscal year 2024-25.[17] The estimated $146,000 decrease in revenue due to the groundwater management scenario, would be a 1.3 percent decrease in annual property tax revenues for the county. Similar to the economic contributions analysis, the analysis assumes that property tax rates and SAVs do not change over the 30-year period of policy implementation.

Exhibit 14. Property Tax Revenues - Pre & Post-Policy

	PRE-POLICY	POST-POLICY
Land Class 2	$674,000	$516,000
Land Class 5	$0	$12,000
Total	**$674,000**	**$528,000**

Source: ECOnorthwest Analysis
NOTE: All dollar values are in 2024 dollars.

[17] Harney County. "Summary of Assessment & Tax Roll: 2024-2025." (2024). https://harneycountyor.gov/wp-content/uploads/2024/10/Harney-County-Summary-of-Assessment-and-Tax-Roll-2024-2025-1.pdf.

5. Ecosystem Services Analysis

The final set of potential impacts that ECO analyzed are the economic impacts to springs, streams, and other ecosystems that support wildlife, recreation, and other local ecosystem services. ECO was able to conduct a qualitative analysis based on interviews with local wildlife managers and other stakeholders identified by RAC members on December 10th, 2024. The results of this analysis are categorical and not quantitative. These interviews, conducted with Oregon Consensus, detailed the importance that local groundwater resources have on springs—particularly Double-O Springs—and their importance for local ecosystem services.

Double-O Springs provide important baseflow to the Malheur National Wildlife Refuge which provides important wetland habitat for wildlife and supports migratory birds along the Pacific Flyway. The wildlife refuge and surrounding areas support outdoor recreational activities—such as bird watching, hunting, fishing, etc.—that support the local Harney County economy. There is economic value associated with outdoor recreational activities and some estimates put that value at a large share of the total economic activity in Harney County.[18] Expert interviews on the role of groundwater management and ecosystem services suggest that groundwater management should help maintain current conditions and recreational opportunities. By at least maintaining current ecosystem conditions, there can be a balance between current economic uses of groundwater resources and future economic uses for posterity. There is peer-reviewed economic research that suggests that individuals value both the immediate use of a natural resource and are willing to pay for use of that resource by future generations.[19] In this analysis, there was not enough information to quantify the increases or decreases in the economic value of ecosystems and recreation as a direct result of fully implementing the rules.

[18] Earth Economics. “Economic Analysis of Outdoor Recreation in Oregon: 2022 Update.” (2024).
[19] Oleson, Kirsten LL, Michele Barnes, Luke M. Brander, Thomas A. Oliver, Ingrid Van Beek, Bienvenue Zafindrasilivonona, and Pieter Van Beukering. "Cultural bequest values for ecosystem service flows among indigenous fishers: A discrete choice experiment validated with mixed methods." *Ecological Economics* 114 (2015): 104-116.

6. Conclusions

ECOnorthwest was brought on to conduct an analysis to understand the potential economic impacts to agriculture (crop and livestock), the local economy, local government revenues, and local ecosystem services of a proposed groundwater management scenario in Harney County, Oregon. The proposed groundwater management scenario would reduce groundwater pumping by 33.6 percent across seven subareas over a 30-year period. The proposed scenario would have significant economic impacts on agricultural production that relies on groundwater resources for irrigating crops and water for livestock. Harney County's economy is dependent on agricultural production with approximately **1 in 5 jobs** being in agricultural related industries. If the currently proposed groundwater management scenario is fully implemented, annual agricultural revenues for the affected area could decrease by as much as $41 million. The reduction in agricultural production will have ramifications on the local economy. **If the proposed groundwater management scenario is fully implemented, it could lead to a reduction of 160 - 320 total jobs and $22 - $61 million in economic output**. This result is consistent with recent peer-reviewed economic research that suggests that resource conservation policies in rural areas reliant on agriculture can lead to job losses and lower wages because of the lack of alternative employment opportunities.[20]

The proposed groundwater management scenario could potentially impact Harney County's property tax revenues due to the lowering of the assessed value of agricultural land. Assessed value for agricultural lands impacted by groundwater management could decrease by as much as $12 million would lead to a $146,000 reduction in annual property tax revenues. Property tax revenues in Harney County are directed to a general fund, hospitals, and local school districts. Local school districts are likely to be the most impacted by a reduction in property tax revenues.

Local ecosystem services could potentially benefit from the proposed groundwater management scenario. Local groundwater resources support local springs—like Double-O Springs—which support baseflows to Malheur National Wildlife Refuge. The Refuge supports critical wetland habitat for wildlife and migratory birds. The Refuge also supports outdoor recreational activities whose spending contributes to Harney's economy.

Limitations of this Analysis

This analysis estimates the potential magnitude of economic and fiscal impacts that groundwater management may have on agriculture and the broader economy in Harney County. It is based on current agricultural practices and evaluates outcomes under a proposed management scenario. **Importantly, the analysis does not account for any adaptation by farmers, local businesses, or government entities in response to changing**

[20] Ray, Srabashi, and Thomas W. Hertel. "Effectiveness and Distributional Impacts of Conservation Policies: The Role of Labor Markets." *Environmental and Resource Economics* (2025): 1-47.

conditions. Instead, this analysis assumes that existing agricultural practices and the local economic conditions remain unchanged throughout the duration of the policy's implementation.

Next Steps

The currently proposed groundwater management scenario will significantly reduce agricultural production and expenditures which will have negative consequences for Harney County's economy. New agricultural production and/or mitigation strategies could be considered to minimize impacts to farmers/ranchers, small businesses, and the local community. Policymakers and relevant stakeholders should research potential strategies to mitigate the potential impacts. Some options could include but are not limited to the feasibility of dryland farming practices, deficit irrigation, and leasing fallowed land for alternative uses (e.g., habitat, grazing, combined grazing/energy, etc.).