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WATER RESOURCES DEPARTMENT

SWIMS TAG Meeting #4

July 7th, 2026

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Agenda

1. **Welcome** *(9:05 – 9:10)*
2. **Recap Meeting #3 and SWIMS Update** *(9:10 – 9:15)*
3. **Irrigation and Municipal Consumptive Use** *(9:20 – 9:55)*
4. **Discussion** *(10:05 – 11:00)*

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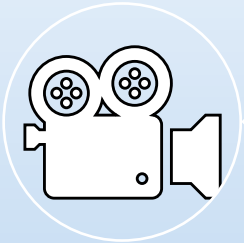
Meeting Rules



Use hand raise feature



Encourage interaction and cameras on (please ask questions to group)



Meetings will be recorded and posted to website

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Recap Meeting #3

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TAG Meeting #3 Summary

Geospatial framework

- Anticipate relying on NHDPlus V2 to establish scale and resolution, support other business needs (interpolation)

Statistical modeling approaches

- Provided overview of approaches for estimating natural streamflow in ungaged watersheds (e.g., statistical, machine learning, physical)

Adapting to climate trends

- Proposed strategy for assessing influence of climate on water availability and evaluating model performance in comparison to changing climate

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SWIMS Status Report

Data acquisition and processing

- Relating Statewide ET field scale data (i.e., agricultural fields) to geospatial framework (HUC12)

Gage installation

- *Abiqua Creek* (Willamette), *Deer Creek* (Powder), *Emigrant Creek* (Malheur), *Long Creek* (Klamath), *North Fork Coquille River* (South Coast) installed; *South Fork Burnt River* (Powder) pending permissions

System architecture

- Expanded data storage to 60+ TB to accommodate data acquisition, processing, and archival
- Established high-powered computing systems to carry out data analysis via parallelized workflows

Preliminary Record Augmentation Findings

Record imputation

- Should gaps in nearly complete flow records be infilled via imputation prior to computing exceedance flows?
- Verdict: do not impute

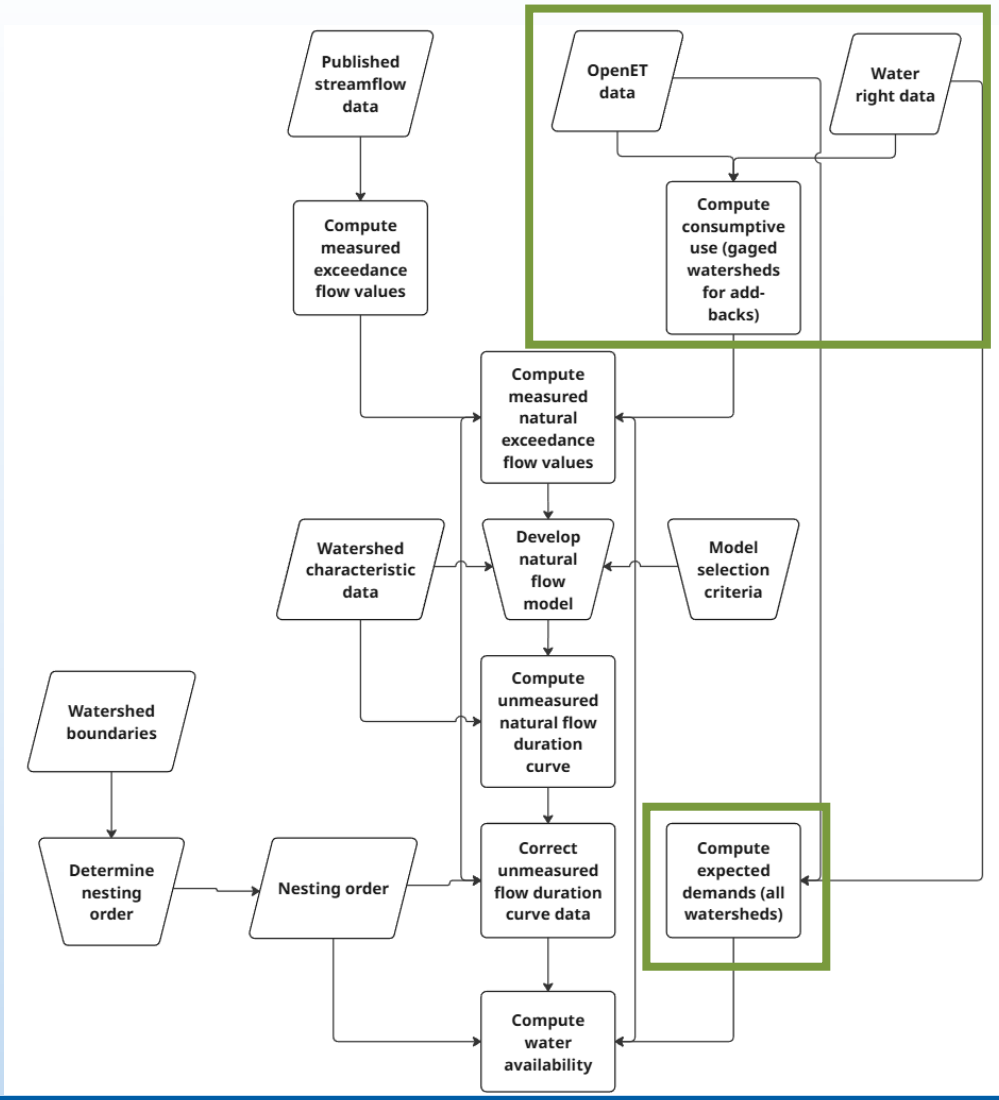
Record extension

- Can out-of-phase records be extended into the base period using information from paired reference gage(s)?
- Verdict: inconclusive, further investigation required

Model Workflow Overview

Meeting theme

- Irrigation consumptive use
- Municipal consumptive use





Water Use and the Water Availability Modeling Framework

Ryan Andrews

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Water Use and Water Availability Modeling Framework

Purposes of incorporating water use information

1. Correcting gaged flow to natural flow (i.e., add-backs)
2. Debiting expected demands from natural flow to calculate water availability

Add-backs

- Estimating natural streamflow for purposes of calculating water availability from reference condition
- Represents total upstream water use that would have impacted measurements at gaging station
- Relied on consumptive use information as expected demand for out-of-stream uses
  - Storage also factored in

Water availability calculation

- Considers expected demands of out-of-stream and instream uses, storage
  - Water availability (WA) = Natural streamflow (Q_{NSF}) – Expected demands
- Most often, the expected demand for out-of-stream uses represents only the portion of a diversion that is considered consumptive
  - Unused portion of diversion is assumed to return to the stream it was withdrawn
  - Diversion (DI) = Consumptive use (CU) + Return flow (RF)

Add-Backs to Naturalize Flow



- Calculate consumptive use of permitted rights for gaged watershed during its period of record
- Calculate measured exceedance flows at 50% and 80% using mean daily flow records
- Calculate natural streamflow by adding consumptive use to gaged exceedance flows
- Calculated on monthly basis

Calculating Water Availability

Q_{NSF}

- Natural streamflow provides basis for deriving water availability
- Estimated using geostatistical approach for ungaged watersheds

Expected Demands

- Considers expected demands of all permitted water rights, including surface water and some groundwater
- Includes consumptive uses, storage, and instream demands

Water Availability

- Calculated by debiting expected demands from natural streamflow
- Calculated on a monthly basis at watershed scale

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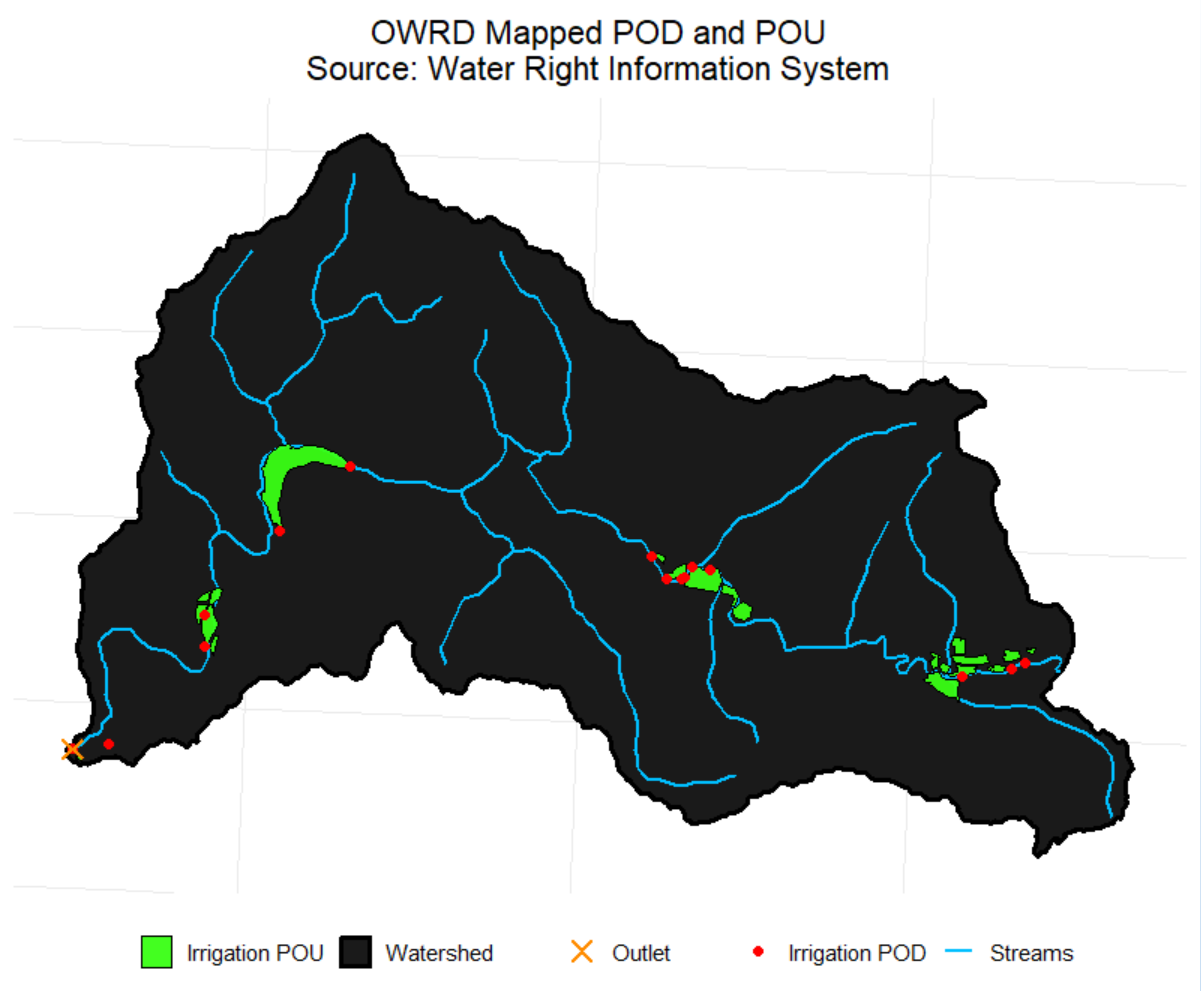
Categorizing Water Use

- Water rights are categorized by use type and source type
- Use types are based on information from permit (i.e., paper water right)
- Modeling framework distinguishes between surface water and groundwater
  - Groundwater permits determined to have hydraulic connection with SW were considered in water availability calculations
  - Surface water-groundwater interactions to be topic of future discussion
- For non-irrigation use types, consumptive use coefficient is applied to permitted use (e.g., rate)

Water Use Category	Consumptive Use Coefficient
Irrigation	Varies regionally and seasonally
Municipal	Varies regionally and seasonally
Agricultural	0.50
Industrial	0.50
Domestic	0.20
Commercial	0.15
Livestock	0.10

Calculating Water Availability at Scale

- OWRD's Water Right Information System provided permit details to quantify water use
  - Details regarding location, source type, diversion rate used to estimate consumptive use
- Most often*, consumptive use was factored in add-backs and water availability calculations
  - With exception for known information (e.g., measured diversions)
- Total consumptive use debited from natural streamflow at outlet to calculate water availability
- Unconsumed water assumed to return to stream it was withdrawn



Other Supporting Datasets

Water Use Reporting

- Dataset with reported annual water use information as required for certain entities
- Reported by water user based on measuring device (e.g., totalizing flow meter)
- About 16% of water rights required to submit
  - Municipalities required to report
  - Used to estimate municipal water use

Measured Diversions

- Gages installed for the purpose of measuring diverted water for irrigation canals, irrigation districts, etc.
- Used to distribute annual use on seasonal basis

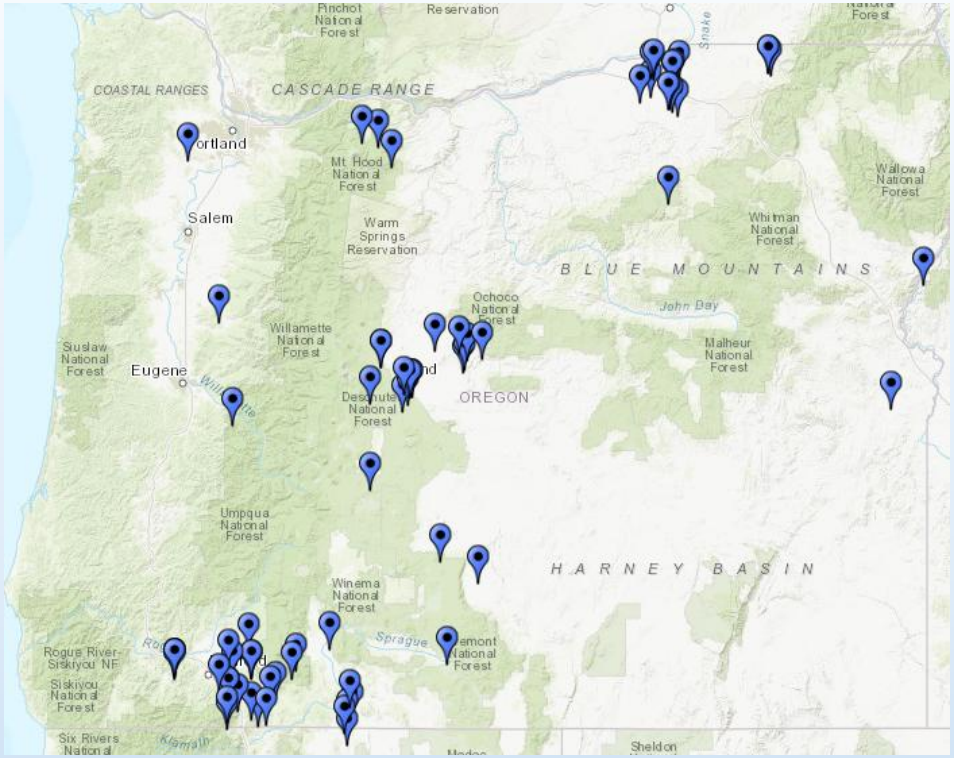


Figure: Active gages measuring water diverted via canal for the purpose of irrigation or likewise. Differs from flow meters for reported water use.

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Irrigation Water Use

Ryan Andrews

Methods Considered for Quantifying Irrigation Water Use

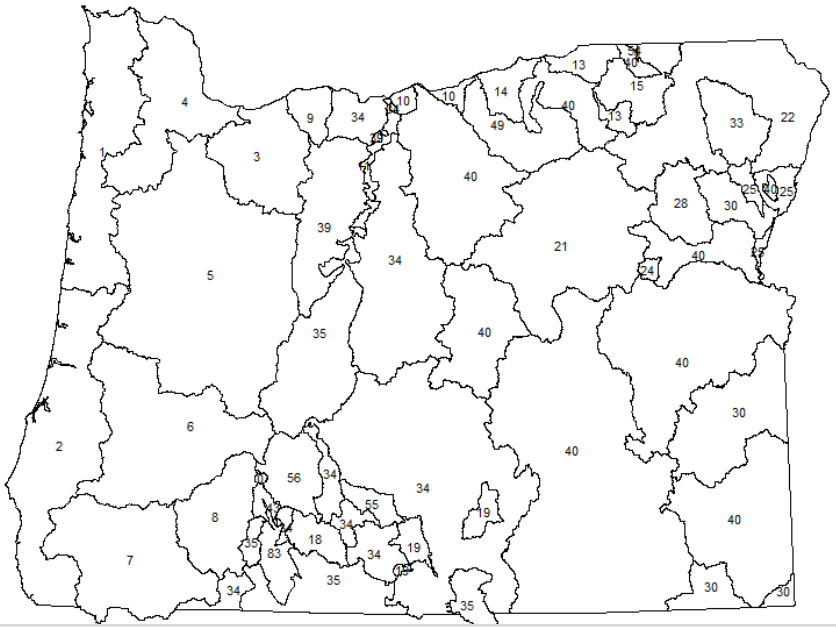
- Irrigation consumptive use in modeling framework was based on annual consumptive use for the hydrologic unit the permit was located
- First three methods described were reasoned to overestimate actual water use

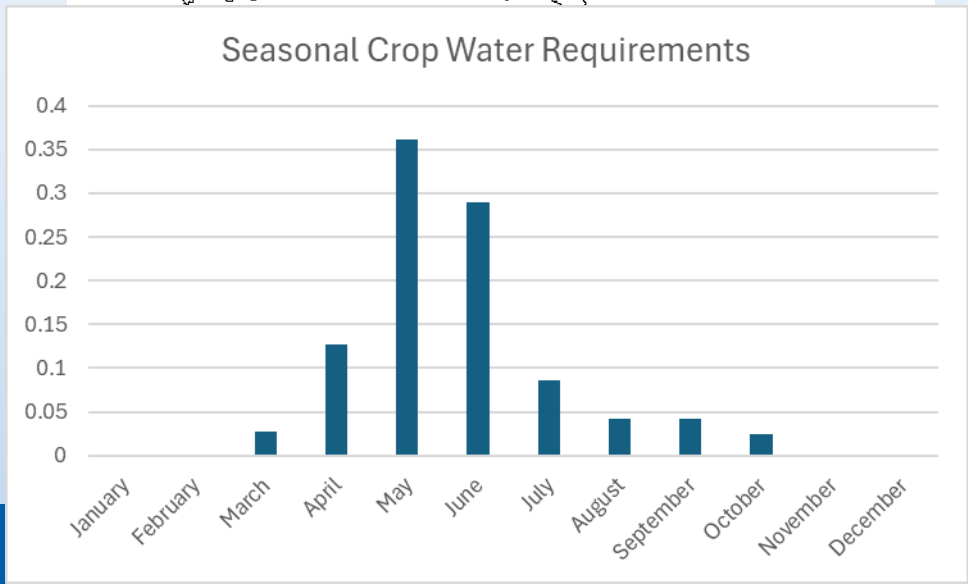
Alternative approaches considered:

1. Multiple permitted acreage by permitted duty
2. Estimate based on permitted diversion rates
3. Use actual diversion measurements
4. Conduct census of irrigated acreage and consumptive use based on crop water requirements

Irrigation Water Use and WA

- Historically, annual crop water use was based on actual irrigated acreage and use from USGS crop census reports
  - Expected demand is related to evaporative and transpirational losses associated with regional crop requirements (Cuenca, 1992)
  - For example, if annual consumptive use was 4,040 acre-foot and irrigated acreage was 1,062 acres, then annual CU for that hydrologic unit was 3.80 acft/ac
- Distributed annual use seasonally (i.e., monthly) based on crop water requirements and measured diversion data
- In modeling framework, consumption is limited by permitted duty and season of use
  - If duty was 4.00 acft/ac, but annual CU was 3.80 acft/ac, then anything exceeding 3.80 was assumed to be non-consumptive





Modern Data and Information

- Statewide ET dataset developed for Oregon to quantify ET from irrigated lands
- Provides monthly and annual metrics of water use for delineated irrigated fields
  - Available for all years since 1985
  - Field-scale data and HUC-8 and HUC-12 summaries

Metric	Definition
Applied water	Amount of irrigation water applied to a field
Consumptive use	Irrigation water removed from hydrological system
Evapotranspiration	Combination of evaporation from land system and transpiration from plant tissues
Net irrigation water requirement	Amount of additional water that needs to be supplied through irrigation to ensure optimal crop growth

Statewide ET in Practice

- Each irrigated field (purple) has associated water use metrics at monthly timestep
- Fields attributed with crop type, irrigation efficiency, irrigation water source (SW, GW, mixed), and irrigation system type

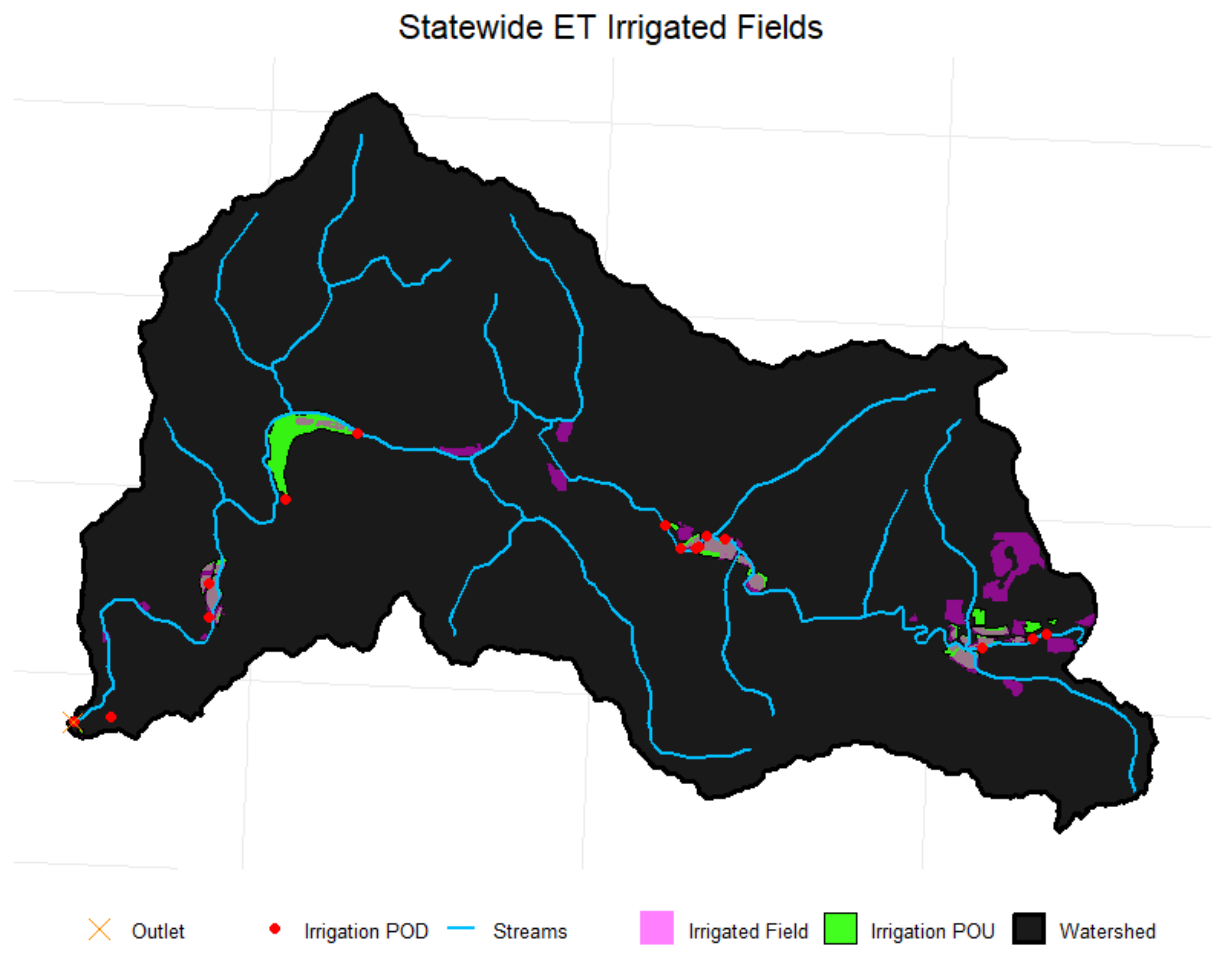
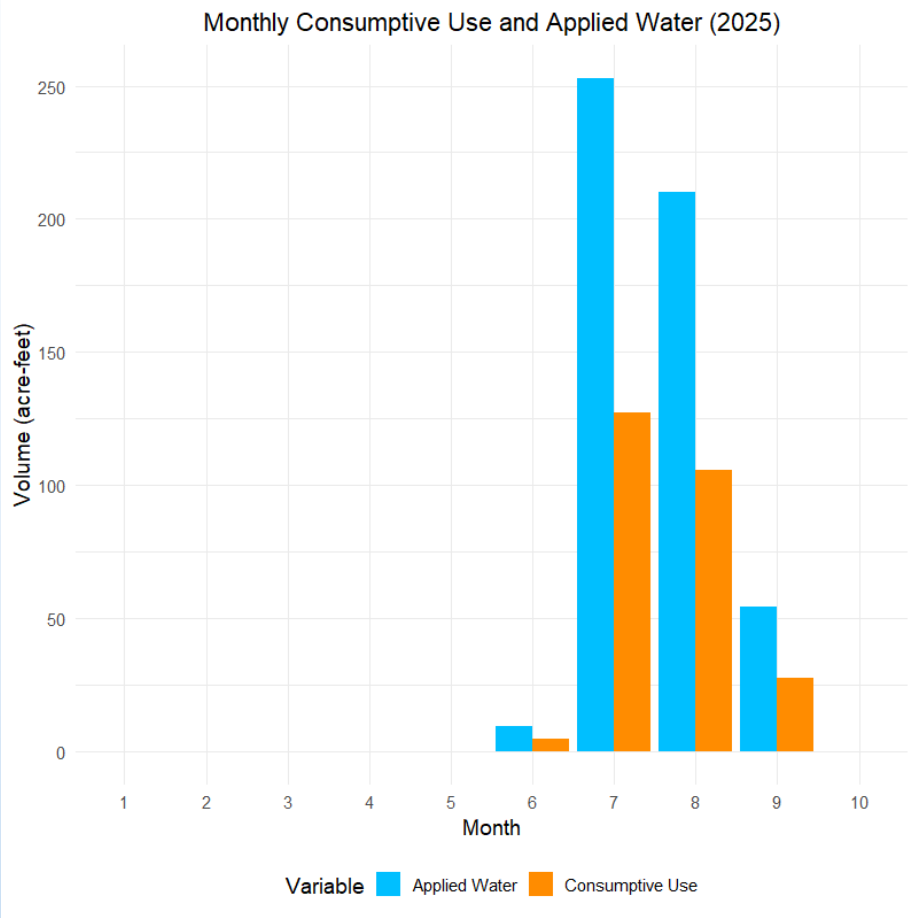


Figure: Statewide ET data in relation to mapped information from Water Right Information System

Statewide ET Water Use Metrics

- Statewide ET data can be summarized to represent aspects of water use
- Applied water (AW) derived from consumptive use and irrigation efficiency
  - Flood irrigation efficiency of 50%
- Consumptive use (CU) represents water that was consumed through irrigation for that month
- AW and CU adjusted based on precipitation surplus
  - If actual ET less than effective precipitation



Important to Consider

Add-backs

- Applied water may better represent impact to stream for estimating add-backs
  - However, it may need to be adjusted to better align with timing of actual diversions; may not align with agricultural operations, opportunistic diversion of water
  - Relies on efficiency of irrigation system, but may not account for conveyance losses

Consumptive use

- Represents irrigation consumptive use or the expected demand similar to current framework
  - Considers carryover based on effective precipitation and ET
  - Does not always align with geospatial data from WRIS, may differ in terms of location and acreage

Return flows

- The dynamics of return flows are dependent on:
  - The hydrogeology of the local system
  - Also depends on the scale and resolution of the geospatial framework

Potential Approaches for Adjustment

- Compare permitted acreage from WRIS to actual irrigated acreage from Statewide ET to avoid overestimating water use
  - Mimics current approach to estimate use for a given water right
- Compare Statewide ET data to water use reporting (i.e., flowmeter data) to evaluate relationships between estimated applied water and reported water use
- Improved mapping of irrigated lands in relation to geospatial framework to better account for where water is applied and associated return flows

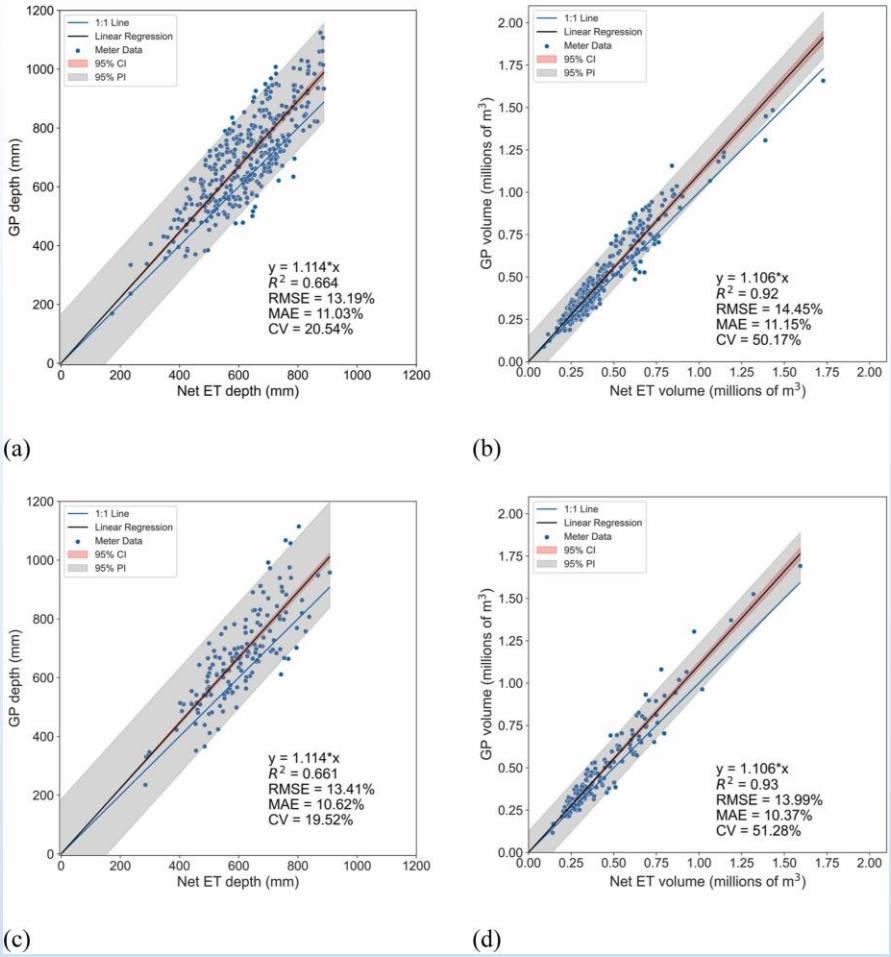


Figure: Comparison of reported groundwater pumping* to net ET (data from Harney Basin [Ott et al., 2024])

Strategic Design Decisions in Modeling Framework

Various water use metrics

- Should different water use metrics be used when considering concepts of add-backs (to calculate natural streamflow) and expected demands (to calculate water availability)?
- Does monthly data accomplish the purposes of seasonal distribution of annual water use in the current WAMF?

Assumptions regarding return flows

- Can a refined geospatial framework (e.g., finer resolution hydrologic units) better support assumptions regarding return flows?

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Municipal Water Use

Junjie Chen

Municipal Water Use and WA

- Municipal use is water delivered under a municipal right — including the domestic, commercial, and industrial water a city supplies. Consumed portion debited, rest returns.

How WARS does it

Consumptive use = regional coefficient x city's **actual reported** diversion

- Coefficient split by **2 seasons** and by whether the system discharge back to the stream (Cooper, p.54)

Table 35. Municipal Consumptive Use Coefficients.

	Coastal Basins	Willamette and Sandy	Rogue and Umpqua	East Side (Summer Discharge)	East Side (No Summer Discharge)
Summer	0.15	0.45	0.64	0.60	1.00
Winter	0.10	0.15	0.15	0.30	0.30

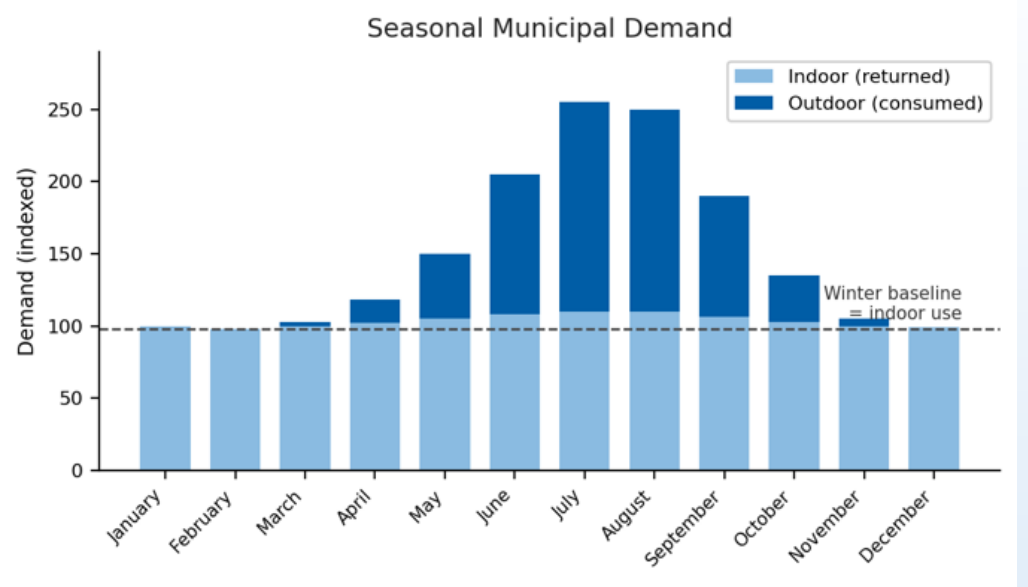
- 1.0 - no return to the stream = 100% consumptive

Proposed SWIMS Approach

- Consumed fraction read from each utility's own **monthly** demand curve
- Return flow placed by sub-watershed; **land applied**, **infiltrated**, and **out-of-basin** cases are flagged as exceptions rather than a coefficient
- More dynamic and higher resolution both **spatially** (HUC12) and **temporally** (12 months)

Estimating Municipal CU

- Consumed fraction is inferred from the seasonal shape of demand
  - Low winter months represent indoor use that largely returns via wastewater
  - The summer rise above that baseline is outdoor landscape irrigation, largely consumed to ET
- Applied to actual diversion from WMCP and Water Use Reporting data
  - Method is dynamic — it tracks conservation and growth as the demand pattern changes
  - Avoids a statewide outfall-routing workflow that is impractical to operate



Consumptive use ≈ outdoor (above baseline) + a small indoor fraction

CU = Diversion – Return Flow

Diversion = Indoor (winter baseline) + Outdoor (summer rise)

CU = (cu_in × Indoor + cu_out × Outdoor) for each month
cu_in: indoor consumptive coefficient (very low 0.05-0.15)
cu_out: outdoor consumptive coefficient (high 0.80-0.95)

What a WMCP gives us

- Water Management and Conservation Plans (WMCPs)
  - WMCPs give population served, annual demand, and per-capita use
  - Include source type, and residential/commercial/industrial splits (some)
  - Report indoor vs. outdoor use (some),
  - Production vs delivered consumption
  - Transmission loss %

Exhibit 2-15. Water Loss, 2016 - 2020

Year	Production (MG)	Consumption (MG)	Process Water and Authorized Unbilled (MG)	Loss (MG)	Loss (%)
2016	3,236.7	2,827.6	85.7	323.5	10.0%
2017	3,243.3	2,864.5	142.5	236.3	7.3%
2018	3,249.9	2,954.4	144.9	150.6	4.6%
2019	3,160.9	2,813.5	110.3	237.1	7.5%
2020	3,209.2	2,834.4	111.8	262.9	8.2%
Average	**3,220.0**	**2,858.9**	**119.0**	**242.1**	**7.5%**

Area	Population (2000)	Population (2010)	AAGR (2000-2010)	Population (2020)
Clackamas County	**338,391**	**375,992**	***1.1%***	**417,602**
Barlow	140	137	*-0.2%*	141
Canby	13,323	17,097	*2.5%*	18,347
Estacada	3,067	3,330	*0.8%*	4,235
Molalla	5,872	8,561	*3.8%*	10,237
Sandy	5,977	9,980	*5.3%*	11,628
Outside UGBs	81,546	79,901	*-0.2%*	86,276

Municipal CU Data Sources

- What is Water Use Reporting?
  - OWRD's program under which certain **water-right** holders are required to measure and report the water they actually divert, at **monthly** resolution, tied to the **point of diversion (POD)**.
  - Fills gaps with monthly point-of-diversion use, can derive each utility's **monthly demand** shape, which drives **indoor/outdoor split**
  - Extend **period of record**, and fill gaps for supplies with no WMCPs
  - Service area and **place of use (POU)** need to be inferred

Primary sources supply demand and its seasonal shape; federal datasets validate

Source	Role
WMCPs	Primary: demand, seasonal shape, sector and indoor/outdoor splits
Water Use Reporting	Primary gap-fill: monthly point-of-diversion use
USGS IWAA	Validation: basin-scale public-supply benchmark
EPA ECHO	Validation: reported wastewater effluent (return flow)

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Municipal CU: Design Decisions

- Setting the consumptive fractions
  - Should the indoor and outdoor rates and coefficient vary **by region**, and on what basis (irrigation season, ET demand, landscape norms)?
- Return flow and spatial placement
  - Assign return flow to the source basin by default (HUC 12 or larger); handle **out-of-basin wastewater as exceptions**
  - How should **distribution loss and land application** be treated, as return flow or as consumed?

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Discussion



Questions?