

# Draining Oregon: GIS considerations and data cleaning

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For our analysis, we used the OWRD Point of Use polygon shapefile and Point of Diversion point shapefile. The POU file contains data on acreage to be irrigated and identifies where it is located. The data field `wris_acres` indicates the legally recognized acreage; any GIS-derived measure of polygon areas can only be considered an approximation. Separately, the POD file contains data on the volume of water that may be applied for a given use under the water right.

As a first step, it was necessary to eliminate several sources of duplication in the POU file. Some duplicates appear to arise from clerical error: exact duplicates entered twice. In addition, some polygons feature have “sliver” overlaps from when they were manually drawn. Finally, some polygons are faithfully and accurately drawn but represent genuine overlaps in location. Because no one may use more water than is allowed on a given set of acres, it’s important to eliminate from our count one or the other of two overlapping water rights.

We were interested only in calculating the total allowable use of groundwater for irrigation. Many supplemental irrigation rights are for when farmers cannot exercise a surface water right. It would be inaccurate to add the water allowed under a supplemental groundwater right to the water allowed under a surface water right for the same land. However, because we have excluded surface water rights from our analysis entirely, this potential source of duplication is not an issue.

What we did need to address was supplemental groundwater rights that overlap each other, and supplemental groundwater rights that overlap primary groundwater rights. These proved to be very few in number, but we made every effort to deduct the overlap from our calculations.

OWRD has included in the POU file a set of “polypoints,” or tiny diamond-shaped polygons meant to approximate the location of water rights with ambiguous locations. Because these diamonds are placed imprecisely, we left them out when identifying and eliminating overlaps.

After estimating unduplicated acreage permitted, it was necessary to multiply acreage in each location by the amount of water allowed per acre. This is known as the “duty” on irrigation. In cases when the POD did not contain this information, we researched the original water permit to find it. In the case of water claims that have not been adjudicated, the department shows only permitted instantaneous flow of cubic feet per second. For these, we applied the dominant irrigation duty in the relevant basin.

The following is a detailed recipe for the GIS processes used to create our final estimates. Find all spreadsheets and shapefiles for these calculations in our [GitHub repository](#).

## GIS recipe for cleaning and de-duplicating water rights files

1. [Download](#) OWRD point of use and point of diversion files:
2. Save 1 layer of groundwater polygons for irrigation, nursery and cranberry uses
3. Save 5 separate layers:

### ➔ Primary rights

*Layer consists of polygons whose use description is not “Supplemental Irrigation” and with Claim No. = 0. This is primary groundwater rights.*

*We only wish to count acreage of primary groundwater rights that does not overlap other primary groundwater rights. Editing rules to eliminate repeated acreage:*

- Delete complete GIS duplicates (polygon atop matching polygon)
- Regardless of overlap, if two polygons have same snp\_id and wris\_acres, delete one.
- Ignore remaining “sliver” overlaps in GIS.
- GIS intersect tool: Spatial join primary rights layer and basin map layer
- GIS area: Calculate area of new polygon pieces and divide by parent polygon’s area. This is percent of each primary right in each basin.
- Multiply wris\_acres by duty on each permitted use, joining POU with POD file by snp\_ID and use\_description.
- Multiply by fraction of polygon in each basin.

### ➔ Water claims

*Layer consists of polygons Claim No. > 0. This is groundwater claims.*

*We only wish to count acreage of groundwater claims that does not overlap other groundwater claims or primary groundwater rights. Editing rules to eliminate repeated acreage:*

- Delete complete GIS duplicates (polygon atop matching polygon)
- Delete polygons with invalid geometry
- Identify overlapping polygons:
  - o Separate “sliver” overlaps with manual editing
  - o When polygons have significant overlap, delete less senior polygon
- GIS “difference” tool: Slice claims layer using primary right layer, thus creating portions of claims polygons that do not overlap primary groundwater rights.
- GIS area: Calculate area of each new polygon and divide it by parent polygon’s area. This is the % of each claim that lies outside any primary right.
- Multiply % by wris\_acres of each claim.
- Multiply new wris\_acres by duty based on average duty in each basin.
- GIS intersect tool: Spatial join claims layer and basin map layer
- GIS area: Calculate area of new polygon pieces and divide by parent polygon’s area. This is % of each claim right in each basin.
- Multiply new wris\_acres by fraction of polygon in each basin.

### ➔ Claims diamonds

*Layer consists of subset of groundwater claims rendered as polypoints, and where "remarks" field indicates the location is approximate.*

- Multiply wris\_acres by duty based on average duty in each basin.
- GIS intersect tool: Spatial join class diamonds layer and basin map layer
- GIS area: Calculate area of new polygon pieces and divide by parent polygon's area. This is % of each claim in each basin.
- Multiply new wris\_acres by fraction of polygon in each basin.

### ➔ Supplemental rights

*Layer consists of polygons whose use\_desc = "Supplemental Irrigation."*

*We only wish to count acreage of supplemental groundwater rights that do not overlap other supplemental groundwater rights, primary groundwater rights or groundwater claims. Editing rules to eliminate repeated acreage:*

- Delete complete GIS duplicates (polygon atop matching polygon)
- Delete polygons with invalid geometry
- Identify overlapping polygons:
  - o Separate "kissing" polygons with manual editing
  - o Delete small polygons nested within larger ones
  - o In case of significant overlap, manually edit one polygon to be smaller and estimate % of overlap to be deducted from its wris\_acres (25%, 50%, or 75%)
- GIS difference tool: Slice supplementals layer using the combined primary and claims layers, thus creating portions of supplemental polygons that do not overlap other groundwater rights.
- GIS area: Calculate area of each new polygon and divide it by parent polygon's area. This is the % of each supplemental right that lies outside any primary right or claim.
- Multiply % by wris\_acres of each supplemental right.
- Multiply new wris\_acres by % of overlap between supplementals.
- Multiply new wris\_acres by duty, as listed in POD file based on matching snp\_ID and use\_description.
- GIS intersect tool: Spatial join supplemental rights layer and basin map layer
- GIS area: Calculate area of new polygon pieces and divide by parent polygon's area. This is percent of each primary right in each basin.
- Multiply new wris\_acres by fraction of polygon in each basin.

### ➔ Supplemental diamonds

*Layer consists of polygons whose use\_desc = "Supplemental Irrigation," and where "remarks" field indicates the location is approximate.*

- Multiply wris\_acres by duty based on average duty in each basin.
- GIS intersect tool: Spatial join supplemental diamonds layer and basin map layer
- GIS area: Calculate area of new polygon pieces and divide by parent polygon's area. This is % of each supplemental right in each basin.
- Multiply new wris\_acres by fraction of polygon in each basin.