

Method to Spatially Relate Wells to Digitized Fields

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Appendix 4.E describes how well completion dates were spatially tied to digitized fields in cases where tabular relations between wells and fields did not exist. The method based on a hierarchical three step process:

1. Use the earliest completion date of any well that falls within a field OR within a 50 foot buffer of the field. The 50 foot buffer was set because wells are sometimes at the edge of fields, and discrepancies in digitization of wells and/or fields sometimes resulted in the well falling just outside of the field.
2. For fields that don't meet the test of step #1, find the nearest well within an 800 foot buffer of the field. Use any available wells (unavailable wells were the wells that were linked to a field in step one). The 800 foot threshold was based on spatial testing of distance to wells and has been used in previous NDNR irrigated field/well analyses. In testing of the Central Platte NRD irrigated fields layer, the 800 foot mark represented a point of diminished returns, where a very limited number of wells were spatially related to fields beyond 800 feet.
3. For fields that don't meet the test of step #1 or #2, find the earliest completion date of the nearest well. Use all wells for this analysis. The assumption is that if a well does not exist within 800 feet, then the well from an adjacent field was used to irrigate both fields.

An example of the results from this process is shown in Figure 1. The red labels on fields show the completion year of the well that was spatially related to the field using steps #1-3 above. Arrows are used to show the spatial relationship of the earliest well that was assumed to irrigate the field. The fields are symbolized according to which method was used: tan indicates that the first method was used, pink indicates that the second method was used, and green indicates that the third method was used. A description of the step-by-step GIS process used to complete the spatial join follows Figure 1.

4-E.1. Step-by-step process used to complete the spatial join

Working geodatabase location

C:\azoller\Projects\Cohyst\LandUse\IrrigatedAcres\CentralPlatte\JoinCertifiedFieldsToWells.gdb\townshipTest

Input data

1. Oldest Irrigation Wells-contains points showing the oldest irrigation well for specific sites in the township.
2. Certified fields-contains polygons of digitized fields where irrigation has been certified in the township.

4-E.1.1 GIS Methods

Data pre-processing

Certified Fields

1. Add a topology to the Certified Fields layer and fix any errors associated with the topology.
2. Hide all fields in the Certified Fields layer except FieldID, Acres and Active.
3. Export the Certified Fields layer into a new feature class called CertifiedFieldsExplode. Explode all features in new layer.

OldestIrrWells

1. If this needs to be created, add the DNR Registered Wells database to ArcMap. Query (by location) the wells in the study area of interest. Query (by table) WellIDs = I (irrigation) and WellStatus = the following:

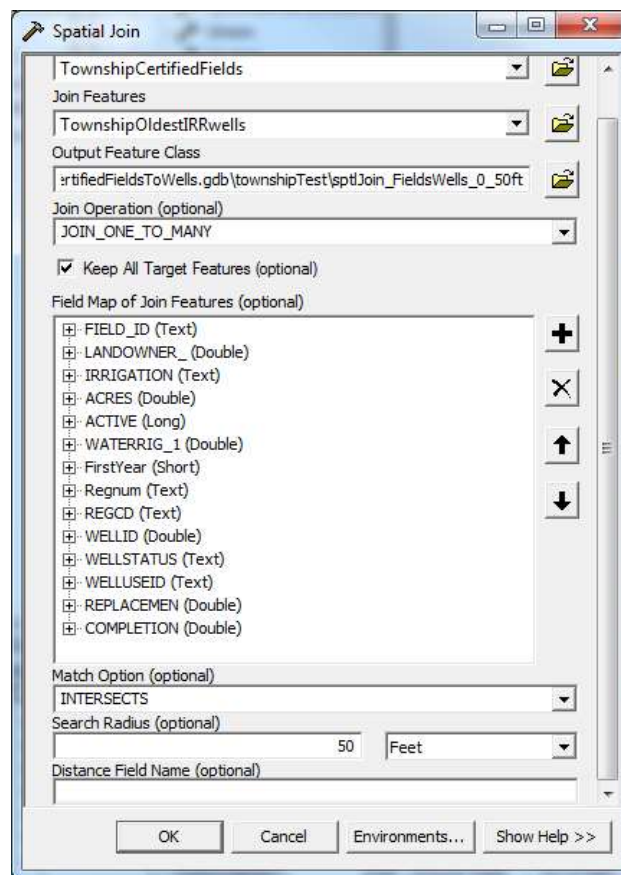
OBJECTID *	WELLSTATUS	Count_WELLSTATUS
1	A	15553
2	I	256
3	S	1
4	U	40
5	X	2484

2. Hide all fields except RegNum, WellID, WellUseID, Replacement, ComDate (completion date). Export to a new layer called OldIrrWells. 7
3. To OldIrrWells, add a field called OldestYear (short integer) and a field called Abandoned (text, length 8).
4. Add the DNR abandoned wells database to the ArcMap. Perform the same steps as performed on the DNR Wells database. Export to a new layer called AbandonedWells.
5. Join the AbandonedWells attributes to the OldIrrWells layer. Sort descending by Abandoned Wells RegNum. You will see that several current wells serviced the same fields as an old abandoned well; as shown by the presence of a RegNum associated with an abandoned well. Calculate the OldestYear for these features as the last four digits of the AbandonedWells.ComDate. Calculate the Abandoned field with a “Yes”. Remove the join.
6. Switch the selection. Calculate the Oldest Year with the last four digits of the OldIrrWells ComDate. Calculate the Abandoned field with a “No”. Then search for 0’s or Nulls in the Oldest_Year attribute, select these and calculate Oldest Year as 9999.
7. Next join the OldIrrWells attributes to the Abandoned wells layer using the Regnum attribute. Sort descending by the OldIrrWells.RegNum. Select all features that did not join to the OldIrrWells (RegNum = Null). Copy and paste these into OldIrrWells layer. Calculate the OldestYear for these new features (should still be selected) as the last four digits of the comDate, and calculate the abandoned field with a “Yes” for these features. Remove the join.
8. Ensure there are no “0’s” or NULLs in the OldestYear attribute. If there are, calculate as 9999. Remove both abandoned wells layers as well as the registered wells layer from ArcMap, leaving the OldIrrWells layer which will be used in subsequent analyses.

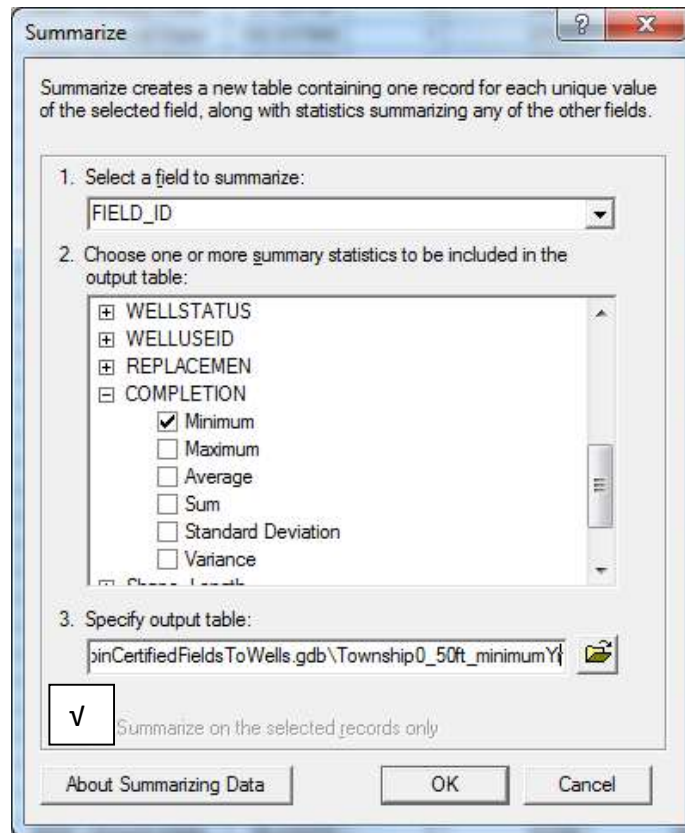
GIS processing

Use spatial join to link well completion data to fields that have a well w/in or w/in 50 feet from edge of field

1. Add the certified fields polygon layer (e.g. CertifiedFields). Add an attribute called Key (short integer) and populate with the ObjectID values. Add an attribute called field called joinMethod (text, 30) and a field called FirstIrrYR (short integer) and leave values blank.
2. Select wells with completion year > 0 and < 9999. Spatially join the OldIrrWells attributes to CertifiedFields. Use spatial join tool to join wells that intersect or lie within 50 feet within digitized fields. Name the output CertFields_SptlJoin_0_50ft or similar.

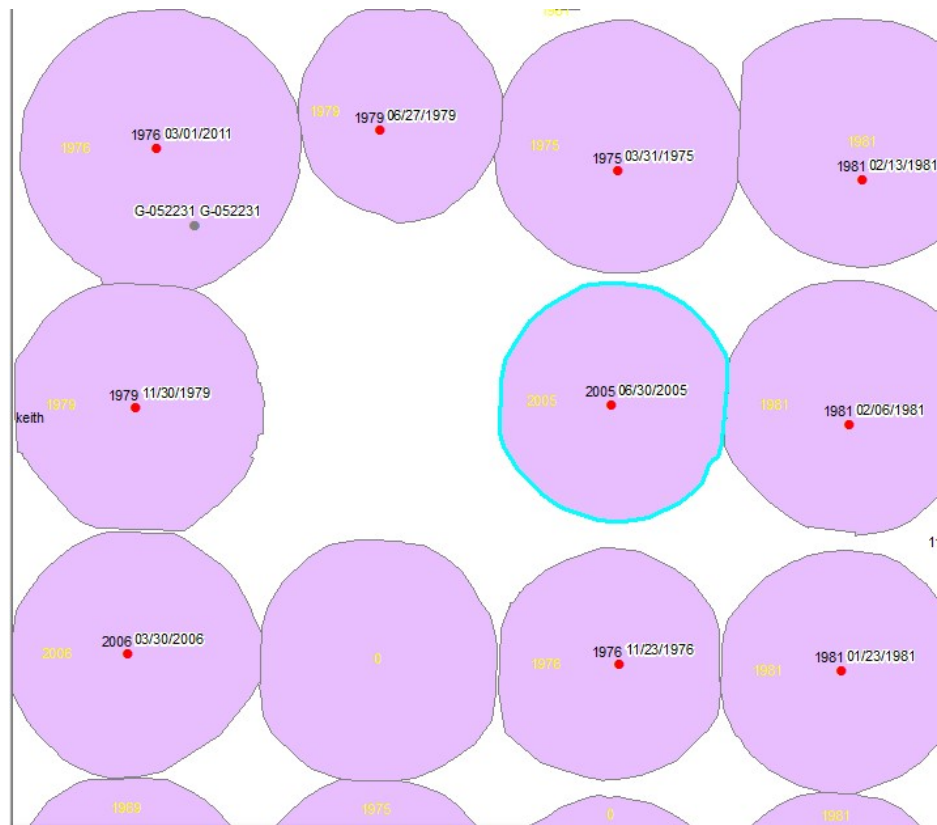


3. Sort CertFields_SptlJoin_0_50ft descending by the CompletionYr field. Select all features that have a value for CompletionYr.
4. Summarize selected features of CertFields_SptlJoin_0_50ft on the Key field-keep the first field ID, and the minimum well year (Oldest_Year attribute or Completion attribute as shown in below example). Name the output table FieldsWithWells_50ft.



5. Join the FieldsWithWells_50Ft attributes to CertifiedFields, using the Object ID and Key fields. Sort descending by the Minimum_Oldest_Yr attribute. Select all that have values for oldest year. Unselect those with values of 9999. Calculate the FirstIrrYear with the selected Minimum_Oldest_Yr attributes, and the JoinMethod attribute with “Spatial Join-0 to 50 feet”. Switch the selection. Calculate selected features with FirstIrrYear = 0 and JoinMethod attribute with “None”. Remove the join.
6. Add a field called RegNum (text, 12 length) to CertifiedFields layer. Join attributes of the CertFields_SptlJoin_0_50ft to the CertifiedFields layer, using the “Key” field from both tables. Populate CertifiedFields.RegNum with the values from CertFields_SptlJoin_0_50ft.RegNum. Remove the join.
7. This is a very good time to check work!! Display features with DNR wells (query out USEID = I or S-for stock watering) and abandoned well databases, using different colored labels to see the difference. Ensure that the methods described above pulled in the correct year.
8. Take a special look at fields that have years of => 2006. If possible, look at these individually. If there is a stock watering well present near the location of the well used, change the FirstIrrYear value to that of the stock watering well. After 1/1/2006, producers were allowed to convert some older wells to stock watering wells, so even though it has the attribute of USE-ID = S, it was likely an irrigation well at one time if it

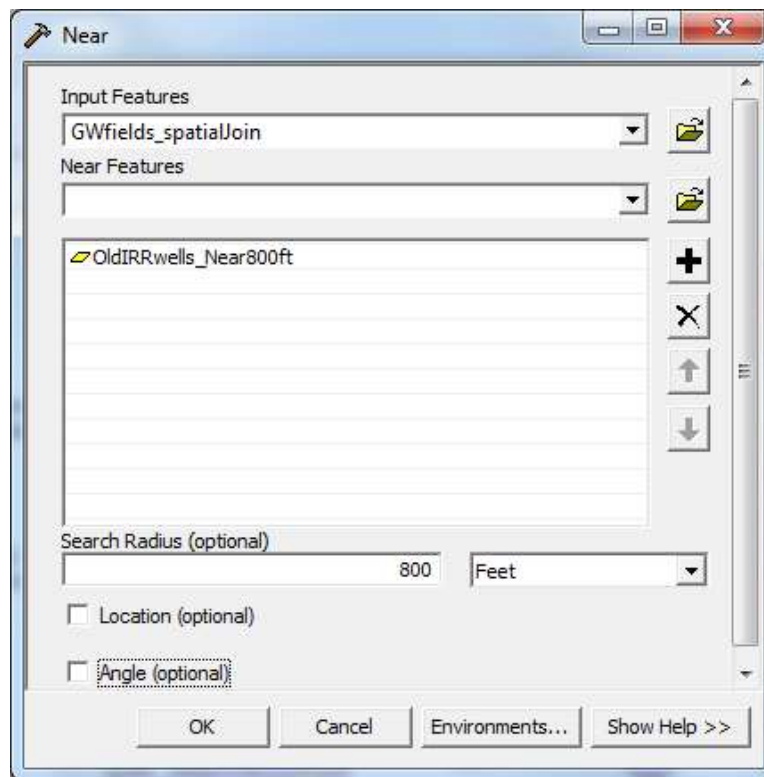
is located on a certified field. If possible, add an attribute called notes and note the year was taken from a stock watering well.



Use the Near tool to link well completion year data to “unclaimed” fields that have a well located between 50 – 800 feet away. The well cannot be contained inside another field boundary.

1. Add a field called JoinMethod (text, 30) to OldIrrWells layer. Join the CertifiedFields attributes to the OldIrrWells layer using the RegNum fields. Populate the new JoinMethod field with the text “SpatialJoin, 0 – 50 ft” for those features that have values for CertifiedFields_RegNum. Switch selection, and populate with the text “None”. Remove join. Clear selected features.
2. Perform a couple queries on OldIrrWells layer. The first is JoinMethod = None. Then use select by location to select from the currently selected features, features that are within CertifiedFields. For the selected features, calculate JoinMethod, to “None, within field”. Clear selection and create a new selection “JoinMethod” = None. These should be the wells that do not fall on fields, and have not been used by the spatial query. Check work here by viewing map. Export features to a new feature class called “OldIrrWells_Near800ft”.

3. Create a definition query on the CertifiedFields layer, so that only features with FirstIrrYr = 0 are showing.
4. Use the Near tool to join certain attributes of the nearest, unused, not within a field wells (i.e. OldIRRwells). Enter a search radius of 800 feet.



5. This tool added two fields to the CertifiedFields layer-one to show the FID number of the nearest well feature, and another to show the distance.
6. Join the attributes of OldIRRWells_Near800ft to the CertifiedFields layer using the NearFID (CertifiedFields) and ObjectID (OldIRRWells_Near800ft) fields. From CertifiedFields select the features with OldIRRWells_Near800ft.OldestYear > 0 AND < 9999.
7. Populate selected features in the Certified Fields layer with JoinMethod = "Near-within 800 ft" and the Certified Fields RegNum with the RegNum from the new wells layer join. Finally, populate the Certified Fields FirstIrrYear with the FirstYear value from the wells layer join. Note the definition query reloads and only shows features with FirstIrrYear = 0.

Use the Near tool to link well completion year data to still unclaimed fields. The well can be contained inside another field boundary. In this case, it is assumed that one well irrigates more than one field. There is no limit on distance in this process.

1. Use the Near tool to join remaining fields with no well, to the closest well in the OldIrrWells layer. Keep the CertifiedFields definition query in place so only the features with FirstIrrYear = 0 are showing. These features may need to be selected for the Near tool to work.
2. Perform the same joins as in the previous Near processing, to populate the RegNum, JoinMethod “Nearest well-no limits” and the FirstIrrYr with corresponding values. Calculate the FirstIrrYr values and Join Method values = “Near-no limit”. Ensure there are no years = 9999 or 0, if there are look at these individually and attribute more appropriately.

