Test Study: Creating Events for the Emmett and Letha Irrigation Districts

1. Introduction

A subset section of the Payette Subbasin was used as an initial test area in order to assess the best method by which to place point events along the NHDFlowline feature class. IDWR Water Right POD locational points were used that fell within and around the Letha and Emmett Irrigation District boundaries because updated linework has been completed in the majority of these areas. Each event point that was placed along the NHDFlowline was individually verified to assess where it was placed, and if there were any additional criteria that should be set before doing the entire analysis. It was also determined that event points within this area could be verified by the local irrigation districts and/or water experts for accuracy, which will help to identify future needs for refinement of the procedures used in this study.

2. Source Data

Two hundred and twelve points of diversion (POD's) were initially identified in this test study area. These points were taken from the IDWR active water rights where point of diversion stream names were known and populated in the source field of the attribute table.

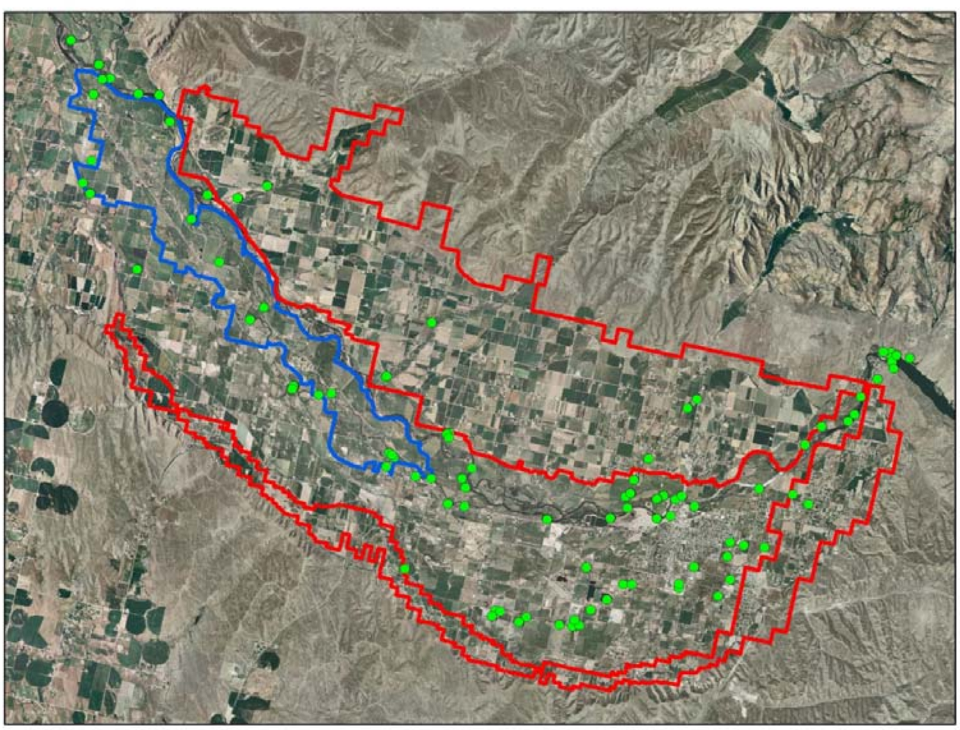


Figure 1 – IDWR Points of Diversion (POD) from the Water Rights Database with named streams as Source

3. Process:

Step 1: Projection

IDWR data is in Idaho Transverse Mercator Projection and the NHD data is in an Albers projection. The shapefile of the 212 PODs was projected into the Albers projection to avoid any conflicts, as it is critical that all projections match before creating events using the HEM Tools.

Step 2: Attribute Assignment

POD data is collected when somebody applies for, or transfers a water right. Historically, the locations of those diversions were identified by the quarter-quarter (QQ) in which they are located. Given the age of many water rights, and the spatial data available at the time those water rights were recorded, many of the POD's have been placed in the center of the QQ, which may or may not coincide with a stream or other natural source described in the water right. Some locations have been digitized on paper or digital maps, and some points are GPS. In order to check the potential locational accuracy of each point, the method of collection for each location was preserved in the attribute field. A separate text field (text, 2) was created in the shapefile attribute table, called DSCODE, and populated with a two-digit code, as follows:

DataSource	DSCODE
Digitized	DZ
GPS	GP
Section	SE
Q	Q1
QQ	Q2
QQQ	Q3
Blank	XX

A separate text field (TEXT, 40) was created in the table called HEMCODE.

A calculation was performed to concatenate the IDWR spatial data ID, POD Source (the Stream Name being diverted from), and Data Source (how was the point derived - GPS? Digitized?).

Calculation: [sp_data_id] &"_" & [Source] &"_" & [DSCode]

Add an attribute field for the N, Y, U stuff.

Step 3: Dissolve

The shapefile was then dissolved on the HEMCODE field, to avoid multiple POD's with the same source (stream) at the same location.

TOOLBOX – Data Management Tools – Generalization – Dissolve

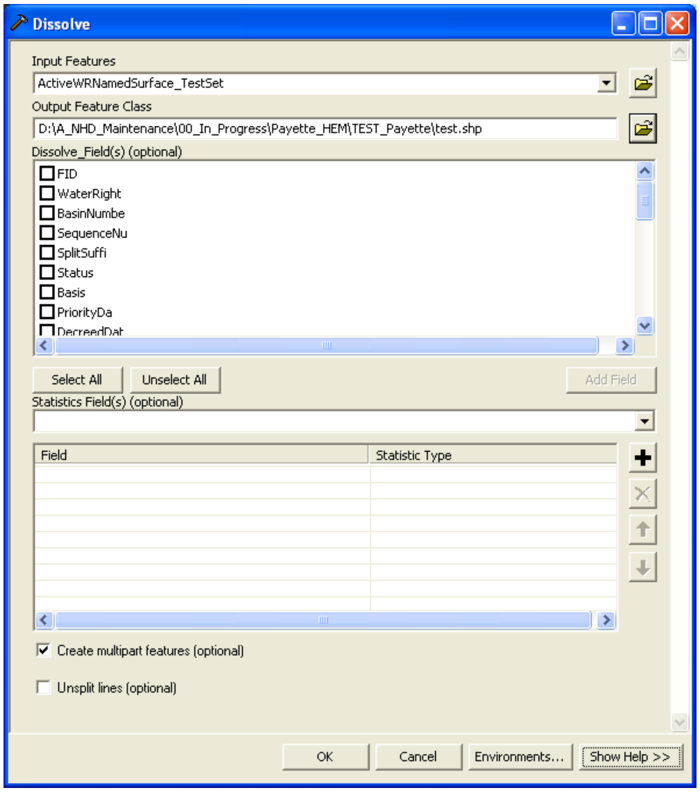
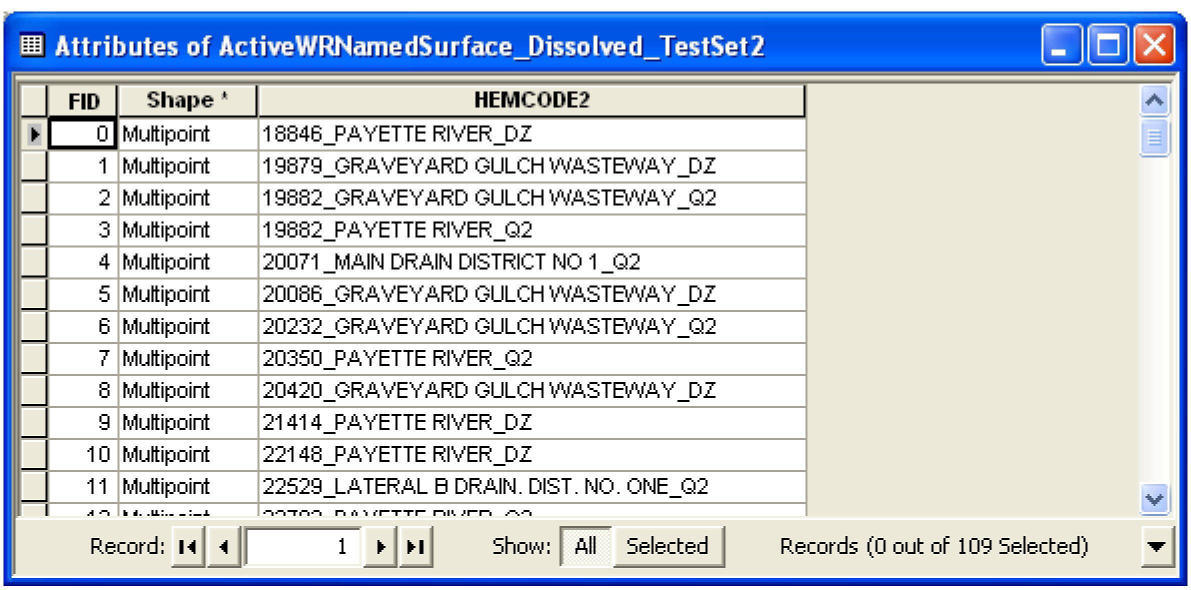


Figure 2 – Data is dissolved, using this dialog box


Attributes of ActiveWRNamedSurface_Dissolved_TestSet2

FID	Shape *	HEMCODE2
0	Multipoint	18846_PAYETTE RIVER_DZ
1	Multipoint	19879_GRAVEYARD GULCH WASTEWAY_DZ
2	Multipoint	19882_GRAVEYARD GULCH WASTEWAY_Q2
3	Multipoint	19882_PAYETTE RIVER_Q2
4	Multipoint	20071_MAIN DRAIN DISTRICT NO 1_Q2
5	Multipoint	20086_GRAVEYARD GULCH WASTEWAY_DZ
6	Multipoint	20232_GRAVEYARD GULCH WASTEWAY_Q2
7	Multipoint	20350_PAYETTE RIVER_Q2
8	Multipoint	20420_GRAVEYARD GULCH WASTEWAY_DZ
9	Multipoint	21414_PAYETTE RIVER_DZ
10	Multipoint	22148_PAYETTE RIVER_DZ
11	Multipoint	22529_LATERAL B DRAIN. DIST. NO. ONE_Q2

Record: 1 Show: All Selected Records (0 out of 109 Selected)

Figure 3 - Resulting table, after the dissolve

Step 4: Explode

As a result of the dissolve process, the shapes created were "multipart" feature points. An additional step was required to "explode" those points, separating them as individual spatial points, thus avoiding any errors while running the HEM tools. In this case, there were multipart features within this dataset, bringing the total records from 105 to 111.

-Editor – Start Editing – (select feature class), rt. Click on feature class – Selection – Select All

Advanced Editing Toolbar – click the "explode multipart feature" icon

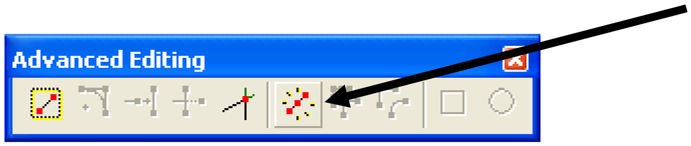


Figure 4 – Advanced Editing Tools – "Explode" icon

Step 5: Use the HEM Tools to Create Events

The Hydro Event Management Tools (ver. 2.2) were used to create events from the dissolved and exploded dataset. The process of creating events from points using the HEM Tools (ver 2.2) has been summarized in Appendix A.

The HEM tools successfully imported 105 out of 111 points. Six points did not import, and resulted in error messages (see Appendix B – HEM Tools Error Report).

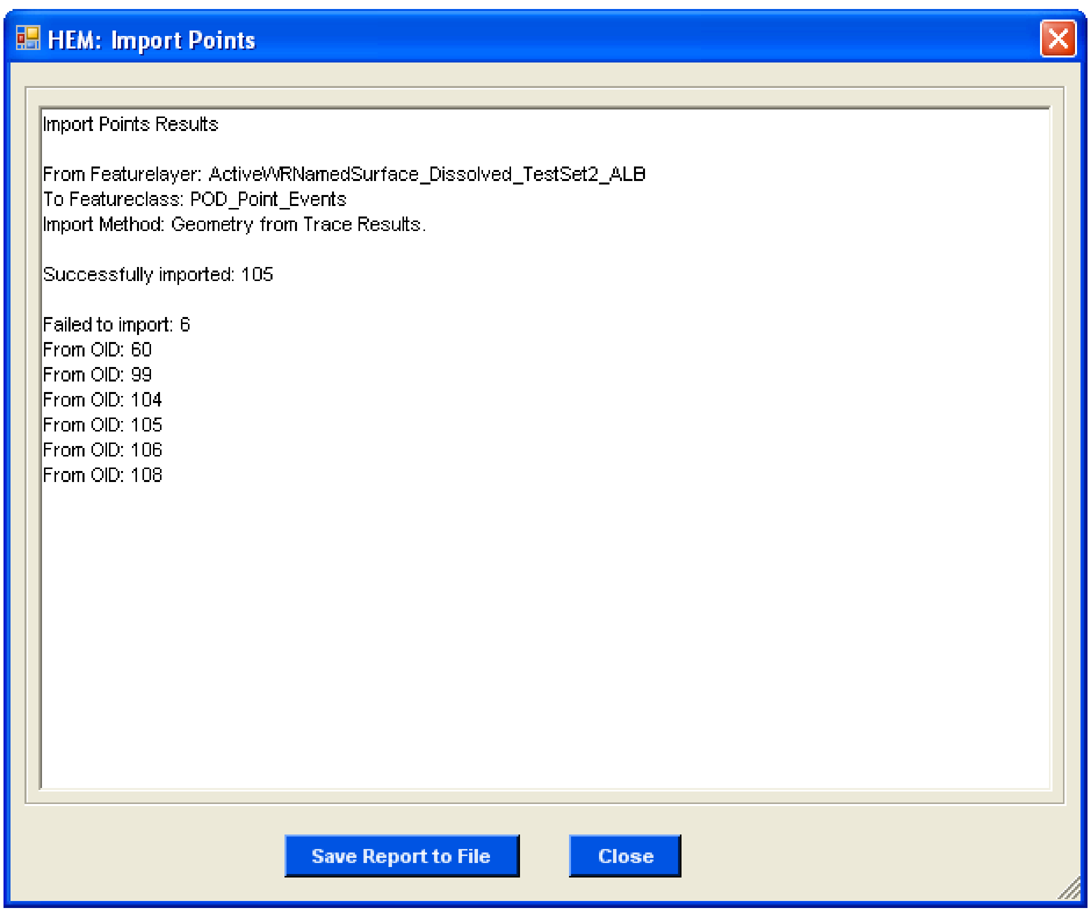


Figure 5 – Dialog Box showing HEM Tool import results

4. **Results**:

Each new imported event was spatially checked and verified to determine accuracy.   Records that were determined to be incorrect were given a "N" attribute. Records that were verified to be correct were given a "Y" attribute. The remaining records were given a "U" attribute for Unknown; these events could not be verified due to various factors described in the "Unknown Events" section of this report.

Collection Method	Number	Correct – Y/N/U
Digitized	16	Y
	26	U
	1	N
GPS	11	Y
Nominal (QQ, QQQ)	12	Y
	28	U
	9	N
Unknown (Blank)	1	Y
	1	U
TOTALS	105	

Figure 4 – Table showing Collection methods and verification results

Incorrect Event Points: Ten event points of 105 snapped to the wrong location. Of these, nine were nominal quarter-quarter (QQ) locations, and one point was digitized. In all cases, these were determined to be errors after being individually verified that they snapped to the wrong stream. These were checked by comparing the stream names in the event table with the NHD Flowline GNIS name attributes. In the example shown below (figure 6), the original POD was located in the centroid of the QQ section, and snapped to the closest stream, which was an unnamed stream.

Figure 6 – QQ nominal point is snapped to the incorrect location

In the case of the digitized point, it snapped to the wrong stream name, and additional authentication would be needed to verify the canal names and locations. In this particular instance, the point snapped to the “Last Chance Canal”, and the IDWR database referenced “Tunnel No. 7 Wasteway” as the POD source (Figure 7). This is an example that further corroboration would be needed to investigate whether this event point did, indeed, snap to the wrong canal, or if it was simply a GNIS naming error. It is possible that this point was digitized incorrectly on the map, named incorrectly in the database, or that “Last Chance Canal” and “Tunnel No. 7 Wasteway” are the same canal, but known by different local names, which would make this a correct match. Additional work may be necessary to update the NHD Flowline and GNIS canal names, depending on the findings.

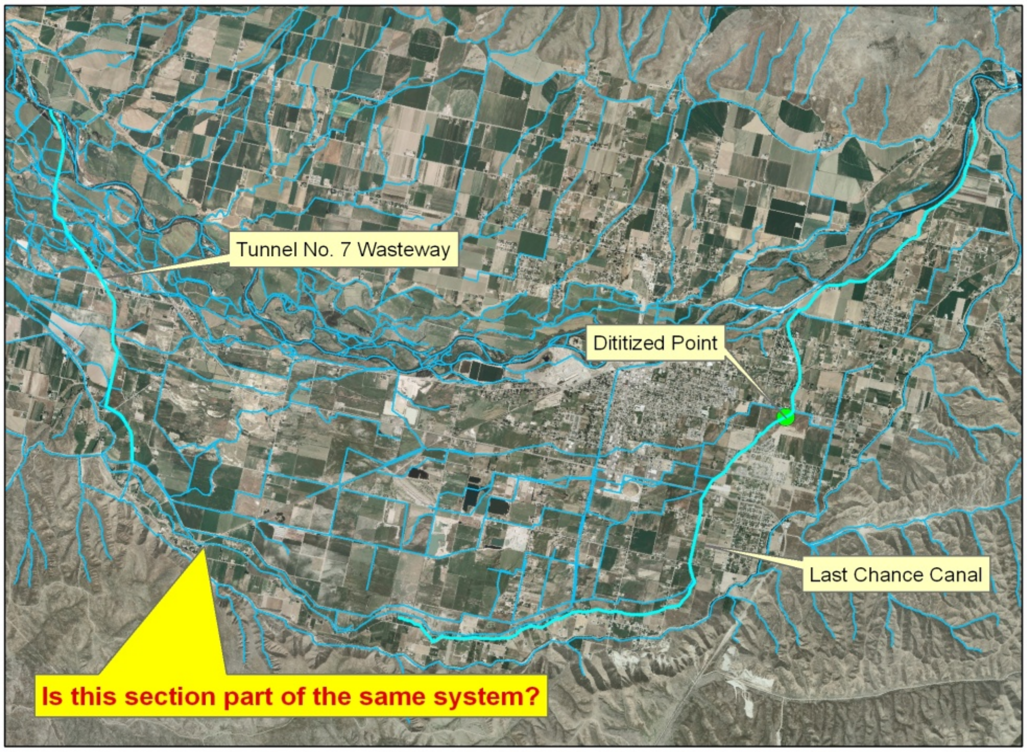


Figure 7 – Does this canal system connect? Is it the same canal but named differently?

Correct Event Points: Forty event points of 105 (38%) snapped to the correct stream, verified by performing a spatial intersect of the event points and the NHD flowline, then comparing the stream name attributes. Areas that contained GNIS name matches were considered correct without further investigation. Twelve events were QQ's, 16 events were digitized, and 11 events were GPS. One event was blank (no stream source was identified in the Water Rights database), but was verified and marked "Y" (matched) by looking at the aerial photography and determining that the Payette River was the only feature in that QQ, therefore, the only hydrography feature that an event could snap to (figure 8).

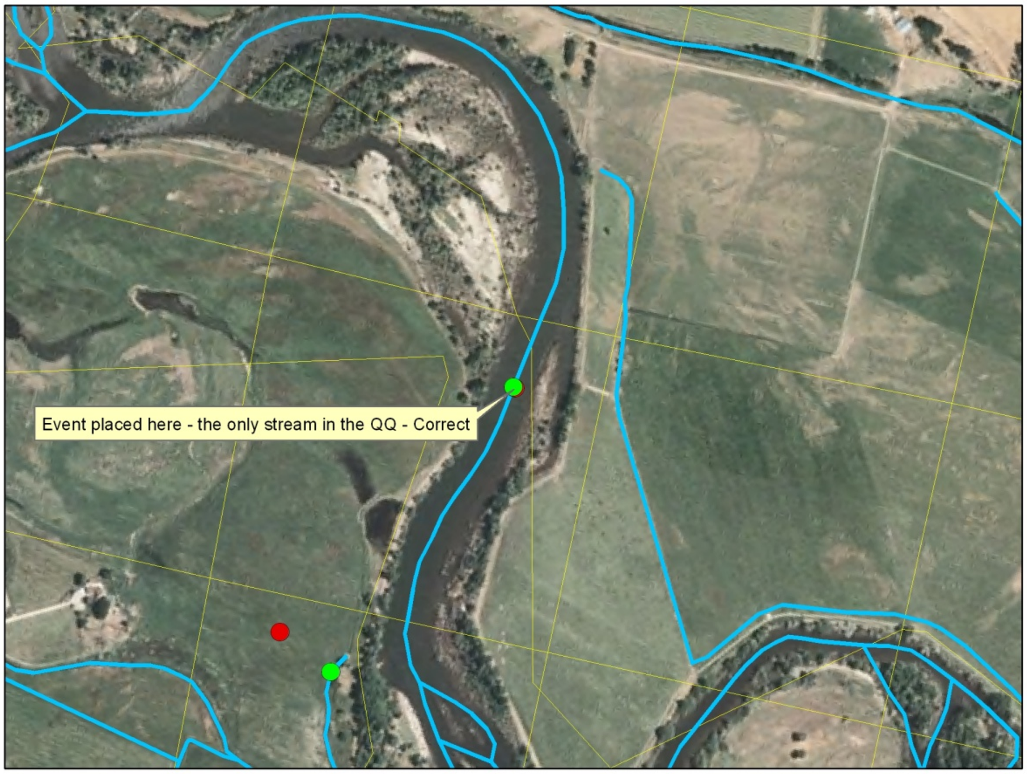


Figure 8 – Snapping to the only stream in the QQ

It was also noted that there were events that snapped to the correct location only because there were no other features within the snapping radius. As irrigation companies update their line work and new canal features are added to the NHD, the areas that are populated with historic QQ nominal points may have a greater probability of error in those areas (figures 9a & 9b).

Figure 9a – This point snapped to the correct stream using the "closest feature" option.

Figure 9b – Using this method, the point event would snap to the closest location, not the correct location as additional canals are digitized into the NHD.

<u>Unknown Event Points</u>: Fifty-five point events of 105 (52%) snapped to a location that could not be definitively verified. Of these, 28 were nominal quarter-quarter (QQ) locations, 26 were digitized points, and there was one additional point with a blank field for POD source from the IDWR database. All of these POD's had source names that differed from the GNIS_Name features in the NHDFlowline table. A closer look at some of these points revealed that they probably were matches, but additional work would need to be performed to check the POD source data against supplementary data supplied by the irrigation districts.

There were some instances of braided streams of the Payette River where the events did not snap directly to the Payette River, but to the river braid. In the example below (Figure 10), this point was coded as "unknown", as the braid portion of the river is not a named feature, causing a "non-match" between the NHD attributes and the IDWR database attributes. Upon further inspection, it was discovered that the original point was a nominal QQ, (placed in the center of the QQ section), so it was unclear where the diversion point was; directly out of the Payette River (from the braid?), or from a tributary stream. Had this point been derived from either a GPS or digitized point, it would have been interpreted as a match, after manual inspection.

Figure 10 – Example of an unnamed braided stream in the Payette River

There were also two instances of injection and re-diversion sites. This occurs when water is diverted out of one location, injected into another location, and re-diverted into yet another location. These events are three separate points of diversion records in the IDWR database, but with the same POD source (usually the original POD). In these cases, the hydro names will match for only one source, the original diversion (see Figure 11). Further investigation and cooperation with local agencies would need to be done to definitively match these sites to the proper diversion points. It was also noted that a separate procedure needs to be worked out when querying the IDWR database to avoid having to manually check each of these records throughout the state.

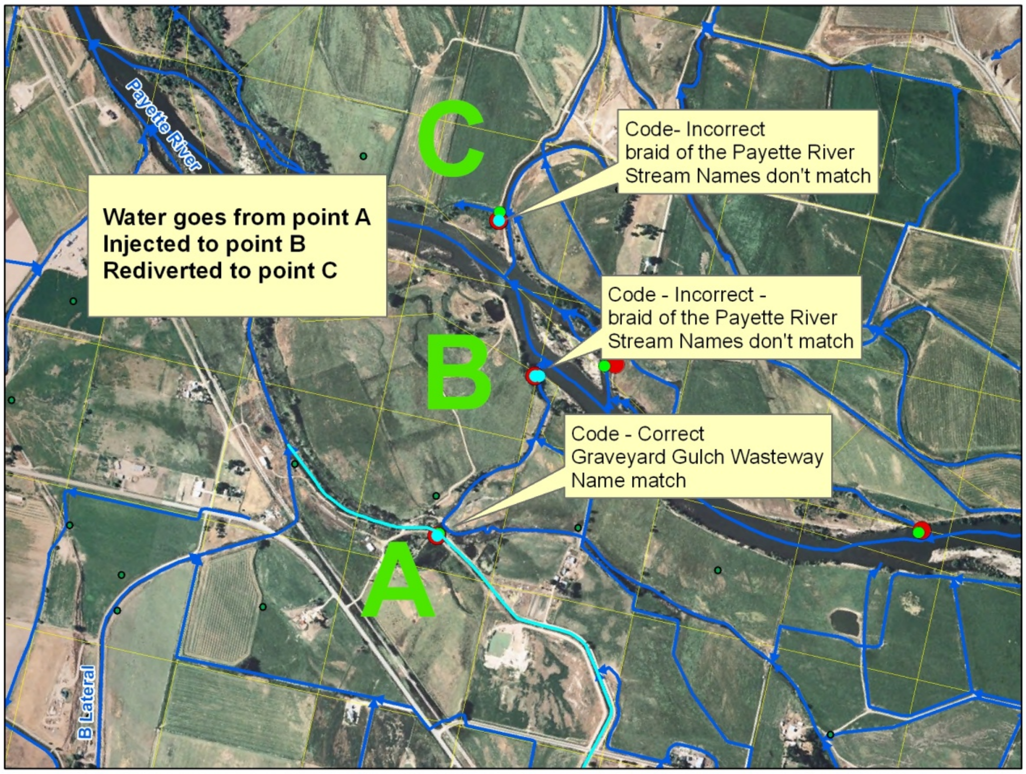


Figure 11 – Example of an Injection and Re-diversion site

The majority of the event points were coded “unknown” simply because the event point snapped to an unnamed stream or canal. Because these NHDFlowline features were did not have names associated with the GNIS_Name field, it was impossible to do a cross-check of named features between the IDWR Water Rights database and NHDFlowline feature class. As work persists with local agencies, name revisions and additions will continue to be added to the NHD, thus providing more opportunity for event matches and further assessments in the future.

5. **Discussion**:

Overall, 50 event points (48%) were determined to be either correct or incorrect, using the HEM Tool Create Points methodology, while the other 55 points (52%) were defined as “unknown” and required additional assessment. The Suppress Route Candidate option was used to avoid having to manually select a route candidate, especially for the nominal QQ points where the exact location is not defined, nor known by the GIS staff performing the analysis. An assessment of whether or not the point snapped to a named stream (in cases where the POD name was present) was the first step in determining whether or not further investigation was warranted. Additional review was conducted to determine how the point was originally collected, i.e., QQ, GPS, or digitized. Events that matched stream names (NHDFlowline and original POD source) that were digitized or GPS were considered correct with no further review, while events that were derived from nominal QQ events may warrant further review to correctly place them along the network in the future.

Several issues arose while using the HEM Tools to create point events. More information can be found in Appendix B "HEM Tools Error Report". There were 6 points that did not import using the HEM tools. A separate process was performed with these points using the ArcMap Locate Features Along Routes Tool, with success. It was noted that point events created with the Locate Features Along Routes Tool maintain the attributes from the original point dataset and will maintain one field from the geometric network. This is nearly opposite of the HEM tools which maintain all of the attributes from the geometric network needed to populate the NHDPointEventFC but only one attribute from the original point dataset. Another advantage of the HEM tool is that it creates a point featureclass. A point featureclass must be generated from the tables using Add Event Theme created by the Locate Features Along Routes Tool.

The procedure implemented by IDWR was that the maps cale should be set at least equal to the extent of the subbasin before beginning to import points. This eliminated any dependence on pixel size and the resulting potential effect on the number of route candidates being adjusted.

6. **<u>Conclusion</u>**:

IDWR successfully used the HEM Tools version 2.2 to create point events for 105 of 111 points (95%) originating from the IDWR Active Water Rights database; populating the Source_FeatureID field with a concatenated attribute consisting of the spatial data id, POD hydrography source, and point collection method. The HEM Tools provide a valuable resource for creating and managing spatial event data along the NHD network, while maintaining all of the attributes necessary to utilize the geometric network of the NHD data model (v2.0). By using this method, IDWR was able to define the data elements required to spatially distinguish which events needed further investigation and construct a workable method by which to accomplish this task.

It should be noted that IDWR has received additional canal updates from local irrigation companies and cooperators in this area, and plans are currently underway to further update the NHD in the Payette Subbasin.

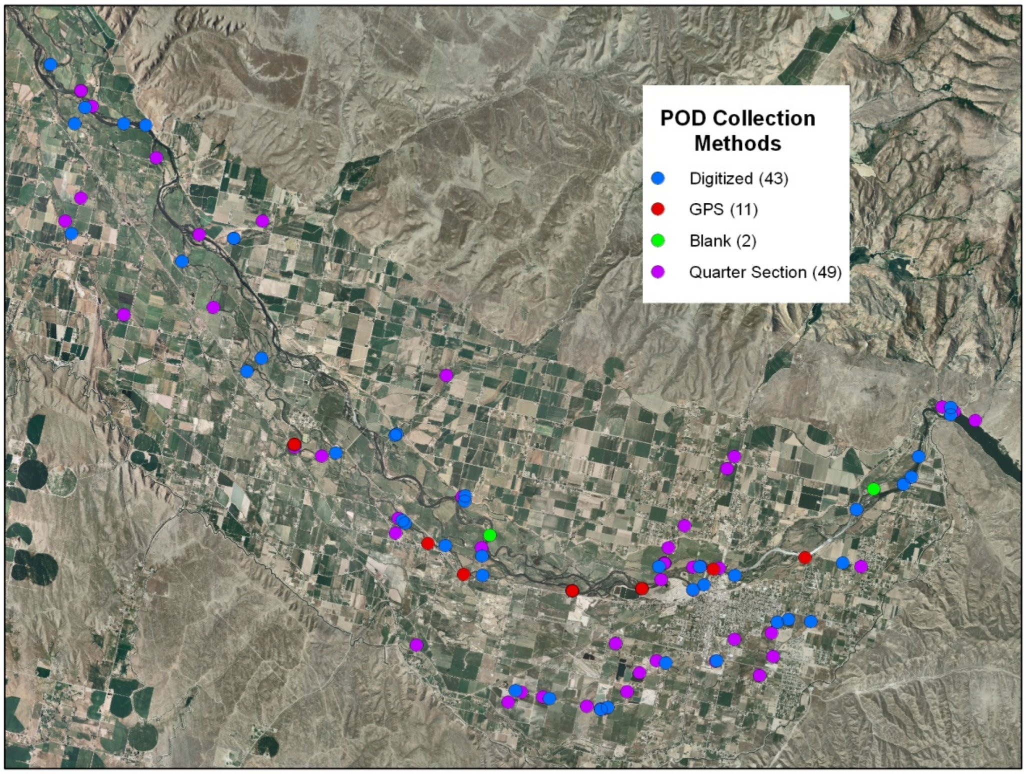


Figure 12 – POD Collection Methods for the 105 event points created with the HEM Tools

Appendix:

A. *Referencing Water Right PODs in the Payette Subbasin to the NHD using the HEM Tools*
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B. *Error Report – Referencing Water Right PODs in the Payette Subbasin*
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Acknowledgements:

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Thanks to Wilma Robertson for her support and contributions during the development of this project and in diligently processing canal company line work and her assistance with getting it all into the NHD.

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