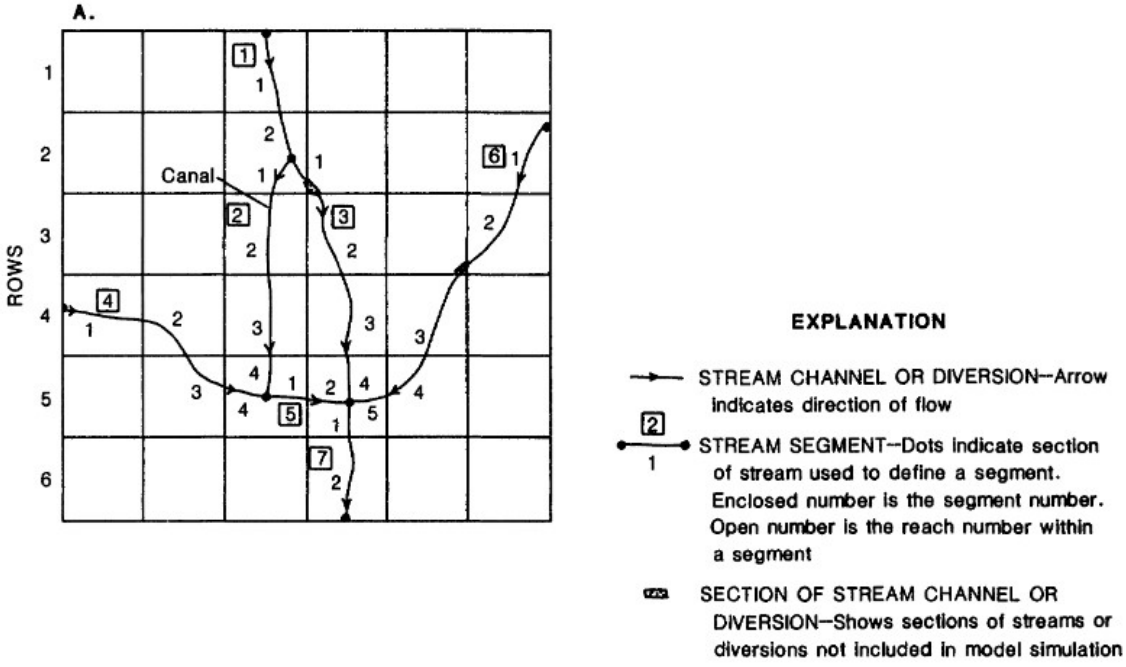
Appendix 9-A

Review of SFR Package

BACKGROUND

This document presents my review of the SFR package. My review was based on spot checks of the stream package and should not be considered a comprehensive review.

The COHYST ground water model currently models the North and South Platte channels, its tributaries and the drains using this package. As with previous MODFLOW stream packages, flow is routed from cell to cell using the Segments and Reaches. A segment is a stream or diversion in which streamflow from surface sources are added at the beginning or the segment or subtracted (in the case of a diversion) at the end of a segment. A reach is part of a segment that corresponds to an individual cell in the grid.



The flow routing used above is similar to how the COHYST model is constructed with the end of one segment generally overlapping the start of the next segment.

CONCLUSIONS

1) The stream package was constructed using automated procedures and as a result has lots of extraneous reaches that could be cleaned up. These extraneous reaches likely result in local effects on ground water levels or gains and losses to the stream, but probably do not greatly affect the regional water balance. However, the stream package as constructed is overly complex, and does not match reality very accurately. Below are several examples this complexity.

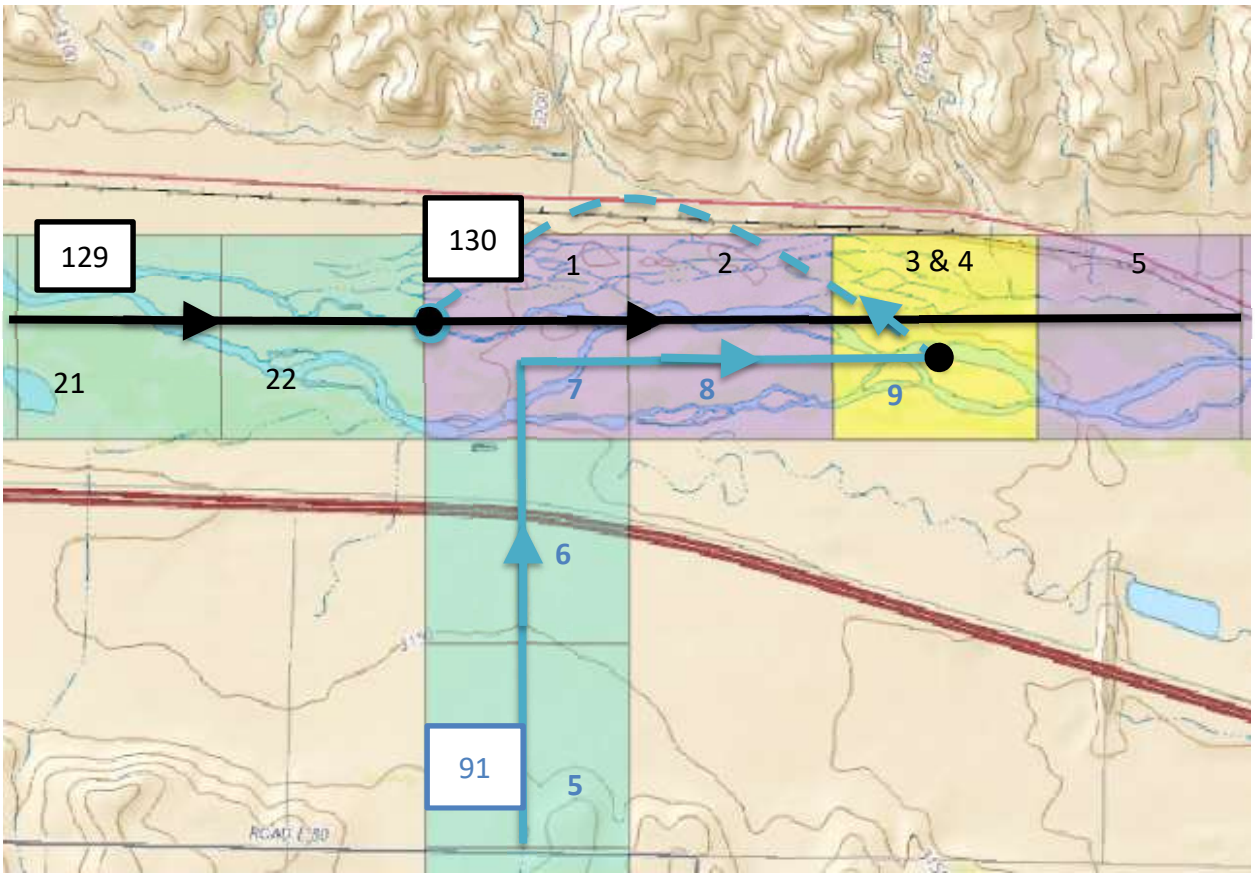
- **Overlapping stream cells, causes duplicate lengths.** It appears that there are overlapping cells where one reach ends and the next reach begins. This type of construction is acceptable; however, in the COHYST model the lengths are the same for each reach. By having the end of one segment overlap with the start of the next segment, the stream package will model double the gain, or double the loss for that cell,

unless the lengths are reduced by half. The table below shows one example of the overlap.

Row	Col	Segment	Reach	Stage	Bottom	K	Slope	Width	Length
127	27	16	32	3291.33	3290.33	2367.47	.001523	1.0	199.87
127	27	89	1	3291.33	3290.33	2367.47	.001449	1.0	199.87

The excess gains/losses in these cells are somewhat mitigated by the calibration of the Hydraulic Conductivity (K). During the calibration process, this value is often adjusted to best match water level targets. The K values would likely change after removing the duplicates and would likely improve the calibration of the model in the localized areas near the stream or drains.

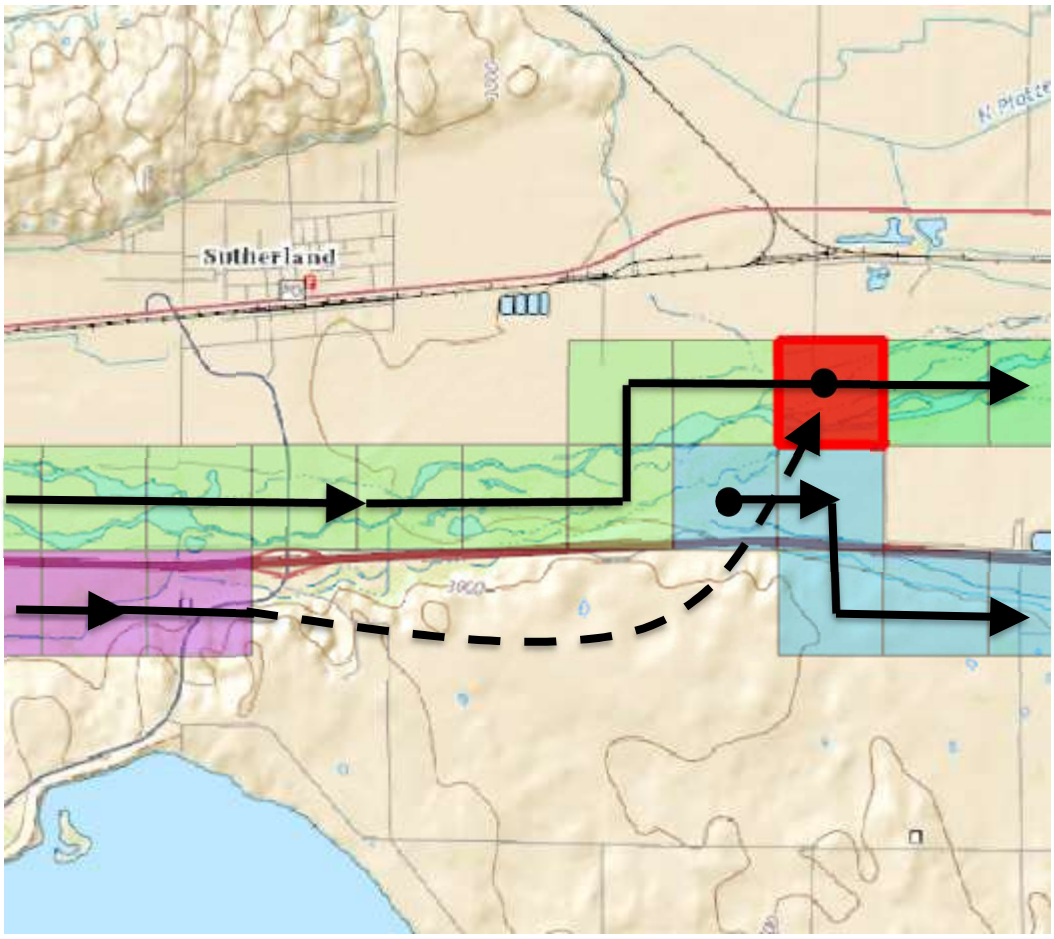
- **Roscoe Draw Example –** The image below is of Roscoe Draw, a tributary that enters the South Platte River just downstream of Roscoe.



As the figure above shows, water from the South Platte flows downstream (to the east) from Segment 129 to 130. Water from Roscoe draw flows north, then east in Segment 91. Segment 91 is supposed to connect to the South Platte at the start of Segment 130, but proceeds east two cells. Additionally, the South Platte has two reaches (3, and 4) in

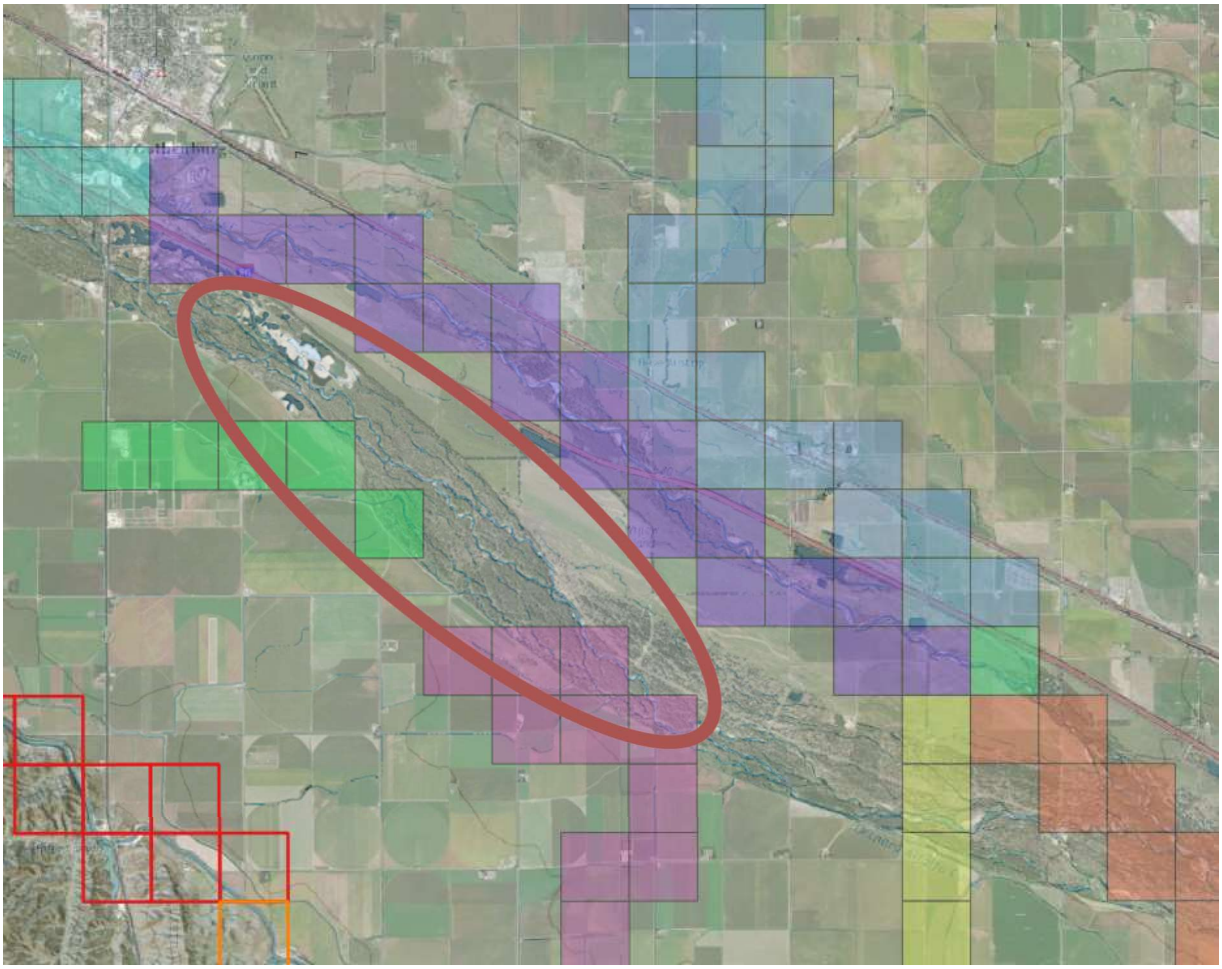
segment 130 in the same cell, thus doubling the gains or losses in this cell. This is a small issue, but could locally affect water levels and stream gains.

- **South Platte and Drains near Sutherland.** The figure below shows the South Platte and two drains near Sutherland Reservoir. The drain located west of Sutherland is currently modeled as entering the South Platte River 3 miles too far east.



Rebuilding the stream package to address these issues will likely improve model calibration locally near the river by correctly modeling the system as it exists in the real world.

2) Not all the channels of the Platte River are modeled. The figure below shows the stream package near Gothenburg where there are two distinct channels associated with the Platte River. Currently, COHYST only models one channel which is designed to be representative of the river. I would recommend adding two channels to better match the real world.



3) The main channel of the Platte River system (including the North and South Platte sections) have widths that range from 80 to 800 feet, but average 300 feet wide. This seems reasonable. The width of tributaries and drains range from 0.6 ft to 40 ft and average 3.3 feet in width. This seems a bit small, but is still reasonable.

4) The major drains are modeled with the stream package. After recent changes to the stream package it appears that most of the major drains are now modeled. A few drains have been identified and are currently being incorporated into future stream package builds.