

MEMORANDUM

June 7, 2002

To: Pam Skaggs
Through: Bob Sutter *NS*
From: Shane Bendixsen
Subject: Application for Transfer 69589: Burdick

It is my understanding this transfer involves diverting part of a Big Wood River right from a well. Part of the water right would be left in the Hiawatha Canal to mitigate conveyance loss and part left in the Big Wood River to mitigate impact of pumping the well. The proposed point of diversion is approximately 90 feet from the Big Wood River. The following is a brief hydrologic review of the applicant's analysis of stream aquifer interaction.

Brockway Engineering completed the analysis and used the image well method (Glover and Balmer, 1954). The method is analytical, is also referred to as the "Jenkins Method" for determining stream depletion, and has been widely used.

The method involves placing an imaginary or 'image well' on the other side of the stream at exactly the same distance as the 'real well' or pumping well. The image well injects water at the same rate the pumping well extracts water. This produces a constant head boundary at the stream. From this the ratio Q_s/Q (Q_s = amount supplied by the stream, Q = amount supplied by the aquifer) can be approximated. For a detailed understanding the reader is referred to Todd (1980).

Several assumptions must be made and are presented in Brockway's letter and are correct. His estimated values for hydraulic conductivity and a storage coefficient are also reasonable.

Brockway also uses the gradient near the stream to show how the system approaches equilibrium.

His method for determining Q_s/Q was in error. He assumed a linear relationship in his spreadsheet analysis, which should have been logarithmic (per communication Chuck Brockway, June 5, 2002 and attached). This produced a much more direct and rapid response than should actually occur. A corrected graph presenting time vs. Q_s/Q is attached using a continuous pumping rate of 18 gpm (.04 cfs). IDWR staff Steve Baker compiled the data with software using the Jenkins Method. This data was also checked using a similar method presented by Todd (1980) and compared to corrected values presented by Brockway. All correlated well.

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the data sheet. Please let i know what you think.

Shane

<<STREAM DEPLETION.doc>> <<Burdick2.dat>>

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Bendixsen, Shane

From: Charles G. Brockway [cbrock4@mindspring.com]
Sent: Wednesday, June 05, 2002 4:04 PM
To: sbendixs@idwr.state.id.us
Subject: RE: Burdick Transfer

Shane,

I reviewed my analysis and found that I had treated the Q_s/Q curve as linear rather than logarithmic when I programmed it into the spreadsheet. This makes a substantial difference especially as Q_s approaches Q . The correct values are:

Q_s/Q	Time (days)
0.50	0.54 (13 hours)
0.80	4.0
0.90	20

In terms of the effect on the river, I believe the responses are still short enough to warrant the surface-to-groundwater transfer. Thanks for reviewing my analysis. Please let me know if you have any other questions.

Chuck

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-----Original Message-----

From: Bendixsen, Shane [mailto:sbendixs@idwr.state.id.us]
Sent: Thursday, May 30, 2002 1:17 PM
To: 'cbrock4@mindspring.com'
Subject: Burdick Transfer

Chuck,

I am finally reviewing the Burdick Transfer. Sorry for being so late with this, but was busy and Pam kept giving me extensions.

I am not getting the same results you presented. I spot checked your data (Q_s/Q) based on Todd (1980. p. 144). Steve Baker then ran an analysis based on software he had obtained using the Jenkin's (1968) method which is based on Glover and Balmer (1954). These correlate, but not with you data. We used the same storage coefficient, conductivity, distance from the stream, and aquifer thickness you presented. Are we missing something?

Attached is a plot with your data and the Glover-Balmer method along with

Brockway's original analysis presented that 80% of equilibrium for Q_s/Q was achieved after 27 hours (1.1 days). The corrected value is approximately 96 hours (4 days). The corrected value for 90 percent is 20 days instead of 4.5 days (not presented on graph).

His analysis of the gradient at the edge of the stream is correct, but the question still remains what portion comes stream versus the aquifer during a given time frame.

In closing, the image well method is an acceptable method for determining stream aquifer interaction on a small scale. Brockway Engineering simply made a computational error and acknowledges this. The attached graph contains the corrected values.

REFERENCES

Glover, R.E., and Balmer G.C., River Depletion Resulting from Pumping a Well Near a River, Trans. Amer. Geophysical Union, v. 35 pp 468-470, 1954.

Todd, David Keith, Ground Water Hydrology, Second Edition, John Willey and Sons, 1980.

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