TECHNICAL MEMORANDUM

Introduction

This technical memorandum describes groundwater flow modeling performed in support of Washington State Department of Ecology (Ecology) Grant G0800066-Development of an Instream Flow (ISF) Rule Recommendation for the Spokane River. A technical memorandum from Spokane County Water Resources dated November 27, 2007 presented results of a model run that simulated the impact of 100% Washington State municipal water right withdrawal on Spokane River Flows. The results show that flow reduction in August at the Spokane Gage from the years 2000 through 2005 ranged between 208 cfs and 280 cfs. These results were presented to the work group at the December 11, 2007 meeting. This model run did not evaluate impacts from increased withdrawal in Idaho. At that meeting work group members expressed an interest in the impacts of increased withdrawals in Idaho on Spokane River flows. To evaluate those impacts three model scenarios were constructed:

1. Increased withdrawal in Idaho with no increase in Washington
2. Increased withdrawal in Washington with no increase in Idaho; and,
3. Increased withdrawal in Idaho and Washington.

Model Setup

Withdrawal increases were based on population projections for 2025 (Table 1). The Kootenai County Planning Department projects a 57% increase in population and the State of Washington Office of Financial Management projects a 29% increase in Spokane County population by 2025. A portion of the aquifer is located in Bonner County, ID, but the Kootenai County growth projection was utilized for the entire Idaho portion of the model.

Table 1 – Projected Population Growth

<table>
<thead>
<tr>
<th>County</th>
<th>Population</th>
<th>2005-2025</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1990</td>
<td>2005</td>
</tr>
<tr>
<td>Kootenai</td>
<td>69,795</td>
<td>131,500</td>
</tr>
<tr>
<td>Spokane</td>
<td>361,333</td>
<td>436,300</td>
</tr>
</tbody>
</table>
To simulate the three scenarios described above the Well Package was modified. The
Well Package represents the following withdrawals from and returns to the aquifer:

1. Water purveyor withdrawals;
2. Domestic withdrawals outside water service areas;
3. Self supplied industrial withdrawals;
4. Net agricultural withdrawals;
5. Septic system returns; and
6. Landscape percolation returns.

To simulate impacts to Spokane River flows from growth values for water purveyor
withdrawals, domestic withdrawals outside water service areas, septic system returns, and
landscape percolation returns were increased by 57% for model cells located in Idaho and
29% for model cells located in Washington. Three different combinations of original
values and growth adjusted values were assembled for the model runs.

Results
Over the period of 1990-2005 if Idaho water use was 57% greater than was originally
modeled and Washington water use did not change there would be an average reduction
in August Spokane River flows as measured at the Spokane at Spokane Gage of 1.75%.
If Washington water use was increased by 29% and Idaho water use did not change the
reduction would be 6.96%, and if water use increased in both states the average reduction
would be 8.34%. In comparison, if all of the Washington municipal water rights were
exercised and there was no change in Idaho water use the average reduction in August
river flows over the period 2000-2005 would be 25.80%. The water use increases for
each state were based on population projections for 2025. It is important to note that a
57% increase in population does not usually result in a 57% increase in water use.

The results demonstrate that even though Idaho is experiencing significant growth (57%)
the impact on river flows from increased water use is on average \(\frac{1}{4}\) of the impact of
increased water use in Washington. The map on page 5, which was presented at the
SVRP Summit, shows the magnitude of Washington’s water use in comparison to Idaho.
Comparison of Modeled Spokane River Flows in Response to Growth in Idaho and Washington

<table>
<thead>
<tr>
<th>Year</th>
<th>Original Model Scenario (cfs)</th>
<th>57% Growth in Idaho</th>
<th>29% Growth in WA</th>
<th>57% growth in ID &amp; 29% Growth in WA</th>
<th>Inchoate Rights exercised in WA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Flow (cfs)</td>
<td>% reduction</td>
<td>Flow (cfs)</td>
<td>% reduction</td>
<td>Flow (cfs)</td>
</tr>
<tr>
<td>1991</td>
<td>1335</td>
<td>1319</td>
<td>1.2%</td>
<td>1270</td>
<td>4.8%</td>
</tr>
<tr>
<td>1992</td>
<td>789</td>
<td>772</td>
<td>2.1%</td>
<td>722</td>
<td>8.4%</td>
</tr>
<tr>
<td>1993</td>
<td>1796</td>
<td>1781</td>
<td>0.8%</td>
<td>1739</td>
<td>3.2%</td>
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<tr>
<td>1994</td>
<td>445</td>
<td>428</td>
<td>3.7%</td>
<td>372</td>
<td>16.3%</td>
</tr>
<tr>
<td>1995</td>
<td>1180</td>
<td>1164</td>
<td>1.4%</td>
<td>1117</td>
<td>5.3%</td>
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<tr>
<td>1996</td>
<td>1225</td>
<td>1208</td>
<td>1.3%</td>
<td>1157</td>
<td>5.5%</td>
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<tr>
<td>1997</td>
<td>1865</td>
<td>1850</td>
<td>0.8%</td>
<td>1797</td>
<td>3.6%</td>
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<tr>
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<td>1.4%</td>
<td>1083</td>
<td>6.2%</td>
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<td>1896</td>
<td>0.9%</td>
<td>1846</td>
<td>3.5%</td>
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<tr>
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<td>1.5%</td>
<td>1021</td>
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<td>654</td>
<td>2.4%</td>
<td>601</td>
<td>10.3%</td>
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<tr>
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<td>1334</td>
<td>1316</td>
<td>1.3%</td>
<td>1267</td>
<td>5.1%</td>
</tr>
<tr>
<td>2003</td>
<td>680</td>
<td>662</td>
<td>2.6%</td>
<td>630</td>
<td>7.3%</td>
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<tr>
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<td>1243</td>
<td>1.7%</td>
<td>1179</td>
<td>6.7%</td>
</tr>
<tr>
<td>2005</td>
<td>714</td>
<td>693</td>
<td>2.9%</td>
<td>627</td>
<td>12.2%</td>
</tr>
</tbody>
</table>

Average Percent Reduction | 1.75% | 6.96% | 8.34% | 25.80% |
Modeled August River Flows with different growth scenarios

- Original Model Scenario
- 57% Growth in Idaho
- 29% Growth in WA
- 57% growth in ID & 29% Growth in WA
- Inchoate Rights exercised in WA
Cell-by-Cell Distribution of Well Term
(average of first year)

Well Term By Cell (ft³/day)

-1000000 - -500000
-500000 - -200000
-200000 - -100000
-100000 - -50000
-50000 - -15000
-15000 - -1500
-1000 - 1000
1000 - 1500

Model Boundary