Overview of the Upper Klamath Lake Drainage Hydrology Analysis
Ground Level Flow Data
Mass Balance Derivations

\[ T_{\text{mix}} = \frac{(Q_{\text{up}} \cdot T_{\text{up}}) + (Q_{\text{in}} \cdot T_{\text{in}})}{(Q_{\text{mix}})} = \frac{(Q_{\text{up}} \cdot T_{\text{up}}) + (Q_{\text{in}} \cdot T_{\text{in}})}{(Q_{\text{up}} + Q_{\text{in}})} \]

\( Q_{\text{up}} \): Stream flow rate upstream from mass transfer process
\( Q_{\text{in}} \): Inflow volume or flow rate
\( Q_{\text{mix}} \): Resulting volume or flow rate from mass transfer process \((Q_{\text{up}} + Q_{\text{in}})\)
\( T_{\text{up}} \): Stream temperature directly upstream from mass transfer process
\( T_{\text{in}} \): Temperature of inflow
\( T_{\text{mix}} \): Resulting stream temperature from mass transfer process assuming complete mix

All water temperatures (i.e. \( T_{\text{up}}, T_{\text{in}} \) and \( T_{\text{mix}} \)) are apparent in the FLIR sampled stream temperature data. Provided that one instream flow rate is known, the other flow rates can be calculated.

<table>
<thead>
<tr>
<th>Number of Mass Transfer Processes</th>
<th>Mass Transfer Process Flow Rates (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tributary Inflows</td>
</tr>
<tr>
<td>N.F. Sprague R.</td>
<td>10</td>
</tr>
<tr>
<td>S.F. Sprague R.</td>
<td>6</td>
</tr>
<tr>
<td>Sycan R.</td>
<td>1</td>
</tr>
<tr>
<td>Sprague R.</td>
<td>6</td>
</tr>
<tr>
<td>Williamson R.</td>
<td>9</td>
</tr>
<tr>
<td>Totals</td>
<td>32</td>
</tr>
</tbody>
</table>
Upper Williamson River - Confluence of Williamson River and Wickiup Springs - River Miles 80.65 to 80.41

\[ Q_{up}: \text{11.5 cfs} \]
\[ T_{up}: \text{72.1}^{\circ}\text{F} \]
\[ Q_{in}: \text{21.0 cfs} \]
\[ T_{in}: \text{46.4}^{\circ}\text{F} \]
\[ Q_{mix}: \text{32.6 cfs} \]
\[ T_{mix}: \text{55.6}^{\circ}\text{F} \]
Lower Williamson River - Unmapped Spring
River Miles 37.97 to 37.46

Q_{up}: 27.3 cfs
T_{up}: 74.7^\circ F
Q_{in}: 0.7 cfs
T_{in}: 48.2^\circ F
Q_{mix}: 28.0 cfs
T_{mix}: 74.0^\circ F
Lower Williamson River - Unmapped Spring
River Miles 22.09 to 21.57

\[ Q_{up}: \text{68.8 cfs} \]
\[ T_{up}: \text{75.0\degree F} \]
\[ Q_{in}: \text{11.3 cfs} \]
\[ T_{in}: \text{48.2\degree F} \]
\[ Q_{mix}: \text{80.1 cfs} \]
\[ T_{mix}: \text{64.5\degree F} \]
Lower Williamson River - Confluence of Spring Creek and Williamson River
River Miles 16.67 to 15.40

\[ Q_{up}: 67.9 \text{ cfs} \]
\[ T_{up}: 66.0^\circ\text{F} \]
\[ Q_{in}: 183.0 \text{ cfs} \]
\[ T_{in}: 48.2^\circ\text{F} \]
\[ Q_{mix}: 250.9 \text{ cfs} \]
\[ T_{mix}: 64.9^\circ\text{F} \]
Lower Williamson River - Confluence of Sprague River and Williamson River
River Miles 11.38 to 10.41

Q_up: 226.0 cfs
T_up: 53.6°F
Q_in: 349.2 cfs
T_in: 67.1°F
Q_mix: 575.2 cfs
T_mix: 61.8°F
Overview of the Upper Klamath Lake Drainage Hydrology Analysis

Results

Williamson River
North Fork Sprague River Derived Mass Balance

*Current Condition and Potential Condition*

![Graph showing flow volume and river mile relationship for North Fork Sprague River. The graph compares measured flow, potential flow volume, and current flow volume across different river miles.](image-url)
South Fork Sprague River Derived Mass Balance

*Current Condition and Potential Condition*

![Graph showing flow volume over river miles with current and potential flow volumes indicated.]
Sycan River Derived Mass Balance
*Current Condition and Potential Condition*

![Graph showing current and potential flow volumes along a river mile with measured flow indicated.](image-url)
Sprague River Derived Mass Balance

Current Condition and Potential Condition

Flow Volume (cfs)

River Mile
Williamson River Derived Mass Balance
Current Condition and Potential Condition