Jun 26th, 2:10 PM - 2:30 PM

Concurrent Sessions D: Glendale Water Supply Improvements Project: Truckee River Full Channel Width Fish Passage Water Diversion Project - TMWA Glendale Water Supply Improvement Project Case Study; Fish Monitoring and Evaluation Results

Jay S. Kidder
P. E. and Fisheries Biologist, Chinook Engineering

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TMWA, Glendale Water Supply Improvement Project Case Study; Fish Monitoring and Evaluation Results
6-26-2013

Presented at the 2013 International Conference on Engineering and Ecohydrology for Fish Passage

Original Work Funded by Truckee Meadows Water Authority

Prepared by

Chinook Engineering

Jay Kidder, P. E. and Fisheries Biologist
GWSIP Project
Fish Passage Aspects of the Roughened Channel

Fish Passage Design Goals
• Mimic Natural Channel
• Low flow roughened channel
• 4% bed slope
• Fish Passage for 9 local fish species
• Use existing location

Construction
• Diversion
• Demolition of existing structures
• Create streambed geometry and install bed material
• Integrate with fish screens and Municipal intake

Finished Project
• Remove diversion and allow river to return to the new full river width roughened channel
• Measure Success
Rubble dam
Full river width
Trash sluice
Bridge downstream
Intake
Glendale Fish Passage Study Timeline

- **Pilot Fish Passage Study**
  - Fall 2008

- **Preconstruction Fish Passage Study**
  - Fall 2009

- **Glendale Diversion Roughened Channel Construction**
  - 2010

- **Post-construction Fish Passage Study**
  - 2011
Glendale Fish Passage Study Purpose

- Monitor and Evaluate for Permit Requirements
- Record Success at Site
- Document Fish Passage Criteria
Methods
- Hydro-acoustic Tags
- "Tag/Recovery" Dilemma removed
- Local Fish and Several New Species
- Home range fidelity
- Evaluate fish passage success

Species Tagged
- Lahontan Cutthroat trout
- Rainbow trout
- Brown trout
- Tahoe Sucker
- Mountain whitefish

Fish Passage Results
- Successful Fish passage
- All species results
- Extensive quantity of data gathered
Multiple Micro-Passage Routes
Receiver Downloading Near Top of Roughened Channel
Behavioral Movement of Five Fish Species Were Measured to Establish Post-Construction Passage Tendencies of Fish Released Above & Below the Roughened Channel

Fish were collected by electroshocking

Tags were inserted

Did fish pass?

Fish were released
One hatchery and four resident fish species tagged:

- Hatchery LCT (USFWS fluvial stock) (450-580mm)
- Rainbow Trout (200-580mm)
- Brown Trout (205-650mm)
- Tahoe sucker (145-285mm)
- Whitefish (175-395mm)
• 109 Resident fish & Hatchery LCT Tagged
• 15 Receivers
• Released Nov. 1&2 (Monitored 32 Days)
• Receiver Downloads @ 2, 4, 32 Days
• 590,774 Detections (>18,000/Day Avg.)
Tahoe Sucker
Brown trout
Hatchery Lahontan Cutthroat trout
Glendale Diversion

395 Bridge

Receiver Array
• 6 Above Diversion
• 9 Below Diversion

Pioneer Diversion
Behavioral Assumptions

• Hatchery LCT Instinctively Move Upstream

• Resident Fish Will Demonstrate Site Fidelity
Results
Number Of Fish Tagged And Detected After 32 Days Of Release

<table>
<thead>
<tr>
<th>Fish</th>
<th>Tagged</th>
<th>Detected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lahontan</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>Cutthroat Trout</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Rainbow Trout</td>
<td>40</td>
<td>38</td>
</tr>
<tr>
<td>Brown Trout</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>Tahoe Sucker</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Whitefish</td>
<td>7</td>
<td>7</td>
</tr>
</tbody>
</table>

97% Detection Rate
Upstream Passage Capabilities Of Resident and Hatchery Fish Released Below Glendale Diversion

Fish Captured Above And Released Below Diversion
Fish Passing Diversion Within 32 Days

All Resident & Hatchery Species And Sizes Demonstrated Upstream Passage Success

<table>
<thead>
<tr>
<th>Species</th>
<th>Fish Captured Above And Released Below Diversion</th>
<th>Fish Passing Diversion Within 32 Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCT</td>
<td>60%</td>
<td>14%</td>
</tr>
<tr>
<td>Brown Trout</td>
<td>74%</td>
<td></td>
</tr>
<tr>
<td>Rainbow Trout</td>
<td>38%</td>
<td></td>
</tr>
<tr>
<td>Tahoe Sucker</td>
<td></td>
<td>14%</td>
</tr>
<tr>
<td>White Fish</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Downstream Passage Capability Of Resident And Hatchery Fish Released Above Glendale Diversion

Fish Captured Below And Released Above Diversion
Fish Passing Diversion Within 32 Days

Fish Number

LCT | Brown Trout | Rainbow Trout

Species

- LCT
- Brown Trout
- Rainbow Trout
<table>
<thead>
<tr>
<th>Hours</th>
<th>Minimum Time (Hours)</th>
<th>Maximum Time (Hours)</th>
<th>Average Time (Hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:00:00</td>
<td>LCT 2009: 1:02:45</td>
<td>556:09:29</td>
<td>97:04:37</td>
</tr>
<tr>
<td>120:00:00</td>
<td>LCT 2011: 1:32:03</td>
<td>98:32:52</td>
<td>21:46:34</td>
</tr>
</tbody>
</table>

Glendale Diversion LCT Passage Times For Pre-And Post Construction Periods

4.6 Fold Improvement

97 Hours

21 Hours
<table>
<thead>
<tr>
<th>Hours</th>
<th>Minimum Time (Hours)</th>
<th>Maximum Time (Hours)</th>
<th>Average Time (Hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:00:00</td>
<td>RBT 2009 3:33:30</td>
<td>154:59:45</td>
<td>36:47:01</td>
</tr>
</tbody>
</table>

Glendale Diversion Rainbow Trout Passage Times For Pre- And Post Construction Periods

- 9 Fold Improvement
- 36 Hours
- 4 Hours
Comparison of Pre & Post Construction Rainbow Trout Average Ascent Times Based On Last Detection At Release Site & First Detection Above Diversion

Rainbow Trout Released Below The Diversion In 2009

7:03

Rainbow Trout Released Below The Diversion In 2011

1:57

3.5 Fold Improvement
Brown Trout Passage Times For Pre- And Post Construction Periods

Minimum Time (Hours) | Maximum Time (Hours) | Average Time (Hours)
---|---|---
Brown 2011 | 0:43:03 | 105:35:00 | 28:45:31

2.9 Fold Improvement

43 minutes to ascend

28 Hours

82 Hours
Glendale Diversion Tahoe Sucker Passage Times For Pre- And Post Construction Periods

<table>
<thead>
<tr>
<th></th>
<th>Minimum Time (Hours)</th>
<th>Maximum Time (Hours)</th>
<th>Average Time (Hours)</th>
</tr>
</thead>
</table>

- **4 x Longer**
- **117 Hours**
- **29 Hours**
2012 Brown Trout Last/First Passage Time v. Length

\[ y = -8E-05x + 0.1051 \]

\[ R^2 = 0.0928 \]
2012 Rainbow Trout Last/First Passage Time v. Fish Length

\[ y = -0.0007x + 0.4212 \]

\[ R^2 = 0.7303 \]
Passage Examples Based On Telemetry Data
Brown Trout (360mm) Captured Above 395 And Released Below Glendale Diversion On November 2nd
Ascends Diversion On November 2nd (20:29)
Descends Diversion On November 5th (11:36)

Day 4
Ascends Diversion On November 7th (02:06)
Descends Diversion On November 10th (20:29)

Day 8
Ascends Diversion On November 11th (14:43) Day 9
Rainbow Trout (290mm)
Captured Above 395 And
Released Below Glendale
Diversion On November 1st
Above Pioneer Diversion On November 2nd (01:07) Day 2
Above Pioneer Diversion On November 4th (03:39) Day 4
Below Pioneer Diversion On November 4th (3:57)
<table>
<thead>
<tr>
<th>Fish Length (inches)</th>
<th>Fish Size (ft.)</th>
<th>Distance Traveled (ft/1000)</th>
<th>Time (Hours)</th>
<th>Fish Feet/Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown Trout Control Group</td>
<td>Brown Trout Diversion Effect Group</td>
<td>Rainbow Trout Control Group</td>
<td>Rainbow Trout Diversion Effect Group</td>
<td></td>
</tr>
<tr>
<td>9.8</td>
<td>0.8</td>
<td>2.64</td>
<td>15</td>
<td>159</td>
</tr>
<tr>
<td>16.6</td>
<td>1.4</td>
<td>13.20</td>
<td></td>
<td>139</td>
</tr>
<tr>
<td>17.8</td>
<td>1.5</td>
<td>5.28</td>
<td></td>
<td>83</td>
</tr>
<tr>
<td>15.9</td>
<td>1.3</td>
<td>7.92</td>
<td></td>
<td>38</td>
</tr>
</tbody>
</table>

Fish Feet/Hour

Fish Feet/Hour
Key Findings:
• All resident and hatchery LCT demonstrated upstream and downstream passage
• Roughened Channel improved passage conditions for all five species tested
• All size classes tested passed roughened channel
• Roughened Channel outperformed the original structure despite more difficult flow conditions (120 cfs v. 500 cfs)
Partnership Appreciation
• USFWS
• NDOW
• City of Sparks
• TMWA Staff
Panel Discussion; Community Partnering
Glendale Water Supply Improvement Project
Ron Penrose, Mike Wilkin, Jay Kidder
6-26-2013
Involved • Educate • Pride of Ownership

Community

Design
• Fish Criteria
• Engineering Criteria

Permitting
• Agencies
• Community
• Successful project
Questions?
Outreach

- Pictures and drawings

Meet

- Monthly Meetings

Interact

- Folks get involved
Questions?
Questions?
Partnering

Future Projects

Teamwork

Streamlining

Success
Questions?