Fifteenmile Watershed
Critical Low Flow Plan

January 2013

Prepared by:
Fifteenmile Watershed Irrigators

In cooperation with:
The Freshwater Trust
Fifteenmile Watershed Council
Oregon Water Resources Department
Oregon Department of Fish & Wildlife
Confederated Tribes of Warm Springs
Wasco County Soil & Water Conservation District
Wy'East RCD
Oregon Department of Environmental Quality
National Oceanic & Atmospheric Administration

Table of Contents

I. Background

In addition to supporting a robust agricultural community, the Fifteenmile watershed provides key habitat for many aquatic species including threatened winter steelhead, Coho, Chinook, Pacific lamprey and other native fish. During mid-late summer months, irrigation withdrawals exacerbate naturally low base flows, reducing available habitat and hindering mobility for juvenile and adult fish. Decreased water levels also raise water temperature and dissolved oxygen levels, increasing aquatic species' susceptibility to disease and predation.

All major Fifteenmile watershed planning documents list low streamflow as a primary limiting factor for viable fish populations and prioritize specific actions to restore the natural hydrograph to the Fifteenmile watershed in order to provide sufficient flows during critical periods. Recommended restoration actions include 1) reducing irrigation withdrawals through the implementation of on-farm efficiency projects, instream water right transfers and leases, the reduction of irrigated acreage and substitution of surface water for ground water irrigation; and 2) increasing natural water storage through the adoption of no-till farming practices and floodplain restoration. The Middle Columbia Steelhead Recovery Plan also identifies a specific flow-related objective for the watershed that includes meeting a flow target of about 7 cfs at the mouth of Fifteenmile Creek for the month of August.

Lead by the efforts of the Fifteenmile Watershed Council and its members, local restoration groups, tribes, and state and federal agencies are taking a comprehensive and cooperative approach to tackling the recommended actions identified in the planning documents. Watershed Council partners recently installed 5 new staff gages and metered all significant irrigation diversions as part of its Fifteenmile Watershed Flow Monitoring Project. This will promote efficient and fair regulation of irrigation withdrawals and help paint a complete picture of water movement throughout the watershed. The Flow Monitoring Project also assessed water savings from irrigation efficiency upgrades and together with partners from Wasco County Soil & Water Conservation District, Natural Resources Conservation Service and Wy'East Resource Conservation & Development Area Council offered irrigators a variety of assistance programs for implementing these improvements. Using this assistance, Fifteenmile irrigators reduced water withdrawals—and saved energy—by installing new pumps and sprinkler hardware and by upgrading to center pivot systems. In addition, The Freshwater Trust continues to offer financial compensation to Fifteenmile irrigators who lease part or all of their water rights for instream use through the Fifteenmile Creek Instream Lease Program.

In 2009, amid these efforts, low flows and extended high air temperatures combined to kill an unknown but significant number of juvenile fish in Fifteenmile Creek, including threatened steelhead. As a result, an enforcement official from the National Oceanic and Atmospheric Administration (NOAA) investigated claims that the watershed violated the Endangered Species Act (ESA), an offense that carries both civil and criminal penalties. Although NOAA's investigation did not result in an enforcement action, the official strongly recommended that irrigators develop a strategy to address future low flow/high air temperature events. The official also cautioned that NOAA must enforce the provisions of the ESA regardless of climate conditions and that someone would be held accountable if a similar event occurs in the future. Since then, the Watershed Council has prioritized raising awareness of irrigator liability under the ESA, including working with NOAA representatives to determine how best to reduce this liability. While restoration actions have increased in the watershed since 2009, low flows are still a primary limiting factor for fish and the potential for another fish kill remains high.

The goal of the Fifteenmile Critical Low Flow Plan (the "Plan") is to reduce irrigator liability under the ESA by preventing future fish kills in the Fifteenmile watershed. Although low flows present multiple problems for aquatic species in the watershed (e.g. dewatering critical rearing and spawning habitat, cutting off fish passage) this Plan is aimed solely at reducing stream temperatures lethal to fish by temporarily restoring streamflow to Fifteenmile Creek and its tributaries under the specific circumstances outlined below. The CLP is a contingency plan that provides only a bare amount of relief for aquatic species. The Fifteenmile watershed recognizes that it must continue to pursue the restoration actions recommended in the planning documents in order to permanently realize long term streamflow restoration and restore the natural hydrograph to the subbasin..

Section II of this document explains the underlying criteria and predictive model that will trigger the initiation of the Plan. Section III outlines the actions the Fifteenmile watershed will take when a low flow/high air temperature event triggers this Plan.

Questions for the group:

- Fifteenmile Watershed Critical Low Flow Plan is just a working title. What would you like to call this plan? Some suggestions so far: Fifteenmile Low Flow Plan, Fifteenmile Flow Protection Plan, Fifteenmile Flow Plan, Fifteenmile Action to Stabilize Temperatures (FAST).

II. Predictive Model

While the Fifteenmile watershed supports at least 18 species of fish, the implementation of the CLP during any given year is contingent on the presence of specific conditions tiered to the biological needs of two focal species: threatened steelhead and Pacific lamprey. The watershed chose these two species primarily because of their legal status in the watershed; steelhead are listed as a threatened species under the ESA and Oregon Department of Fish and Wildlife identify Pacific lamprey as a vulnerable species. However, these species have particularly sensitive habitat requirements and management strategies aimed at benefitting these species will likely improve the habitat for all aquatic species.

Derrek Faber, ODFW steelhead research project leader for Fifteenmile watershed, used streamflow and air temperature data collected in the watershed to develop a model to make near-term predictions of stream temperature. Faber based the model on current flow measurements, air temperature, and predicted weather conditions from the National Weather Service. The model predicts water temperatures for seven days using location-specific climate predictions generated by the National Weather Service (NWS). The model pulls localized climate predictions (including air temperature, dew point, and humidity) from the NWS website daily, in addition to instantaneous Fifteenmile Creek discharges posted on the Oregon Water Resources Division website and uses these data in a mixed-model framework (McLean et al, 1991) to generate the daily average water temperature prediction. Each measurement site has a unique set of covariates (including geology, riparian cover, groundwater penetration, and water sources), and while the mixed-model framework is an excellent tool for predicting long-term data with various inputs, it is ultimately bound to weather predictions.

Faber will monitor the accuracy of the model over time by validating model predictions of water temperature measured by temperature-loggers at each site. If model predictions do not accurately represent actual water temperature, model covariates can be adjusted to produce more reliable predictions. Currently, this model makes stream temperature predictions for two sites on lower

Fifteenmile Creek: Fifteenmile Creek at the mouth of Eightmile Creek (200 ft elevation) and the Fifteenmile valley near Emerson-Roberts Rd crossing (900 ft elevation). To date, the model effectively predicted water temperatures for these two sites to within one-half of a degree. Faber plans to further refine the model and apply it to two additional Fifteenmile Creek monitoring sites in the Dufur valley: one at the city of Dufur and another at the Fifteenmile Creek confluence with Ramsey Creek. Modeling these four different sites on Fifteenmile Creek will yield a comprehensive forecast for water temperature gradients throughout the watershed.

The watershed will use this predictive model to determine when high stream temperatures will increase risk of salmonid and lamprey mortality. The literature on critical temperatures for steelhead finds a range between 22°C-24°C (71°F-75°F) causes lethality, not accounting for cold water refugia. From field observations in the Fifteenmile watershed by ODFW, it is very likely that the 900 ft elevation has very low densities of juvenile steelhead during the summer. Instead steelhead migrate to higher elevations with lower stream temperatures, or into areas of upwelling such as the Dufur Valley. In these areas, the high densities of fish may be more vulnerable to higher stream temperatures. For example, during the 2009 fish kills, the average water temperature in the Dufur Valley (1200 ft elevation) was between 21.5°C-22.5°C (71°F- 72°F), at the lower end of the lethal range.

For this reason, this Plan articulates different temperature triggers depending on location and field observations. When the model predicts that water temperatures will reach over 23° C (73° F) at the mid-valley site (900 ft elevation) and 21.5° C (71° F) at the Dufur Valley site (1200 ft elevation), the watershed will follow the implementation steps outlined in the next section.

Fifteenmile Stream Temperature Triggers

900' elevation	23° C (73° F)
1200' elevation	21.5° C (71° F)

Questions for the group:

- What are the needs of running and maintaining the model (e.g. dedicated computer, staff time, funding, etc.)? Who should be responsible for this?
- The predictive model forecasts for average stream temperature only and the maximum stream temperature is likely 2-3 degrees higher than the average reported. Should we alter the temperature triggers to account for this? Need to find balance between precautious and practicable. Want to avoid is seeing a fish kill where no warning was sent.
- In terms of liability, the most compelling part of this Plan is that it is voluntary and watershed-driven. In that vein, should the watershed irrigators form a "low flow" group/entity that takes at least partial responsibility (possibly in partnership with the WC) for the predictive model and implementation of the Plan? And eventually funding (see compensation section below)?

III. Plan Implementation

The following steps represent actions Fifteenmile irrigators will take to prevent fish mortality in the Fifteenmile watershed.

A. Response to Forecast Alert

The watershed will take a two-prong approach in responding to a forecast alert: 1) pre-irrigation season planning, and 2) a year-specific Action Plan (e.g. 2013 Action Plan). The primary goal of the watershed is to reduce the occurrence of high stream temperature events through planning and appropriate reduction of water use, and the secondary goal is to develop a practical Action Plan based on irrigators' land management plans.

Irrigation Season Planning

The appointed representative will convene two meetings prior to each irrigation season. The first meeting will focus on reviewing current snowpack conditions, long-term weather forecasts and predicted water availability for the coming irrigation season, including a summary of water protected through instream transfers and leases. Irrigators can use this information to solidify land management plans. Depending on the forecast, irrigators may choose to modify land management plans to use less water. Modifications may include switching to crops that use less water, rotating crops, or letting pieces of less productive land go fallow for part of the season and leasing the water rights for instream use during the remainder of the season. For example, if the forecast is for a dry summer and snowpack is low, it might make sense for an irrigator to plant wheat in the spring/early summer and enter into a split-season lease for the rest of the season. To the extent practicable, irrigators will share land use plans with the group and the appointed representative will document these plans. The focus of the first meeting is on using the long-term forecast to inform land management decisions that are consistent with predicted water availability.

Action Plan

The second meeting will focus on the development of an Action Plan using the information gathered in the first meeting. While it is important to note that each forecast alert will have a unique set of circumstances shaping the watershed's response (time of season, priority date regulation, land use management, warning location, etc.) some variables are fairly consistent and predictable from season to season. Data from 2004-present shows that high stream temperatures and water availability share an inverse relationship. As stream temperatures rise, regulation tightens and the number of irrigators able to use water declines, indicating less water is available for diversion. During the 2009 fish kills, for instance, temperatures at the 1200' elevation gage spiked to between 71-72°F from July 28-August 3. During this same time period, the Watermaster's priority date regulation proportionally increased from 1912 on 7/29 to 1909 on 7/31, and finally to 1908 on 8/3. Prior to 7/28, the Watermaster regulated for 1960 priority dates.

This is a traditional regulation pattern where priority date regulation is responsive to flows in real time. Under Oregon Law, Watermasters have little flexibility on when to begin regulation—when water is physically flowing, the law requires the Watermaster to distribute that water according to priority. However, traditional regulation practices are not responsive enough to achieve the goals laid out in this document. The predictive model gives the watershed the ability to proactively regulate to help avoid or lessen the intensity of high air temperature/low flow events. Because the Watermaster may not have legal authority to regulate proactively according to the predicative model, this manner of regulation must be voluntary (voluntary self-regulation). Voluntary self-regulation will form the backbone of the Action Plan and represents the first line of defense to a forecasted alert, year-to-year.

The second meeting will culminate in the identification of specific actions that irrigators can take to temporarily restore flow to the Creek, in the event that voluntary self-regulation does not avert high

stream temperatures. The watershed will draft year-specific action plans (2013 Action Plan) using the information collected in the first meeting. The watershed may draft several plans for implementation depending on the specific circumstances of the alert (i.e. 2013 Action Plan A). The following are examples of tools to include in the Action Plans:

1. **Rotation Agreements**

Irrigators coordinate with neighbors and take turns bypassing water.

2. **Minimum Flow Agreements**

Irrigators agree to jointly manage water use and delivery systems to ensure a specified volume of water remains instream at a specified point during a specified period of time.

3. **Curtailed Use**

Irrigators agree to forego the use of some or all of their water for a specified period of time.

The Action Plan will also identify how other, non-irrigating water users can support these actions including agreeing not to divert bypassed water, etc. Although the burden on implementing these year-specific action plans will fall heavily on more senior water users, all irrigators have a role to play.

The appointed representative will draft the Action Plan(s) for recording purposes and each participant will sign, indicating their voluntary willingness to abide by the actions identified in the document. The appointed representative will distribute the Action Plan via email, website, and posting at a pre-determined public place in Dufur (post-office, Kramer's, other?). The appointed representative will distribute the Action Plan to any irrigators that did not attend the meeting.

Questions for the group:

- Need to make sure that senior users attend the pre-irrigation season meeting since these users are essential to planning and implementing the year-specific Action Plans.
- In looking back at the stream temperature data I received from Derrek from the previous 20 years, we need to be aware that forecasted alerts may occur several times a year. Is this ok? We may be able to refine this process long term after we get a few years under our belt.
- What are the limitations on the Watermaster's ability to proactively regulate or participate in coordinating a voluntary self-regulation for the Fifteenmile watershed?
- Is it useful to also have a post-alert meeting with senior irrigators to fine-tune the year-specific action plans? It may seem like a lot of meetings but having a paper trail in the event of a fish kill is helpful in diminishing liability.

B. Alert & Irrigator Notification

Interested parties can view the 7-day predicted stream temperature, in addition to the daily weather forecast and current Fifteenmile Creek discharge measurements (Fifteenmile Creek Water Temperature Forecast or Forecast; see example below), in one of three ways:

1) Email: ODFW [or other party?] will send a group email with the daily Forecast.

2) Website: The appointed representative [Who?] will maintain a website with daily postings of the Forecast, links to the FCLFP and other pertinent information.

3) Public posting: The appointed representative [Who?] will post the daily Forecast in one or more easily accessible public places [Dufur Post Office? Kramer's Market? Other? Both?]

When the model predicts that water temperatures will reach over 23° C (73° F) at the mid-valley site (900 ft elevation) and 21.5° C (71° F) at the Dufur Valley site (1200 ft elevation), known lethal temperatures for steelhead and lamprey, the appointed representative [the Watershed Council? appointed irrigator? other? Maybe it changes yearly?] will issue an alert and collaborate with the Watermaster (and others?) to 1) analyzing alert details to determine where, when and how much water is needed, accounting for loss and travel time, and 2) identify the water users that are currently irrigating and can potentially supply this water. The appointed representative will issuse a voluntary self-regulation date based on the outcome of this analysis.

Notification of the voluntary self-regulation will be available via the means described above. In addition, the appointed representative will develop a call list and assign Watershed Council members and/or other Fifteenmile watershed members to help notify irrigators and applicable agency representatives of the alert and voluntary self-regulation.

Forecast Example

Fifteenmile Creek Weather and Water Temperature Forecast								
Day	**Fifteenmile Ck at Eightmile Ck Confluence (200 ft elevation) Degrees C**	**Fifteenmile Ck at Dufur (1200 ft elevation) Degrees C**	**Low/High Air Temperature (F)**	**Chance of Precip (%)**	**Snow Level (ft elev)**	**Dewpoint (F)**	**Fifteenmile Discharge, Daily Avg (cfs)**	
Sunday, July 26, 2009	23.5	20.5	71/98				5.1	
Mon, July 27, 2009	25.1	21.5	72/102					
Tues, July 28, 2009	25.6	22.2	68/108				4.8	
Wednesday, July 29, 2009	25.8	22.4	72/103					Fish Kill Observed
Thurs, July 30, 2009	24.9	21.9	66/105					Fish Kill Observed
Friday, July 31, 2009	25.5	22.1	73/104					Fish Kill Observed
Saturday, Aug 1, 2009	25.6	22.3	74/103					Fish Kill Observed

Questions for group:

- Thoughts on how to implement voluntary self-regulation? Is this something we can determine beforehand so that irrigators can implement upon notification?

- How to notify implementation of year-specific Action Plans? Should this be concurrent with voluntary self-regulation?

C. Compliance

If irrigators have legal entitlement to use water, the Watermaster has no authority to shut them off for instream benefit to cool the stream. For this reason, participation in the Action Plan is strictly voluntary and individual compliance, in the absence of any instream leases or transfers, must be an irrigator-driven process. Fortunately, Fifteenmile's system of gauges allows for tight monitoring of instream and out-of stream water use, which will aid in the efficient and targeted implementation of the Action Plan.

All major diversions from Fifteenmile and Eightmile Creeks have totalizing flow meters installed. This will allow for independent verification of an irrigator's compliance with the voluntary self-regulation and Action Plan. Furthermore, there are three continuously recording gauges on Fifteenmile Creek (one at RM 1.75, 6, and Fifteenmile Creek at Ramsey confluence) that will allow for the tracking/accounting of water movement downstream.

D. Compensation

The Freshwater Trust is committed to seeking funding for compensating irrigators who voluntarily shut-off or curtail their water use as a result of Plan implementation. Although the form of compensation has yet to be determined, payments will likely be modest and aimed at alleviating the inconvenience of interrupting water use. *The primary benefit to irrigators modifying water use during times of critical low flow is reducing personal liability under the ESA.* Furthermore, the watershed anticipates this Plan will raise awareness of critical low flow events, encouraging irrigators to proactively manage their water use in ways that reduce the occurrence of these events.

Options

1. *Event-based Payment*: calculate, on average, how often high air temps/low flow events occur in Fifteenmile watershed. Sign several year deals with participating irrigators based on this figure (ie: if event occurs twelve times every three years, pay irrigator for use of water for twelve days over a three year contract).
2. *Slush Fund*: the watershed creates a critical low flow "slush" fund using small contributions from participating irrigators for payments to water users, should the need arise. A self-supporting system like this would strengthen the watershed's case for ESA compliance.
3. Others?

Question for the group:

- Is compensation really needed? Is reducing liability enough? Especially given that the Creek reaches lethal temperatures often.
- Perhaps compensation is needed just for the first few years while the watershed figures out how to adjust to the implementation of the plan and hopefully how to avoid its implementation.

E. Yearly Report

The appointed representative will produce a yearly CLP report summarizing the implementation of the CLP for the given year. Any Action Plan(s) implemented for the year will be included in the report. The appointedrepresentative will be responsible for distributing copies of this report to participating irrigators, agencies (including NOAA) and restoration groups, as well as posting the report on the CLP website.

In subsequent years, the pre-irrigation season meeting can also serve as a forum to review the Action Plan of the previous year and share any lessons learned.