

Management of Western Watermilfoil in the Friant-Kern Canal

*Eric R. Quinley, Maintenance Manager, Friant Water Authority
854 N. Harvard Ave., Lindsay, CA 93247
Email: equinley@friantwater.org*

Background of the Friant-Kern Canal

The Friant Water Authority (Authority) oversees the Operation and Maintenance (O&M) of the Friant-Kern Canal (FKC). A principal feature of the Central Valley Project, the 152 mile long FKC conveys critical supplies of water to Water Contractors (Contractors) along the eastern side of the lower San Joaquin Valley. These Contractors utilize their supplies for agricultural, municipal/industrial, and groundwater recharge purposes within their service areas. Approximately 1,000,000 acres of highly productive farmland in the counties of Fresno, Tulare, Kern, and Kings are served by water supplied from the Friant-Kern Canal. This acreage is owned and cultivated by nearly 15,000 mostly small family farming operations. In addition, several municipalities including Fresno, Orange Cove, and Lindsay rely on water conveyed by the FKC for some or all of their domestic water supply



Myriophyllum Hippuroides or Western Watermilfoil. Source: Lars Anderson

Background of Invasive Weed

Friant Water Authority first noted the existence of a “new” invasive aquatic weed growing in the FKC in 1998. The location of the initial identification was near the transition from concrete lined to earthen canal at FKC MP 34.94. Over the past 14 years, the invasive weed has spread to entire sections encompassing 22.37 miles of earthen canal in Tulare and Fresno Counties, a 2.01 mile earthen section adjacent to Woollomes Equalizing Reservoir in Kern County, Woollomes Equalizing Reservoir, areas of the FKC that are concrete lined and

contain silt accumulation, and numerous facilities including canals, laterals, and recharge basins operated by Contractors who take delivery of water from the FKC.

Identification of Western Watermilfoil

Efforts to identify the invasive weed began in 2001 and continued through 2004. Participants involved in the identification process included Friant Water Authority, United States Bureau of Reclamation, California Department of Food and Agriculture, University of California at Davis, and the United States Department of Agriculture - Agricultural Research Service. Ultimately, the invasive weed was identified as *Myriophyllum hippuroides* or western watermilfoil (WWM). Western watermilfoil is a perennial aquatic plant. Most of the plant grows submerged below the water surface, but stems which bear reproductive structures do penetrate the water surface. The plant is rooted in earthen sections of the FKC and on a more limited basis where silt has accumulated in concrete lined sections. Vegetative growth can be extensive, with plants having multiple stems of ten or more feet in length. WWM forms roots which store nutrient reserves to support the spread of vegetative growth in the water column. In addition to spreading by root growth, stem fragments that break off from plants can settle on the substrate. These fragments subsequently root and generate new plants. Spread by sexual reproduction is less common than by vegetative means.

Impacts on Friant-Kern Canal and Water Users

Infestation of WWM in the FKC causes many issues that impact proper operation of the facilities. Within the FKC, WWM's growth and spread has led to an approximately 10% reduction in capacity during peak flow periods which greatly affects the ability to convey flows to both agricultural and municipal/industrial contractors. Further, as WWM breaks apart, the fragments are transported in the water column to Contractors' turnouts. These fragments regularly impair deliveries as they accumulate on the face of Contractors' turnout trash racks. In some cases, WWM fragments have reduced deliveries by up to 50% in a 24-hour period. Such flow impediments restrict the Contractors' ability to deliver water to their customers.

Infestation of WWM also impacts distribution systems of Contractors who derive their supplies from the FKC. Contractors report that WWM has taken root in distribution canals, laterals, lift ponds, and groundwater recharge basins. Agricultural Contractors report WWM fragments delivered in the water supply regularly clog delivery meters, pumps, and micro irrigation equipment. Municipal contractors report lowered efficiencies of treatment plants, increased downtime, and additional maintenance due to WWM.



Western Watermilfoil in the Friant-Kern Canal Adjacent to a District Turnout. Source: Friant Water Authority

Past Management Efforts

FWA has undertaken efforts to manage WWM in the FKC. Since 2003, on one occasion for each control chemical, FWA has applied diquat, glyphosate, and triclopyr on various limited and broad based control efforts. Observations of the treated areas suggested that existing WWM plants were only minimally affected, reportedly responding to the contact herbicides only by leaf-tip and terminal “burning and dieback”; complete dieback and plant death did not occur. Significant projects to remove silt accumulations which provide a substrate for WWM have been completed. Furthermore, intensive mechanical extraction efforts by hand and machine have aimed to remove WWM from the FKC. These efforts have had limited impact on the infestation of WWM in the FKC.



Past Mechanical Extraction of Western Watermilfoil. Source: Friant Water Authority

Further Research

Due to the spread of the weed, lack of successful control, impact to the FKC, impacts to Contractors, FWA sought to further evaluate WWM. In 2009, FWA entered into a research agreement with the United States Department of Agriculture - Agricultural Research Service at UC Davis. Dr. Lars Anderson headed the project in order to further understand WWM's life cycle, means of reproduction, growth characteristics, and susceptibility to various control chemicals.



Western Watermilfoil Chemical Trial Tanks. Source: Lars Anderson

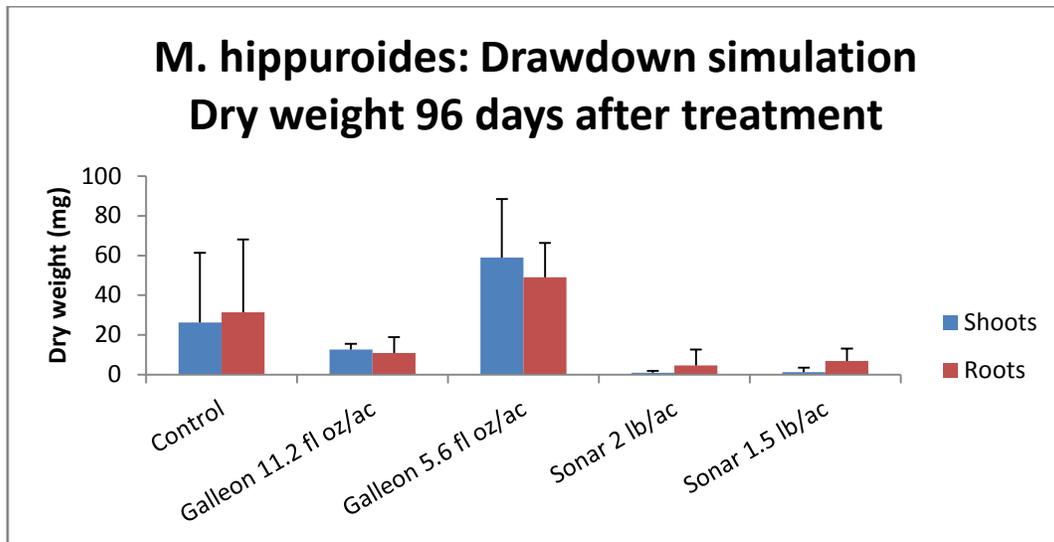
Further Management Options Presented

Chemical control options to address WWM while keeping the FKC in operation were presented to the FWA Advisory Committee for review in 2010 and 2011. The committee determined there was not sufficient consensus to pursue such an application given the varied interests served by the FKC. In 2011 and 2012, FWA staff pursued the potential permitting and introduction of triploid grass carp with the California Department of Fish and Game in order to utilize a non-chemical means of WWM control in the FKC. As a result of these efforts it was determined FWA would not be eligible to receive the necessary permits for the introduction of triploid grass carp in the FKC. In mid-2012, FWA staff presented to the Operation and Maintenance Committee and Board of Directors options related to potential chemical control options to address WWM during a drawdown of the FKC. This potential treatment was presented in order to address continued concerns and requests by Contractors to address the WWM issue in the FKC.

Chemical Treatment 2012/2013

The treatment in the drawdown FKC employed the use of fluridone and imazamox. Fluridone was identified by Dr. Anderson as having notable effect on WWM and imazamox was identified as having successful control on other watermilfoil species by SePRO Corporation.

FWA consulted with SePRO on the potential use of these chemicals in the FKC to determine if the chemicals would fit the uses and needs demanded by the water users. Fluridone, trade name Sonar Genesis, is manufactured and distributed by SePRO Corporation. Imazamox, trade name Clearcast, is manufactured by BASF and distributed by SePRO Corporation. Both are FIFRA labeled, EPA approved, and approved by the California Department of Pesticide Regulation for pre-emergent control of aquatic weeds in canals that are drawn down. Both chemicals are labeled for use in agricultural and domestic water systems with limited restrictions and limitations.



Effectiveness of Chemicals in Drawdown Simulation. Source: Lars Anderson

Consultation with Governing Agencies and Stakeholders

FWA submitted the WWM treatment plan to all Contractors on the FKC for input and comment. The plan was further submitted to the California Department of Public Health, United States Bureau of Reclamation, along with the Agricultural Commissioners of Fresno, Tulare, and Kern Counties. The California Department of Pesticide Regulation was consulted related to the acceptability of use and registration of the products. Contractors and regulating entities provided their respective comments, confirmation, and approval of the WWM treatment plan.

Location and Timing of the Application

Sonar Genesis and Clearcast herbicides were applied to the drawn down FKC invert and embankments beginning at MP 34.94 through MP 61.99 excluding intermittent concrete lined areas and siphons. Applications took place the last two weeks of 2012. Both labels call for a minimum 14 day hold time prior to reintroduction of water. FWA utilized hold times of roughly 30 days in order to allow for proper incorporation into the FKC embankments.

Herbicide Application

Sonar Genesis was applied at a rate of 2.0 lbs. active ingredient (ai) per acre or 4.0 gallons per acre. Clearcast was applied at a rate of 0.50 lbs. ai per acre or 0.50 gallons per acre. The two chemicals were tank mixed prior to application. Application to the FKC embankments was completed using truck mounted booms and the invert was sprayed by truck mounted boom, hand wand, and a spray highline suspended by two vehicles on opposite sides of the FKC. A spray solution of 30-120 gallons per acre was applied depending on the application method.

Herbicide Label Limitations on Domestic and Agricultural Uses

Requirements on the specimen labels for Sonar Genesis and Clearcast have limited use restrictions, precautions, and limitations. Sonar Genesis and Clearcast are approved by the EPA and the State of California Department of Pesticide Regulation for agricultural and drinking water use. The California Department of Public Health provided limitations on any residual levels of treatment agents. However, Sonar formulations have been used extensively for over a decade to combat invasive aquatic weeds in the Sacramento-San Joaquin Delta by the California Department of Boating and Waterways.

Safety Protocols

As the FKC was in a dewatered state, the Contractors' turnouts were not in service. The FKC control structures within the treatment area were closed then locked and tagged out and a series of secondary containment was installed downstream of the treatment zone. Additionally, the turnout of the one municipal Contractor within the treatment zone was also locked and tagged out as an added precaution.

Canal Re-Watering, Depuration, and Water Quality Monitoring

SePRO was consulted by FWA to determine anticipated levels of depuration which may be expected upon reintroduction of water in the FKC. In their experience, depuration rates of 10% - 20% have been observed. Several calculations utilizing different refill scenarios were run to determine anticipated residuals. Upon reintroduction of water in the FKC, water quality will be monitored. Samples to determine any residual levels of the active ingredients found in Sonar Genesis and Clearcast will be collected. Samples will be taken from within the application zone 1 day (d), 2d, 5d, and 7d after water reintroduction. Water samples will also be taken at the site of municipal Contractors' turnouts within the treatment area and extending through Tulare County. Samples will be tested by SePRO's laboratory along with a third party laboratory. Water will not be released for use by Contractors until label restrictions are met.