

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 5
Section 3

Colorado's Initial Water Project (Tamarack I)
December 7, 2005

I. PROJECT DESIGN

Colorado's initial water project (Tamarack I) involves the use of participating existing and future wells and other water facilities in Colorado to re-regulate flows that are in excess of legal rights to and physical demands for water in Colorado in a manner that is consistent with the flow-related goals of the Platte River Recovery Implementation Program (Program). As a result of the geographic location of Tamarack I near the state line, re-timing of stream flow that results from Tamarack I is estimated to develop an average annual yield of at least 10,000 acre-feet during times of target flow shortages and after any canal interception has occurred. As stated in the Program description, all signatories have agreed that the combined operations of Tamarack I and the other two initial Program water projects in the Program shall score and be credited with reducing flow shortages by 80,000 acre-feet. Water rights for the operation of the components of Tamarack I will be obtained and exercised under Colorado law for beneficial uses in Colorado.

Participating wells, ditches or other facilities, and associated water rights, may also be operated for purposes other than those associated with the Program, for example but not by way of limitation, augmentation purposes and protection and enhancement of native species and wildlife. Such operations are not part of Tamarack I, and references to Tamarack I do not include such operations.

The components of Tamarack I will be developed within the 40 miles above the state line beginning at about the Tamarack Ranch State Wildlife Area owned by the Colorado Division of Wildlife near Crook, Colorado. The goal for the development of Tamarack I facilities will focus on private and public lands nearest the state line so interception of accretions by Colorado ditches will be minimized. These facilities will include wells located adjacent to the South Platte River that divert groundwater from the alluvial aquifer, canals that divert water from the South Platte River, and off-channel reservoirs.

When operating recharge facilities, water that percolates into the groundwater alluvium from these facilities will return to the South Platte River at a later time. Inflows to canals and recharge basins will be identified as Tamarack I water, new depletions plan water, or water for state wildlife area purposes. All such inflows will be measured and recharge or seepage will be computed as inflows minus evaporation. Evaporation in acre-feet will be determined by using available weather station data and the surface areas of the recharge sites. Recharge basins are typically located in sandy upland areas with high infiltration rates such that free water surface areas are minimal, resulting in low evaporation amounts. The evaporation computed for existing recharge projects in the lower South Platte River basin in Colorado is typically less than one percent of gross flows. Colorado will identify and account for contributions from off-channel reservoirs in the same manner as recharge accounting.

Any Tamarack I accretions intercepted by Colorado canals will be accounted for, reported to other parties to the Program and will not count towards satisfying Colorado's obligations.

By selecting the optimal location of recharge basins, the return flows are less likely to be intercepted by Colorado's senior ditches. Observation wells will be located between the recharge basins and the river so that groundwater gradients and return flows to the river from the recharge basins' seepage can be monitored. The accounting methods used by Colorado to estimate return flows to the river from the operation of Tamarack I shall be approved by the Governance Committee.

II. HISTORICAL ANALYSIS

Colorado has analyzed how Tamarack I would have operated during the period 1947-1994. For the purpose of this historical analysis, periods and amounts of excess flows for diversion by the Tamarack I to recharge facilities in Colorado were assumed to occur when the following two conditions were satisfied: (1) South Platte River Compact requirements were satisfied and (2) flows exceeded the U.S. Fish and Wildlife Service ("FWS") year round target flows at the Grand Island gage on the Platte River in Nebraska. Existing target flows for every month were used in this analysis and the monthly target values varied with hydrologic conditions of wet, average, and dry.

This analysis assumed that pumping of new groundwater wells located next to the river to recharge basins could occur during the winter because wells can operate during freezing periods due to warmer groundwater temperatures. Colorado plans to install up to forty recharge wells and/or canal lift stations in conjunction with pipelines, recharge basins, and related monitoring features. For the 1947-1994 study period, the average annual diversion to recharge in the Tamarack I would have been 29,640-acre feet. Recharge from canal systems is accomplished during periods when there is unused canal capacity. These periods occur in the fall and winter after the irrigation season until freeze-up, typically through the month of November and during spring runoff when there are excess river flows.

Tables 1 and 2 list the reregulation results of Tamarack I operations for this historical analysis of the 1947-1994 period. Table 1 lists the monthly additions or increases that would have occurred to the historic Julesburg gage flows as a result of the accretions or return flows to the river caused by the groundwater recharge of Tamarack I. As the header to Table 1 indicates, shrink during the summer months due to canal interception is included in the table values. These are net values and occurred for months when river accretions exceeded the diversions to the recharge basins. Table 2 lists the monthly net depletions that would have occurred for months when the diversion to the recharge basins exceeded the accretions in that month. From Table 1, the average annual net addition or accretion is 12.3 thousand acre-feet ("kaf") after canal interception. There was actually 15.2 kaf total of accretions but 2.9 kaf is intercepted by downstream canals resulting in the 12.3 kaf after canal interception. From Table 2, the average annual net depletion is 19.4 kaf. The difference between the total average annual accretion of 15.2 kaf and the average annual depletion of 19.4 kaf is due to

evaporation and some of the accretions to the river not being accounted for because they would have occurred after 1994, which is the last year of the modeled period.

III. CRITERIA FOR OPERATION OF TAMARACK I

- A. In operating Tamarack I, Colorado will make a good faith effort to minimize canal interception. All such facilities will be operated by Colorado and its water users in compliance with the requirements of the South Platte River Compact and for Program purposes during times of excesses to target flows.
1. Operations of Tamarack I recharge facilities during the First Increment of the Program will focus on periods for diversions that result in accretions back to the river during times of shortages in February through June when downstream canal interceptions are the least. The months of greatest diversion by Tamarack I facilities will be December and January when greatest target flow excesses exist. Operations to the extent practical will minimize accretions back to the river during July and August. These months have the greatest canal interception and losing river reaches. Diversions for Tamarack I during the First Increment of the Program will be limited to a ten-year running annual diversions average of 30,000 acre feet, with simultaneous diversions limited to 225 cfs.
 2. For the purposes of these criteria, times of target flow shortages are measured against the flow conditions that exist as of July 1997. The Grand Island gage will be compared to routed amounts of water that would be diverted by Tamarack I. This routed diversion will utilize the lag and loss factors approved by the Governance Committee. The routed amount reduced by the loss factors will be subtracted from the expected (i.e., based on trends and scheduled operational releases from Lake McConaughy) Grand Island gage flow occurring for the number of days of lag in the future and if this computed Grand Island gage flow is still above a desired target then diversions for Tamarack I will take place to the extent that Grand Island gage flows do not drop below targets.
- B. Each year the Environmental Account (EA) Manager, in consultation with project sponsors, EA Committee (EAC), and Reservoir Coordinating Committee (RCC), will develop a Program Annual Operating Plan (AOP) based on AOP's provided by project sponsors. Colorado will develop an AOP for Tamarack I and coordinate Tamarack I operations with the EA Manager.

Colorado will operate Tamarack I so not to increase shortages to target flows at the associated habitat unless requested otherwise by the EA Manager. Tamarack I facilities may also be operated for purposes other than the Program, subject to requirements of state law and the South Platte River Compact, so long as (1) such operation does not interfere with the use of those facilities for the purposes described in this plan or Colorado's new depletions plan and (2) any associated

new depletions are mitigated in accordance with Colorado's Plan for Future Depletions.

C. Consistent with Section E.2.a. of the Program Document, as long as Tamarack I is constructed and operated as described herein, the target flow shortage reduction credited to Tamarack I individually or to the three initial water projects collectively will not be reduced even if the real time frequency and magnitude of flows in excess to targets at Grand Island causes Tamarack I to produce an average annual yield that is less than that projected under historic flow conditions, regardless of the reasons for the change.

TABLE 1
 Additions to Historic Julesburg Gage Flows from TAM 1 Scenario of Reregulation
 SUMMER SHRINK
 INCLUDED

Units = kAF	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	April- Sept Total	
1947	0	0	0.9	0.7	0.5	0	0	0	0.9	1.1	1.1	0	0	5.2	3.2
1948	0	0	0	2.5	2.5	2.2	1.9	0	0	0	1.3	0	0	11.6	9.2
1949	0	3.1	0	0	2.2	0	0	0	0	0	1.6	0	0	6.8	2.2
1950	0	0	3.9	3.3	3.0	0	2.3	2.0	1.8	1.7	1.5	0	0	19.4	12.4
1951	0	3.4	2.8	2.2	1.9	0.1	0	1.6	0	0	0	0	0	11.8	5.6
1952	0	0	0	0	3.7	3.5	0	0	0	0	2.1	0	0	9.2	7.2
1953	0	3.8	3.2	2.5	2.2	0	1.7	0	0	0	1.2	0	0	14.7	6.5
1954	0	3.2	2.7	2.1	0	0	0	0	0	0	1.0	0	0	8.9	2.1
1955	0	1.9	1.6	1.3	0	1.0	0	0	0	0	0.7	0	0	6.5	2.3
1956	0	1.4	1.2	0.9	0	0	0	0	0	0.6	0.5	0	0	4.6	0.9
1957	0.6	0.5	0.6	0.5	0.5	0	0	0.9	1.0	1.0	0.9	0	0	6.6	3.0
1958	0	2.9	2.4	1.2	0	0.3	0	0	0	1.7	1.5	0	0	10.0	1.5
1959	0	3.3	2.8	2.1	1.8	1.5	0	0	0	1.0	0.9	0	0	13.4	5.4
1960	0	2.9	0	1.9	1.9	1.7	0	0	0	1.1	1.0	0	0	10.6	5.5
1961	0	2.5	2.0	1.5	1.3	1.1	0	0	0.8	0.8	0.7	0	0	10.7	4.7
1962	0	2.8	0	1.9	1.9	0	0.9	1.8	1.6	1.5	1.3	0	0	13.7	8.0
1963	0	0	2.0	1.9	0	0	0	0	1.1	1.1	1.0	0	0	7.0	3.0
1964	0	3.1	2.4	1.8	1.6	0	1.2	0	0	0	0.8	0	0	10.9	4.6
1965	0	2.0	1.7	1.3	0	0	0	1.4	0	0	0	0	0	6.3	2.7
1966	0	0.9	3.9	3.2	2.8	2.3	2.1	0	1.7	1.6	1.4	1.3	0	21.2	12.1
1967	0	2.6	2.1	1.6	1.4	0	0	0	0	1.8	1.6	0	0	11.3	3.1
1968	0	3.5	2.8	2.1	1.8	1.6	1.4	1.3	1.2	1.1	0	1.1	0	17.8	9.4
1969	0	2.6	0	1.8	1.8	1.6	0	0	0	1.6	0	0	0	9.5	5.3
1970	0	0	3.4	0	2.7	2.4	0	0	2.2	2.1	1.9	0	0	14.7	7.3
1971	0	3.7	3.1	2.4	2.1	0	1.8	0	1.8	1.7	0	0	0	16.5	8.1
1972	0.1	0	2.7	2.5	2.3	2.0	1.9	1.7	1.5	1.4	1.3	0	0	17.4	11.9
1973	0	0	2.9	0	0	0	2.9	2.9	2.6	0	0	0	0	11.3	8.4
1974	0	0	0	0	3.9	3.7	0	0	2.7	2.5	0	0	0.5	13.3	10.3
1975	0	3.7	3.2	2.6	2.3	2.0	1.9	0	1.6	1.5	1.4	0	0	20.1	10.3
1976	0	3.5	2.8	2.2	1.9	0	0	1.4	1.3	1.2	1.1	1.1	0	16.5	6.8
1977	0	2.5	2.0	1.5	1.3	1.2	0	0	0	0.9	0.8	0	0	10.2	4.0
1978	1.5	1.4	0	1.3	0	1.4	0	0	1.1	1.1	1.0	0.9	0	9.7	3.9
1979	0.9	0.8	0.8	0.7	0.7	0	0	1.3	1.5	1.5	1.1	0	0	9.3	4.3
1980	0	0	0	2.6	0	0	2.8	0	2.5	2.3	2.0	0.6	0	12.9	7.9

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1981	0	3.1	2.6	2.1	1.8	1.6	0	0	0	1.2	1.1	0	13.5
1982	0	3.1	2.6	2.0	1.7	1.4	1.3	0	1.1	1.0	0.9	0	15.2
1983	0	0	2.6	0	0	0	0	0	0	0	0	0	2.6
1984	0	0	0	0	0	0	0	4.6	0	0	0	0	4.6
1985	0	0	0	2.2	4.9	4.4	4.1	3.7	0	3.3	3.2	0	25.7
1986	0	0	4.3	0	0	0	0	0	0	0	0	0	4.3
1987	0	0	0	0	0	0	0	5.0	0	4.2	0	0	9.1
1988	0	0	5.5	4.8	4.4	3.8	0	0	0	2.8	2.6	0	26.9
1989	0	4.3	3.8	3.1	0	2.4	0	0	0	2.1	2.2	2.2	20.1
1990	0	3.3	2.9	2.3	2.1	1.9	0	0	0	1.5	1.4	1.4	18.4
1991	0	2.0	1.8	1.5	1.4	1.3	0	0	0	1.1	1.0	0	11.3
1992	0.8	1.9	1.7	1.5	1.4	1.2	1.2	1.1	1.0	1.0	0.9	0.9	14.6
1993	0	2.0	0	1.5	1.6	1.5	0	0	1.5	1.3	1.5	0	9.5
1994	0	3.3	2.8	2.1	1.8	1.6	0	0	1.1	1.2	1.2	0	13.9
avg	0.1	1.8	1.9	1.6	1.5	1.1	0.6	0.7	1.2	1.2	0.9	0.2	12.3
max	1.5	4.3	5.5	4.8	4.9	4.4	4.1	5.0	2.9	4.2	3.2	2.2	26.9
min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6
std	0.3	1.5	1.4	1.1	1.3	1.2	1.0	1.2	0.9	0.9	0.8	0.5	5.4

TABLE 2

Depletions to Historic Julesburg Gage Flows from TAM 1 Scenario of Reregulation
 These are Net Depletions which equal diversions to recharge sites reduced by return flows resulting from the COL2A Scenario recharge.
 Units = KAF

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1947	-6.1	-1.8	0	0	0	-7.5	-7.7	0	0	0	-7.0	-7.2	-37.3
1948	-5.9	-4.0	-5.4	0	0	0	0	0	0	0	0	-7.1	-22.5
1949	-6.1	0	-5.7	-5.9	0	-5.8	-6.0	0	-3.8	0	-5.6	-5.8	-44.7
1950	-4.6	-3.1	0	0	0	0	0	0	0	0	0	-6.8	-14.5
1951	-5.8	0	0	0	0	0	-6.8	0	-6.3	-6.4	-5.9	-5.7	-36.9
1952	-4.5	-2.8	-4.2	-4.4	0	0	0	0	0	0	0	-6.3	-22.1
1953	-5.3	0	0	0	0	0	0	0	0	0	0	-7.0	-12.3
1954	-6.0	0	0	0	0	0	0	0	0	0	0	-3.4	-9.4
1955	-2.3	0	0	0	0	0	0	0	0	0	0	-0.7	-3.0
1956	-2.5	0	0	0	0	0	0	0	0	0	0	-0.6	-3.1
1957	0	0	0	0	0	-7.5	-2.2	0	0	0	0	-7.4	-17.0
1958	-6.3	0	0	0	-6.8	0	-6.6	0	0	0	0	-6.8	-26.5
1959	-5.8	0	0	0	0	0	0	0	0	0	0	-7.3	-13.1
1960	-5.6	0	-5.9	0	0	0	0	0	0	0	0	-1.3	-12.8
1961	-6.7	0	0	0	0	0	0	0	0	0	0	-7.5	-14.2
1962	-6.4	0	-5.9	0	0	-6.3	0	0	0	0	0	-4.6	-23.3
1963	-1.2	-5.4	0	0	0	0	0	0	0	0	0	-7.3	-13.8
1964	-6.2	0	0	0	0	0	0	0	0	0	0	-3.4	-9.6
1965	-3.8	0	0	0	0	-7.0	-7.2	0	-6.4	-6.5	-6.0	-5.8	-42.5
1966	-4.6	0	0	0	0	0	0	0	0	0	0	0	-4.6
1967	-6.5	0	0	0	0	-6.7	-6.9	0	0	0	0	-5.7	-25.8
1968	-5.8	0	0	0	0	0	0	0	0	0	-3.5	0	-9.3
1969	-6.6	0	-6.0	0	0	0	-6.7	0	0	0	-6.5	-6.6	-32.4
1970	-5.4	-3.7	0	-1.7	0	0	-6.0	0	0	0	0	-6.4	-23.2
1971	-5.5	0	0	0	0	-6.2	-6.0	0	0	0	-6.5	-6.6	-24.7
1972	0	-4.6	0	0	0	0	0	0	0	0	0	-6.9	-11.5
1973	-5.9	-4.1	0	-5.5	-5.8	-5.4	0	0	0	0	-5.6	-5.6	-43.7
1974	-4.3	-2.8	-4.0	-4.2	0	0	0	0	0	-5.8	-3.5	0	-18.8
1975	-5.4	0	0	0	0	0	0	0	0	0	0	-6.9	-12.2
1976	-5.8	0	0	0	0	0	0	0	0	0	0	0	-5.8
1977	-6.8	0	0	0	0	0	0	0	0	0	0	-7.0	-13.7
1978	0	0	-6.9	0	0	0	0	0	0	0	0	0	-6.9

