FINAL MEMORANDUM

July 6, 2001

TO: File

FROM: Meg Frantz

SUBJECT: **CRDSS Daily Yampa Model Subtask 1 - Equivalent daily return flow factors**

Purpose

The purpose of this task was to determine daily return flow factors for use in the delay table file of the Yampa River daily time-step model. Specifically, this series of factors represents the fraction of the recharge applied in day *n* that reaches the stream in days *n, n+1, n+2,* and so on until all of the recharged amount has entered the stream.

A monthly return flow pattern was determined in earlier phases of CRDSS and applied to all irrigation diversions in the Yampa basin monthly planning model. The monthly return fractions represented the fraction of a month's application that returned within the same month and each of the following four months. The daily return flow pattern sought in this subtask was the unique pattern, which, when applied to 30 or 31 days of uniform recharge, resulted in equivalent amounts of return over the recharge month and the subsequent four months as that computed using the monthly recharge pattern.

Approach

The middle column of Table 1 shows the original return flow fractions as they appeared in the *.*dly* file of the Yampa River monthly model. These were developed assuming that 50 percent of the excess irrigation application returns immediately via the surface, and 50 percent returns after some delay, via the subsurface system. The third column shows the monthly subsurface return expressed as a fraction of the delayed recharge portion alone.

TABLE 1
Phase IIIb Monthly Return Flow Fractions

	Monthly Return as a Fraction of Total Recharge (%)	Subsurface Return as a Fraction of Subsurface Recharge (%)
Month 1	75.3	(75.3-50)/0.5 = 50.6
Month 2	17.0	17.0/0.5 = 34.0
Month 3	5.4	5.4/0.5 = 10.8
Month 4	1.8	1.8/0.5 = 3.6
Month 5	0.5	0.5/0.5 = 1.0

The computer code originally used to develop these fractions was unavailable to Boyle, and basic data documentation was incomplete (Task Memorandum 1.15-17) . However, the fractions were reasonably replicated by the Division of Water Resources stream depletion model (here applied to recharge and accretion) using the following input values and a monthly time step solution:

- Transmissivity = 22440 gpd/ft (saturated thickness of 30 ft; K=100ft/day)
- Storage coefficient = 0.2
- Distance from recharge source to stream = 400 ft
- Distance from alluvial boundary to stream = 1000 ft

The resulting return fractions for months 1 through 5 were 51.4 percent, 34.0 percent, 9.8 percent, 3.2 percent, and 1.0 percent. Although not exact, these fractions were considered very close to the original fractions, allowing for differences in solution techniques.

The next step was to execute the depletion model for a single day of recharge, supplying the same aquifer properties and alluvial geometry. The estimated daily returns from this recharge "pulse" extended for approximately 150 days, although 97 percent returned in the first 90 days.

To simplify model input and reduce Statemod's computational burden, the series of subsurface daily return flow fractions was shortened to 90 days by putting the last 3 percent of returns into days 50 through 90. To account for the nearly instantaneous returns via the surface, all return fractions were then reduced by a factor of two so they could appropriately be applied to the total return amount, not just the delayed portion. Furthermore, 50 percent was added to the return fraction for the day following the diversion.

Results

The column labeled "Combined Return Fraction" in the attached **Table 2** gives daily return fractions that will be used in the Yampa daily model's **.dld* file. The spreadsheet table was developed to demonstrate that when the daily return flow fractions are applied to each day in a 30-day recharge period, the net accretion to the stream in the recharge month and subsequent months is the same (or nearly the same) as that estimated by the original monthly return flow fractions.

Columns 1 through 30 represent each day of a 30-day recharge period. In this case, 3.33333 af (i.e., 100 af uniformly distributed across 30 days) is recharged each day. Rows 1 through 122 represent the <u>four</u> months required for the 30 days' recharge to reach the stream. (Note that since return flow from a single day of recharge persists for 90 days, return flow from 30 days of recharge persists until Day 119. This is because the effects of Day 30's recharge do not expire until Day 120 of the study period.) The matrix value at position *(i,j)* is the volume of the return flow on day *i* which is attributable to the recharge that occurred on day *j*. The column labeled "Daily Totals" shows the return flow for a given day, resulting from superposition of all thirty days of recharge. The rightmost column accumulates the volumetric returns for each month.

Table 3 compares the original monthly return fractions with the monthly return fractions that result when the proposed daily fractions are applied to daily time steps of recharge:

This worksheet calculates return flows for the 30-day recharge schedule shown on the horizontal axis, given the return flow fractions associated with a single day of recharge shown on the vertical axis. These return flow fractions reflect both a surface return of 50% in the day following application, and the return fractions shown in worksheet 'Adjusted Results for GW' representing delayed returns through the groundwater system. For example, the value in row 11, column 4 is the return on Day 11 attributable to recharge applied on Day 4. Total return for each day is shown at the extreme right.

TABLE 2 Return Flow Calculator for 30 Days of Recharge

Day	GW Return Fraction	Combined Return Fraction	Recharge amount-->	3.333333	3.333333	3.333333	3.333333	3.333333	3.333333	3.333333	3.333333	3.333333	3.333333	3.333333	3.333333	3.333333	3.333333	3.333333	3.333333	3.333333	3.333333	3.333333	3.333333	3.333333	3.333333	3.333333	3.333333	3.333333	3.333333	3.333333	3.333333	3.333333	3.333333	Daily Totals	Monthly Total
			Recharge day-->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		
1	0.00447	0	0	0																														0	
2	0.05559	0.53003	0.53003	1.766767	0																													1.766767	
3	0.08346	0.04173	0.57176	0.1391	1.766767	0																												1.905867	
4	0.0729	0.03645	0.60821	0.1215	0.1391	1.766767	0																											2.027367	
5	0.05938	0.02969	0.6379	0.098967	0.1215	0.1391	1.766767	0																										2.126333	
6	0.04866	0.02433	0.66223	0.0811	0.098967	0.1215	0.1391	1.766767	0																									2.207433	
7	0.04055	0.020275	0.682505	0.067583	0.0811	0.098967	0.1215	0.1391	1.766767	0																								2.275017	
8	0.03455	0.017275	0.69978	0.057583	0.067583	0.0811	0.098967	0.1215	0.1391	1.766767	0																							2.3326	
9	0.03005	0.015025	0.714805	0.050083	0.057583	0.067583	0.0811	0.098967	0.1215	0.1391	1.766767	0																						2.382683	
10	0.02663	0.013315	0.72812	0.044383	0.050083	0.057583	0.067583	0.0811	0.098967	0.1215	0.1391	1.766767	0																					2.427067	
11	0.02399	0.011995	0.740115	0.039983	0.044383	0.050083	0.057583	0.067583	0.0811	0.098967	0.1215	0.1391	1.766767	0																				2.46705	
12	0.02187	0.010935	0.75105	0.03645	0.039983	0.044383	0.050083	0.057583	0.067583	0.0811	0.098967	0.1215	0.1391	1.766767	0																			2.5035	
13	0.02027	0.010135	0.761185	0.033783	0.03645	0.039983	0.044383	0.050083	0.057583	0.067583	0.0811	0.098967	0.1215	0.1391	1.766767	0																		2.537283	
14	0.01891	0.009455	0.77064	0.031517	0.033783	0.03645	0.039983	0.044383	0.050083	0.057583	0.067583	0.0811	0.098967	0.1215	0.1391	1.766767	0																	2.5688	
15	0.01778	0.00889	0.77953	0.029633	0.031517	0.033783	0.03645	0.039983	0.044383	0.050083	0.057583	0.067583	0.0811	0.098967	0.1215	0.1391	1.766767	0																2.598433	
16	0.01681	0.008405	0.787935	0.028017	0.029633	0.031517	0.033783	0.03645	0.039983	0.044383	0.050083	0.057583	0.067583	0.0811	0.098967	0.1215	0.1391	1.766767	0															2.62645	
17	0.01598	0.00799	0.795925	0.026633	0.028017	0.029633	0.031517	0.033783	0.03645	0.039983	0.044383	0.050083	0.057583	0.067583	0.0811	0.098967	0.1215	0.1391	1.766767	0														2.653083	
18	0.01524	0.00762	0.803545	0.0254	0.026633	0.028017	0.029633	0.031517	0.033783	0.03645	0.039983	0.044383	0.050083	0.057583	0.067583	0.0811	0.098967	0.1215	0.1391	1.766767	0													2.678483	
19	0.01457	0.007285	0.81083	0.024283	0.0254	0.026633	0.028017	0.029633	0.031517	0.033783	0.03645	0.039983	0.044383	0.050083	0.057583	0.067583	0.0811	0.098967	0.1215	0.1391	1.766767	0												2.702767	
20	0.01396	0.00698	0.81781	0.023267	0.024283	0.0254	0.026633	0.028017	0.029633	0.031517	0.033783	0.03645	0.039983	0.044383	0.050083	0.057583	0.067583	0.0811	0.098967	0.1215	0.1391	1.766767	0											2.726033	
21	0.01338	0.00669	0.8245	0.0223	0.023267	0.024283	0.0254	0.026633	0.028017	0.029633	0.031517	0.033783	0.03645	0.039983	0.044383	0.050083	0.057583	0.067583	0.0811	0.098967	0.1215	0.1391	1.766767	0										2.748333	
22	0.01286	0.00643	0.83093	0.021433	0.0223	0.023267	0.024283	0.0254	0.026633	0.028017	0.029633	0.031517	0.033783	0.03645	0.039983	0.044383	0.050083	0.057583	0.067583	0.0811	0.098967	0.1215	0.1391	1.766767	0									2.769767	
23	0.01237	0.006185	0.837115	0.020617	0.021433	0.0223	0.023267	0.024283	0.0254	0.026633	0.028017	0.029633	0.031517	0.033783	0.03645	0.039983	0.044383	0.050083	0.057583	0.067583	0.0811	0.098967	0.1215	0.1391	1.766767	0								2.790383	
24	0.01189	0.005945	0.84306	0.019817	0.020617	0.021433	0.0223	0.023267	0.024283	0.0254	0.026633	0.028017	0.029633	0.031517	0.033783	0.03645	0.039983	0.044383	0.050083	0.057583	0.067583	0.0811	0.098967	0.1215	0.1391	1.766767	0							2.8102	
25	0.01144	0.00572	0.84878	0.019067	0.019817	0.020617	0.021433	0.0223	0.023267	0.024283	0.0254	0.026633	0.028017	0.029633	0.031517	0.033783	0.03645	0.039983	0.044383	0.050083	0.057583	0.067583	0.0811	0.098967	0.1215	0.1391	1.766767	0						2.829267	
26	0.01093	0.005465	0.854245	0.018217	0.019067	0.019817	0.020617	0.021433	0.0223	0.023267	0.024283	0.0254	0.026633	0.028017	0.029633	0.031517	0.033783	0.03645	0.039983	0.044383	0.050083	0.057583	0.067583	0.0811	0.098967	0.1215	0.1391	1.766767	0					2.847483	
27	0.01067	0.005335	0.85958	0.017783	0.018217	0.019067	0.019817	0.020617	0.021433	0.0223	0.023267	0.024283	0.0254	0.026633	0.028017	0.029633	0.031517	0.033783	0.03645	0.039983	0.044383	0.050083	0.057583	0.067583	0.0811	0.098967	0.1215	0.1391	1.766767	0				2.865267	
28	0.0102	0.0051	0.86468	0.017	0.017783	0.018217	0.019067	0.019817	0.020617	0.021433	0.0223	0.023267	0.024283	0.0254	0.026633	0.028017	0.029633	0.031517	0.033783	0.03645	0.039983	0.044383	0.050083	0.057583	0.067583	0.0811	0.098967	0.1215	0.1391	1.766767	0			2.882267	
29	0.00985	0.004925	0.869605	0.016417	0.017	0.017783	0.018217	0.019067	0.019817	0.020617	0.021433	0.0223	0.023267	0.024283	0.0254	0.026633	0.028017	0.029633	0.031517	0.033783	0.03645	0.039983	0.044383	0.050083	0.057583	0.067583	0.0811	0.098967	0.1215	0.1391	1.766767	0		2.898683	
30	0.00948	0.00474	0.874345	0.0158	0.016417	0.017	0.017783	0.018217	0.019067	0.019817	0.020617	0.021433	0.0223	0.023267	0.024283	0.0254	0.026633	0.028017	0.029633	0.031517	0.033783	0.03645	0.039983	0.044383	0.050083	0.057583	0.067583	0.0811	0.098967	0.1215	0.1391	1.766767	0	2.914483	73.86915
31	0.00913	0.004565	0.87891	0.015217	0.0158	0.016417	0.017	0.017783	0.018217	0.019067	0.019817	0.020617	0.021433	0.0223	0.023267	0.024283	0.0254	0.026633	0.028017	0.029633	0.031517	0.033783	0.03645	0.039983	0.044383	0.050083	0.057583	0.067583	0.0811	0.098967	0.1215	0.1391	1.766767	2.9297	
32	0.0088	0.0044	0.88331	0.014667	0.015217	0.0158	0.016417	0.017	0.017783	0.018217	0.019067	0.019817	0.020617	0.021433	0.0223	0.023267	0.024283	0.0254	0.026633	0.028017	0.029633	0.031517	0.033783	0.03645	0.039983	0.044383	0.050083	0.057583	0.067583	0.0811	0.098967	0.1215	0.1391	1.1776	
33	0.00847	0.004235	0.887545	0.014117	0.014667	0.015217	0.0158	0.016417	0.017	0.017783	0.018217	0.019067	0.019817	0.020617	0.021433	0.0223	0.023267	0.024283	0.0254	0.026633	0.028017	0.029633	0.031517	0.033783	0.03645	0.039983	0.044383	0.050083	0.057583	0.067583	0.0811	0.098967	0.1215	1.052617	
34	0.00818	0.00409	0.891635	0.013633	0.014117	0.014667	0.015217	0.0158	0.016417	0.017	0.017783	0.018217	0.019067	0.019817	0.020617	0.021433	0.0223	0.023267	0.024283	0.0254	0.026633	0.028017	0.029633	0.031517	0.033783	0.03645	0.039983	0.044383	0.050083	0.057583	0.067583	0.0811	0.098967	0.94475	
35	0.00785	0.003925	0.89556	0.013083	0.013633	0.014117	0.014667	0.015217	0.0158	0.016417	0.017	0.017783	0.018217	0.019067	0.019817	0.020617	0.021433	0.0223	0.023267	0.024283	0.0254	0.026633	0.028017	0.029633	0.031517	0.033783	0.03645	0.039983	0.044383	0.050083	0.057583	0.067583	0.0811	0.858867	
36	0.00759	0.003795	0.899355	0.01265	0.013083	0.013633	0.014117	0.014667	0.015217	0.0158	0.016417	0.017	0.017783	0.018217	0.019067	0.019817	0.020617	0.021433	0.0223	0.023267	0.024283	0.0254	0.026633	0.028017	0.029633	0.031517	0.033783	0.03645	0.039983	0.044383	0.050083	0.057583	0.067583	0.790417	
37	0.0073	0.00365	0.903005	0.012167	0.01265	0.013083	0.013633	0.014117	0.014667	0.015217	0.0158	0.016417	0.017	0.017783	0.018217	0.019067	0.019817	0.020617	0.021433	0.0223	0.023267	0.024283	0.0254	0.026633	0.028017	0.029633	0.031517	0.033783	0.03645	0.039983	0.044383	0.050083	0.057583	0.735	
38	0.00703	0.003515	0.90652	0.011717	0.012167	0.01265	0.013083	0.013633	0.014117	0.014667	0.015217	0.0158	0.016417	0.017	0.017783	0.018217	0.019067	0.019817	0.020617	0.021433	0.0223	0.023267	0.024283	0.0254	0.026633	0.028017	0.029633	0.031517	0.033783	0.03645	0.039983	0.044383	0.050083	0.689133	
39	0.00697	0.003485	0.910005	0.011617	0.011717	0.012167	0.01265	0.013083	0.013633	0.014117	0.014667	0.015217	0.0158	0.016417	0.017	0.017783	0.018217	0.019067	0.019817	0.020617	0.021433	0.0223	0.023267	0.024283	0.0254	0.026633	0.028017	0.029633	0.031517	0.033783	0.03645	0.039983	0.044383	0.650667	
40	0.00639	0.003195	0.9132	0.01065	0.011617	0.011717	0.012167	0.01265	0.013083	0.013633	0.014117	0.014667	0.015217	0.0158	0.016417	0.017	0.017783	0.018217	0.019067	0.019817	0.020617	0.021433	0.0223	0.023267	0.024283	0.0254	0.026633	0.028017	0.029633	0.031517	0.033783	0.03645	0.039983	0.616933	
41	0.00629	0.003145	0.916345	0.010483	0.01065	0.011617	0.011717	0.012167	0.01265	0.013083	0.013633	0.014117	0.014667	0.015217	0.0158	0.016417	0.017	0.017783	0.018217	0.019067	0.019817	0.020617	0.021433	0.0223	0.023267	0.024283	0.0254	0.026633	0.028017	0.029633	0.031517	0.033783	0.03645	0.587433	
42	0.0061	0.00305	0.919395	0.010167	0.010483	0.01065	0.011617	0.011717	0.012167	0.01265	0.013083	0.013633	0.014117	0.014667	0.015217	0.0158	0.016417	0.017	0.017783	0.018217	0.019067	0.019817	0.020617	0.021433	0.0223	0.023267	0.024283	0.0254	0.026633	0.028017	0.029633	0.031517	0.033783	0.56115	
43	0.00585	0.002925	0.92232	0.00975	0.010167	0.010483	0.01065	0.011617	0.011717	0.012167	0.01265	0.013083	0.013633	0.014117	0.014667	0.015217	0.0158	0.016417	0.017	0.017783	0.018217	0.019067	0.019817	0.020617	0.021433	0.0223	0.023267	0.024283	0.0254	0.026633	0.028017	0.029633	0.031517	0.537117	
44	0.00564	0.00282	0.92514	0.0094	0.00975	0.010167	0.010483	0.01065	0.011617	0.011717	0.012167	0.01265	0.013083	0.013633	0.014117	0.014667	0.015217	0.0158	0.016417	0.017	0.017783	0.018217	0.019067	0.019817	0.020617	0.021433	0.0223	0.023267	0.024283	0.0254	0.026633	0.028017	0.029633	0.515	
45	0.00542	0.00271	0.92785	0.009033	0.0094	0.00975	0.010167	0.010483	0.01065	0.011617	0.011717	0.012167	0.01265	0.013083	0.013633	0.014117	0.014667	0.015217	0.0158	0.016417	0.017	0.017783	0.018217	0.019067	0.019817	0.020617	0.021433	0.0223	0.023267	0.024283	0.0254	0.026633	0.028017	0.4944	
46	0.00523	0.002615	0.930465	0.008717	0.009033	0.0094	0.00975	0.010167	0.010483	0.01065	0.011617	0.011717	0.012167	0.01265	0.013083	0.013633	0.014117	0.014667	0.015217	0.0158	0.016417	0.017	0.017783	0.018217	0.019067	0.019817	0.020617	0.021433	0.0223	0.023267	0.024283	0.0254	0.026633	0.4751	
47	0.00507	0.002535	0.933	0.00845	0.008717	0.009033	0.0094	0.00975	0.010167	0.010483	0.01065	0.011617	0.011717	0.012167	0.01265	0.013083	0.013633	0.014117	0.014667	0.015217	0.0158	0.016417	0.017	0.017783	0.018217	0.019067	0.019817	0.020617	0.021433	0.0223	0.023267	0.024283	0.0254	0.456917	
48	0.00484	0.00242	0.93542	0.008067	0.00845	0.008717	0.009033	0.0094	0.00975	0.010167	0.010483	0.01065	0.011617	0.011717	0.012167	0.01265	0.013083	0.013633	0.014117	0.014667	0.015217	0.0158	0.016417	0.017	0.017783	0.018217	0.019067	0.019817	0.020617	0.021433	0.0223	0.023267	0.024283	0.439583	
49	0.00471	0.002355	0.937775	0.00785	0.008067	0.00845	0.008717	0.009033	0.0094	0.00975	0.010167	0.010483	0.01065	0.011617	0.011717	0.012167	0.01265	0.013083	0.013633	0.014117	0.014667	0.015217	0.0158	0.016417	0.017	0.017783	0.018217	0.019067	0.019817	0.020617	0.021433	0.0223	0.023267	0.42315	
50	0.0045	0.00225	0.940025	0.0075	0.00785	0.008067	0.00845	0.008717	0.009033	0.0094	0.00975	0.010167	0.010483	0.01065	0.011617	0.011717	0.012167	0.01265	0.013083	0.013633	0.014117	0.014667	0.015217	0.0158	0.016417	0.017	0.017783	0.018217	0.019067	0.019817	0.020617	0.021433	0.0223	0.407383	
51	0.00438	0.00219	0.942215	0.0073	0.0075	0.00785	0.008067	0.00845	0.008717	0.009033	0.0094	0.00975	0.010167	0.010483	0.01065	0.011617	0.011717	0.012167	0.01265	0.013083	0.013633	0.014117	0.014667	0.015217	0.0158	0.016417	0.017	0.017783	0.018217	0.019067	0.019817	0.020617	0.021433	0.392383	
52	0.0042	0.0021	0.944315	0.007	0.0073	0.0075	0.00785	0.008067	0.00845	0.008717	0.009033	0.0094	0.00975	0.010167	0.010483	0.01065	0.011617	0.011717	0.012167	0.01265	0.013083	0.013633	0.014117	0.014667	0.015217	0.0158	0.016417	0.017	0.017783	0.018217	0.019067	0.019817	0.020617	0.37795	
53	0.0042	0.0021	0.946415	0.007	0.007	0.0073	0.0075	0.00785	0.008067	0.00845	0.008717	0.009033	0.0094	0.00975	0.010167	0.010483	0.01065	0.011617	0.011717	0.012167	0.01265	0.013083	0.013633	0.014117	0.014667	0.015217	0.0158	0.016417	0.017	0.017783	0.018217	0.019067	0.019817	0.364333	
54	0.0042	0.0021	0.948515	0.007	0.007	0.007	0.0073	0.0075	0.00785	0.008067	0.00845	0.008717	0.009033	0.0094	0.00975	0.010167	0.010483	0.01065	0.011617	0.011717	0.012167	0.01265	0.013083	0.013633	0.014117	0.014667	0.015217	0.0158	0.016417	0.017	0.017783	0.018217	0.019067	0.351517	
55	0.0042	0.0021	0.950615	0.007	0.007	0.007	0.007	0.0073	0.0075	0.00785	0.008067	0.00845	0.008717	0.009033	0.0094	0.00975	0.010167	0.010483	0.01065	0.011617	0.011717	0.012167	0.01265	0.013083	0.013633	0.014117	0.014667	0.015217	0.0158	0.016417	0.017	0.017783	0.018217	0.33945	
56	0.0042	0.0021	0.952715	0.007	0.007	0.007	0.007	0.007	0.0073	0.0075	0.00785	0.008067	0.00845	0.008717	0.009033	0.0094	0.00975	0.010167	0.010483	0.01065	0.011617	0.011717	0.012167	0.01265	0.013083	0.013633	0.014117	0.014667	0.015217	0.0158	0.016417	0.017	0.017783	0.328233	
57	0.0035	0.00175	0.954465	0.005833	0.007	0.007	0.007	0.007	0.007	0.0073	0.0075	0.00785	0.008067	0.00845	0.008717	0.009033	0.0094	0.00975	0.010167	0.010483	0.01065	0.011617	0.011717	0.012167	0.01265	0.013083	0.013633	0.014117	0.014667	0.015217	0.0158	0.016417	0.017	0.316283	
58	0.0035	0.00175	0.956215	0.005833	0.005833	0.007	0.007	0.007	0.007	0.007	0.0073	0.0075	0.00785	0.008067	0.00845	0.008717	0.009033	0.0094	0.00975	0.010167	0.010483	0.01065	0.011617	0.011717	0.012167	0.01265	0.013083	0.013633	0.014117	0.014667	0.015217	0.0158	0.016417	0.305117	
59	0.0035	0.00175	0.957965	0.005833	0.005833	0.005833	0.007	0.007	0.007	0.007	0.007	0.0073	0.0075	0.00785	0.008067	0.00845	0.008717	0.009033	0.0094	0.00975	0.010167	0.010483	0.01065	0.011617	0.011717	0.012167	0.01265	0.013083	0.013633	0.014117	0.014667	0.015217	0.0158	0.294533	
60	0.0035	0.00175	0.959715	0.005833	0.005833	0.005833	0.005833	0.007	0.007	0.007	0.007	0.007	0.0073	0.0075	0.00785	0.008067	0.00845	0.008717	0.009033	0.0094	0.00975	0.010167	0.010483	0.01065	0.011617	0.011717	0.012167	0.01265	0.013083	0.013633	0.014117	0.014667	0.015217	0.284567	
61	0.0035	0.00175	0.961465	0.005833	0.005833	0.005833	0.005833	0.005833	0.007	0.007	0.007	0.007	0.007	0.0073	0.0075	0.00785	0.008067	0.00845	0.008717	0.009033	0.0094	0.00975	0.010167	0.010483	0.01065	0.011617	0.011717	0.012167	0.01265	0.013083	0.013633	0.014117	0.014667	0.275183	18.972467

		0																																	
62	0.0035	0.00175	0.963215	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.007	0.007	0.007	0.007	0.007	0.0073	0.0075	0.00785	0.008067	0.00845	0.008717	0.009033	0.0094	0.00975	0.010167	0.010483	0.01065	0.011617	0.011717	0.012167	0.01265	0.013083	0.013633	0.014117	0.26635	
63	0.0035	0.00175	0.964965	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.007	0.007	0.007	0.007	0.007	0.0073	0.0075	0.00785	0.008067	0.00845	0.008717	0.009033	0.0094	0.00975	0.010167	0.010483	0.01065	0.011617	0.011717	0.012167	0.01265	0.013083	0.013633	0.258067	
64	0.0035	0.00175	0.966715	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.007	0.007	0.007	0.007	0.007	0.0073	0.0075	0.00785	0.008067	0.00845	0.008717	0.009033	0.0094	0.00975	0.010167	0.010483	0.01065	0.011617	0.011717	0.012167	0.01265	0.013083	0.250267	
65	0.0035	0.00175	0.968465	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.007	0.007	0.007	0.007	0.007	0.0073	0.0075	0.00785	0.008067	0.00845	0.008717	0.009033	0.0094	0.00975	0.010167	0.010483	0.01065	0.011617	0.011717	0.012167	0.01265	0.243017	
66	0.0035	0.00175	0.970215	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.007	0.007	0.007	0.007	0.007	0.0073	0.0075	0.00785	0.008067	0.00845	0.008717	0.009033	0.0094	0.00975	0.010167	0.010483	0.01065	0.011617	0.011717	0.012167	0.2362	
67	0.0025	0.00125	0.971465	0.004167	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.007	0.007	0.007	0.007	0.007	0.0073	0.0075	0.00785	0.008067	0.00845	0.008717	0.009033	0.0094	0.00975	0.010167	0.010483	0.01065	0.011617	0.011717	0.2282	
68	0.0025	0.00125	0.972715	0.004167	0.004167	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.007	0.007	0.007	0.007	0.007	0.0073	0.0075	0.00785	0.008067	0.00845	0.008717	0.009033	0.0094	0.00975	0.010167	0.010483	0.01065	0.011617	0.22065	
69	0.0025	0.00125	0.973965	0.004167	0.004167	0.004167	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.007	0.007	0.007	0.007	0.007	0.0073	0.0075	0.00785	0.008067	0.00845	0.008717	0.009033	0.0094	0.00975	0.010167	0.010483	0.01065	0.2132	
70	0.0025	0.00125	0.975215	0.004167	0.004167	0.004167	0.004167	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.007	0.007	0.007	0.007	0.007	0.0073	0.0075	0.00785	0.008067	0.00845	0.008717	0.009033	0.0094	0.00975	0.010167	0.010483	0.206717	
71	0.0025	0.00125	0.976465	0.004167	0.004167	0.004167	0.004167	0.004167	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.007	0.007	0.007	0.007	0.007	0.0073	0.0075	0.00785	0.008067	0.00845	0.008717	0.009033	0.0094	0.00975	0.010167	0.2004	
72	0.0025	0.00125	0.977715	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.007	0.007	0.007	0.007	0.007	0.0073	0.0075	0.00785	0.008067	0.00845	0.008717	0.009033	0.0094	0.00975	0.1944	
73	0.0025	0.00125	0.978965	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.007	0.007	0.007	0.007	0.007	0.0073	0.0075	0.00785	0.008067	0.00845	0.008717	0.009033	0.0094	0.188817	
74	0.0025	0.00125	0.980215	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.007	0.007	0.007	0.007	0.007	0.0073	0.0075	0.00785	0.008067	0.00845	0.008717	0.009033	0.183583	
75	0.0025	0.00125	0.981465	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.007	0.007	0.007	0.007	0.007	0.0073	0.0075	0.00785	0.008067	0.00845	0.008717	0.178717	
76	0.0025	0.00125	0.982715	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.007	0.007	0.007	0.007	0.007	0.0073	0.0075	0.00785	0.008067	0.00845	0.174167	
77	0.0025	0.00125	0.983965	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.007	0.007	0.007	0.007	0.007	0.0073	0.0075	0.00785	0.008067	0.169883	
78	0.0025	0.00125	0.985215	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.007	0.007	0.007	0.007	0.007	0.0073	0.0075	0.00785	0.165983	
79	0.0025	0.00125	0.986465	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.007	0.007	0.007	0.007	0.007	0.0073	0.0075	0.1623	
80	0.0025	0.00125	0.987715	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.007	0.007	0.007	0.007	0.007	0.0073	0.158967	
81	0.0025	0.00125	0.988965	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.007	0.007	0.007	0.007	0.007	0.155833	
82	0.0025	0.00125	0.990215	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.007	0.007	0.007	0.007	0.153	
83	0.0025	0.00125	0.991465	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.007	0.007	0.007	0.150167	
84	0.0025	0.00125	0.992715	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.007	0.007	0.147333	
85	0.0025	0.00125	0.993965	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.007	0.1445	
86	0.0025	0.00125	0.995215	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.141667	
87	0.0025	0.00125	0.996465	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.14	
88	0.0025	0.00125	0.997715	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.138333	
89	0.0025	0.00125	0.998965	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.136667	
90	0.0021	0.00105	1.000015	0.0035	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.005833	0.005833	0.005833	0.005833	0.005833	0.005833	0.134333	
91	0	0		0	0.0035	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.005833	0.005833	0.005833	0.005833	0.005833	0.1285	
92	0	0		0	0	0.0035	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.005833	0.005833	0.005833	0.005833	0.122667	5.5928833
93	0	0		0	0	0	0.0035	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.005833	0.005833	0.005833	0.116833	
94	0	0		0	0	0	0	0.0035	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.005833	0.005833	0.111	
95	0	0		0	0	0	0	0	0.0035	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.005833	0.105167	
96	0	0		0	0	0	0	0	0	0.0035	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.099333	
97	0	0		0	0	0	0	0	0	0	0.0035	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.095167	
98	0	0		0	0	0	0	0	0	0	0	0.0035	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.091	
99	0	0		0	0	0	0	0	0	0	0	0	0.0035	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.086833	
100	0	0		0	0	0	0	0	0	0	0	0	0	0.0035	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.082667	
101	0	0		0	0	0	0	0	0	0	0	0	0	0	0.0035	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.0785	
102	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0.0035	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.074333	
103	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0.0035	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.070167	
104	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0035	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.066	
105	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0035	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.061833	
106	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0035	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.057667	
107	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0035	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.0535	
108	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0035	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.049333	
109	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0035	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.045167	
110	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0035	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.041	
111	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0035	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.036833	
112	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0035	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.032667	
113	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0035	0.004167	0.004167	0.004167	0.004167	0.004167	0.004167	0.0285	
114	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0035	0.004167	0.004167	0.004167	0.004167	0.004167	0.024333	
115	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0035	0.004167	0.004167	0.004167	0.004167	0.020167	
116	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0035	0.004167	0.004167	0.004167	0.016	
117	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0035	0.004167	0.004167	0.011833	
118	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0035	0.004167	0.007667	
119	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0035	0.0035	
120	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
121	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
122	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.567

July 6, 2001

TABLE 3
Phase IIIb Monthly Return Flow Fractions

	Monthly Model Return Fractions (%)	Monthly Return Fractions based on Proposed Daily Return Fractions (%)
Month 1	75.3	73.9
Month 2	17.0	19.0
Month 3	5.4	5.6
Month 4	1.8	1.5
Month 5	0.5	0

Conclusion

In summary, effects of the proposed daily return flow pattern are very similar to the monthly return flow pattern used in earlier phases of CDSS. Monthly and daily model results related to return flows will be comparable if the proposed daily return flow pattern is adopted.

The relatively small discrepancies between the two columns of Table 3 are well-understood, and are related to the following:

1. inability to exactly recreate the original monthly return flow fractions using the State's Analytical Stream Depletion Analysis program (D. Schroeder, 1987); a different program was used in the original CRDSS effort and numerical methods and tolerances may have been different.

2. Length of months in the monthly Glover model used to derive the first pattern was 365/12 days, and the fractions are the same in each month regardless of whether the month has 31, 30, or 28 days. In the daily model, the effective monthly return fraction varies with number of days in the month. The fractions shown in the right column of Table 3 are based on a 30-day recharge month followed by two 31-day months and a 30-day month (i.e., appropriate numbers for June recharge). With a different sequence of number of days in the month, these fractions will vary slightly.

3. To relieve input and computational burden, the "tail" of the daily return fraction was adjusted so that effects of days 91 through 150 were distributed through days 50 through 90. Reducing the duration of the single-day return to 90 days resulted in a 4-month, rather than 5-month, pattern on a monthly basis.