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MEMORANDUM

TO: Ms. Victoria Whitney, State Water Resources Control Board, Division of Water Rights

FROM: David P. Lounsbury, P.E.
James C. Hanson Consulting Civil Engineers

DATE: May 31, 2007

RE: **Required Analysis and Calculations for Water Right Application by Brooktrails Township Community Services District**

This letter summarizes the results of the Required Analysis and Calculations for the above referenced application. The calculations are performed for the diversion period October 1 through March 31, with demand calculated for the same period. The Points of Interest (POI) analyzed for this project were identified by the applicant and are described below. The points are labeled POI No. 1 through POI No. 5 and are located within the Outlet Creek watershed tributary to the Upper Eel River.

Locations of Points of Interest

POI No.	Location
1	Lake Emily
2	Lake Ada Rose
3	Willits Creek immediately above the confluence with Mill Creek
4	Mill Creek immediately above the confluence with Outlet Creek
5	Outlet Creek immediately above the confluence with the Upper Eel River

The objectives of the analysis are as follows:

- To determine whether water is available for appropriation in accordance with California Water Code section 1260 (k); and
- To estimate the impact of the diversions sought on streamflows and the potential resulting impacts to fishery resources.

PROJECT DESCRIPTION

The project is located in Mendocino County, and is situated about 2 miles northwest of the City of Willits, to the west of Highway 101. The place of use described by the application is a housing and golf course development of approximately 8,400 acres. Approximately 1,500 of the planned 5,800 homes have been built thus far, and are served with water stored in two existing onstream reservoirs referred to herein as Lake Emily and Lake Ada Rose (see attached map). Lake Emily has a permitted capacity of 270 af under Permit 15913 (Application 23038). The applicant has submitted a Petition for Redistribution of Storage (Petition) to request the transfer of 30 af currently authorized for storage in the abandoned South Lake Reservoir to storage in Lake Emily, and an application to appropriate an additional 285 af to storage in Lake Emily. Both the Petition and the application are pending before the Board and Lake Emily will be enlarged to a capacity of 585 af (270 + 30 + 285 = 585) to accommodate the additional water. Lake Ada Rose has an existing capacity of 138 af authorized under Permit 14218 (Application 21275). The applicant is hereby filing an application for storage of additional water in Lake Ada Rose to ensure that the water resources required to support the municipality are sufficient for the existing and proposed population.

This application seeks the right to divert water from Willits Creek tributary to Mill Creek thence Outlet Creek thence the Eel River and from two unnamed streams tributary to Willits Creek thence Mill Creek thence Outlet Creek thence the Eel River. The point of diversion (POD) on Willits Creek is identified in the application as POD No. 1 and the PODs on the unnamed streams are identified as POD Nos. 2A and 2B, respectively. This application seeks diversion from POD Nos. 1, 2A and 2B to storage in Lake Ada Rose. Under this application, POD Nos. 2A and 2B are points of diversion to onstream storage in Lake Ada Rose, and points of rediversion to offstream storage for water diverted at POD No. 1. Water diverted at POD No. 1 will be transported from Lake Emily through two 24" diameter pipes to points of rediversion 2A and 2B and thence into Lake Ada Rose. POD No. 1 is an existing POD under Permit 15913 (Application 23038) and Brooktrails' pending application for additional storage in Lake Emily. POD No. 2A is an existing POD under Permit 14218 (Application 21275).

This application is requesting a total of 725 af to be diverted to storage in Lake Ada Rose from October 1 through March 31 of the following year for irrigation, domestic, recreation and municipal uses. The applicant may withdraw the amount requested entirely from the Lake Ada Rose watershed (the watershed tributary to POI No. 2) or the Lake Emily watershed (watershed tributary to POI No. 1) or in any combination thereof. The total amount to be diverted under this application and Permit 14218 will not exceed 725 af. Lake Ada Rose will be enlarged to a capacity of 725 af to accommodate the water authorized under Permit 14218 and the water requested by this application.

ESTIMATED SEASONAL UNIMPAIRED FLOW

Unimpaired flow during the project's diversion season is the total volume of water, on average, that would flow past a selected point of interest on a seasonal basis if no diversions (impairments) were taking place in the watershed above that point.

The seasonal unimpaired flows around this project are estimated by correlating the gaged stream flows at USGS Gaging Station No. 11472160, Willits Creek above Lake Emily (Willits Creek gage) and USGS Gaging Station No. 11472200, Outlet Creek near Longvale (Outlet Creek gage) to the watersheds tributary to the POIs. The Willits Creek gage is located on Willits Creek about 1,500 feet above Lake Emily and has records available from water years 2004 through 2007 (see attached Table 6). The Outlet Creek gage is located about 4,000 feet above the confluence with the Upper Eel River and has records available from water years 1957 through 1994 (see attached Table 7).

To evaluate the seasonal flows recorded at the Willits Creek gage, we reviewed the precipitation records obtained from National Oceanic and Atmospheric Administration (NOAA) gage Willits NE1, located about two miles south east of the project site. We computed the seasonal precipitation amounts during the period of record of the Willits Creek stream gage and the Willits NE1 precipitation gage to determine the relation of the short period of record to the long-term average. The Willits precipitation gage has a period of record of 47 years, from 1960 to 2007, and a long-term seasonal average of 43.62 inches (see attached Table 8). The seasonal precipitation during the period of record of the Willits Creek stream gage (2004 - 2007) is 43.98 inches, which is 101% of the long-term seasonal average. Following the assumption that the run off and stream flow for the period of record of the Willits Creek stream gage would also be near average, we determined that it is appropriate to use the average of the seasonal flows measured at the Willits Creek gage as the estimated seasonal unimpaired flow.

The seasonal flows recorded at the Outlet Creek gage are taken to represent the long term average without adjustment due to the relatively long period of record of flows available. The estimated seasonal unimpaired flow (estimated seasonal flow) during the diversion season of October 1 through March 31 as measured at each gage is as follows:

Location	Total (af)
Willits Creek Gage	5,358
Outlet Creek Gage	150,777

The estimated seasonal streamflow at POI Nos. 1, 2, 3, and 4 was estimated by adjusting the Willits Creek gage data for differences in drainage area. Based on the proximity and topographical similarities of the Willits Creek gage to the watersheds for POI Nos. 1, 2, 3, and 4, we assume that no adjustment of gage records to account for differences in precipitation is necessary. The estimated seasonal flow for POI No. 5 is taken directly from the Outlet Creek gage records with no adjustments for drainage area or precipitation. The watershed areas for the Willits Creek gage and Outlet Creek gage sites are as follows:

Location	Watershed Area (ac)
Willits Creek Gage	2,364
Outlet Creek Gage	103,657

The tributary drainage areas for the watershed above each POI are shown on the attached map. Watersheds were delineated on digital USGS 7.5 minute quad maps, with watershed areas determined using AutoCad. Flows from the watershed areas tributary to the POIs were estimated using the following formula:

$$Q_2 = Q_1 \times (A_2 / A_1)$$

Where:

Q_2 = Flow at point of interest on tributary watershed;
Q_1 = Flow at the gage;
A_2 = Watershed area above point of interest;
A_1 = Watershed area above gage;

The tributary drainage area and estimated seasonal unimpaired flows for the watershed above each POI are summarized on attached Table 9.

WATER RIGHTS OF RECORD

The total face value of recorded water rights within the Outlet Creek watershed for the period of October 1 to March 31 were tabulated based on the SWRCB's stream code database, the SWRCB's WRIMS database, and review of selected water right files. Recorded water rights within each watershed are shown on the attached Tables 1 - 5. The last column of each table is a running

cumulative total of all rights of record within the watershed. For purposes of accumulating diversions, it has been assumed that all statements of diversion and use have priority over appropriative rights. Footnotes on each table disclose assumptions made when deviating from face value for certain filings.

CUMULATIVE FLOW IMPAIRMENT INDEX

The Cumulative Flow Impairment Index (CFII) is computed by dividing the total face value of water rights of record for the period of October 1 through March 31 by the estimated seasonal unimpaired flow for the period of October 1 through March 31. Based on the forgoing calculations, CFII values computed for each watershed are shown on the attached Table 9. CFII values have been calculated for two probable project operation scenarios. "Operational Scenario A" evaluates the CFII when average or above-average amounts of rainfall ensure that all water requested under this application is available from the watershed tributary to POI No. 2 (Lake Ada Rose). "Operational Scenario B" evaluates the CFII during below-average periods of rainfall, when water is not available at POI No. 2 and all water requested under this application is diverted from the watershed tributary to POI No. 1 (Lake Emily).

The foregoing CFIIs are likely conservative for the following reasons:

1. Use of the full face value of water rights overestimates impairment. The full face value of each water right is not diverted each and every year.

2. Claims of rights shown on Tables 1 through 5 have not been verified as valid.

3. No adjustment of Outlet Creek or Willits Creek gage data was made for flow impairment during the period of record, therefore, the gaged flow underestimates unimpaired flow resulting in an overestimation of CFII.

We trust the foregoing satisfactorily addresses the issue of water available within the stream system affected by the pending application.

c.c Mike Chapman
BTRLE.029

TABLE 6

USGS Gaging Station No. 11472160,
"Willits Creek above Lake Emily" Flow Data
October 1 - March 31 Diversion Season Flows
(all amounts in acre-feet)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Diversion Season Total
2004	1	28	1,408	1,090	2,050	542	5,120
2005	23	21	591	856	424	1,426	3,341
2006	14	90	3,811	2,759	1,412	2,813	10,899
2007	2	50	411	269	823	517	2,072

Period of Record Average for Diversion Season Only: **5,358**

TABLE 7

USGS Gage No. 11472200
"Outlet Creek Near Longvale" Flow Data
October 1 - March 31 Diversion Season Flows
(all amounts in acre-feet)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Diversion Season Total
1956-57	5,625	2,398	1,946	34,654	63,135	69,807	177,565
58	512	95	633	26,145	30,679	66,013	124,076
59	79,624	3,614	1,936	374	92	89	85,728
1959-60	74,544	77,255	13,127	8,029	1,486	423	174,864
61	110	137	898	21,900	154,521	68,520	246,086
62	408	121	72	133	9,857	62,667	73,257
63	17,637	13,587	2,464	430	110	109	34,337
64	24,746	85,737	59,255	6,387	2,303	581	179,009
1964-65	33,788	1,991	65,154	4,616	89,273	11,695	206,517
66	575	167	136	673	43,063	21,930	66,543
67	6,532	2,465	940	206	62	45	10,250
68	239,916	30,044	6,048	38,244	6,510	1,291	322,053
69	94	7,600	12,915	144,133	37,427	42,090	244,258
1969-70	265	52	52	91	11,480	76,075	88,015
71	63,151	14,618	2,398	437	103	16	80,723
72	54,076	48,443	60,417	9,090	1,686	929	174,642
73	228	2,076	48,522	195,662	131,800	51,492	429,780
74	417	89	55	292	783	24,209	25,845
1974-75	5,056	2,122	700	252	76	65	8,272
76	98,887	28,664	40,765	59,638	7,835	2,031	237,820
77	164	892	20,716	19,339	55,246	66,176	162,533
78	296	107	91	1,014	11,669	13,490	26,666
79	25,553	3,322	873	232	61	44	30,085
1979-80	74,306	120,131	88,972	120,472	6,266	1,404	411,550
81	93	527	9,009	46,178	80,274	86,268	222,350
82	514	170	126	180	3,820	17,861	22,671
83	19,169	6,889	1,107	333	83	219	27,799
84	1,161	977	4,973	6,873	735	443	15,162
1984-85	202	1,798	14,450	130,399	132,551	73,747	353,147
86	639	140	194	161	104	453	1,691
87	20,777	17,740	4,114	472	94	58	43,256
88	39,724	102,200	98,766	28,217	8,118	2,233	279,259
89	57	206	18,536	6,809	56,877	38,305	120,790
1989-90	259	29	7	105	3,536	61,208	65,144
91	85,897	49,385	3,312	548	142	95	139,380
92	95,817	121,886	114,190	138,914	33,898	7,486	512,191
93	191	407	57,135	103,219	8,283	43,084	212,319
94	990	158	94	83	5,292	87,292	93,909
			Period of Record Average for Diversion Season Only:				**150,777**

TABLE 8

Willits 1 NE Precipitation Station
Monthly Precipitation Data
Diversion Season October 1 - March 31
(all amounts in Inches)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Total	Percent of Average
1960-61	1.22	8.89	8.46	5.38	8.17	10.07	42.19	96.7%
62	2.10	9.00	5.07	3.99	11.60	7.53	39.29	90.1%
63	11.36	5.17	6.56	6.89	4.70	7.92	42.60	97.7%
64	4.59	12.82	2.75	10.36	0.69	4.88	36.09	82.7%
1964-65	1.68	12.78	31.41	10.23	1.92	2.66	60.68	139.1%
66	0.83	10.94	6.32	12.73	5.89	3.90	40.61	93.1%
67	0.05	11.18	8.28	14.08	0.98	10.05	44.62	102.3%
68	3.76	4.04	7.02	10.75	7.07	5.86	38.50	88.3%
69	2.29	5.45	20.89	22.79	12.20	2.37	65.99	151.3%
1969-70	3.39	1.82	15.05	26.05	5.50	2.65	54.46	124.8%
71	3.79	12.18	14.51	10.29	1.09	11.44	53.30	122.2%
72	0.86	6.17	8.31	7.22	6.83	3.69	33.08	75.8%
73	2.54	7.31	10.69	16.69	7.87	5.63	50.73	116.3%
74	5.69	18.99	9.87	13.17	8.22	14.28	70.22	161.0%
1974-75	2.62	2.10	7.01	8.18	14.82	18.43	53.16	121.9%
76	6.41	3.53	4.21	1.28	9.76	1.99	27.18	62.3%
77	--	--	--	--	--	--	--	--
78	1.79	6.13	13.30	16.25	10.62	7.62	55.71	127.7%
79	0.00	1.89	1.17	10.27	12.66	3.61	29.60	67.9%
1979-80	6.85	10.35	7.07	10.27	10.83	3.98	49.35	113.1%
81	1.90	1.91	8.78	10.41	5.15	5.29	33.44	76.7%
82	6.03	15.62	16.28	6.92	8.56	10.70	64.11	147.0%
83	6.08	13.78	11.96	11.58	16.96	17.25	77.61	177.9%
84	1.47	19.18	16.27	0.83	6.63	3.66	48.04	110.1%
1984-85	4.73	17.22	1.63	1.29	4.90	6.46	36.23	83.0%
86	3.16	7.43	5.17	11.06	21.62	9.21	57.65	132.2%
87	1.69	1.09	4.26	8.22	7.13	9.36	31.75	72.8%
88	2.52	5.64	13.42	8.86	0.23	--	30.67	70.3%
89	0.30	--	6.09	3.70	1.38	--	11.47	26.3%
1989-90	2.55	2.00	0.18	--	4.82	3.37	12.92	29.6%
91	1.45	0.75	2.12	1.65	4.40	14.52	24.89	57.1%
92	2.78	3.35	4.01	4.69	12.10	4.79	31.72	72.7%
93	4.97	1.83	14.59	13.46	7.99	4.86	47.70	109.3%
94	1.13	2.13	6.97	6.32	7.06	0.69	24.30	55.7%

TABLE 8 - CONTINUED

Willits 1 NE Precipitation Station
Monthly Precipitation Data
Diversion Season October 1 - March 31
(all amounts in Inches)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Total	Percent of Average
1994-95	0.42	8.19	6.54	28.36	2.24	18.93	64.68	148.3%
96	0.00	0.76	17.24	18.42	11.74	4.83	52.99	121.5%
97	2.29	5.50	25.17	11.14	2.33	1.66	48.09	110.2%
98	3.49	8.11	3.62	23.83	--	9.10	48.15	110.4%
99	2.23	11.13	4.35	7.15	18.08	7.73	50.67	116.2%
1999-2000	2.10	8.18	1.38	10.79	12.88	2.70	38.03	87.2%
01	4.94	1.63	2.67	7.25	8.91	3.49	28.89	66.2%
02	1.11	14.56	--	6.68	4.95	4.08	31.38	71.9%
03	0.00	6.02	26.11	6.22	3.03	6.69	48.07	110.2%
04	0.00	6.20	18.81	4.52	12.24	2.29	44.06	101.0%
2004-05	4.48	1.21	11.36	7.13	3.98	9.52	37.68	86.4%
06	1.63	7.21*	24.29	11.55	6.95	13.06	64.69	148.3%
07	0.29	6.38	9.70	1.03	10.96	1.12	29.48	67.6%
Period of Record Average for Diversion Season Only:							**43.62**	
Average Precipitation for 2004 - 2007:							**43.98**	100.8%

*Monthly precipitation for Nov. 2005 not recorded at Willits gage. Value taken from nearby NOAA Station No. 47109 "Potter Valley P H"