MAHANNAH & ASSOCIATES, LLC

EXPERT REPORT

DATE: 28 June 2010

TO: Mike Van Zandt, Esq.
Nathan Metcalf, Esq.
Rusty Jardine, Esq.

FROM: Chris C. Mahannah, P.E., SWRS

RE: Protestants Expert Report - M&I Consumptive Use Analysis (In the Matter of Protested Nevada Applications 73783, et al. and Related Secondary Applications)

I. Introduction

This report and associated expert witness testimony was presented at hearing on 14-15 December 2009 before the Nevada State Engineer relating to applications before him seeking to store the consumptive use component of municipal surface water rights owned by Truckee Meadows Water Authority (TMWA), et al in upstream California reservoirs. Pursuant to Nevada State Engineer Interim Order #1, dated 10 September 2008 (TCID-259), wherein the State Engineer "agrees that the actual figure(s) for what will constitute the consumptive use component is an issue that needs further exploration and clarification" (page 15) and Interim Order #3, dated 24 August 2009 (TCID-260), Items # 2 and 3, the following is offered. All the pending storage applications seek to store the consumptive use portion of base rights which have an existing manner of use as municipal. The applicants erroneously assume the storage applications are converting decreed rights and seek to store the decreed consumptive use component. All of the base rights sought to be stored were converted to municipal use, in many cases decades ago. Table 1 is a summary of the primary storage applications and associated base rights traced back to the original Orr Ditch Decree claim number. Table 2 is a summary of all applications sorted from the earliest to latest date when the base right was converted from decreed to municipal. The earliest conversion from decreed to municipal occurred over 54 years ago in 1955 and 17, 61, 78, and 98% of the cumulative duty was converted prior to 1970, 1980, 1990 and 2000 respectively. The average conversion date for all the applications was 1982 or over a quarter century ago. The conversion from decreed to municipal use has a different return flow pattern and volumes which are relied upon by downstream decreed rights.

EXHIBIT
tabbies
TCID 244

The basis for the State Engineer to review the pending storage applications must be from their current use as municipal and not the prior decreed use. In the recent State Engineer Ruling #5791 (TCID-245), regarding Pyramid Lake Indian Tribe (PLIT) protests to underground change applications in Carson Valley, the State Engineer agreed with the applicants that the issue of available groundwater was dealt with in the prior permitting of the change applications. The State Engineer agreed that if the Protestants had any issue with the initial granting of these groundwater rights, they should have protested when the notice of the original application was made (See page 18 of Ruling 5791). In Ruling #5823 (TCID-246), at page 21 the State Engineer made the same finding. Additionally, in Ruling #5823 the PLIT made a protest claim that an agricultural consumptive use should be applied to base rights which had previously been converted to municipal. The State Engineer overruled this point on the basis the subject applications were not requesting a change in manner of use from irrigation since they had already been converted to municipal. This is the exact situation associated with the subject applications whose base rights were converted to municipal use decades ago (see pages 32-33 of Ruling #5823).

Many of the base right conversions from decreed to municipal shown on Table 1 were protested by TCID, overruled and rulings issued. Table 1 summarizes the ruling numbers for those protested applications which are included in Exhibits 247-254. Return flow and consumptive use issues resulting from the conversion of decreed rights to municipal were addressed in the testimony and rulings in the late 1980s, therefore those conversions were ruled upon at that time. The proper analysis before the State Engineer in the pending storage applications is the conversion from a municipal right and its associated consumptive use and return flow patterns to a storage right. Therefore, the remainder of this report will focus on a municipal consumptive use analysis.

II. Prior State Engineer Rulings

On 14 November 1989, the State Engineer held a hearing regarding testimony on applications protested by TCID seeking to convert decreed rights to municipal. Joe Burns, a

longtime consultant for SPPCo/Westpac/TMWA, presented testimony that the municipal return flows through the wastewater treatment plant were approximately 50% of the diverted flows. According to Mr. Burns, this assumption is also used in the Truckee River Operations Model. Additional testimony was presented and there was discussion by State Engineer, Pete Morros, Mike Turnipseed and Watermaster, Garry Stone regarding Westpac's water right dedication Rule 17 that had been adopted by the Public Service Commission which was based on a critical-year yield. This rule stated that for every 1.0 AF of actual demand, a developer would need to dedicate 1.72 AF to yield 1.0 AF of wet water in a critical drought year. This is also referred to as the '58% Rule'. The State Engineer overruled TCID's protests and issued Ruling #3739 which is part of the transcript for the 14 November 1989 hearing (TCID-247) on the basis of a municipal return flow component of 50% and during all but drought years, the 58% Rule would also protect return flows. See discussion at pages 112-113 of the transcript (TCID-247) where Mr. Morros and Mr. Stone agree return flow must be protected. There is also discussion at pages 88-92 (TCID-247) regarding the 58% Rule and belief by Mr. Morros that unless new water is added from sources that are independent from the Truckee River or additional storage is created, the 58% Rule must be maintained. Ms. Oldham agreed and indicated they would not propose to change the 58% Rule (page 91). This is precisely what was done under water right dedication Rule 7 and Section 4B of TROA which relaxes the dedication rate from 1.72 to 1.11 AF for each 1.0 AF of demand. Therefore, the concern expressed by Mr. Morros at the 1989 hearing has occurred. More recently, the State Engineer in Ruling #5823 (TCID-246) found "...that the dedication requirements that have been in place for years do adequately protect existing users. As noted, by the Applicants, the requirements of multiple State Engineers have built in a margin of safety that protects existing users." TROA, the subject applications and relaxed dedication rates will unravel that margin of safety.

Subsequently, the State Engineer overruled TCID protests of decreed to municipal conversions without a hearing and referenced the 14 November 1989 hearing and Ruling# 3739. (See Ruling numbers 3875, 4582, 4005, 4449, 4011 and 4486.) Each of these rulings has language similar to: "The SPPCo. Service area is sewered and the wastewater is treated and returned to the Truckee River upstream of the protestant's point of diversion. The State Engineer

finds that the change of the full duty of water from irrigation to municipal use as proposed under Applications 56732 and 56734 will not reduce the flow in the Truckee River."

III. Municipal Consumptive Use Analysis

In 1991 TCID protested Westpac's application 55675 which sought to move an underground right to a location in close proximity to the Truckee River. The protest claim was that the new well location would intercept river flow. Westpac presented the argument that there would be a net gain in river flow because approximately 50% of Sierra's municipal water is returned to the river at the Truckee Meadows Water Reclamation Facility (TMWRF). Municipal return flows through the TMWRF were analyzed by Water Research & Development, Inc. (WRD) in 1991 to prepare evidence supporting TCID's protest. The protest was settled the morning of the hearing and a groundwater management agreement was negotiated whereby Westpac's underground pumpage in the river corridor was limited, among other provisions. (See TCID-255 which is excerpts from the WRD report which was later presented to the State Engineer even though a hearing was not conducted.) Effluent return flows were analyzed from 1980 to 1988 resulting in an average annual return flow of 46%. The analysis showed monthly municipal return flows that range from 27% in July when outside irrigation is at a peak to a maximum of 87% in January when there is virtually no outdoor watering. The analysis covered a time period before any significant effluent re-use, imported effluent, surface water exported to South Truckee Meadows, and artificial groundwater recharge operations were occurring which would complicate the analysis.

In 1994, when the State Engineer was preparing to take action on the City of Reno/Sparks primary effluent application 29973, a municipal consumptive use analysis was requested and the State Engineer offered a procedure for doing such to determine the groundwater and surface water components of the effluent. (See TCID-256, a letter dated 6 July 1994.) In response, the cities through Consulting Engineering Services (CES) prepared a municipal consumptive use analysis dated 20 September 1994. (TCID-257) This analysis followed the procedure outlined in the 6 July 1994 State Engineer letter to arrive at an average municipal return flow of 54.1% over the period 1983 to 1993. This return flow percentage of 54% was higher than that calculated by

WRD in 1991 of 46% due to: (1) considering water exported which was not sewered back to TMWRF and (2) the assumption that 10% of Sierra's customers were still on septic systems. The unsewered septic assumption of 10% resulted in the majority of the discrepancy between the WRD and CES analysis. The CES analysis was accepted by the State Engineer whereby 54.1% municipal return flow was used to arrive at a groundwater effluent component of 6,700 afa.

An updated municipal consumptive use analysis has been performed for the period 1989 to 2005 using a procedure similar to that outlined in the State Engineer, 6 July 1994 letter, to account for exports out of the Truckee Meadows which are not sewered back to TMWRF. Logic and results are presented in Table 3 showing the average return flows over this period are 45% including effluent irrigation reuse and 44% excluding effluent reuse. The current return flow analysis is conservative in that it did not account for unsewered (septic) municipal water service customers in the Truckee Meadow and is comparable with results obtained by WRD in the 1991.

Monthly municipal return flow and consumptive use percentages are reported on Table 4 for the period 1990 to 2005. The average monthly return flow percentages are also comparable with the 1991 WRD analysis.

The updated return flow percentages would also be conservative since they only account for return of municipal effluent at TMWRF. There are additional returns to the river from lawn watering via urban runoff to the storm drains, artificial surface drains, and channels which drain to the river. Additionally, there is a deep percolation component of return flow from lawn watering which returns to the aquifer and eventually the river. A poignant example of such urban runoff is demonstrated in the City of Reno's application 77221 which sought a new appropriation from Chalk Creek, which is tributary to the Truckee River and drains an urbanized area in northwest Reno on the flanks of Peavine Mountain. The City of Reno was seeking to appropriate urban return flows from water which has already been appropriated and run through TMWA's system. Remarks to this application indicate: "This creek has developed subsequent to the decree on the Truckee River as a result of urbanization. In 1980 prior to the bulk of development, the Chalk Creek was ephemeral. By 2006, much of the watershed had been developed and the creek has become a flowing perennial stream as a result of secondary

recharge. Storm water flowing from impervious surfaces, irrigation and over watering has contributed to making this flow continuous." This application was protested by Churchill County, TCID and TMWA and the State Engineer denied the application in Ruling 5972 which found in part: "Ultimately, these applications were approved for full duty, rather than for only the consumptive use portion of the irrigation, under the reasoning that there would remain return flows to the river under the municipal uses. It is these non-consumptive portions of the upstream rights returning to the river that help serve those rights downstream." (page 5) (See TCID-258 which contains copies of application 77221, protests and Ruling 5972).

Furthermore, the effluent storage Permit 29973 issued to the Cities of Reno and Sparks allocated the surface and groundwater components and conditioned any secondary application for the surface water component. It was contingent upon an application to change being filed to show the disposition of any water rights for which the surface water components of the effluent was being substituted. (TCID-261) In a 1984 agreement between the PLIT, Sierra Pacific Power Company (now TMWA), Washoe County Water Conservation District, Washoe County and Cities of Reno and Sparks, agreed that:

> "The Cities shall insure that return flow to the Truckee River is no less than it would have been had the Surface Water Component not been used by the Cities and that the timing of such return flow is not changed." (TCID-262, Section 5.2(b))

In 1996, correspondence between TCID and the State Engineer confirmed the State Engineers position to protect effluent return flows and that for every acre foot of effluent removed from the river, an acre foot of water must be left in the river so as not to impair the rights of downstream users. (TCID-263 & 264)

IV. Summary

Based on past and current municipal return flow analysis, other conservative factors outlined above and prior State Engineer rulings, a 50% annual average municipal return flow appears reasonable. At the 21 March 2008 Status Conference before the State Engineer, TMWA presented a series of PowerPoint slides which used a municipal return flow percentage of 48%. Therefore the volume allowed to be stored in any given year under these applications should be a

maximum of 50% of the annual duty or 6,823 afa (13,646/2). Should drought conditions exist in any given year, whereby the Watermaster deems the original municipal duty could not be diverted, then the volumes stored should be proportionately reduced.

The storage timing of the municipal consumptive use component should match the monthly municipal consumptive use percentages. These monthly percentages are arrived at by taking (1 – monthly return flow percentage) x monthly demand percentage, which are reported on Table 4. The monthly consumptive use storage percentages have been adjusted such that the annual municipal consumptive use is 50%. By matching and allowing monthly storage with monthly historical municipal consumptive use patterns, which have been in place now up to 54 years or a few decades for the majority of the municipal rights sought to be stored under these applications, the downstream return flow patterns will be maintained and downstream rights will be protected.

EXHBIT LIST

Exhibit	
TCID-245	State Engineer Ruling #5791
TCID-246	State Engineer Ruling #5823
TCID-247	Transcript of 11/14/89 Hearing & State Engineer Ruling #3739
TCID-248	State Engineer Ruling #3875
TCID-249	State Engineer Ruling #4005
TCID-250	State Engineer Ruling #4011
TCID-251	State Engineer Ruling #4449
TCID-252	State Engineer Ruling #4486
TCID-253	State Engineer Ruling #4582
TCID-254	State Engineer Ruling #4642
TCID-255	Water Research & Development (WRD) Report Excerpts, App #55675, November, 1991
TCID-256	State Engineer Letter to City of Reno, 7/6/1994
TCID-257	CES Letter Report to City of Reno, 9/20/1994
TCID-258	Application 77221, TCID, TMWA & Churchill Co. Protests & State Engineer Ruling #5972
TCID-259	State Engineer Interim Order #1, 9/10/08
TCID-260	State Engineer Interim Order #3, 9/24/09
TCID-261	State Engineer Permit 29973
TCID-262	Agreement Concerning Applications to Appropriate the Waters of the Truckee River & Tributaries, 5/31/94
TCID-263	Letter from Lyman McConnell to Mike Turnipseed, 1/4/96
TCID-264	Letter from Mike Turnipseed to Lyman McConnell, 1/5/96

Table 1. SUMMARY OF TROA PRIMARY STORAGE APPLICATIONS - REVISED

APP #	CHANGE OF	CHANGE OF	CHANGE OF	CHANGE OF	OWNER	FILE DATE	RATE (CFS)	USE	DUTY (AFA)	PROTESTED BY:	BASE RIGHT SE RULING#	DATE CONVERTED FROM DECREED TO M&I
73783	42732	314DTR			TMWA	2/1/06	1.200	STO	330.80	Churchill, TCID, Fallon		1980
73791	42733	311DTR			TMWA	2/3/06	3.229	STO	623.24	Churchill, TCID, Fallon		1980
73792	42736	619DTR			TMWA	2/3/06	3.400	STO	322.00	Churchill, TCID, Fallon		1980
73794	58383	337DTR 338DTR			RENO-CITY	2/3/06	0.911	STO	264.96	Churchill, TCID, Fallon		1992
73795	62406	42713	31939	52DTR	RENO-CITY	2/3/06	0.487	STO	128.13	Churchill, TCID, Fallon		1977
73796	62855	25444	67DTR		RENO-CITY	2/3/06	0.207	STO	86.30	Churchill, TCID, Fallon		1997
73797	63601	29104	65DTR		TMWA	2/3/06	0.431	STO	161.20	Churchill, TCID, Fallon		1974
73798	63785	88DTR 88ADTR			TMWA	2/3/06		STO	43.31	Churchill, TCID, Fallon		1998
73799	63507	47636	35752	142DTR	RENO-CITY	2/3/06	5.643	STO	451.52	Churchill, TCID, Fallon		1978
73800	69871	343DTR 344DTR			TMWA	2/3/06	1.180	STO	111.68	Churchill, TCID, Fallon		2003
73849	27756	534DTR 535DTR			TMWA	2/17/06	0.375	STO	144.16	Churchill, TCID, Fallon		1973
73850	27757	570DTR			TMWA	2/17/06	3.660	STO	628.00	Churchill, TCID, Fallon		1973
73851	27758	578DTR			TMWA	2/17/06	3.430	STO	396.00	Churchill, TCID, Fallon		1973
73852	27759	579DTR 580DTR			TMWA	2/17/06	2.812	STO	523.32	Churchill, TCID, Fallon		1973
73853	42727	19938	611DTR		TMWA	2/17/06	3.680	STO	383.72	Churchill, TCID, Fallon		1980
73854	42728	615DTR			TMWA	2/17/06	2.180	STO	213.00	Churchill, TCID, Fallon		1980
73855	55383	356DTR 357DTR			TMWA	2/17/06	2.330	STO	277.78	Churchill, TCID, Fallon	4582	1990
73863	46465	529DTR			TMWA	2/23/06	0.175	STO	86.76	Churchill, TCID, Fallon		1982
73865	50015	522DTR 524DTR			TMWA	2/23/06	0.885	STO	154.98	Churchill, TCID, Fallon		1986
73868	56062	574DTR 575DTR			TMWA	2/23/06	0.955	STO	152.00	Churchill, TCID, Fallon	4005	1991
73869	57013	485DTR 489DTR			RENO-CITY	2/23/06	2.897	STO	344.45	Churchill, TCID, Fallon	4449	1991
73870	57309	583DTR			RENO-CITY	2/23/06	3.780	STO	454.37	Churchill, TCID, Fallon	4011	1992
73871	62454	48903	405DTR 406DTR		RENO-CITY	2/23/06	1.377	STO	167.00	Churchill, TCID, Fallon		1996
73872	65244	576DTR 577DTR			TMWA	2/23/06	0.720	STO	119.84	Churchill, TCID, Fallon		1999
73908	66158	25118	514DTR		TMWA	3/1/06	3.550	STO	638.60	Churchill, TCID, Fallon		1969
73909	66575	24132	409DTR		TMWA	3/1/06	2.250	STO	237.00	Churchill, TCID, Fallon		1967
73910	66577	23074	569DTR		TMWA	3/1/06	1.410	STO	203.80	Churchill, TCID, Fallon		1966
73911	66578	23075	325DTR		TMWA	3/1/06	0.625	STO	185.59	Churchill, TCID, Fallon		1966
73912	66660	22640	517DTR		TMWA	3/1/06	0.630	STO	80.00	Churchill, TCID, Fallon		1965
73913	66676	23653	20425	503DTR	TMWA	3/1/06	0.475	STO	43.00	Churchill, TCID, Fallon		1962
73914	66695	25121	584DTR		TMWA	3/1/06	0.494	STO	59.90	Churchill, TCID, Fallon		1969
73915	68649	387DTR			TMWA	3/1/06	0.535	STO	67.68	Churchill, TCID, Fallon		2002
73917	27755	532DTR 533DTR			TMWA	3/1/06	1.589	STO	466.24	Churchill, TCID, Fallon		1973
73986	58559	346DTR 347DTR			SPARKS / TMWA	3/13/06	0.926	STO	273.83	Churchill, TCID		1993
73987	58560	343DTR 344DTR			SPARKS / TMWA	3/13/06	0.908	STO	137.20	Churchill, TCID		1993
74076	42735	329DTR			TMWA	3/28/06	0.420	STO	100.60	Churchill, TCID		1980
74077	65970	23118	600DTR		TMWA	3/28/06	3.421	STO	548.00	Churchill, TCID		1966
74078	65204	491DTR			TMWA	3/28/06	0.537	STO	48.01	Churchill, TCID		1999
74079	65583	405DTR 406DTR			TMWA	3/28/06	0.503	STO	61.00	Churchill, TCID		1999

74080	66463	568aDTR 568DTR			TMWA	3/28/06	0.274	STO	59.64	Churchill, TCID		2000
74081	66750	23266	440DTR		TMWA	3/28/06	0.175	STO	28.00	Churchill, TCID		1966
74082	68159	46361	80DTR		TMWA	3/28/06	2.373	STO	550.23	Churchill, TCID		1982
74083	68160	46360	74DTR		TMWA	3/28/06	0.508	STO	112.79	Churchill, TCID		1982
74084	69420	581DTR			TMWA	3/28/06	0.355	STO	64.92	Churchill, TCID		2002
74085	70494	581DTR			TMWA	3/28/06	0.220	STO	40.04	Churchill, TCID		2003
74193	16494	413DTR			TMWA	4/13/06	0.460	STO	111.69	Churchill, TCID, Fallon		1955
74194	16758	434DTR			TMWA	4/13/06	0.240	STO	64.03	Churchill, TCID, Fallon		1955
74195	28972	19938	611DTR		TMWA	4/13/06	0.783	STO	64.96	Churchill, TCID, Fallon		1974
74196	56734	24614	181DTR		TMWA	4/13/06	0.399	STO	160.65	Churchill, TCID, Fallon	4486	1968
74197	62534	576DTR			RENO/SPARKS/ TMWA	4/13/06	1.170	STO	187.15	Churchill, TCID, Fallon		1996
74198	66590	26351	407DTR		TMWA	4/13/06	1.243	STO	154.00	Churchill, TCID, Fallon		1971
74199	68158	46359	86DTR		TMWA	4/13/06	0.900	STO	180.60	Churchill, TCID, Fallon		1982
74200	38212	130DTR			TMWA	4/13/06	3.420	STO	783.15	Churchill, TCID, Fallon		1979
74201	61498	351DTR 352DTR			SPARKS-CITY	4/13/06	0.211	STO	69.50	Churchill, TCID, Fallon		1995
74202	62405	124DTR			TMWA	4/13/06	1.568	STO	334.10	Churchill, TCID, Fallon	4642	1996

TOTAL DUTY: 12,684.42

Table 2. CONVERSION FROM DECREED TO M&I - REVISED

APP #	CHANGE OF	CHANGE OF	CHANGE OF	CHANGE OF	OWNER	FILE DATE	RATE (CFS)	USE	DUTY (AFA)	CUMULATIVE DUTY (AFA)	BASE RIGHT SE RULING#	APP DATE CONVERTED FROM DECREED TO M&I	YEARS SINCE CONVERTED FROM DECREED TO M&I	CUMULATIVE % CONVERTED TO M&I
74193	16494	413DTR			TMWA	4/13/06	0.460	STO	111.69	112		1955	54	1%
74194	16758	434DTR			TMWA	4/13/06	0.240	STO	64.03	176		1955	54	1%
73913	66676	23653	20425	503DTR	TMWA	3/1/06	0.475	STO	43.00	219		1962	47	2%
73912	66660	22640	517DTR		TMWA	3/1/06	0.630	STO	80.00	299		1965	44	2%
73910	66577	23074	569DTR		TMWA	3/1/06	1.410	STO	203.80	503		1966	43	4%
73911	66578	23075	325DTR		TMWA	3/1/06	0.625	STO	185.59	688		1966	43	5%
74077	65970	23118	600DTR		TMWA	3/28/06	3.421	STO	548.00	1,236		1966	43	10%
74081	66750	23266	440DTR		TMWA	3/28/06	0.175	STO	28.00	1,264		1966	43	10%
73909	66575	24132	409DTR		TMWA	3/1/06	2.250	STO	237.00	1,501		1967	42	12%
74196	56734	24614	181DTR		TMWA	4/13/06	0.399	STO	160.65	1,662	4486	1968	41	13%
73908	66158	25118	514DTR		TMWA	3/1/06	3.550	STO	638.60	2,300		1969	40	18%
73914	66695	25121	584DTR		TMWA	3/1/06	0.494	STO	59.90	2,360		1969	40	19%
74198	66590	26351	407DTR		TMWA	4/13/06	1.243	STO	154.00	2,514		1971	38	20%
73849	27756	534DTR 535DTR			TMWA	2/17/06	0.375	STO	144.16	2,658		1973	36	21%
73850	27757	570DTR			TMWA	2/17/06	3.660	STO	628.00	3,286		1973	36	26%
73851	27758	578DTR			TMWA	2/17/06	3.430	STO	396.00	3,682		1973	36	29%
73852	27759	579DTR 580DTR			TMWA	2/17/06	2.812	STO	523.32	4,206		1973	36	33%
73917	27755	532DTR 533DTR			TMWA	3/1/06	1.589	STO	466.24	4,672		1973	36	37%
73797	63601	29104	65DTR		TMWA	2/3/06	0.431	STO	161.20	4,833		1974	35	38%
74195	28972	19938	611DTR		TMWA	4/13/06	0.783	STO	64.96	4,898		1974	35	39%
73795	62406	42713	31939	52DTR	RENO-CITY	2/3/06	0.487	STO	128.13	5,026		1977	32	40%
73799	63507	47636	35752	142DTR	RENO-CITY	2/3/06	5.643	STO	451.52	5,478		1978	31	43%
74200	38212	130DTR			TMWA	4/13/06	3.420	STO	783.15	6,261		1979	30	49%
73783	42732	314DTR			TMWA	2/1/06	1.200	STO	330.80	6,592		1980	29	52%
73791	42733	311DTR			TMWA	2/3/06	3.229	STO	623.24	7,215		1980	29	57%
73792	42736	619DTR			TMWA	2/3/06	3.400	STO	322.00	7,537		1980	29	59%
73853	42727	19938	611DTR		TMWA	2/17/06	3.680	STO	383.72	7,921		1980	29	62%
73854	42728	615DTR			TMWA	2/17/06	2.180	STO	213.00	8,134		1980	29	64%
74076	42735	329DTR			TMWA	3/28/06	0.420	STO	100.60	8,234		1980	29	65%
73863	46465	529DTR			TMWA	2/23/06	0.175	STO	86.76	8,321		1982	27	66%
74082	68159	46361	80DTR		TMWA	3/28/06	2.373	STO	550.23	8,871		1982	27	70%
74083	68160	46360	74DTR		TMWA	3/28/06	0.508	STO	112.79	8,984		1982	27	71%
74199	68158	46359	86DTR		TMWA	4/13/06	0.900	STO	180.60	9,165		1982	27	72%
73865	50015	522DTR 524DTR			TMWA	2/23/06	0.885	STO	154.98	9,320		1986	23	73%
73855	55383	356DTR 357DTR			TMWA	2/17/06	2.330	STO	277.78	9,597	4582	1990	19	76%
73868	56062	574DTR 575DTR			TMWA	2/23/06	0.955	STO	152.00	9,749	4005	1991	18	77%
73869	57013	485DTR 489DTR			RENO-CITY	2/23/06	2.897	STO	344.45	10,094	4449	1991	18	80%
73794	58383	337DTR 338DTR			RENO-CITY	2/3/06	0.911	STO	264.96	10,359		1992	17	82%
73870	57309	583DTR			RENO-CITY	2/23/06	3.780	STO	454.37	10,813	4011	1992	17	85%
73986	58559	346DTR 347DTR			SPARKS / TMWA	3/13/06	0.926	STO	273.83	11,087		1993	16	87%
73987	58560	343DTR 344DTR			SPARKS / TMWA	3/13/06	0.908	STO	137.20	11,224		1993	16	88%
74201	61498	351DTR 352DTR			SPARKS-CITY	4/13/06	0.211	STO	69.50	11,294		1995	14	89%
73871	62454	48903	405DTR 406DTR		RENO-CITY	2/23/06	1.377	STO	167.00	11,461		1996	13	90%
74197	62534	576DTR			RENO/SPARKS/ TMWA	4/13/06	1.170	STO	187.15	11,648		1996	13	92%
74202	62405	124DTR			TMWA	4/13/06	1.568	STO	334.10	11,982	4642	1996	13	94%
73796	62855	25444	67DTR		RENO-CITY	2/3/06	0.207	STO	86.30	12,068		1997	12	95%
73798	63785	88DTR 88ADTR			TMWA	2/3/06		STO	43.31	12,112		1998	11	95%
73872	65244	576DTR 577DTR			TMWA	2/23/06	0.720	STO	119.84	12,231		1999	10	96%
74078	65204	491DTR			TMWA	3/28/06	0.537	STO	48.01	12,279		1999	10	97%
74079	65583	405DTR 406DTR			TMWA	3/28/06	0.503	STO	61.00	12,340		1999	10	97%
74080	66463	568aDTR 568DTR			TMWA	3/28/06	0.274	STO	59.64	12,400		2000	9	98%
73915	68649	387DTR			TMWA	3/1/06	0.535	STO	67.68	12,468		2002	7	98%
74084	69420	581DTR			TMWA	3/28/06	0.355	STO	64.92	12,533		2002	7	99%
73800	69871	343DTR 344DTR			TMWA	2/3/06	1.180	STO	111.68	12,644		2003	6	100%
74085	70494	581DTR			TMWA	3/28/06	0.220	STO	40.04	12,684		2003	6	100%
								TOTAL DUTY:	12,684.42			AVG	1982	27

Table 3. TRUCKEE MEADOWS ANNUAL MUNICIPAL RETURN FLOWS (ACRE-FEET)

YEAR	1 TRUCKEE RIVER M&I DIVERSIONS	2 TRUCKEE MEADOWS M&I GROUND WATER PUMPING	3 TRUCKEE MEADOWS GROUND WATER RECHARGE	4 LEMMON VALLEY GROUND WATER RECHARGE	5 GOLDEN VALLEY GROUND WATER RECHARGE	6 S. TRUCKEE MEADOWS EXPORT	7 TMWRF EFFLUENT DISCHARGED TO RIVER	8 TMWRF EFFLUENT IRRIGATION REUSE	9 RETURN FLOW WITH EFFLUENT IRRIGATION REUSE	10 RETURN FLOW W/O EFFLUENT IRRIGATION REUSE
1989	54,554	12,812					29,221		43%	43%
1990	47,691	14,557					30,150		48%	48%
1991	47,934	14,461					29,122		47%	47%
1992	45,662	15,696					27,933		46%	46%
1993	48,804	9,490	81				27,587	822	49%	47%
1994	46,039	15,728	9				26,933	798	45%	44%
1995	43,121	14,718	116				30,315	472	53%	53%
1996	55,502	12,629	132			131	32,004	565	48%	47%
1997	63,576	7,857	133			263	33,921	1,080	49%	48%
1998	59,912	7,744	550			394	33,708	863	52%	51%
1999	65,740	11,757	778			526	32,748	1,389	45%	43%
2000	68,920	11,903	1,717	32		657	32,028	1,218	42%	41%
2001	70,702	16,581	2,693	391		789	31,531	1,181	39%	38%
2002	68,319	14,277	2,176	293	14	920	31,510	2,124	42%	40%
2003	68,847	15,437	2,401	263	68	1,052	29,195	909	37%	36%
2004	70,104	13,123	1,815	239	75	1,184	27,366	1,262	36%	34%
2005	67,311	8,126	1,037	230	73	1,627	31,047	3,961	48%	43%
								AVG:	45%	44%

Column 1	Data provided by US District Court Federal Watermaster from TMWA
Columns 2, 3, 4	TMWA Data obtained from State Engineer, Watermaster or CES 9/20/94 Report
Columns 5, 6	Washoe County Utility Division. 2004-05 S. Truckee Meadows export data reported & 1996-2003 reduced linerally
Columns 7 & 8	1993-2005 data provided by City of Sparks and/or NDEP Discharge Monitoring Reports (DMR's). 1989-1992 data obtained from TMWRF website 5/30/06
Column 9	(Columns 7+8)/(Columns 1+2-3-4-5-6)
Column 10	(Columns 7)/(Columns 1+2-3-4-5-6)

Table 4. TRUCKEE MEADOWS MONTHLY MUNICIPAL RETURN FLOW & CONSUMPTIVE USE (CU) (%)

	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
	1990	97%	85%	79%	51%	41%	34%	32%	32%	36%	48%	67%	90%	
	1991	87%	85%	90%	60%	44%	35%	30%	28%	35%	41%	57%	76%	
	1992	75%	77%	76%	45%	35%	35%	33%	32%	33%	41%	76%	84%	
	1993	91%	92%	90%	49%	37%	37%	29%	30%	34%	54%	68%	83%	
	1994	94%	85%	72%	42%	44%	30%	25%	26%	30%	46%	79%	83%	
	1995	87%	79%	93%	65%	53%	43%	37%	32%	35%	47%	70%	91%	
	1996	86%	94%	88%	47%	38%	32%	29%	29%	36%	46%	82%	91%	
	1997	84%	98%	73%	49%	33%	36%	27%	28%	36%	49%	74%	81%	
	1998	81%	87%	84%	62%	45%	41%	28%	27%	42%	57%	78%	80%	
	1999	76%	81%	74%	55%	34%	29%	25%	30%	31%	40%	66%	72%	
	2002	76%	72%	65%	39%	31%	25%	23%	24%	28%	39%	72%	74%	
	2003	70%	68%	57%	44%	27%	20%	17%	25%	27%	31%	66%	64%	
	2004	66%	70%	56%	29%	22%	20%	18%	20%	23%	38%	77%	70%	
	2005	78%	82%	81%	50%	37%	25%	20%	23%	30%	40%	73%	89%	
(A)	AVG:	82%	82%	77%	49%	37%	31%	27%	28%	33%	44%	72%	81%	
	1980-88 AVG:	87%	85%	76%	52%	37%	32%	27%	30%	38%	56%	75%	84%	
(B)	M&I CU:	18.01%	17.62%	23.10%	50.95%	62.67%	68.50%	73.25%	72.46%	67.34%	55.90%	28.18%	19.48%	
(C)	M&I SW+GW DEMAND:	4.55%	4.15%	4.96%	7.33%	10.15%	11.65%	14.06%	13.87%	11.36%	8.42%	4.92%	4.58%	100%
(D)	M&I CU STORAGE:	0.82%	0.73%	1.15%	3.73%	6.36%	7.98%	10.30%	10.05%	7.65%	4.71%	1.39%	0.89%	55.76%
(E)	**M&I CU STORAGE = 50%:**	**0.73%**	**0.66%**	**1.03%**	**3.35%**	**5.71%**	**7.16%**	**9.23%**	**9.01%**	**6.86%**	**4.22%**	**1.24%**	**0.80%**	**50.00%**

Note: January 1997 Return Flows exceeded 100% due to sewer infiltration from flood, therefore average of January 1996 & 1998 were used

Row Calculations:

(A) = 1990 - 2005 Monthly Return Flow Average

(B) = 1 - (A)

(C) = TMWA Monthly GW + SW Diversions / Annual GW + SW Diversions

(D) = (B) x (C)

(E) = (0.50 / 0.5576) x (D)

BINDER & ASSOCIATES CONSULTING, INC.

101 Parkshore Drive, Suite 100, Folsom, CA 95630 • (916) 932-2335 • (916) 932-2336 (fax)

TECHNICAL MEMORANDUM

TO: Michael J. Van Zandt

FROM: Charles W. Binder

RE: Reported Elevation and Storage Data for Selected Reservoirs, Truckee and Carson River Basins, January 1917 through December 2008

DATE: August 14, 2009

Daily records for water surface elevation and storage content were compiled for selected reservoirs in the Truckee and Carson River Basins for the period January 1917 through December 2008. The selected reservoirs and period of record for daily data are listed below. As indicated in the notes following the table, periodic daily or monthly data are available for earlier years for some reservoirs.

Period of Record for Daily Elevation and Storage Data
for Selected Reservoirs
Truckee and Carson River Basins

Reservoir	USGS Station ID	Start Date	End Date
Gage Height/Elevation			
Lake Tahoe	10337000	10/1/1957	present
Donner Lake	10338400	1/5/1989	present
Prosser Creek Reservoir	10340300	10/18/1996	present
Independence Lake	10342900	11/10/1988	present
Stampede Reservoir	10344300	10/18/1996	present
Boca Reservoir	10344490	4/30/1999	present
Lahontan Reservoir	10312100	12/24/1999	present
Storage Content			
Lake Tahoe	10337000	---	---
Donner Lake	10338400	1/5/1989	present
Prosser Creek Reservoir	10340300	1/1/1964	present
Independence Lake	10342900	11/10/1988	present
Stampede Reservoir	10344300	8/9/1970	present
Boca Reservoir	10344490	10/1/1960	present
Lahontan Reservoir	10312100	10/1/1960	present

(a) Some missing data for certain days within range of start and end dates for some stations.
(b) End-of-month data available for Lake Tahoe for period January 31, 1917 through September 30, 1957.
(c) Periodic daily data available for Donner Lake for period June 1929 through December 1988.
(d) Periodic daily data available for Independence Lake for period June 1943 through October 1988.
(e) End-of-month data available for Boca Reservoir for period December 31, 1938 through September 30, 1960.
(f) End-of-month data available for Lahontan Reservoir for period January 31, 1917 through September 30, 1960.

BINDER & ASSOCIATES CONSULTING, INC.

101 Parkshore Drive, Suite 100, Folsom, CA 95630 • (916) 932-2335 • (916) 932-2336 (fax)

TECHNICAL MEMORANDUM

TO: Michael J. Van Zandt

FROM: Charles W. Binder

RE: Reported Daily Discharge for Selected Gages, Truckee and Carson River Basins, January 1909 through December 2008

DATE: August 14, 2009

Daily discharge records were compiled for selected streamflow gages in the Truckee and Carson River Basins for the period January 1909 through December 2008. The selected gages and period of record are listed below. All data were obtained from the U.S. Geological Survey except Truckee Canal at Derby (Water Master Gage) and Independence Creek near Truckee (1953 through 1965) data were obtained from the Office of the Federal Water Master. The daily discharge data for the selected gages are provided in the following tables.

Period of Record for Selected Streamflow Gages
Truckee and Carson River Basins

Station Name	USGS Station ID	Start Date	End Date
Truckee River at Tahoe City	10337500	1/1/1909	present
Donner Creek at Donner Dam	10338500	1/1/1929	present
Prosser Creek below Prosser Creek Dam	10340500	10/1/1942	present
Independence Creek near Truckee	10343000	6/6/1952	present
Sagehen Creek near Truckee	10343500	10/1/1953	present
Little Truckee River above Boca	10344400	9/1/1939	present
Little Truckee River below Boca	10344500	1/1/1911	present
Truckee River at Farad	10346000	1/1/1909	present
Truckee River at Reno	10348000	1/1/1909	present
Truckee River at Vista	10350000	1/1/1932	present
Truckee River below Derby Dam	10351600	1/1/1918	present
Truckee River at Wadsworth	10351650	5/1/1965	present
Truckee River near Nixon	10351700	10/1/1957	present
T. Canal at Derby (Water Master Gage)	10351010	4/1/1927	12/28/1999
T. Canal near Wadsworth	10351300	10/1/1966	present
T. Canal near Hazen	10351400	10/1/1966	present
Carson River near Fort Churchill	10312000	4/13/1911	present
Carson River below Lahontan	10312150	10/1/1966	present

(a) Data for Truckee Canal at Derby reported by USGS for Station ID 10351010 for some years.
(b) Some data missing for certain days within range of start and end dates for some stations.