Date: 26/04/2007

BRIEFING NOTE FOR QUEENSLAND WATER INFRASTRUCTURE

SUBJECT: TRAVESTON CROSSING DAM - EVAPORATION AND SEEPAGE

PURPOSE

Queensland Water Infrastructure has requested SunWater provide an assessment of the anticipated evaporation and seepage from the proposed Traveston Crossing Dam storage, and compare the nett average evaporation with other storages.

EVAPORATION AT TRAVESTON CROSSING DAM

Nambour DPI is the closest complete weather station to the Mary Catchment, recording rainfall, pan evaporation, and sunshine hours. With the data recorded at this station, relationships between pan evaporation and lake evaporation have been determined. The determination of this relationship requires all the above data to be available for a significant number of years.

The average annual pan evaporation recorded at Nambour (1448 mm/a) is slightly higher than that recorded at the nearest site within the Mary Catchment, Gympie (1399 mm/a), for the same period of record (1976 to 1998). Unfortunately, Gympie did not have a complete weather station, and the measurement of evaporation data ceased in 1999.

It is considered the accuracy of the recorded evaporation figures is acceptable. The conversion of evaporation from a small pan to a large body of water is generally done using a conversion factor. The conversion factor used in the Mary is significantly higher, being 0.91 on average, than that used in NSW, where a conversion factor of 0.7 is most commonly used. Table 1 lists the monthly data used.

Table 1: Evaporation Factors

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
Pan Evaporation (mm)	168	137	132	101	81	69	76	97	123	145	156	166	1448
Pan to Lake Factor	0.93	0.94	0.9	0.91	0.81	0.73	0.72	0.82	0.9	0.93	1.00	0.92	0.91
Lake Evaporation (mm)	156	129	118	92	65	50	55	78	110	135	156	153	1318

SEEPAGE AT TRAVESTON CROSSING DAM

It is anticipated that seepage from the reservoir will be low. This is despite the existence of relatively high permeability alluvium because:

- Seepage at the dam itself will be minimised because the alluvium will be cut off by the dam structure and the rock in the foundation below the alluvium will be grouted. Grouting is a common practice, consisting of drilling a line or lines of drill holes into the dam foundation and forcing cement slurry into the foundation under pressure. The grouting is carried out to reduce leakage through the dam foundation. Based upon the results of the geological investigation carried out it has been determined that a single grout curtain will be adequate to limit seepage beneath the dam. Elsewhere, seepage from the reservoir can only occur through the rock mass below the alluvium. All investigations at the dam site indicate the rock mass permeability is much lower than the permeability of the alluvium.
- The reservoir rim investigation, currently being completed, indicates that alluvial materials within the reservoir area are not continuous with alluvial materials in adjoining catchments outside the reservoir area. For example the alluvium in Kandanga Creek (within the reservoir) is not connected to Amamoor Creek (outside the reservoir). Similar circumstances apply to the Mary river alluvium and the alluvium in all other tributary streams. Therefore at locations on the reservoir rim remote from the dam, seepage can only occur through the low permeability rock mass – ie limiting probability of seepage.
- The groundwater gradient driving the seepage is likely to be very low because of the subdued topography. This will further assist in lowering seepage rates.

While more accurate seepage data is currently being better determine, it is accepted practice to make an allowance for seepage in any storage. This allowance is commonly 300 mm/year for large storages in Queensland, unless better local information is available. As seepage is normally small compared to evaporation, errors in the estimation of seepage tend not to be significant.

Table 2 lists the monthly seepage values used.

Table 2: Seepage values used

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Seepage (mm)	25	25	25	25	25	25	25	25	25	25	25	25	300

COMPARISON OF NETT AVERAGE ANNUAL SEEPAGE

To determine the nett average annual evaporation from a storage, the lake evaporation, seepage and rainfall on the storage must all be accounted for, using the following equation:

Nett Evap = Pan Evap * Lake Factor + Seepage – Rainfall on Storage[1]

This has been carried out for a number of storages in Queensland, using the closest recorded weather data only.

Table 3 below lists the results.

Table 3: Nett Storage Loss

STORAGE	Evaporation	Rainfall	Nett Evap (mm/a)	Period
Hinze Dam	1493	1280	319	1995 - 2005
North Pine Dam	1522	1219	375	1972 - 2005
Traveston Dam	1448	1097	521	1975 - 2005
Borumba Dam	1448	1079	539	1976 - 2005
Wyaralong Dam	1287	843	574	1967 - 2005
Lenthalls' Dam	1448	944	674	1976 - 2005
Ross River Dam	2606	1044	950	1970 - 2005
Coolmunda Dam	1678	642	1052	1974 - 1984
Wivenhoe Dam	2045	740	1150	1993 - 2005
Burdekin Falls Dam	1825	573	1388	1994 - 2005
Beardmore Dam	2067	536	1480	1996 - 2006

Note: Care should be taken in comparing nett storage losses that have been derived with different periods of record.

[1] Equation is based on the Water Budget Determination Method, as described in Linsley,J.R., Kohler,M.A., Paulus,J.L.H., Hydrology for Engineers, Third edition.