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EastLink

ENVIRONMENT PROTECTION ACT 1970

RESPONSE TO SECTION 22

NOTICE TO SUPPLY FURTHER INFORMATION

ATTACHMENT "D"

Surface Water

ATTACHMENT "D"

D1: For wetland design in the treatment train, provide the 90th% and the 95th% concentrations for Total Suspended Solids (TSS), Total Nitrogen (TN) and Total Phosphate (TP) discharging from the wetland to the receiving waterway.

Response:

Water quality is the subject of the Design Report Issued For Construction - Wetland B (attached as Appendix 5 to this Section 22 Notice response), extracts of which are reproduced below.

Modeling

Table D1a summarises the pollutant concentration values that were adopted in the MUSIC modelling. These were extracted from the Draft Australian Runoff Quality guidelines, and are applicable for urban roads and freeways. These values are specified as minimum levels in the PS&PR. Table D1b shows the physical characteristics of Wetland B as designed.

		Parameter		
		TSS (mg/l)	**TP (mg/l)**	**TN (mg/l)**
Flow Rates		mg/l	mg/l	mg/l
Base Flow	Mean	15	0.16	2.1
	Mean +1 Standard Deviation	43	0.58	4.8
Storm Flow	Mean	260	0.35*	2.6*
	Mean +1 Standard Deviation	750	0.81	4.2

Table D1a – Pollutant concentration values used as inputs in MUSIC model

		Treatment Zone	
Characteristic	Units	Sediment Pond	Macrophyte Zone
Surface Area	m^2	80	860
Permanent Pool Depth	**m**	2.0	
Permanent Pool Volume	m^3	161	408
Extended Detention Depth	**m**	0.8	0.75
Extended Detention Volume	m^3	64	645
Equivalent Outlet Diameter	m	0.027	0.035
Estimated Detention Time	hrs	11.7	72.5

Table D1b – Physical characteristics of Wetland B used as inputs in MUSIC model

Using the inputs in Table D1a and the physical characteristics of Wetland B as shown in Table D1b, the sediment basin and macrophyte zone size as designed was validated using MUSIC following the methodology defined in the design report for Wetland B. Table D1c shows the modelled reduction of pollutants in waters discharged from Wetland B to Mullum Mullum Creek via Hillcrest Drain.

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Water Quality Parameter	% retention per Zone		Total Reduction (%)
	Sediment Pond	Macrophyte Zone	
Total Suspended Solids	68.4	76.5	92.6
Total Phosphorus	52.4	60.3	81.1
Total Nitrogen	19.4	41.9	53.2
Gross Pollutants	99.5	85.8	99.9

Table D1c – Modeled reduction in pollutant levels after treatment in Wetland B

The results shown in Table D1c demonstrate that Wetland B meets the Retention (%) and Treatment train effectiveness (% Reduction) levels specified by Melbourne Water. These values were accepted by Melbourne Water when they reviewed the MUSIC modeling.

Comparison with SEPP (Waters of Victoria)

The outflow from the wetland is required to meet the State Environment Protection Policy for the Waters of Victoria (SEPP – Water of Victoria), which states that the following levels must be met.

- TSS 90th% <90 mg/l
- TSS 50th% <25 mg/l
- TN 90th% <1.0 mg/l
- TP 90th% <0.1 mg/l

The MUSIC model was run with the standard background concentration Levels (C* values) for wetlands and obtained the following values.

- TSS 90th% 6.05 mg/l (Note: if TSS 90th% complies then so will TSS 50th%)
- TN 90th% 1.39 mg/l
- TP 90th% 0.09 mg/l

It can be seen that these values meet the SEPP guidelines for all parameters except Total Nitrogen.

Revised modeling of TN

In developing MUSIC, Melbourne Water verified the model against real results from the Hampton Park wetland, and found that running the model using a C* value of 0.9 mg/l provided the best match between the model and actual monitoring results.

The Hampton park wetland is fed from a mixed urban catchment (ie mixed landuse – parks, residential, commercial, industrial, etc.).

As the catchment for Wetland B is mostly road surface with potentially a small contribution from landscaping (ie less % vegetation than in the Hampton Park wetland catchment), the use of less than 0.9 would be a more representative C* value. The MUSIC users guide advises that values between 0.7 and 1.3 mg/l can be used for TN (refer to MUSIC user guide, P193, Table F-5: Summary of Theoretical, observed and recommended k and C* values).

Comparison with Mullum Mullum Creek recorded TN values

The nearest water quality site from which TN data is available for Mullum Mullum Creek is flow site 229648 (Doncaster), also known as WQ Site MY012.

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The 90th percentile TN for all flow regimes at this station are 4.71 mg/L. The modeled 90th percentile TN output from Wetland B is 1.39 mg/L, representing only 30% of the actual 90th percentile TN of Mullum Mullum Creek.

Consequently, the modeled TN output from Wetland B is well below that observed to date and will not have a detrimental effect.

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D2: Provide an outline of the operating procedure or procedures for the process of deciding where surface water captured in the tunnel will be discharged.

Response:

Water entering the tunnels surface water system may come from any of three sources:

- Rainwater carried into the tunnels on vehicles;
- Incidents; and
- Maintenance activities.

<u>Rainwater (Rain-based Surface Water)</u>

It can reasonably be expected that that rain water entering the tunnel and reaching the main sump will contain contaminants similar to those experienced on the open road. Based on this premise, it is expected that rain-based surface water would generally be satisfactory for treatment by passing through wetlands. Consequently, it is intended that rain based water will be pumped directly to Wetland B under normal operating conditions. Wetland B has been designed to treat road runoff as per all the PS&PR and in fact will also treat runoff from road sections adjacent to the tunnel section..

During the initial period of operation of the tunnels, sampling and testing of rain based surface water from the surface water sump will be conducted to verify that the typical quality of such water entering the tunnel and reaching the main sumps is suitable for pumping to wetland. This water will be stored in the surface water sump until test results are received. Discharge to wetland will not occur unless the test results in conjunction with the designed treatment within the wetland indicate that the waters to be discharged from the wetland to Mullum Mullum Ck will meet EPA's discharge requirements.

Periodic ongoing check tests will be made to monitor any long term changes in water quality from rain sources.

<u>Incidents (Spills & Fires):</u>

In the event of spills in the tunnel that reach the main sumps, the surface water system will be isolated (automatically in the event of a hydrocarbon spill) and water flows directed to the waste water sump where the material will be tested for contaminants before a decision is made on its ultimate destination. The parameters to be tested for will be varied based on the nature of the spilt material.

Dependent on the test results, disposal will be either via tanker to a Licensed facility or to sewer in accordance with a Trade Waste Agreement. It is considered unlikely a spill would result in water quality suitable for disposal to wetland.

Water which originates from fire fighting activities will be collected through tunnel drainage in the waste water sump and held for testing as required to determine its ultimate destination. Ultimate disposal route for these waters could be either via tanker, sewer or wetland, dependent on quality as shown by test results.

<u>Maintenance Activities:</u>

Water collected during maintenance activities such as deluge testing or wash down activities will be tested after initial sessions to establish a baseline for contaminants in waste water from these events. Thereafter water would be disposed to wetland or sewer as dictated by typical water composition from initial testing.

Periodic testing of such waters over the longer term would be carried out to monitor any change in water quality from such events. The intent is that most water from wall washing would be essentially caught and retained by the washing equipment, and separately disposed of.

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Overall, should testing at any stage show a contaminant level unacceptable for wetland processing, there are two options dependant on the nature and concentration of any contaminants:

a) Water directed to sewer via groundwater pumps
b) Water directed to tanker at tunnel portal for off-site treatment.

A detailed operating procedure incorporating the approach above will be developed by the Operator prior to opening of the tunnel to traffic.

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D3: Provide additional detail or a revised design of the in tunnel surface water drainage system that demonstrates the capacity to detect, manage and prevent contaminant spills entering the wetlands.

Response:

Spills are always associated with an incident of some kind within the tunnels. These incidents include but are not limited to actual motor vehicle accidents, 'lost loads', and accidental spills of chemicals during maintenance activities.

Detection

Regardless of source, these spills will be detected by the operator through a variety of identification systems and processes:

- Accidents and lost loads will be identified by the Automatic Incident Detection system. This system will initiate an audible and visual alarm in the traffic control room.
- Accidents and lost loads will also be identified through continuous CCTV surveillance of the tunnels by the operators in the traffic control room.
- Accidents and lost loads will also be identified through in-tunnel surveillance of the roadway by the incident response and maintenance staff.
- During maintenance, any spill will be notified directly to the traffic control room.
- In addition to the above, the public and others will notify the operator of spills through the operators call centre arrangements.

In addition to the above, hydrocarbon sensors will be installed in the sumps. These sensors will alarm in the traffic control room and also automatically trigger the disablement of discharge to the surface wetlands. Hydrocarbon sensors are considered appropriate as 85% of all spills on freeway-type roads are hydrocarbons.

Together these surveillance systems and procedures will ensure that spills within the tunnels are detected in a timely fashion. Effectively, the tunnels will be under multiple and continuous surveillance at all times. It is therefore very unlikely that a spill will go undetected.

Management

Once a spill is detected the operator will implement its incident management procedures, which will include diversion of the surface water system to the wastewater sump and disabling the pumps that discharge to wetland. In the event that a hydrocarbon alarm is received the control system will cause this to occur automatically. The surface water pumps will be shut off and water, including that which has entered the pipe networks, will be directed to wastewater sump. The hydrocarbon sensor alarm automatically disables the surface water pumps, diverts the surface water flows to the wastewater sump, and alerts the operator. Spills of all other contaminants will not automatically trigger disablement of the surface water pumps or diversion of surface water flows to the wastewater sump - operator intervention will be required in this case to disable the surface water pumps and divert surface water flows to the wastewater sump.

This 'incident state' will continue until such time as the operator has dealt with the spilt material and returned the surface water system to its original state. Discharge to wetlands or sewer will only be possible once the operator has manually re-enabled these discharge routes.

Transport of spills through the drainage system is not an instantaneous process as the drainage system is similar in operation to an urbanised catchment. Generally speaking, only relatively large spills will reach main tunnel sumps. Smaller spills will be captured at tunnel pits prior to the sumps and will be managed using sucker trucks. Consequently, the operator will have sufficient time in which to initiate an 'incident state'

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and thereby halt discharge from the tunnels, following which the operator can commence the clean-up phase.

Prevention of contaminants reaching the surface wetland

The system as designed has the capacity to manage and prevent contaminant spills entering the wetland. Incidents will be detected by the multiple overlapping detection/ surveillance systems and processes described above. There is a significant time period from a spill event until it reaches the sumps and can reach up to the surface (to the pit adjacent to Wetland B) via pumping.

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D4: Provide preliminary design level drawings of the off-take point to tanker. Inclusive in the design drawing will be the location of the off-take point and spill protection provisions (bunded area and capacity, drainage management).

Response:

A kamloc fitting on the offtake from the wastewater sump has been provided to ensure that spillage cannot occur between the wastewater sump and the tanker. Figure D4 below shows this arrangement. The applicable design report is provided in Appendix 4 to this Section 22 Notice response.

In the unlikely event that a spill does occur, the pump-out area is bunded in that it is located in the low point in the tunnel and any spillage will recycle back into the tunnel pump sump via the surface-water drainage system (ie across the pavement).

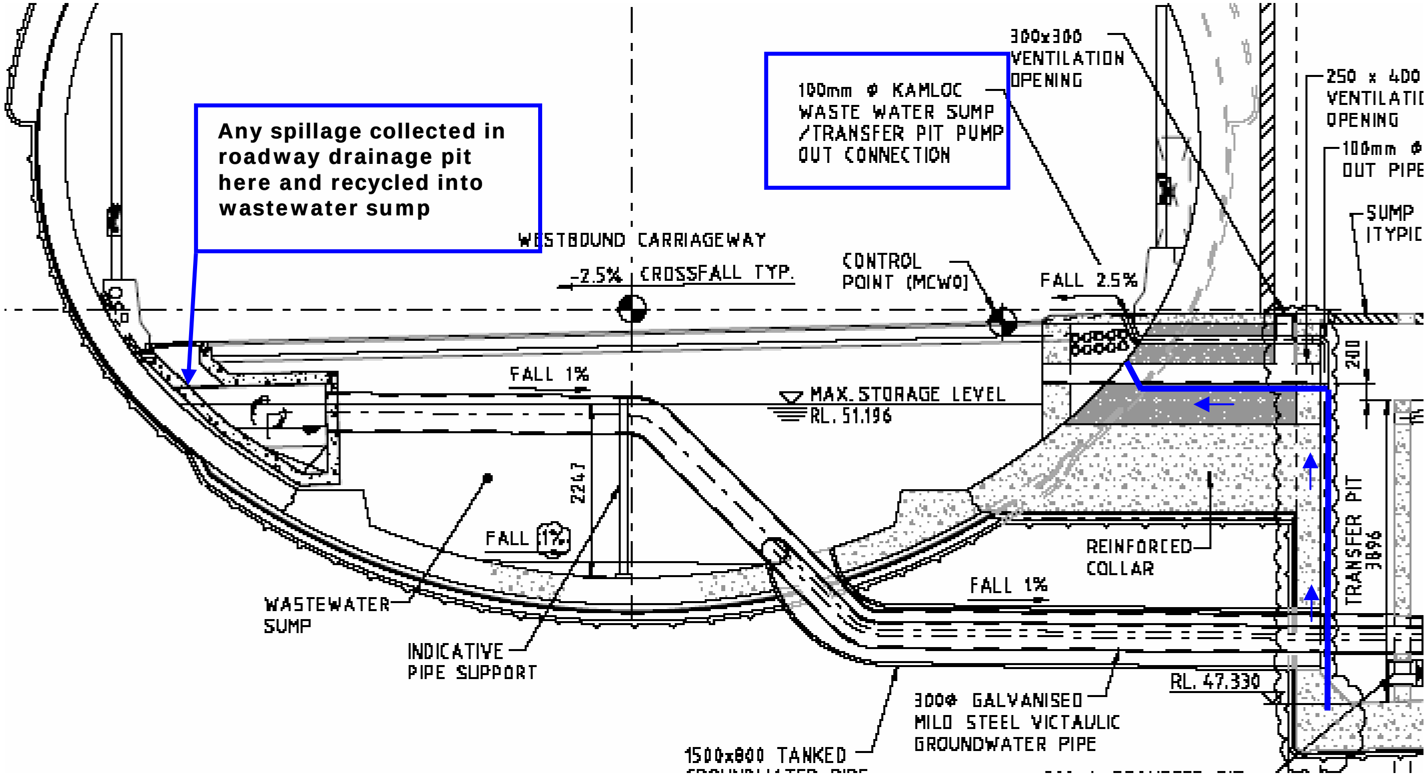

Figure D4 – Offtake from Wastewater Sump to Tanker

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D5: Provide a description of the redundancy in the groundwater off-take system to sewer and wastewater pump out system.

Response:

Redundancy in the off-take system to sewer is supplied by two service pumps notionally of 6-8 litres/second capacity each (one duty, one standby, only one litre/second required).

Redundancy in the surface water system to wetland is supplied by three service pumps notionally of 75 litres/second capacity (two duty, one standby).

Redundancy in the wastewater system is provided through removal by tanker from the wastewater sump in the event that the pump system is not available. Wastewater can also be pumped out from the overflow weir in the pump station or alternatively through access pits in the roadway.

A spare 250mm pipe is provided within the riser for the operator to use in the event of rising main failure or other issues requiring temporary removal of a rising main from service. This provides redundancy for both surface water and groundwater systems.

All pumps are readily available standard items, consequently no significant delay is expected in obtaining additional pumps in the event of failure.

The applicable design report is provided in Appendix 4 to this Section 22 Notice response.

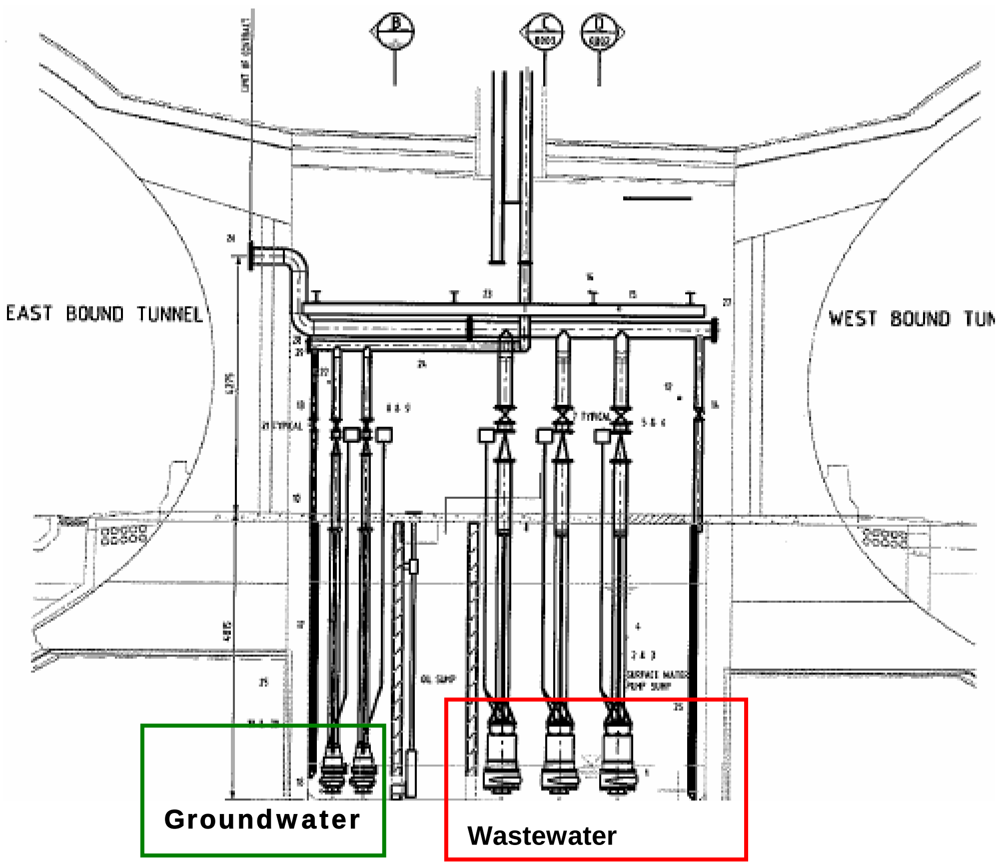

Figure D5 – Pumpstation layout showing pumps

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D6: Provide an impact assessment (assuming 1 L/s) and associated sensitivity analysis (inflow volumes exceed 1 L/s) of drawdown in groundwater associated with the discharge to the operating tunnel on the flows in the Mullum Mullum Creek. Include a discussion of the basis for selection of the sensitivity flow values and any impacts on monitoring or management that higher inflows may cause.

Response:

<u>Tunnel Design</u>

The tunnel has been designed as a 'tanked tunnel' (ie watertight), however allowance has been made for a small inflow as a result of construction imperfections or damage. Consequently, it must also be recognised that groundwater inflows may be experienced at any point along either tunnel and that these inflows are very unlikely to be sourced solely from Mullum Mullum Creek. During the construction of the tunnel, the design allows for the grouting of any 'significant' groundwater inflows and the installation of an impervious membrane between the primary shotcrete and the secondary concrete lining. The tunnels groundwater drainage sump has a capacity of 14 m3 with two pumps (duty and standby) able to discharge greater than 3 l/s each.

The allowed 1 l/s inflow of groundwater into the tunnel is an arbitrary figure imposed by the PS&PR and does not relate directly to flows in Mullum Mulllum Creek. Groundwater drawdown contours resulting from 1 l/s inflow into the tunnel are discussed in Section 4.4 and presented in Drawings 47 and 48 of Volume 4 of the Groundwater Impact Assessment Reports (attached to this Section 22 Notice response as Appendix 6).

The tunnel is being constructed through a low permeability siltstone of the Anderson Creek Formation. This rock unit is not regarded as an aquifer unit. The siltstone and its interbedded sandstone units have very low primary porosity and groundwater is contained within and moves through secondary features such as joints and fractures.

Recharge of the groundwater system occurs via infiltration of rainfall, irrigation of lawns/gardens and through leakage of water supply/stormwater/sewerage pipes. Due to the generally steep topography of the area and low permeability of the surfical soils and rock, the majority of the water available for recharge runs off as surface flow or is held in a shallow root zone.

<u>Groundwater Impact Assessment</u>

Flows in Mullum Mullum creek have been measured for approximately the last 25 years. Volume 4 of the Groundwater Impact Assessment contains an assessment of creek flows within Mullum Mullum Creek. Flows in the creek can vary widely throughout the year and from one year to the next. The median of all flows recorded is 33 l/s varying from the minimum recorded of 2 l/s to the maximum of 6400 l/s. The median yearly summer low flow is 6.9 l/s with the 10 percentile all summer flows of 7.5 l/s. On average every year, the flow drops to 6.9 l/s, and once in every five years, the flow drops to 4.8 l/s.

Review of existing data indicates that given the variability of the flows in Mullum Mullum Creek, on average the flow drops below 5 l/s for 5 days per year. (In the entire recording period, the flow has fallen below 5 l/s in 5 years, ie once every 5 years on average, and this has occurred for a total of 121 days in the 25 year record). If an additional 1 l/s was taken out of Mullum Mullum Creek the number of days that flow drops below 5 l/s could be expected to increases to 8 days per year. If only an additional 0.5 l/s is taken out of Mullum Mullum Creek, flows drop below 5 l/s on average 6 to 7 days per year.

Chart D6 below shows that the relationship between loss of water from Mullum Mullum Creek and number of days (on average) flow is less than 5 l/s is approximately linear up to 10 l/s extraction.

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As stated earlier, only a small part of any groundwater inflow into the tunnel is likely to come from the creek or the groundwater which contributes to creek flows. It could be expected for an additional 1 l/s reduction in creek flow, the tunnel groundwater inflow would have to increase to greater than 3 l/s.

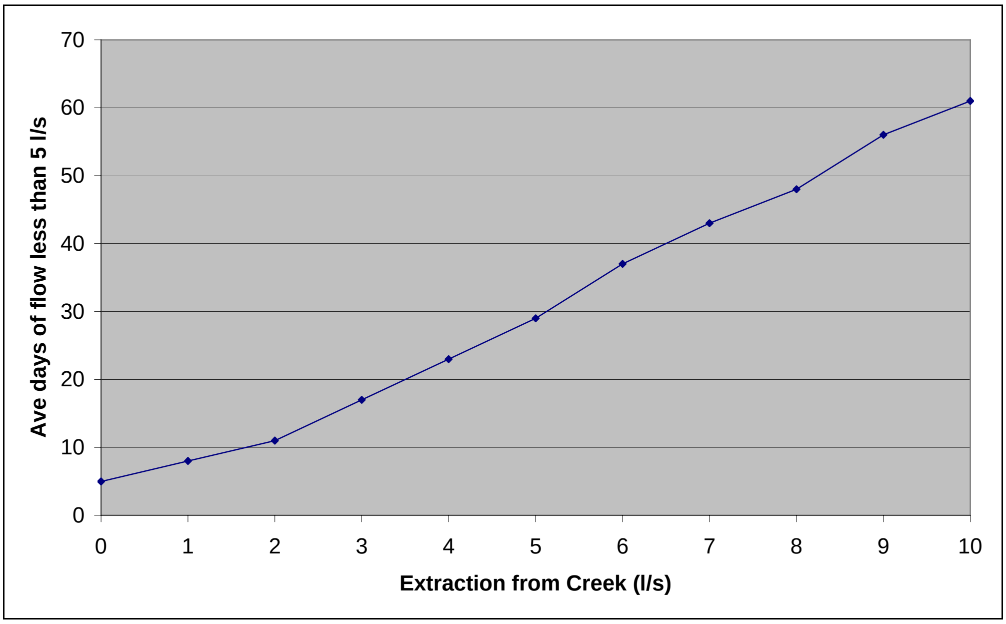

Chart D6 – Sensitivity of low flow regime to increased extraction from Mullum Mullum Creek

<u>Hydrologic Impact</u>

In hydrologic terms, a drawdown of 0.5 l/s in Mullum Mullum Creek which results in an extra one to two days of average flow less than 5 l/s is not considered to be significant as the flows experienced in the waterway are already extremely low. Consequently, a reduction by 0.5 l/s (eg 5.0 l/s to 4.5 l/s, 6.5 l/s to 6.0 l/s, etc) will not alter noticeably the effective flow regime already in place.

This conclusion is supported by Dr Richard Evans of Sinclair Knight Merz (SKM) – 2002b report *"Eastern Freeway Extension – Additional Groundwater Investigation: Task 3 – Impact on Mullum Mullum Creek"* which concluded that, given the controls and proposed grouting methods will satisfactorily stop all significant leakage into the tunnel, the impact of groundwater drawdown on Mullum Mullum Creek will be small.

<u>Ecological Impact</u>

It must be recognised that the creek ecosystem has adapted to survive regular low flow periods almost every summer. The flow in summer is often (ie. 50% of the time) less than 22 l/s and sometimes (ie. 10% of the time) less than 7.5 l/s. On average every year, the flow drops to 6.9 l/s, and once in every five years, the flow drops to 4.8 l/s. Due to the topography of the area the source of the majority of Mullum Mullum Creek flows is from surface water runoff.

It is expected that at the low flow of 5 l/s, Mullum Mulllum Creek would become a series of pools joined by a trickle, creating a series of riffle habitats. A reduction of this flow to 4 l/s is not expected to reduce the viability of the pools as 80% of the 5 l/s would still be maintained (if 5 l/s is enough to flush the pool the 4 l/s should be as well) and pool levels would remain unaffected.

Consequently, it is expected that if there was a further reduction of 1 l/s in an average years flow of 5 L/s this reduction in flow would not unduly stress the waterway in it's 'low flow' state beyond viability limits.

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D7: Provide more detail on what is meant by supplementing water flows in the Mullum Mullum Creek "such that …. SEPP requirements are met".

Response:

Operation Phase

The tunnel has been designed as a 'tanked tunnel' (ie watertight). There is no intention to supplement flows during operation.

Construction Phase

In the event that grouting does not limit the inflow during construction to acceptable levels as defined in Section 7 of the Groundwater Monitoring Strategy (attached as Appendix 2), supplementary flows may be considered with the intent of maintaining a low flow regime within the Mullum Mullum Creek on days where the average flow drops below 5 L/s. However based on the quality of water extracted from the tunnel to date, it is the no longer considered viable to supplement creek flow using water collected from within the tunnel – refer to D8 response below for details.

Any water used to supplement creek flows needs to be of a quality such that the receiving waters are not adversely affected as required by the SEPP (Waters of Victoria) or as otherwise agreed with EPA. The words "such that … SEPP requirements are met" meant that any water used to supplement flows must not cause an exceedence or breach of any requirements contained in the SEPP (Waters of Victoria) which relate to the receiving waters (ie Mullum Mullum Creek). SEPP (Waters of Victoria) environmental quality objectives for Mullum Mullum Creek are shown below in Table D7.

Segment	INDICATOR							
	Total Phosphorous (micrograms/L)	Total Nitrogen (micrograms/L)	Dissolved Oxygen % Saturation		Turbidity (NTU)	Electrical Conductivity (microsiemens/cm)	pH (pH units)	
	75th percentile	75th percentile	75th percentile	Maximum	75th percentile	75th percentile	75th percentile	75th percentile
Cleared Hills & Coastal Plains – lowlands of Yarra	<= 45	<= 600	>= 85	110	<=10	<= 500	>= 6.4	<=7.7

Table D7 – Extract from SEPP (Waters of Victoria) Table A1: Environmental Quality Objectives for Rivers & Streams – Water Quality

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D8: Provide a concept diagram and associated discussion of how supplementary flows to the Mullum Mullum Creek will be implemented. This will include consideration of source water supplies (including volume, capacity and accessibility), inlet points and monitoring.

Response:

Operation Phase

There is no intention to implement supplementary flows during the operation phase. Some natural supplementing of the creek will occur through seepage from Wetland B of treated surface waters (from both inside the tunnel and outside from surface roads) into local groundwater and hence Mullum Mullum Ck.

Construction Phase

Details of construction phase monitoring and management of Mullum Mullum Creek flows are provided in the Groundwater Monitoring Specification. Grouting of the tunnel extrados to limit inflows into the tunnel are covered in section 7 of the Tunnel Excavation and Primary Support Specification (attached as Appendix 3, refer also to E1 response below), and will be implemented before supplementary flows are considered.

Temporary supplementing of flows in Mullum Mullum Creek using water of a suitable quality obtained from the tunnel water treatment plant at each portal was initially considered in the unlikely event that grouting does not reduce inflows to below the trigger levels. However, to date, treated water from the tunnel treatment plant at each portal has been found to be unsuitable for use in supplementing flows in Mullum Mullum Creek, and consequently it is expected that supplementing flows using treated tunnel water will not be possible. The use of potable water to supplement flows has not been considered acceptable at any stage. Consequently, supplementing flows in Mullum Mullum Creek is no longer considered as a viable option unless the quality of water obtained from the tunnel improves significantly.

In the event that grouting is initially ineffective and supplementing flows with treated tunnel waters is not possible for the reasons stated above, overpumping or piping around the affected reach of Mullum Mullum Creek will be implemented until such time as trigger levels are no longer exceeded, thereby guaranteeing viability of the creek, minimising inflows to the tunnel and allowing the completion of grouting works.