Stage 1 – **Lilydale** *(starting at 21.1 km, clear of the 'Station Road' Level Crossing, and about 300 metres on the Launceston side of the Station platform)* **through to Wyena** *(finishing at 37.5 km, about 600 metres ahead of the Wyena Station platform, and about 150 metres short of the 'Shepherds Rivulet' Trestle Bridge).*

The Raylink report states that the cost to rehabilitate the necessary rail infrastructure between Lilydale and Wyena for operation of the rail car is approximately $4.0m.

At **Lilydale** there are already two tracks through the Station's yard, connected to the mainlines at both ends by way of turnouts. This arrangement enables rolling-stock items to be re-arranged by shunting, or temporarily parked clear of the Station's platform track. These abilities will aid track-based restoration of future Stages located both sides of Lilydale.

9753,  **9749**

 At the township end of Lilydale yard, towards Station Road, at least 120 metres of the future-extended mainline single track (clear of the existing turnout) is available for train shunting activities and/or temporary parking of rolling-stock items.

At **Wyena** the rail car's journey will *(temporarily)* finish just ahead of the left-hand curve leading onto the bridge *(due for replacement)* over Shepherds Rivulet.

This Stage 1 section of the railway is the most scenic part it, with its 1888-built 700 metre long Tunnel, and the 1887 Queen Victoria 'Jubilee' Arch-culvert, which guides the Denison River through the embankment, deep beneath the railway. In the past a pathway had been developed for visitors to descend to river level, for a better appreciation of the Denison Gorge and its famous 'Jubilee' Arch. This path could be redeveloped.

Sleeper replacement and Rail-Joint Rehabilitation:

The Raylink report states that it would cost $1.89m for re-sleepering works, and $0.94m for fish-plated rail-joint rehabilitation. That amounts to $2.83m across the railway between Turners Marsh and Scottsdale. For this Stage 1, the report estimates these costs amount to $700,000.

The Raylink report's premise about all fish-plate bolts having to be cut-off and replaced, has amounted to that action not being required. This railway's mainline track has been built from rail 'strings' comprising fifteen 45 ft. rail lengths welded together to form 200 metre "Long Welded Rails" (LWR), which are connected together in-track by mechanical 'fish-plated' joints. Only the two outer ends of LWR strings are possibly subject to temperature driven expansion/contraction movements. Some pairs of these 200 m long ‘strings’ have been field-welded together to form 400 m long ‘strings’, which are then classified as being “Continuously Welded Rail” (CWR). Only rails shorter than 110 m are classified as being ‘Short Welded Rails’ (SWR), joined to each other by mechanical (fish-plated) joints. No SWR examples were sighted during our April ’17 inspection of this railway. Refer to AS 7639 “Track Structure and Support” Appendix B, Clauses 5, 12 and 17.

Furthermore, the ability of LNER to obtain adequate numbers of second-hand steel sleepers from Tasrail free of charge; their transportation to site by others, again at no cost; and installation into the track by volunteers, means that virtually none of these anticipated expenditures will be required.

A lot of this section of track is mainly in curves which already have a reasonably high percentage of steel sleepers.
BobV RAIL’s first estimate of ‘Bad’ timber sleepers needing to be replaced, was based on field judgements made by Wayne Venn during our walking inspection in April ’17. For this *(new)* Stage 1 section (from Lilydale to Wyena), this first estimate indicated that about **<u>713</u>** ‘bad’ timber sleepers (2.7% of all sleeper positions) need to be replaced by steel sleepers, to enable a basic Railcar-only operation to begin.
BobV RAIL’s second estimate was based on a later desktop evaluation reflecting the desirable proportions of ‘effective’ sleepers required for each curve’s radius *(based on a simple model developed by BobV)* to enable full operation by locomotive-hauled passenger trains. This estimate for the same Stage 1 track section required an **<u>additional 1,431</u>** (5.3%) steel sleepers to be inserted, or **<u>2,144 in total</u> (equivalent to <u>8.0%</u> of all sleeper positions)**. This estimate might be slightly higher than necessary, as it ignores those timber sleepers currently in-track that are still “effective” in securing the rails. A more detailed walking inspection would be required to re-quantify to this level of detail. In any case, those “effective” timber sleepers, if removed from mainline, may be stock-piled for use in yard track extensions and maintenance.

It is worth noting that the Raylink report recommends that **<u>4,566</u>** timber sleepers be replaced in this Stage 1 section of track. This is equivalent to **<u>17.0%</u>** of all sleeper positions, which is **more than double** the BobV RAIL recommendation. *This significant over-estimate is driven by the original Raylink recommendation that at least **1 in 2** sleepers should be “effective” (because ‘other heritage railways’ apply that ratio), while the Australian Standard on this matter only requires about half that number (such as 1 in 4) to be “effective”.*
Ultimately, we may well be able to achieve or better those high proportions of steel sleepers, but right now we need less ambitious targets that are realistically achievable and safely fit-for-purpose.

The Tunnel:

Why we would retain the tunnel *(apart from getting to the other end)*: It is much safer for people to experience the tunnel from a train than on foot, as you are safely enclosed with others on what is effectively a familiar, slow moving ‘viewing platform’ - not slipping around on wet ground, feeling alone and claustrophobic, particularly when it's another 350 metres to the nearest exit.

Tunnel and drainage:

The Raylink report has been critical of having a tunnel with some water moving through it. However, it is the nature of underground tunnels worldwide – that small water leakages are a common phenomenon inside them. Some have more than others. In a *'perfect world'*, all railway tunnels would be located near the crest of a hill, with the railway's vertical alignment deliberately designed to include a crest vertical curve near its centre. This would ensure internal leakages are shared to drain to their respective nearest exits, and that little or no externally generated drainage flows can enter the tunnel entrances. Unfortunately, like a great many *'real world'* tunnels, this tunnel has had to be located where it is, for other good engineering reasons that over-rode the drainage considerations. Consequently this 700 m long, straight tunnel is wholly located on a steady 1 in 60 falling gradient. It's approach cutting, starting about 200 m away (nearer to 'Tunnel' Station) begins this same falling gradient towards the tunnel's higher portal.

The main problem here is not what leaks into the tunnel from the ground above it, but much of the water that falls around this higher approach to the tunnel, ends up following the track downhill into the tunnel. Dense vegetation growing on the natural surfaces and batter-slopes of this uphill cutting, effectively traps some of the water, and moderates the remaining flow-rates down the slopes into the cutting's track area. Unfortunately this track's side drains have been deliberately filled-in by earth (presumably by a Rail authority wanting to drive rubber tyred maintenance vehicles down to the tunnel portal, then reversing back over it). Through this cutting it looks much like an unsealed street 'Tram track' road surface. This long near-planar earthen surface would cause higher peak flow-rates towards the tunnel entrance after a storm, and probably carry some mud in with it.

However, historically there seems to be no evidence of any significant damage to the mainly timber-sleepered track inside the tunnel. There have been a couple of attempts to put pipes and concrete gutters to direct the main water-flow along one side. These attempts have apparently failed and are no longer maintained, so it appears they are not really necessary.

Possible Future Enquiries:

1. Reduction of Tunnel's External Inflow.
   It should be easy to explore the concept of adding narrow cut off drains along both sides of the upstream cutting, starting from points located wide and high above the tunnel entrance, then falling gradually along both cutting faces, eventually leading down to discharge away from the railway, near the Station end of the cutting. This would interrupt the two flows of water presently flowing down from the cutting faces onto the track area. The bench-drains cut into the faces of the cuttings would only need to be wide enough to support a small excavator. This might possibly capture and redirect up to about half the water running down the cutting faces, significantly reducing inflow at the tunnel portal. TasRail may have already considered / studied this concept.

2. Removal or Replacement of earthen track-fill with porous material. In the interests of inspecting and preserving sleeper life it through this cutting it would

be best to completely remove this in-fill material (by using rail-based maintenance vehicles). If necessary to fill the track area for rubber-tyred access, better to use a course porous stone (eg small-sized railway ballast).

Footnote: Bob Vanselow has some indirect experience with shallow water running constantly through a long railway tunnel (approx. 500 metres) in WA's Pilbara region. The water-flow ran for nearly a full year, due to an allusive, distant burst water-main. The water-flow caused no damage track or tunnel, and did not interfere with the railway's slow-speed operation of loading ore trains through the tunnel.

'Local Low Point' Bridge – Lilydale side of Goldconda Road, approaching Lilydale Falls.
This bridge is about 8 metres long and its main supporting structure of concrete abutments and steel beams is sound and fit-for-purpose. However, its existing ballasted-track-supporting timber deck and associated timber side-kerbs, are failing and need to be replaced by about 14 evenly spaced pre-cast concrete transoms fixed to the main steel beams. The finished (ballast-less) track's rails will be resiliently fastened onto every transom.
The 'On Track' report cost is $3,000 *(need to ask Chris Martin for cost of Concrete Transoms).*

a. **'Local Low Point' (22.6 km) 9747,**

b. This bridge is the shortest on this railway, being a single span of about 8 metres. It is not equipped with Guard Rails. The bridge is of the 'ballasted track over timber-deck' type, and accordingly has problems with rotting timber decking and side-kerbs, causing ballast losses and, consequently, a poorly supported track skeleton. However, beneath its failing decking, its main steel box-girder structure and supporting concrete abutments appear to be structurally sound. Again, **a Transom-top <u>ballast-free</u> track structure, similar to the 1987 rebuild of Greeta's "Lisle Creek" bridge** (45.8 km)**, is recommended for this bridge's form of track-support.** One secondary issue warranting consideration: The shortness of this bridge will require either some <u>lowering</u> of the adjoining track approaches (possibly undesirable for peak flood events, but operationally tolerable due to the 40 km/h speed limit already applying close by). Alternatively, increasing the effective cross-sectional depth of the bridge's track-transoms *(possibly by robust packing),* rail levels could match <u>existing</u>. **9748**

9743

Level Crossings:

The Raylink report states the cost of each crossing to be $300,000. This is the accepted cost using commercial suppliers.

After the Scottsdale line's train services ceased operating, Tasrail removed its actively protected level crossing lights and associated electrical control equipment for safekeeping. It would seem to be reasonable that this infrastructure should be replaced.

The pre-existing track circuits, which were used to detect trains, are still in the track. If it is decided to use these, and they need to be repaired or upgraded, LNER would purchase second hand equipment from the mainland and refurbish them. However, when considering the relatively infrequent nature of its proposed lighter-weight railcar services, particularly during Stage 1, LNER would be concerned about the ability of track-circuits to reliably detect a train's presence. Factors such as rusty rails, leaves on the track, or sand applied onto the rails by locomotives having wheel-slip problems, can (and occasionally do) cause trains to go undetected by track circuits. Other problems with track-circuits relate to the need to insulate the rails from all steel sleepers (which are only going to increase in number), and the need to extend the lengths of all track-circuits to suit the additional warning time required for the Advance Warning Lights being proposed for all of these Actively Protected Level Crossings.
Accordingly we would prefer to use a more reliable technology for train-detection, such as Radar (post-mounted beside the approach and departure tracks for both train directions), which does not require any track circuits, is reasonably priced, and does not rely on every train driver's actions. Another Australian heritage operation uses an on-board Remote Control system to activate and de-activate the level crossing protection equipment, relying on the train driver to push the appropriate buttons at the right locations. Another suitable technology uses Axle Counters mounted at low level beside the track, but this is more appropriate for high speed operations, making it much more expensive.

Solar panels will charge batteries that power each crossing's operating mechanism and all its flashing lights. The recommended Radar-based control system would be appropriately priced and offer increased safety, with more reliably than any sort of track-based control system. The system will include an advisory 'healthy-state' signal directed towards the approaching train. If the crossing-lights are flashing it sends a white strobe light down the track, so advising the train driver that the flashing lights are all operating properly.

Boom gates are not used on other heritage railways. Advance Warning Lights may be required by the road authority.

24.1 km Highway B 81 (Golconda Road) beyond Lilydale Falls. **9693,**


Looking towards Lilydale Falls.

Why advance warning lights are required.

Bob V's experience in Western Australia – going back to the early 1980's – Hamersley Iron, who owns its own heavy-haul railway from its iron ore mines located hundreds of kilometres inland, had trouble with the main North West Coastal Highway near Karratha (located on the coast). Road trains with three loaded trailers were unable to stop in time on their approach to the level crossing, so they would deliberately 'speed across' the railway, and in so doing, collided with and destroyed the boom-barriers, rather than risk braking too late then colliding heavily with the train itself. The fast moving trucks were destroying the boom-barriers just ahead of the train's passage through the crossing. Working with WA's Main Roads Department, we discovered that, under bright sunlight, the truck drivers could not properly see the incandescent red flashing lights at the crossing early enough to safely stop before reaching the boom-barrier. There were frequent accidents where the boom-barriers had to be replaced – this was an inherent fault that needed to be addressed. Main Roads had already developed these Advance Warning Lights for use in the Perth area, where road traffic signals located around a corner or over the crest of the hill, were often being 'run through' by heavy trucks that couldn't stop in time.

The WA Main Roads Department and Hamersley Iron (part of Rio Tinto) decided to install these Advance Warning Lights on the approaches to this level crossing. Immediately the problem was solved – no more broken boom barriers, and a lot of happier truck and train drivers.

Other recent improvements to many Actively Protected Level Crossings, include:

1. The new LED lights in the (Yellow) Advance Warning Lights and the (Red) Flashing Lights at the crossing itself, have a much brighter light and this is definitely the way to go. The new lights can be fitted to existing equipment.
2. A white laser 'tell tale' light is directed back towards the train driver to let him know that the crossing's flashing lights are operating.

Warning lights on the train – especially important for Passively Protected Level Crossings Relying on "Give Way" or "STOP – Look for trains" Signs, alone.
On the railcar or passenger train itself, to have LED chasing lights fitted up-high along both sides of the railcar or the passenger train's locomotive. These 'chasing' lights are linked into the speed of the rail car. Its success relies on the motorist's / truck driver's peripheral vision. If the train is travelling at the same speed as you are there is no sense that there is anything moving. Bob V has suggested that LNER fit this feature to both sides of the railcar and the passenger train's locomotives. The 'chasing' lights on the rail car ensure that it will be noticed by a motorist approaching the level crossing at right angles, by making the train appear to be moving twice as fast as it really is, so triggering the motorist's / truck driver's peripheral vision, warning that the train is crossing his/her field of view, so brake to a STOP before you collide with it at the level crossing.

It is strongly recommended that an extra **Actively Protected** Level Crossing be included at **Bacala Road** as it is a long straight stretch of road (at 100km/h) with heavy log trucks travelling at speed. There would be no existing cables connected to this level crossing's track, so this could be a cost that might need to be included.

Level crossing protection systems that comply with the current standards:

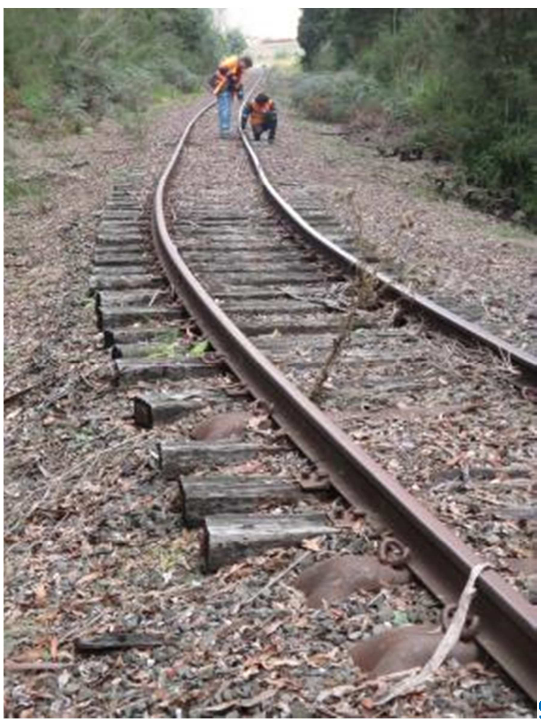
In every state on the mainland, all the highways have reduced speed limit to 80km/h around railway crossings whether they are Passive or Actively Protected. It is usually a large **80** sign followed by a smaller one. Quite often they are doubled up on the opposite side of the road i.e. 8 x 80km/h speed limit signs per crossing. Logic is that traffic lights in 100km/h road will not be noticed. Level crossing warning lights are a form of traffic light. It is there to slow motorists down to 80km/h to ensure they see the level crossing warning signs or flashing lights and respond accordingly.

Washaway at Bacala

Uphill from Tunnel station 200mtrs. The drainage has not been built properly. floodwaters have pushed the ballast out from between the sleepers. This has allowed the track to buckle. The culvert needs to be rebuilt but the expertise and experience of the LNER group would enable this to be achieved. It needs to be backfilled with cement stabilised sand to prevent any further wash away. and needs to be realigned. This can easily be done with an excavator and volunteer labour . ($1,500 was included in the 'On Track' report for these works).
See Photo's: 9652, 9638. 9637 words (below).

Below: Inlet-**rocks** encouraging ***'piping'***. **9638**

…causing Formation collapse,



9652 … & ballast Wash-out & Track Buckle, and

9637 … the partially obstructed Outlet (obstructed by flood debris ex the track area), & formation-piping's outlet-flow hole (covered by the old sleeper). ***Warning***: Encouraging or not-preventing drainage-water ***'Piping'*** **through** the track-formation **around the outside** of culvert pipes is effectively inviting **formation wash-out** which also removes track-ballast, compromising track-integrity.

R G (Bob) Vanselow
14 June 2018