



AUSTRALIAN RAIL TRACK CORPORATION LTD

Engineering

Guideline

Mud Hole Management Guideline

ETH-10-01

Applicability

ARTC Network Wide	✓
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Document Status

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Amendment Record

Version	Date Reviewed	Clause	Description of Amendment
1.0	03 May 11		New guideline created including consultation feedback.
1.1	11 Nov 11	Appendix E	Addition of Appendix E to clarify coding definition of Mud Holes and Foul Ballast within Asset Management Systems.
1.2	12 Nov 13	4.3.1	Addition of Clause 4.3.1 for use of depression pegs. Changes include removal of CRN applicability table, update of references to superseded document numbers, removal of references to Maximo, previously used in Victoria, and other minor editorial and formatting changes throughout. Other minor editorial changes following review of stakeholder consultation.

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1 Introduction

1.1 Purpose

To provide guidance to field staff in the management of fouled ballast and mud holes.

1.2 Scope

This guideline applies ARTC network wide.

The guideline addresses:

- The causes of fouled ballast and mud holes
- Degradation of fouled ballast into a mud hole
- The short and long term remedial actions
- The application of geometry standards at mud holes.

1.3 Relevant Procedure

This guideline supports ARTC Track & Civil Code of Practice, Section 5, or Track Geometry Standards for NSW.

1.4 Responsibilities

The Manager Standards is the guideline owner and is the initial point of contact for all queries relating to this guideline.

1.5 Reference Documents

The following documents support this guideline:

- ARTC Track and Civil Code of Practice Section 4 Ballast
- ARTC Track and Civil Code of Practice Section 5 Geometry
- ETF-05-01 Track Geometry Standards for Construction, Upgrading and Maintenance (in NSW/QLD)
- EGP-10-01 Asset Maintenance Works Management
- RTS 3432 Track Drainage Inspection and Maintenance
- RTS 3430 Track Reconditioning Guidelines
- ARTC Manual on performing subgrade maintenance

1.6 Definitions

The following terms and acronyms are used within this document:

Term or acronym	Description
Mud Hole (sometimes called a Bog Hole)	Fouled ballast to the extent that one or more sleepers are surrounded by mud rather than ballast, OR Weak formation below ballast, leading to loss of track geometry
Length of Mud Hole	Measured in metres.

2 Specification

2.1 Application of Geometry Standards

Mud holes may cause geometry to deteriorate. This guideline addresses the management of mud holes in accordance with the geometry standards.

2.2 Background

2.2.1 Introduction

This section describes drainage, the types of mud holes, causes of ballast fouling, degradation to mud holes and degradation of soft formation.

2.2.2 Drainage

In properly drained track, water from the surface of the track drains down through the ballast to the formation. The water then drains across the formation and out through the toe of the ballast. Finally, the water drains across the formation cress, over the formation shoulder or into a side drain. The side drain should be free draining and eventually discharge to a natural creek. With poor drainage, mud holes can form around the sleepers or the formation can become soft. Ancillary drainage works should be considered when carrying out any mud hole rectification works. Refer to clause 1.5 for procedures relating to drainage.

2.2.3 Types of mud holes

There are two main types of mud holes:

- Fouled ballast mud holes: In severely fouled ballast, the sleeper will be surrounded by mud that retains a pool of water (or sloppy mud) around the individual sleepers. This puddle can be “perched” around the sleeper with dryer ballast beneath. Alternatively the mud can extend down to a solid formation (this often occurs when there is inadequate ballast depth above a rock formation). In both cases the problem is fouled ballast. The resulting geometry faults are often short sharp faults.



Photo 2.2.1 – Fouled ballast type mud hole
(This is a perched type with water and mud in pockets around the sleepers)

- Soft formation: On soft formation, the track overall becomes wavy with repeat faults. There may however be a single fault and it is generally longer and gentler than for the fouled ballast mud hole. The single soft formation fault is often referred to as a ballast pocket. The formation outside the toe of the ballast may be soft and muddy to walk on. In severe cases the shoulders of the formation may “heave” outside the toe of the ballast, as the track sinks.



**Photo 2.2.2 – Soft formation mud hole
(refer to drainage manuals listed in clause 1.5)**

There are guidelines for the treatment of soft formation so this is not addressed in this guideline. Refer to ARTC Drainage manuals for more information on this type of drainage problem.

It is important to clearly distinguish between these two conditions as the treatment is dependent on the problem. Sometimes both conditions exist at the one location, and in these cases the remedial actions must address both conditions. In all cases however, the drainage of the track should be addressed.

2.2.4 Causes of ballast fouling

There are a number of ways that ballast becomes foul:

- Poorly graded new ballast with excessive fines
- Ballast break down over time
 - Under the action of train loading
 - During ballast tamping to correct alignment and level of the track
- Windblown dust or sand
- Storm water washes in fines
- Soft formation can pump up through the ballast when it becomes wet
- Hard rock formation with insufficient ballast depth can cause abrasion of the ballast and rock surface.

2.2.5 Degradation of fouled ballast into a mud hole

When ballast is fouled the water is trapped in the ballast around the sleeper. The fines in the ballast appear as mud surrounding the sleeper and in some cases the sleeper “pumps” up and down in the mud when under train loading. The actual geometry under the load of a train can be worse than the unloaded geometry due to voids under the pumping sleepers. This pumping can become severe enough that the track geometry fails to meet the track geometry standard.

2.2.6 Degradation of soft formation

Some weaker formations become soft when wet and depress to form a puddle under the ballast. The ballast sinks into the formation and this leads to loss of track geometry.

Soft formation is addressed in other ARTC drainage standards and manuals. Refer to the ARTC Drainage manual RTS 3432, Track reconditioning guidelines RTS 3430 and the Manual on What to do and What not to do when Performing Sub-grade Maintenance.

3 Fouled Ballast

3.1.1 Preventing ballast becoming foul

It is inevitable that ballast will become fouled over time. There are however steps that can reduce fouling:

- Purchase ballast in accordance with specification and in particular reject ballast with excessive fines.
- Avoid excessive tamping. If only a few hundred metres require tamping then do not tamp the whole km. This avoids unnecessary ballast degradation. It also reduces total tamping costs.
- Clean out silt from cuttings. The long term effect of delaying such work is that the ballast becomes fouled with the silt.
- When ballast regulating,
 - avoid grading the formation shoulder up into the ballast
 - ensure the side ballast plough does not put a groove in the formation at the ballast toe
- When grading the formation ensure the toe of the ballast is allowed to drain freely.
- Provide adequate ballast under sleepers.
- Vegetation control at the toe of the ballast limiting drainage.

3.1.2 Preventing foul ballast becoming a mud hole and growing in length

When ballast becomes foul, mud holes can form. There are practical ways to prevent the formation of mud holes in fouled ballast:

- Pick out sleeper ends to allow water to drain from sleeper bay
- Inspect rail to ensure no wheel burns; squats or rail blemishes – remove
- Avoid recovery of foul ballast by Ballast Regulators during resurfacing operations
- Clean the ballast shoulder. It is important to ensure the toe of the ballast is not left foul. If left foul, the formation will not drain properly and may become soft
- Short sections of foul ballast can be simply graded out and discarded. This is appropriate when the cost of screening either by portable screen or ballast cleaner is not justified for small sections
- Distribute new clean ballast and give the track a high lift.

3.1.3 Soft formation

Note that the remedial actions for fouled ballast also can be used to address soft formation. There are also other techniques for strengthening soft formation and these are addressed in other guidelines. However all remedial actions for soft formation require good surface drainage as do the treatments for foul ballast mud holes.

4 Mud Hole Management

4.1 Introduction

This section addresses the inspection and the treatment of mud holes.

4.2 Inspection for mud holes

4.2.1 General inspections

Each mud hole found during normal patrol inspection, reported by train crews or otherwise identified, should be inspected as specified in the ARTC Code of Practice clause 5.4.1

A general inspection should be carried out at specific locations when suspected defects are identified from conditions determined during patrol inspections and as defined by the responses in Table 5.6A. The geometry at the location should be measured and compared with specified limits. The cause, restrictions and repair work should be determined taking into account the local conditions at the site that may affect deterioration rates. General inspections should also identify the need for further specialist inspection.

At locations with mud holes, the geometry at the location should be measured and compared to applicable track geometry standard. The track geometry standard then applies.

4.2.2 Follow up inspections

Individual mud hole locations may require ongoing monitoring with increased regular general inspections scheduled in the Asset Maintenance Works Management system. These locations should be listed with the reinspection interval shown (for NSW, do not use the priority system that is used for the geometry faults, rather use the facility to schedule an activity by a nominated date and in this case the action is a follow up general inspection).

The factors that should be considered when setting inspection interval are:

- Rainfall
- Rail condition
- Measured track pump under load
- Fixed points within the local area (e.g. bridges, turnouts, etc.)
- Previous track history
- Effectiveness of Local Drainage
- Curves
- Existence of adjacent or multiple mud holes in the track sections.

The aim of the increased inspections is to inspect and measure geometry frequently enough to detect geometry faults that must then be managed in accordance with the standards for track geometry.

4.3 Assessment of geometry and the voids under sleepers during general inspection

Measurement of track geometry shall be in accordance with the ARTC Track & Civil Code of Practice Section 5: Track Geometry. This loaded condition can be measured by:

- The AK car or other measuring system with axle load above 5 tonne, or
- By assessment during front of train inspection, or

- Measuring the unloaded track geometry to which is added the extent of depression under load. Examples of measuring unloaded geometry are:
 - Measurement by manual means using stringlines, tapes and cant boards, or
 - Use of light weight measuring trolleys.
- The extent of depression under load can be measured by:
 - Use of depression pegs to measure rail depression relative to the ballast, or
 - Digging out the ballast from the end of sleepers and measuring the void under the sleeper, or
 - Observing the passage of trains, or
 - Use of Void Metres.

4.3.1 General Concept - Use of Depression Pegs

The “depression peg” is a tool to measure voids under a sleeper in track while under load. There are typically two main types: Type one, designed with a slide-able stopper (as shown in Figure 1) the other type two, is a simple assembly of a sharp spike with horizontal pin (as shown in Figure 2).

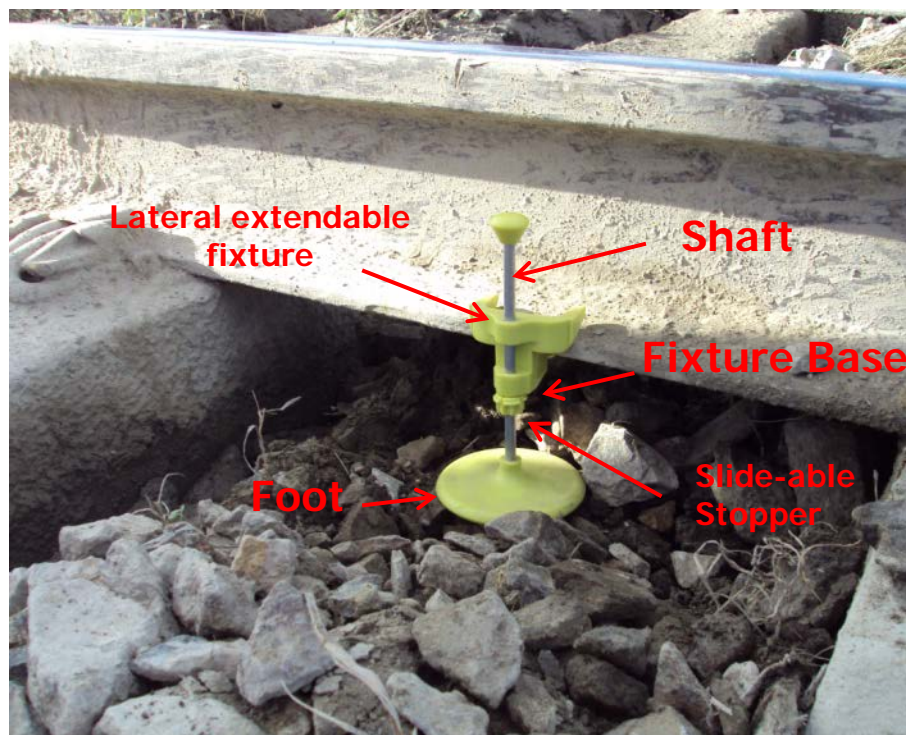


Figure 1: Type 1, Depression peg (designed with a slide-able stopper), prior to passage of a train.



Figure 2: Type 2, Depression peg (simple assembly of a sharp spike), after passage of a train.

Simple application of depression pegs:

Set up the peg in the middle of a sleeper bay at a location of concern, ensuring fixture base & slide stopper are in contact, and horizontal pin is in contact with foot of rail. The amount of void/pumping/subsidence-settling may be determined by measuring the distance between:

- the bottom of the fixture base and top of the slide-able stopper for type 1 (ensuring the foot is on the ballast) or,
- the gap between the rail foot and horizontal pin for the spike type 2

after a train traverses the location.

To filter out the “elastic” movement, a function of track stiffness, test points are required as a reference baseline. (Two pegs are required for a reference baseline each end, and they should be set up at least 1 sleeper-spacing out of the defective area, and not further than 7 sleeper bays away from the defective interface.) This is illustrated in Figure 3.

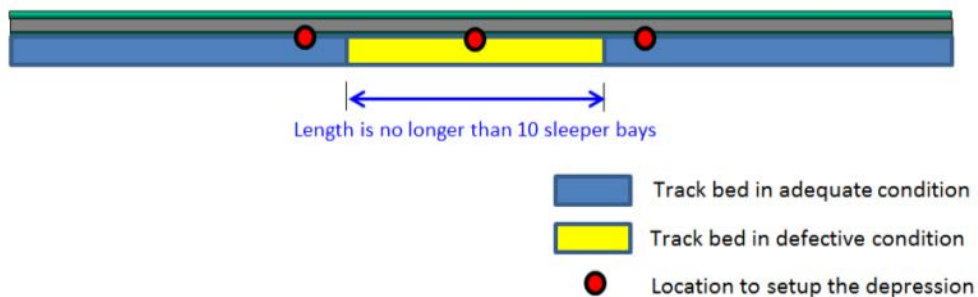


Figure 3: Simple application of depression pegs for the defective length of track bed which is no longer than 10 sleeper bays.

The application of depression pegs in track depends mainly on the length of a mud-hole location, defect location, and track characteristics. The measurement must be conducted on both rails of the track.

Distribution of depression pegs – simple application:

- o For each measurement location, a minimum of 6 pegs is required (4 for the reference baseline on both rails, 2 for the depression location on both rails);

- For mud hole lengths less than 10 sleeper bays (which is approximately equal to half-length between two bogie centres), 2 pegs should be applied in the defective area (either in the middle distance or the most severe location);
- For mud hole lengths longer than 10-20 sleeper bays, multiple pegs should be applied in the defective area;
- The depression measurement may be factored to the geometry measurements at that location to assess the simple extent of depression under load.

Detailed application of depression pegs:

More detailed application of depression pegs may be required to allow for in depth analysis of the assessment of geometry under load.

Distribution of depression pegs – detailed application:

- Detailed application involves deploying depression pegs at two metre intervals to best line up with two metre geometry station measurements. Set up the pegs per the simple application in application, but at two metre geometry station intervals;
- Extend the peg station to be at least 2m each side of the mud hole defective interface;
- After the passage of a train measure the depression for each peg in the same manner as the simple application.
- Calculate the loaded 4 m top by adding the depression at each station less $\frac{1}{2}$ the depression one end of the chord and less $\frac{1}{2}$ the depression the other end.
- Calculate the loaded twist by checking for a difference in depression between rails at each station. If there is no difference, the twist will be as statically measured. If there is a difference, this amount needs to be added or subtracted to the superelevation measured & full loaded twist recalculated with the loaded superelevation.

Detailed application may also be applied at a sample of simple application measurements as confirmation that the simpler process is providing a satisfactory representation of the depression under load.

For the application in turnout area, the measurement and reference baseline should be separately conducted to the main direction, turnout direction, switch area, closure connection area, and V crossing areas.

4.4 Treatment of mud holes

4.4.1 Interim treatment

Short term treatment involves draining the sleepers that are pumping. This is generally done by forming a narrow drain from the level of the bottom of the sleeper out past the ballast shoulder. At a later time when drained the ballast is then tamped back under the sleeper. Tamping such sleepers without drainage will not be as successful.

In warmer months from November to March, a stability analysis is to take account of the disturbance to the ballast at the location when the sleeper ends are exposed in this manner as a buckle may occur.

For further guidelines see Appendix C.

4.4.2 Long term treatment

There are many options for long term treatment but all involve improving the drainage of the ballast before tamping. The main solutions are:

- Shoulder ballast cleaning. Shoulder cleaning can be done at spot locations using excavator equipment, or on-face with large on track shoulder ballast cleaners.
 - Replacing or cleaning the ballast in the cribs in association with shoulder ballast cleaning improves the effectiveness of shoulder ballast cleaning.

- Full ballast cleaning. This can be done over larger sections using large on track ballast cleaners.
- Full ballast replacement. This can be done with excavators or on-track undercutters.
- Sledding is an option that will enable new free draining ballast to be placed below and around sleepers.

For these options the toe of the ballast needs to be cleaned to prevent ponding on the formation inside the toe. Such ponding can soften the formation.

For further guidelines see Appendix C.

5 Sections with a Severe Mud Hole Problem

5.1 Introduction

Some sections of track are prone to mud holes due to the severity of ballast fouling. In addition to the guidelines above, these sections may require additional inspection processes to ensure track geometry is maintained until the problems are rectified. There may also be additional resources required for remedial action.

5.2 Inspection regime

The increased inspection regime may include increased patrols, or increased general inspections or increased front of train inspections, or a combination of these.

5.2.1 Patrols

As a guide, areas severely affected with mud holes should be inspected by patrol or front of train inspection following significant rain when mud holes can be expected to deteriorate or new mud holes form. Sections patrolled two times per week will generally remain the same, but sections normally patrolled once per week may need additional patrols during wet weather.

5.2.2 General inspections

Individual mud hole locations may require ongoing monitoring with regular general inspections scheduled in the Asset Maintenance Works Management System (WMS). These locations should be listed with the reinspection interval shown. (In NSW, do not use the priority system that is used for the geometry faults, rather use the facility to schedule an activity by a nominated date and in this case the action is a follow up general inspection. These follow up general inspections may be scheduled at regular shorter interval)

The factors that should be considered when setting inspection interval are listed in 4.2.2 above.

5.2.3 Front of train inspections

The frequency of front of train inspections should be reviewed for sections where mud holes are known to be a significant issue. During dry spells when the foul ballast becomes stable the number of front of train inspections should again be reviewed to reduce to a frequency appropriate to detect rough ride locations.

These inspections are to be planned in accordance with the Asset Maintenance Works Management system.

5.3 Planning remedial work

The normal Asset Management Work Management System (WMS) is to be used for planning and controlling the remedial work in addition to planning and controlling any increased inspections.

Where the extent and severity of mud holes in an area is beyond the resources of the local maintenance staff to control, a plan should be prepared to address the mud hole problem and submitted for approval and funding.

6 Measure

6.1 Monitoring the geometry

The successive runs of the AK car will produce the KPI's for the track geometry in accordance with procedure ETP-00-02. The TQI and the trend data for number of defects in the E1 and E2 range will demonstrate success in managing mud holes in a manner to maintain track geometry.

7 Appendix A

7.1 Guidelines for setting general inspection frequencies

Following is an example of setting inspection frequencies for locations where fouled ballast has deteriorated to a mud hole. This example is from the Melbourne to Sydney corridor when the mud hole conditions were severe:

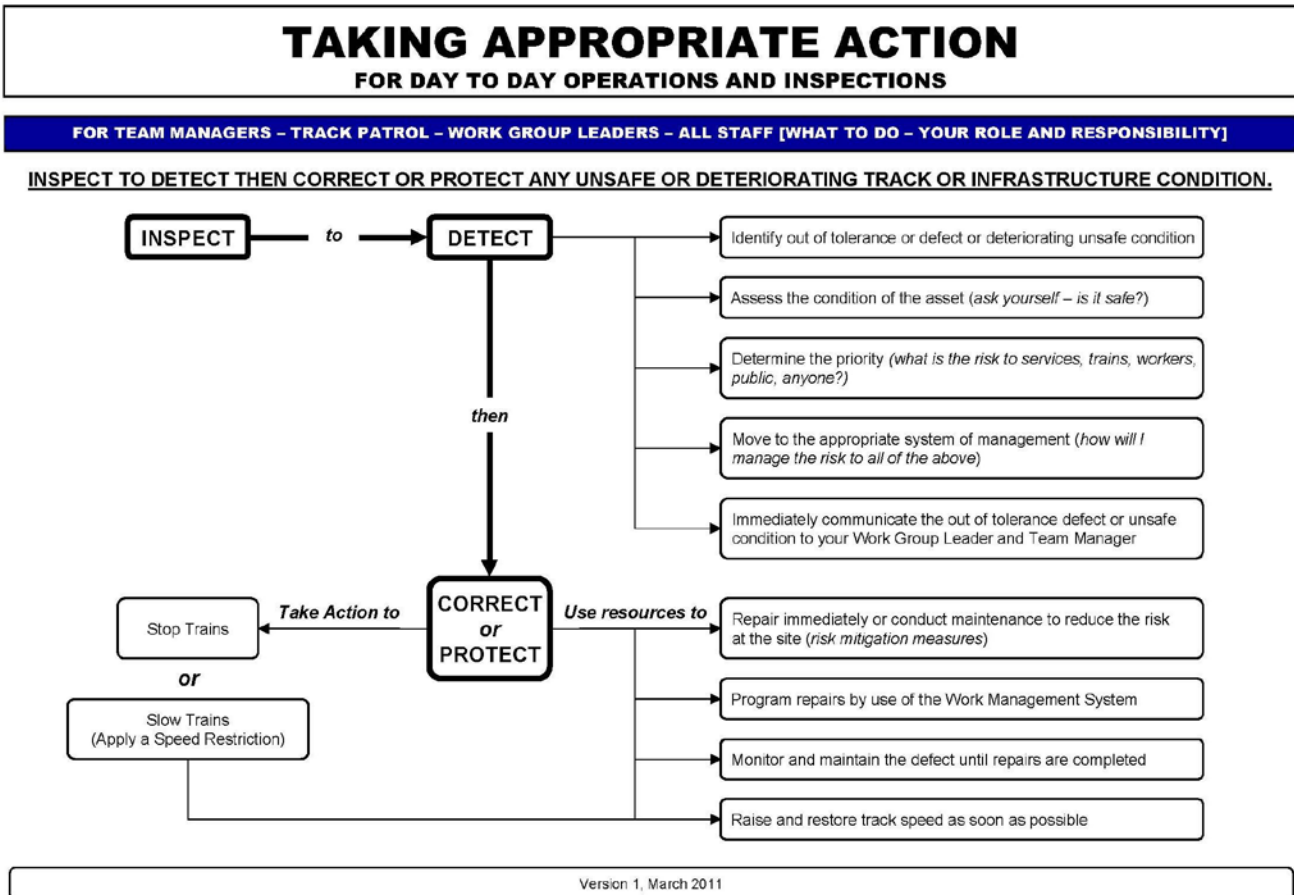
	Reinspection interval		
	7 days	28 days	Part of patrol inspection
Melbourne to Sydney Corridor			
Where a geometry fault exists at the location the response and speed restriction shall be in accordance with the Geometry standard. Inspection intervals shall be as specified in the geometry standard.			
Mud hole – mud evident but no reportable geometric defects present			X
Mud hole with rail condition being the primary initiator		X	
Mud hole in transition of curve	X		
Mud hole within 25 metres of a fixed point		X	
Mud hole within 25 metres of a fixed point with rail condition	X		
Mud hole within 100 metres of an overhead bridge		X	
Mud hole within 100 metres of an overhead bridge with rail condition	X		
Partial mud hole		X	
Shoulder excavated below bottom of sleeper	X		
Cyclic Top with 60 kph TSR	X		

Notes:

1. Time frames recommended for condition as described but no reportable geometry fault. For a geometry fault, the geometry Standard shall apply.
2. The requirements for ballast shoulder for track lateral stability shall still apply when the shoulder is removed to allow a mud hole to drain. Refer to the relevant track stability standard or WTSA analysis.

8 Appendix B

8.1 Flow chart for inspection process



Version 1, March 2011

9 Appendix C

9.1 Guidelines for remedial action

9.2 Introduction

This Appendix contains guidelines for remedial action.

Also refer to the ARTC Engineering Manual, RTS 3432 Track Drainage Inspection and Maintenance.

9.3 Interim plans for mud holes

There can be interim plans to attenuate the problems pending final solution. Examples are:

- Narrow drains from the end of the effected sleepers from the level of the bottom of the sleeper out past the shoulder to drain the perched water pocket. A pelican pick is often used to dig this drain.
- Removal of the ballast from the end of each sleeper affected by the mud hole.

Care should be taken not to excessively undermine the ballast underneath the sleeper as the support may collapse completely.

A precautionary speed restriction more conservative than that prescribed in the Track and Civil Code of Practice (or applicable Standard in NSW) may apply when the sleeper's ends are exposed.

In warmer months from November to March, a stability analysis is to take account of the disturbance to the ballast at the location when the sleeper ends are exposed in this manner as a buckle may occur.

- In addition to draining the end of the sleeper, 20mm gravel can be used around the sleepers to pack the void under the sleeper without disturbing the mud beneath the sleeper.
- High lift tamping can be used. Where it is used the effectiveness should be monitored. It can be more effective if it follows shoulder ballast cleaning.
- Digging out shoulders and cribs with small excavators is an interim solution. This is sometimes a permanent solution.

9.4 Permanent solutions for mud holes

Permanent solutions for mud holes caused by fouled ballast are:

- Full section ballast cleaning. This must include removal of the fouled toe of the ballast. It is also desirable to give a cross fall to the new bed for the cleaned and make-up ballast. There should be enough make-up ballast to ensure adequate total ballast depth. The surface drainage across the new bed should ensure there is no ponding under the track. There should also be free drainage with no ponding out to the side drains.
- Shoulder ballast cleaning. When this method is used this should include removal of the fouled toe of the ballast. The surface drainage from the bottom of the cleaned section across the formation to side drains should ensure there is no ponding. There should be enough make up ballast to ensure adequate total ballast depth for sleepers. Notwithstanding total ballast depth following shoulder cleaning, there should be a minimum 50mm tamping lift. Shoulder cleaning is far cheaper than full section cleaning and less disruptive to train operations. This process can be repeated a number of time as the shoulder may become fouled with the fines that leach out from around the sleepers. A speed restriction should be left on the track and track monitored during the time the track consolidates following shoulder ballast cleaning. Various machines can be used for shoulder cleaning for example:
 - Purpose built production shoulder cleaners
 - Excavators with "flip screens"

- Loaders feeding a mobile screen
- A variation to shoulder cleaning is removal of the shoulder and replacing with new ballast. This is often used for smaller mud holes where it's not economic to bring in the specialised equipment.
- Finger drains are drains in the cribs between the sleepers and can be used in conjunction with shoulder cleaning or shoulder replacement to improve the effectiveness of the shoulder cleaning. The bottom of the finger drains should drain water out past the toe of the new clean ballast and the formation cess to the side drain.
- Where the fouling of ballast is extreme, full section ballast cleaning or shoulder cleaning becomes uneconomic as the cost increases due to clogging of the screens and the percentage of returned ballast is low. Sledding or full section replacement should then be considered.
- Sledding. This method can be used to improve drainage of surface water away from the sleepers. The main requirements are:
 - Free draining sledded surface.
 - Any windrow outside the sledded surface is to be removed
 - May involve grading out the shoulders of the sledded surface. This is often done for highly fouled ballast.
 - Clean ballast is placed under and around sleepers
- It is crucial that the surrounding track drainage also be addressed to minimise water within the ballast/formation. Drainage guidelines can be found in the ARTC Drainage manual RTS 3432, Track Reconditioning Guidelines RTS 3430, and the Manual on What to do and What not to do when Performing Subgrade Maintenance.
- Where evident in mud hole site, it is advisable to rectify any potential instigators such as dipped or peaked welds, badly worn rail or skewed/broken sleepers.

9.5 Solution for Soft Formation

Refer to the ARTC Drainage manual RTS 3432, Track reconditioning guidelines RTS 3430 and the Manual on What to do and What not to do when Performing Subgrade Maintenance.

10 Appendix D

10.1 Mud hole register

When special resources are required to supplement normal local gang activities, the mud hole information can be extracted from the Works Management System on to a register and managed as a project to address the locations. An example of such a register follows:

Mud Hole Register 10/11										
Location (km)	Length (sleepers)	Repair Status	Priority Note 1	Comments	TSR (km/h)	TCR No.(s)	Fixed Point	Date Planned	Date Completed	Complete
Metro										
Tottenham to Jacana										
12.500	45		P1		60		Level Crossing			N
13.070	30	Repair	P1				Level Crossing			Y
13.800	30		P3	Under IRJ's			Subway			N
14.050	30	Repair	P1							Y
14.150	23	Repair	P1							Y
14.700	45	Repair	P1				Subway			Y
15.000	15	Repair	P1							Y
15.100	15	Repair	P1							Y
15.500	30	Repair	P1							Y
15.600	30	Repair	P2							Y
16.000	30	Repaired	P3				Bridge			Y
16.450	120	Repair	P1							Y
16.500	225	Repair	P1	Under IRJ's			Turnout			Y
18.400	15	Repair	P2							Y

18.850	15	Repair	P2							Y
19.100	120	Repair	P3							Y
19.400	75	Repair	P1							Y
19.700	120	Repair	P2							Y
19.800	75	Repair	P2							Y
20.100	60	Repair	P1							Y
20.200	30	Repair	P1							Y
20.400	60	Repair	P1	2x10m holes						Y
20.600	15	Repair	P1	Under IRJ's						Y
21.700	30		P1	2x10m holes						Y
21.900	120		P1							y
22.000	150		P2				Turnout			y
22.150	120		P2							N
23.050	75	Repair	P1	Formation Renewal	60					Y
24.250	15	Repair	P1							Y
24.400	15		P3							N
24.900	75		P1	Under IRJ's						N
25.100	150		P1		65					N
25.150	75	Repair	P1							Y
25.600	75		P1		65		Turnout			N
25.900	40		P1		65					N
25.950	120	Repair	P1							Y
26.150	75		P3							N
26.600	30		P3							N
38	2418									
	1612 metres									

Note: In NSW, do not use these priority codes – use the codes specified in EGP-10-01.

11 Appendix E

11.1 Mud Hole Classification

11.2 Purpose

This Appendix serves as clarification for the coding definition of Mud Holes and Foul Ballast within the Asset Management System used across the ARTC Network.

It seeks to clarify the definition of “generally fouled” track to better obtain accurate conditional data and avoid recording passive foul ballast as a mud hole. This will assist better programming of corridor wide works to remediate the condition of the track.

It is accepted that there is a considerable amount of interpretation, judgment and track experience used in defining a mud hole and that there will be some variation.

11.3 Definition

Mud hole: WMS: Component TR00 Track – Defect Mudhl

This would be an active mud hole site with visible dry or oozing mud. There would be gaps around the sleepers and evidence of pumping. Vegetation alone in the track is not a mud hole. The ballast is completely fouled and if not active, minimal rainfall will turn the site into an active mud hole. Tamping alone will not remediate the site. Photo examples below:



Fouled Ballast: WMS: Component TR01 Ballast – Defect Dirty

This would be a passive mud hole site that may not turn active for some time if at all. The ballast would range from foul to completely fouled. The site may become a priority works location in the future. There is no visible mud or ooze. Some vegetation may be growing in the track (grass, weeds etc). There are no gaps around the sleepers or evidence of pumping. The site is flagged "Dirty" or foul to hit the agenda for planned maintenance. Photo examples below:



If fouled ballast turns into an active mud hole then the site should be reclassified as a mud hole.

11.4 Length and Grouping of Defects

Due to the active characteristics of a mud hole the minimum length shall be 1m. When a series of mud holes appear they can be grouped into lengths with gaps of up to 12m. Gaps greater than 12m would action separate logging of the defect.

Note: using the term "defect", in reference to the asset management system, is just a term to log a condition and does not indicate that there is a track geometry defect. A geometry defect would be recorded separately.