

**AREA 1 MAC
SEVERE WEATHER PLAN
2013/2014
(Final Version – October 2013)**



DOCUMENT CONTROL AND DISTRIBUTION

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CONTENTS

DOCUMENT CONTROL AND DISTRIBUTION		ii
1	INTRODUCTION	2-1
1.1	Statement of service.....	2-1
1.1.1	Risk periods.....	2-1
1.1.2	Service timetable.....	2-2
1.2	Contractual arrangements.....	2-2
1.2.1	Liability.....	2-2
1.3	Area 1 Network.....	2-3
1.3.1	Description of Area 1 Network.....	2-3
1.3.2	Extent of Area Network.....	2-3
1.3.3	Area 1 Salt Bins.....	2-4
1.3.4	Area 1 Network Features.....	2-4
1.3.5	Vulnerable locations.....	2-4
1.3.6	Network Heights Greater than 150 & 200m.....	2-5
2	GENERAL PLANNING	3-6
2.1	Operational planning.....	3-6
2.1.1	General arrangements.....	3-6
2.1.2	Liaison and arrangements.....	3-7
2.1.3	Highways Agency's Crisis Management Manual.....	3-9
2.1.4	Health and Safety.....	3-11
2.2	Reporting.....	3-11
2.2.1	Winter Reporting.....	3-11
2.2.2	Severe Weather reporting.....	3-12
2.2.3	Additional reporting.....	3-12
2.3	Records.....	3-12
2.4	Review.....	3-10
2.5	Weather information & ESS Maintenance.....	3-10
2.5.1	National Domain Network of Environmental Sensor Stations.....	3-11
3	RESOURCES	4-1
3.1	Human resources.....	4-1
3.1.1	Key personnel.....	4-1
3.1.2	Staffing levels.....	4-2
3.2	Compounds and facilities.....	4-2
3.2.1	Compounds.....	Error! Bookmark not defined.
3.2.2	Fuel.....	4-2
3.3	Treatment materials.....	4-2
3.3.1	Material storage and brine production (see also A.15 & B3).....	4-2
3.3.2	Supply arrangements.....	4-3
3.3.3	Reserve / contingency arrangements.....	4-3
3.4	Vehicles and plant.....	4-4
3.4.1	Operational Reserve Winter Service Vehicle and contingency arrangements.....	4-4
3.4.2	Vehicle maintenance arrangements.....	4-4
3.4.3	Arrangements with supply chain partners.....	4-5
4	WINTER SERVICE ROUTE PLANNING	5-1
4.1	Winter Service Route design.....	5-1
4.1.1	Precautionary treatment routes.....	5-2
4.1.2	Snow Clearance Routes.....	5-2
4.2	Winter Service Route summary.....	5-3
5	ACTIONS FOR WEATHER CONDITIONS	6-1
5.1	Winter decision and treatment matrices.....	6-1
5.1.1	Decision Matrix.....	6-2
5.1.2	Guidance for repeat treatments for road surface temperatures expected to fall below 1°C.....	6-3
5.1.4	Treatment Matrix Guide - Precautionary treatments, including alternative materials, when spreading in extreme cold.....	6-7

5.1.5	Precautionary Treatment Matrix Guide - Treatments, including alternative materials, before snow and freezing rain when spreading in extreme cold	6-8
5.1.7	Footway and cycle track treatment snow clearance	6-10
5.2	Treatment/Actions	6-11
5.2.1	Precautionary treatment	6-11
5.2.2	Reactionary treatment for snow and ice.....	6-12
5.2.3	Freezing rain / rain falling on extremely cold surfaces.....	6-14
5.2.4	High winds (including Severe Gales and Storms).....	6-15
5.2.5	Heavy rain.....	6-16
5.2.6	Fog.....	6-17
5.2.7	High temperatures	6-18
APPENDICES & SCHEDULES		1
A.1	Definitions and Abbreviations	2
A.2	Audit Checklist.....	1
A.3	Area Map.....	A.3-1
A.4	Interface Drawings	A.4-18
A.5	Network Features	A.5-1
A.6	Decision Maker Duty Rota	A.6-1
A.7	Internal Contact List.....	A.7-1
A.8	External Contact List.....	A.8-1
A.9	Mutual Aid Agreements	A.9-2
A.10	Severe Weather Desk Duty Rota.....	A.10-5
A.11	Risk Assessments	A.11-1
A.12	Back up Reporting Forms	A.12-1
A.13	Operatives Schedule	A.13-1
A.14	Training Records	A.14-1
A.15	Compounds, Depots and Facilities Schedule	A.15-1
A.16	Fuel, Pump Maintenance and contingency arrangements	A.16-1
A.17	Vehicles and Plant Schedule.....	A.17-2
A.18	Winter Service Route Schedules and Drawings	1
A.19	Solid Vertical Barrier Schedule and Clearance Plan	1
A.20	Vulnerable Locations schedule	A.20-1
A.21	Salt Re-stocking plan & Reporting Threshold	A.21-1
A.22	Winter Maintenance Decision & instruction flow chart.....	A.22-3
A.23	severe Weather desk escalation flow chart.....	A.23-1
A.24	severe Weather desk procedure	A.24-1
B.1	Severe Weather Desk Exercises and Briefings.....	B.1-1
B.2	Weather Information.....	B.2-2
B.3	Anti-icing/De-icing Materials	B.3-1
B.4	Deployment of Reserve Winter Service Vehicles	B.4-1
B.5	Special Considerations.....	B.5-1
B.6	Treatment Options/Techniques	B.6-1

2 INTRODUCTION

Severe Weather refers to any meteorological phenomena with the potential to endanger safe passage or cause disruption on the Area 1 Network, and includes snow, ice, heavy rain, high winds, fog and high temperatures. As such year round planning is required to manage Severe Weather events in an appropriate manner.

Severe Weather Service comprises the operational and alert procedures, and actions necessary to ensure safe passage on the Area 1 Network is not endangered by Severe Weather, as far as is reasonably practicable. Winter Service is the element of Severe Weather Service which focuses on the routine precautionary and reactive treatments required to keep lanes on the Area 1 Network free of ice and snow.

This section of the Severe Weather Plan outlines the scope of the services provided, responsibilities for provision of those services and details the extent of the Area 1 Network on which the service is provided. The definitions and abbreviations are provided in Appendix A.1.

This Severe Weather Plan for Area 1 describes the procedures and operational arrangements for the delivery of an effective Winter Service, to ensure safe passage for customers using the highway, and details the alert procedures and actions in the event of other Severe Weather. It is a mandatory requirement for the Service Provider to demonstrate their preparedness by developing this Severe Weather Plan.

EM will ensure the operational activities contained in this plan dovetail with other Highways Agency's Severe Weather Plans (e.g. Traffic Officer's Severe Weather Plan) and the Crisis Management Manual.

The document serves a number of specific purposes:

- Contract Document – The Severe Weather Plan outlines contractual responsibilities of the Highways Agency and their Service Provider.
- Quality Plan – The Severe Weather Plan forms part of Service Provider's quality or business management system.
- Contingency Plan – The Severe Weather Plan is linked with the Highways Agency's wider contingency arrangements.
- Operations Manual – The Severe Weather Plan describes the processes, procedures and operational arrangements for those responsible for delivering Winter Services and details the alert procedures and actions in the event of Severe Weather.
- Reference Document – The Severe Weather Plan is a comprehensive reference document.

2.1 Statement of service

EM will endeavour to fulfil the Highways Agency's Severe Weather Requirement within Area 1 in an efficient and safe manner.

2.1.1 Risk periods

The year round weather service provided through HAWIS facilitates improved planning and warning for Severe Weather events. Certain weather types can be expected during particular risk periods, these are shown below for guidance. This does not absolve the Service Provider of the obligation to provide an appropriate service at any other time of the year if the need arises. In addition to HAWIS EM will continue to receive severe weather warnings from its forecast provider, NILO and Environment Agency via the NCC.

Weather Type	Risk Periods (months inclusive)
Snow, Ice and Freezing rain	October through to April
Heavy rain	January through to December
High winds (including Severe Gales and Storms)	September through to June
Fog	October through to January
High temperatures	June through to August

2.1.2 Service timetable

Key dates for the provision of reports and preparedness are summarised in the following table.

A checklist is provided in Appendix A.2.

Date	Who	Action
21 August	Service Provider	Submit Severe Weather Plan (<i>hold point</i>)
18 September	HA Service Manager HA National Winter & Severe Weather Team	Check and accept Severe Weather Plan
30 September		Operational Summer Period concludes
1 October		Operational Winter Period commences
Monthly from 15 October	Service Provider	Complete and submit Non warranty defect report spreadsheet
No later than end of October	Service Provider	Completion of Snow Desk exercises
No later than end of November	Service Provider	Completion of Severe Weather Briefings
Between 1 st December and 31 st March	Service Provider	Include Vehicle Daily Off Road (VOR) numbers on defect reports
by 18 December	Service Provider	Feedback and action planning from exercises and briefings
1 March	Service Provider	Review and update the Winter Service and Severe Weather infrastructure inventory database
30 April	Service Provider	Finalise list of lessons learnt (or update Severe Weather Action Plan (SWAP) to feed into the Operational Assessment Report
30 April		Operational Winter Period concludes
1 May		Operational Summer Period commences
May	Service Provider	Winter & Severe Weather review
31 May	Service Provider	Submit Salt Restocking Plan (<i>Hold point</i>)
30 June	HA Service Manager HA National Winter & Severe Weather Team	Check and accept Salt Restocking Plan
June	Service Provider	Winter & Severe Weather report to HA (Operational Assessment Report)

2.2 Contractual arrangements

Winter Service duties including precautionary treatment, reactive treatment and snow clearance are the responsibility of EM. Severe Weather duties including operational considerations, alert procedures and actions are the responsibility of EM.

The TOS/Area 1 Joint Operating Principles states that the TOS will not have any input into the winter maintenance decision making process. Their primary involvement will be providing information to Area 1 on road/weather conditions, details relating to recovery of abandoned vehicles and involvement in the Haldon Hill Plan.

2.2.1 Liability

Where arrangements are made with other service providers or Highway Authorities for Winter Service provision and Severe Weather actions to be provided by them on the Area 1 Network, it is the responsibility of EM to ensure such service has been carried out. Arrangements made do not absolve the Service Provider's obligations.

2.3 Area 1 Network

2.3.1 Description of Area 1 Network

The Area 1 MAC incorporates the Highways Agency All Purpose Trunk Road Network within Devon and Cornwall (west of Exeter) comprising the roads described in 1.3.2.

Devon A38 and A30 - predominantly 2 lane dual carriageway with metre strip (some locations do not have metre strip). There are sections of 3 lane dual carriageway on the A38 at Kennford and Plympton.

Cornwall A38 and A30 - both dual and single carriageway with metre strip (some of the single has crawler lanes). There is a three lane section EB on the A30 at Fraddon.

The network is managed from the head office at Ash House, Exeter. There are two depots in Devon (Sowton and Pridhamsleigh) and one depot in Cornwall (Doublebois) which are Highways Agency compounds; in addition there are three depots in Cornwall jointly occupied with CORMAC (Notter Bridge, Scorrier, and Tolpetherwin).

Saltash Tunnel – this 410m single bore structure carries the A38 underneath the town of Saltash. The structure is owned by the Highways Agency and maintained by EM. However, together with the Tamar Bridge (to which it is linked), it forms part of the A38 tidal flow system connecting Cornwall with Plymouth. In addition to the tidal flow system (illuminated road studs and overhead matrix) the tunnel has CCTV, SPECS, a ventilation system and Automatic Incident Detection System. The day to day management and monitoring of the tunnel and its technology is carried out by the Tamar Bridge & Torpoint Ferry Joint Committee's (TB&TPFJC) 24/7 control room located at the eastern end of the bridge. The tunnel, which is lined and has 'back of wall' and carriageway drainage, does not have water problems and there are no records of ice or hoar frost having ever formed on the carriageway. Treatments through the tunnel have therefore been considered as unnecessary. Under normal precautionary salting EM will treat (pre-wet) up to the tunnel portals on both approaches which ensures that de-icing material is subsequently 'tracked' by other vehicles an acceptable distance within the tunnel thereby eliminating any risk of icing at the entrances.

Tamar Bridge – this privately owned (by the TB&TPFJC) 560m tolled suspension bridge carries the A38 over the River Tamar and links Plymouth to Cornwall. All management and maintenance is the responsibility of the TB&TPFJC, they have a contractual agreement with CORMAC to treat the structure with UREA during the winter. Their procedure dictates that when Area 1 treats that part of the A38 they will instruct CORMAC to treat the bridge.

2.3.2 Extent of Area Network

The extent of Area 1 covered by this plan is shown in the following table and also detailed in the Area Map at Appendix A.3. The key interfaces are defined in the interface drawings which are included within Appendix A.4.

Extent of Area 1 Network		
Road	Extent	Length (km)
A30	M5 Junction 31 Pearce's Hill to Chy-An-Mor Roundabout, at Penzance.	175
A38	M5 Junction 31, Pearce's Hill Exeter to Carminow Roundabout at Bodmin.	112

Sections of three lane or more carriageway		
Road	Extent	Number of lanes
A38	M5 J31 to A380 Junction Splatford (WB)	3
A38	Haldon Hill (WB)	3
A38	A380 Junction Splatford to M5 J31 (EB)	3
A38	Voss Farm to Marsh Mills (WB)	3
A38	Marsh Mills to Voss Farm (EB)	3
A30	Fraddon to Highgate (EB)	3

2.3.3 Area 1 Salt Bins

Salt bins are provided at the following locations:

Footbridges: - A38 Landrake, A30 Ide, A30 Marsh Lane and A30 Poniou.

Subways: - A38 Victoria Road

Salt bins will be refilled before the winter period and will be checked by maintenance crews and re-filled if required after each period of severe weather or at periods not exceeding 6 weeks throughout the winter service period.

2.3.4 Area 1 Network Features

EM has identified network features that require special consideration with regard to weather within the Area 1 Network, and features that occur at boundary interfaces. Details are contained in Appendix A.5.

2.3.5 Vulnerable locations

Following 3 successive severe winters it is apparent that certain locations on the network are particularly vulnerable to severe winter conditions. In addition there are a number of locations where although problems may not have actually occurred, due to a number of factors they may be at increased risk from a severe weather event. For some of these vulnerable locations (or trouble spots) special consideration and mitigation measures within the Area 1 Network have been identified.

The following table identifies the locations (reviewed annually), and a brief key word summary of the problem. Where applicable each is cross referenced to detailed individual site mitigation plans contained within Appendix A.20.

Vulnerable Locations		
Location	Reference <i>To view detail mitigation plan</i>	Problem (very brief summary)
A38 Haldon Hill E & WB - MP103 to MP108 Dual c/way	SEE A.20 - Haldon Hill Severe Weather Response Plan	Prone to heavy snow falls/drifts - 220m above sea level. Vehicles loose traction on 6 & 10% gradients.
A38 Dobwalls Bypass E & WB - MP15/5 to MP18/5 Dual c/way	SEE A.20 - Dobwalls Ice Mitigation Plan	This is a TPI scheme defect legacy with water seeping up through the carriageway in lanes 1 & 2 of both c/ways and forming ice when RSTs are below zero. Discussions between HA Major Projects and the contractor to find a permanent solution are on-going.
A30 Hayle Bypass E & WB - MP33	SEE A.20 - Hayle Bypass Mitigation Plan	Icicles develop on the stone arch Network Rail overbridge and hang down over the A30.
A30 Whiddon Down to Bodmin E & WB - MP100 to MP170 Dual & single c/way	NO SPECIFIC MITIGATION PLAN - If snow with accumulations is forecast then 4x4 tractors are deployed to patrol and assist with clearance of snow and stranded HGVs. Operational Reserves will also be deployed to support the Winter Service Routes. NCC will activate warning messages on appropriate Area 1 mobile VMS.	High (some sections over 200m) exposed route. prone to snow/drifts and vehicles losing traction on several gradients (Temple, Cannafraze, Bolventor, Two Bridges, Sourton Cross, Meldon, Okehampton, Whiddon Down etc).
A38 Colesloggett E & WB - MP3 to MP5 Single c/way	NO SPECIFIC MITIGATION PLAN - If snow with accumulations is forecast then 4x4 tractors are deployed to patrol and assist with clearance of snow and stranded HGVs. Operational Reserves will also be deployed to support the Winter Service Routes. NCC will activate warning messages on appropriate Area 1 mobile VMS.	Gradient where snowfall may result in loss of traction for HGVs.
A30 Bodmin Moor E & WB - MP98 to MP118 Dual & single c/way	NO SPECIFIC MITIGATION PLAN - The Area 1 NCC can see on CCTV (Helland & Temple) when these conditions prevail and will set messages on approaching mobile VMS	Prone to mist & fog
A38 Glynn Valley E & WB - MP5 to MP15 Single c/way	NO SPECIFIC MITIGATION PLAN - Maintenance crews will respond as and when required.	Prone to flooding/landslip/fallen trees.

2.3.1 Network Heights Greater than 150 & 200m

Height	Location & Gradients (L & W.B)
Greater than 150m	A38 Dry Bridge - Devon (Gradients 8 & 6%)
	A30 Highgate - Cornwall (Gradients 6%)
	A30 Carninow - Cornwall (Gradient slack)
Greater than 200m	A38 Haldon Hill - Devon (Gradients 6 & 10%)
	A30 Cardinham to Two Bridges - Cornwall
	A30 Ebsworthy to Cheriton Bishop - Devon

3 GENERAL PLANNING

3.1 Operational planning

This section of the Severe Weather Plan contains EM's general operational procedures for delivery of winter service and details the alert procedures and actions in the event of severe weather on the Area 1 network and includes arrangements for liaison and co-operation with key stakeholders to promote delivery of a consistent and co-ordinated service.

For the purpose of managing winter service, the Area 1 MAC is divided into 2 separate geographic areas (Devon and Cornwall) and 4 climatic zones - domains; this arrangement facilitates closer co-ordination of resources between EM, the County Councils and Unitary Authorities.

Winter Service will be managed and monitored jointly between the Network Control Centre (NCC) as the main communications hub and the relevant severe weather staff working to a duty rota. All staff involved in winter service will have appropriate training and experience.

Throughout the winter period the following staff will be on duty at all times:

- NCC operators to log and record all winter related decisions and actions, issue notifications of proposed actions and update WRF1; detailed and accurate handover between the various NCC shifts will take place.
- An on call Duty Manager (DM) drawn from five experienced managers
- Two experienced Duty Supervisors (DS) Supervisors from a pool of ten will each cover either Devon or Cornwall.

The weekly duty rota for both DM and DS will commence each Monday at 07:00 hrs.

Operational procedures detailed in this Severe Weather Plan will be reviewed throughout the winter period at the mid and end season reviews.

EM will plan and execute a Severe Weather Desk exercise prior to the Operational Winter Period to test the delivery and resilience of the Severe Weather Plan and identify areas for improvement. Planning for the exercise will be in consultation with the Service Manager, Emergency Planning Managers and the National Winter & Severe Weather Team to ensure critical and vulnerable points in the service are tested (Appendix B.1).

EM will hold Severe Weather briefing sessions prior to the Operational Winter Period to ensure the duty staff and relevant stakeholders are fully briefed. Feedback and actions will be reported to the National Winter and Severe Weather Team as per the service timetable (Section 1.1.2).

3.1.1 General arrangements

3.1.1.1 Process

A detailed description of the process including forecast, decision, instruction, treatment, monitoring, record keeping and command and control arrangements can be found as a flow diagram in **Appendix A.22**

3.1.1.2 Decision Makers

Duty Managers (DM)

- Oversees winter/severe weather operations.
- Provides advice and support to DS during periods of difficult forecast periods.
- Provides advice and support to NCC staff.
- Makes the decision on when to call 'Severe Weather Desk' – jointly with other DMs.
- Keeps a log, recording all conversations, decisions made relating to winter maintenance/severe weather and forwards all such records to the NCC for archiving.
- Takes part in multi-agency teleconferences for Haldon Hill
- Makes the decision on when to activate the Dobwalls Mitigation Plan
- Makes the decision on when to activate the Contingency Plan

Duty Supervisors (DS)

- Accessing the forecast every day.
- Discussing forecasts with the other DS
- Monitoring weather stations/graphs and radar etc for changes when necessary.
- Deciding proposed treatment in line with the decision and treatment matrix and amending when necessary.
- Advising NCC of proposed treatment decisions.
- Providing detailed instruction to the NCC if the NCC are required to monitor weather data.
- Liaising with the DM if the forecast is more than a straight-forward pre-salt.
- Mobilising and instructing all crews for salting vehicles.
- Liaising with drivers if plant/vehicles breakdown, calling out reserve vehicles and advising the NCC accordingly.
- Liaising with the forecast provider as and when necessary.
- Maintain contact with the NCC for information relating to changing weather/road conditions.
- Should weather conditions deteriorate beyond that forecast then must notify the DM immediately
- Keep a log, recording all conversations, decisions made relating to winter maintenance/severe weather and forwarding all such records to the NCC for archiving.
- Patrolling and providing weather/road condition reports to the Severe Weather Desk

The key personnel responsible for delivery of the services defined within this document are detailed in Section 4.1.1.

3.1.1.3 Duty Rota

The Decision Maker Duty Rota is included at Appendix A.6.

3.1.1.4 Salt management

EM will develop and submit a Salt Restocking Plan (Service Timetable Section 1.1.2), providing evidence for supply arrangements and complete the template in A.21

EM will submit a Salt Capability Spread sheet (Service Timetable Section 1.1.2) to indicate EM stock holding capability and Reporting Threshold profile (with supporting evidence) in line with the Minimum Contractual Salt Stock Levels (Appendix B.3).

3.1.2 Liaison and arrangements

The management of the Area 1 Network and the interface with other networks is essential to the consistent provision of winter service and actions in the event of severe weather. Liaison with Traffic Management Directorate (TMD) is also important to provide up to date customer-facing functions such as traffic information, active management of traffic flows and incident response.

3.1.2.1 Internal communication arrangements

EM will provide and maintain an effective telecommunications system between the Service Manager, the Service Provider's supervisory staff and operational vehicles. Mobile telephone communication must

not be relied upon since these can become over loaded particularly during extreme conditions, or in the event of an incident causing major congestion.

The communication system for all winter service vehicles and the back-up communication system for all winter service vehicles include.

- Internal communication is by dedicated radio system.
- The arrangements for backup communications are mobile phone & Airwave radio.
- Internal communication arrangements include landline and mobile phone.

A comprehensive internal contact list can be found in Appendix A.7.

3.1.2.2 External communication arrangements

EM has established clear lines of communication and agreed contact names and numbers to ensure communication is possible at all times.

The following table indicates the contacts of stakeholders who are important to EM operational effectiveness.

Road	Location	Contact
A38 & A30	Devon County	Devon County Control Room (HOCC)
A38 & A30	Cornwall Council	Cornwall Highways Control
A38	Plymouth City	Plymouth Highways Control
A38 & A30	M5 J31	Area 2 NCC
A38	Tamar Bridge, Plymouth	Tamar Bridge & Torpoint Ferry Joint Committee

A comprehensive external contact list can be found in Appendix A.8.

3.1.2.3 Liaison with major highway schemes

EM will include advanced notification of any major schemes within the Area 1 Network and contacts for any such schemes in the table below to maintain continuity with all winter treatments and any severe weather procedures and actions.

Road	Location (e.g. junction to junction)	Type of scheme	Contact
NO MAJOR SCHEMES CURRENTLY IN THE FORWARD PROGRAMME			

3.1.2.4 Mutual Aid Agreements

Mutual aid is where one service provider has a resource issue, and a second or third (etc) service provider is able to assist in delivering the same goal. Mutual aid can be in the form of sharing of resources such as salt, the sharing of facilities that may provide improved resilience of the Area Network, or the provision of a full winter service to a particular part of another network. For example, there are local roads that Service Providers may treat to ensure their own operational effectiveness such as access routes to depots.

EM have entered into an agreement with Area 2 Skanska over the pooling of resources in severe weather conditions. Should the need arise, then Area 1 will assist with the treatment of the M5 between junctions 31 and 27, and Area 2 will assist in the treatment of the A30 from junction 31 to Okehampton. Full details relating to resource pooling can be found in Appendix A.9.

EM will document all requests for support from, or to, other operators and the subsequent decisions, with reasons, by completing the Mutual Aid Agreement forms. Completed forms can be found in Appendix A.9 (an electronic version of the template is available from the Service Manager). EM will submit signed copies of completed forms to the Service Manager for approval with additional copies

issued to the provider/recipient of mutual aid. It is noted that mutual aid arrangements do not absolve EM of its obligations.

3.1.2.5 Cross boundary agreements

Given experiences from the last few severe winters, the critical need for clear and agreed cross boundary agreements has been highlighted.

EM will ensure the cross boundary agreements are in place at the interface of the Area 1 Network and adjacent networks (Appendix A.4) to ensure a consistent service that will not leave potentially important sections of either network untreated. EM will review adjacent Highway Authorities and Service Providers route plans to ensure continuity with the Area 1 Network. Each day EM decision makers will review proposed actions from adjacent Highway Authorities and Service Providers to compare proposed treatments and timings. EM will liaise with adjacent Highway Authorities and Service Providers should significant variations be apparent.

3.1.2.6 Abandoned vehicle arrangements

Wherever possible the owners of abandoned vehicles will be contacted and requested to remove the vehicles, but where this is not possible, the specific details of the vehicles, its location and the reason why it needs to be moved will be provided to the Police/Traffic Officer/National Vehicle Recovery Manager (NVRM) and a log of all communications kept. The NVRM will provide an end-to-end vehicle recovery service. **EMi must only move vehicles once an instruction from a Police/Traffic Officer has been received.**

Where owners do leave their information, details will be obtained by EM and lodged with the Severe Weather Desk, and RCC.

3.1.2.7 Incidents Involving Winter Service Vehicles

Any incident involving the Highways Agency's own vehicles will be reported to the Service Manager and the National Winter Service Coordinator. The report will be made on form HA 20001 and will be submitted as soon as possible but no later than before 0900 hours the following working day. Where the accident involves a fatality or serious injury the report will be made immediately.

3.1.2.8 Media liaison

In order to facilitate media liaison EM will make available to the Service Manager and/or Highways Agency Press Officers such information as requested. Direct liaison with the media will only take place when directed by the Service Manager.

3.1.3 Highways Agency's Crisis Management Manual

The Crisis Management Manual (CMM) provides guidance on managing the Highways Agency's response to crises and emergencies. Severe weather events make up a significant proportion of the events that trigger the CMM escalation steps. The five stages of escalation are as follows:

Routine Operations – HA and service provider resources respond to incidents following standard procedures. Weather forecast and warning services would be continuously monitored and if anything shows up escalation would be considered. If service providers become aware of emerging resilience threats they should inform the Agency immediately.

Regional Alert (RA) – when a significant weather event is expected that potentially could cause disruption on the network a regional alert would be declared. Monitoring will be heightened and telephone conferences will take place to ensure we are as prepared as possible prior to the arrival of the forecast weather. Service providers will be required to provide information and to dial into telephone conferences in line with normal expectations. The regional alert process does not change responsibilities within each service type (i.e. service responders will remain fully responsible for managing and delivering their own service), but will act to better coordinate the individual responses to ensure a more effective combined response as well as to provide the most accurate information to road users.

Regional Crisis – if the SRN is severely affected where sections of the network are closed or road users have become trapped, and are likely to be so for some time or overnight, a Regional Crisis is likely to be

declared. The profile of the event is thus raised, a more senior commander will be appointed and the event will be more visible both inside and outside the Agency. During this stage information reporting and the need to dial-in to or attend meetings will be similar to a RA although possibly at an increased frequency but still in line with normal expectations.

National Alert – when more than one region is at Regional Crisis or in advance of a widespread severe weather event the Agency is likely to declare a National Alert. This facilitates coordination across regions as well as providing an accurate national picture of network conditions to inform road users, DfT and maybe Ministers. Service provider activity would be the same as during a Regional Crisis which would still be operating in the region.

National Crisis – this is for the most extreme of events and incidents. As with a National Alert, service provider activity would be the same as during a Regional Crisis.

A key component in the success of any response is accurate and timely information. Service Providers must have appropriate processes to continuously monitor and manage the effectiveness of their severe weather service. During a severe weather event Service Providers must be able to provide real time network performance and service delivery intelligence and information to support the incident coordination process to enable informed appropriate decisions to be made by HA commander.

During a severe weather event conditions may deteriorate to a point where the continuous and safe operation of the network may be placed at risk. The CMM processes will facilitate an early identification of a potential interruption to the network operation with appropriate responses triggered. Any decision to close a route during severe weather should only be made by the identified HA commander at the time.

3.1.3.1 Severe Weather Desk establishment

The Severe Weather Desk will be established prior to the forecasted commencement of severe weather that may cause disruption to the Area 1 Network or snow falls that are likely to be sufficient to settle on the carriageway and substantially hinder the passage of traffic. The SWD will be established as soon as possible and until that time the Duty Manager will control actions.

The severe weather desk will be established at Area 1 NCC Ash House Exeter. Meeting room G3 will be utilised as the Severe Weather Desk Annex.

The Severe Weather Desk/control room has the ability to communicate directly with motoring organisations and local authorities and to listen to/watch local news/traffic media.

Where decisions, and their implications, require strategic oversight they will be referred to the Service Manager.

The Area 1 Severe Weather Desk Procedure is detailed in Appendix A.24.

The Severe Weather Desk Duty Rota is included at Appendix A.10.

3.1.3.2 Activation of Contingency Plan

Contingency plan arrangements will be enacted if the planned response is insufficient to cope with severe weather conditions, if procedures fail or if an incident is compounded by a series of further incidents. Emergency customer welfare (ECW) arrangements will be detailed within the contingency plan and will be in line with the Highways Agency's policy for provision of ECW. Foil blankets for distribution to stranded motorists are carried by maintenance crews and additional supplies are held in emergency sign stores located around the network.

Light snow conditions will be dealt with by the day to day duty winter maintenance team. However, should snow be forecast with significant accumulations which are likely to affect traffic movements then the Duty Manager, after consultation with other Duty Managers and the forecast provider, will instruct that the Severe Weather Desk Team based at Ash House will be mobilised. In the event of exceptional weather conditions developing and if EM's standard resource is unable to cope, e.g. the situation impacts on adjoining networks, there are multiple incidents on the network and road user/community welfare is at risk (common incident objectives as defined in section 1.6 of the Contingency Plan) then the Duty Manager will implement the appropriate stage of the Contingency Plan. The Duty Manager will

decide if the Severe Weather Team is sufficient to manage the situation or if the establishment of a separate Tactical Management Team (as defined in the Contingency Plan) is required.

During normal hours and where a severe weather desk has not been called, the Duty Supervisor will control winter related activities i.e. monitoring weather and the mobilisation of teams for treatment. Generally, incidents will be dealt with in accordance with EM's AMOR procedures; this will initially involve the ISUs/maintenance crews and NCC. Subject to the severity of the incident, it may require the mobilisation of additional resources including supervisors to manage the incident scene and liaise with the emergency services. The management of any significant incident will normally be undertaken by experienced staff not at the time involved in winter decision making so as not to dilute the winter service.

Out of hours, the Duty Supervisor will be responsible for winter service and managing resources and response to incidents. If necessary the Duty Supervisor will request any additional resource via the NCC. The Area 1 Contingency Plan must be activated when the DM becomes aware of a major or critical incident taking place that is beyond the capability of EM's resource and is likely to compromise the common incident objectives referred to in the Contingency Plan and detailed below:

COMMON INCIDENT OBJECTIVES

- saving and protecting life
- relieving suffering
- protecting property
- providing the public with timely information
- containing the emergency – limiting its spread
- maintaining critical services
- maintaining normal services at an appropriate level
- protecting the health and safety of personnel
- safeguarding the environment
- promoting self help and recovery
- restoring normality as soon as possible

The Duty Manager will assume the role of Tactical Manager and immediately put in place the actions outlined within the contingency plan.

3.1.4 Health and Safety

Health and Safety for Winter Service Operations is covered principally within the Area 1 MAC EM Winter Service Method Statement, this covers issues such as operational aspects of winter service, work equipment, treatment speed, ploughing, loading and off-loading, resources, Personal Protective Equipment, First aid, Welfare and communications.

EM will undertake risk assessments to ensure the practices expected of operatives and other members of staff on the network in conditions such as freezing rain are adequately recognised. Completed risk assessments are referred to in Appendix A.11.

3.2 Reporting

3.2.1 Winter Reporting

EM will notify the Highways Agency, forecast provider, police, adjacent Service Providers, NTIS Embedded Forecaster and local highway authorities of all proposed winter service treatments.

EM will, as soon as practicable, notify the Highways Agency, forecast provider, police, adjacent Service Providers, NTIS Embedded Forecaster and local highway authorities of other actions including changes to proposed treatments.

The Winter Reporting Form (WRF1) system, provided by the Highways Agency, will be used throughout the Operational Winter Period for the above notifications and for confirmation of treatments. The WRF1 system will be kept up to date with plant, salt and fuel resilience to ensure a true and accurate representation of the current situation.

The internet based reporting system is at <http://winter.atkinsglobal.com/winter>. A backup service is available at <http://78.40.241.12/winter>. In case of failure of the internet based facilities standard forms at Appendix A.12 will be used to fax the reports to the back-up fax number [REDACTED]

WRF1 reporting and updating will be carried out by the Area 1 NCC who receive pre-season in-house refresher training.

WRF1 reporting will include as a minimum:

- Daily updates by 10:00 hours with salt stock capability, Area Operational Reserve Winter Service Vehicle levels, and fuel status, where there is a possibility of fuel disruption. Additional reports submitted in the event of a change to salt stock capability, status of fuel levels or an Area Operational Reserve vehicle being used or relocated.
- A "Full" or "No Action" report submitted by 1600 hours each day which details the proposed actions to be undertaken in the following 24 hour period. However, where a decision is made after 1600 hours or a previous decision is changed, the appropriate report will be submitted within 30 minutes of a decision, and no later than the proposed start time of the treatment.
- A "Previous Action" report to confirm all the actions undertaken since the submission of the last "Full" or "No Action" report. This daily report(s) will be submitted (by 1000 hours on the following day), but, where possible, submitted within 30 minutes of the treatment being completed.
- An hourly update, when Severe Weather Desk is in operation

EM will monitor salt stocks (and stocks of other appropriate materials) regularly during the Operational Winter Period and report using the WRF1 electronic reporting system.

3.2.2 Severe Weather reporting

EM will notify the Highways Agency, forecast provider, police, adjacent Service Providers, NTIS Embedded Forecaster and local highway authorities of all proposed actions.

See Appendix A.12 for details of reporting forms. EM will also report the number of severe weather events that required treatment/actions to the Area 1 Monthly Watchman & Routine Service Meetings and South West Joint Operations Meetings.

3.2.3 Additional reporting

EM will report on thermal mapping as required.

The report on thermal mapping will include any changes adjacent to and on the Area 1 Network which will affect the Highways Agency's thermal mapping information, review coverage of thermal maps, and identify areas of improvement.

EM will submit details of all non-warranty defects and maintenance for the Highways Agency's winter fleet vehicles for the previous calendar month by the 15th of each month. Submissions will be made using the spreadsheet available from the National Winter & Severe Weather Team.

EM will submit vehicle off road (VOR) figures on defect reports for all HA owned winter fleets, to the National Winter & Severe Weather Team. Template spreadsheets are available from the National Winter & Severe Weather Team.

EM will submit an Operational Assessment Report as stipulated in the Service Timetable in Section 1.1.2.

Reports will be used for hot and cold de-briefs, as part of developing new research programmes, or identifying areas for review, as part of the lessons learnt process, therefore it is essential that the information is complete and accurate.

3.3 Records

Collection of good quality records covering decisions made together with reasons, and advice and information provided is fundamental especially to defend against liability claims made in respect of winter service and any actions taken in the case of Severe Weather. See table below.

Information	Record Content	Format	Storage Media	Retention Period
Weather Forecast	24hrs Open Road Forecast. 2 to 10 day Forecast. Morning Summary. Morning Preliminary Forecast.	Word Documents	EM database.	6 Years
Actual Weather Conditions	Winter Maintenance Action Logs. Site Specific Data	Excel Documents Database	EM database. Vaisala Database	6 Years
Reports received	Winter Maintenance Action Logs. Severe Weather Desk Log Details of reports received.	Excel Documents Area 1 Database	EM database.	6 Years 6 Years
Decisions made	Winter Maintenance Action Logs. Severe Weather Desk Log	Excel Documents	EM database.	6 Years
Instructions made	Winter Maintenance Action Logs. Severe Weather Desk Log	Excel Documents	EM database.	6 Years
Confirmations	Daily Operational Report Winter Maintenance Action Logs. Severe Weather Desk Log	Excel Documents	EM database.	6 Years
Actions taken	Winter Maintenance Action Logs. Severe Weather Desk Log	Excel Documents	EM database.	6 Years
Liaison and communications log	Winter Maintenance Action Logs. Severe Weather Desk Log	Excel Documents	EM database.	6 Years
Telephone conversations including with forecast provider	Winter Maintenance Action Logs. Severe Weather Desk Log	Excel Documents	EM database.	6 Years
Material usage	Salt & Fuel usage and stock levels	Excel Documents	EM database.	6 Years
Fleet breakdowns	Full details of vehicle defects	Vehicle Defect Duplicate Book	Copy kept in book in the vehicle and a copy kept with the vehicle records at the depot.	6 Years
Times taken to complete treatments	Daily Operational Report Route by route Treatment Compliance Record	Excel Documents	EM database.	6 Years

Information (continued)	Record Content	Format	Storage Media	Retention Period
Use of additional resources (Including reserve fleet and mutual aid)	Winter Maintenance Action Logs. Severe Weather Desk Log	Excel Documents	EM database.	6 Years
Road Closures/blockages due to weather conditions	Winter Maintenance Action Logs. Severe Weather Desk Log	Excel Documents	EM database.	6 Years
Complaints received relating to conditions due to weather	Winter Maintenance Action Logs Severe Weather Desk Log Full details of complaint and action taken	Excel Documents HAIL Register	EM database.	6 Years
End of season records (e.g. accuracy of weather information and lessons learnt or Severe Weather Action Plan.	Treatment Compliance Record, minutes of meetings	Excel Documents	EM database.	6 Years
Fleetstar	Daily Detailed & Summary Reports	HTML Zip files	EM database	6 Years

3.4 Review

EM will carry out pre-season, mid-season and post season reviews of winter service with the forecast provider and the Highways Agency. The Operational Assessment Report will be submitted as required by the Service Timetable 1.1.2. Any actions required will be documented.

A hard copy of the Severe Weather Plan will be held by the document owner identified at the front of this Plan. Any amendments and comments will be recorded into this copy of the plan and subject to the importance and number of changes the plan (or sections thereof) shall be re-issued under a new revision number.

Typical issues for the review may include:

- *response and treatment times;*
- *decision making;*
- *command and control;*
- *escalation and Severe Weather Desk;*
- *liaison and communications;*
- *weather forecasting and ice prediction;*
- *actual weather conditions;*
- *operational issues;*
- *records;*
- *health and safety;*
- *human resources;*
- *vehicles and plant;*
- *anti / de-icing materials;*
- *compounds and facilities;*
- *other issues e.g. traffic flow, adjacent roads etc;*
- *areas for improvement;*
- *Identified vulnerable locations on the network.*

3.5 Weather information & ESS Maintenance

The Highways Agency Weather Information Service (HAWIS) has been developed to provide weather forecasts, the continuous monitoring of actual conditions to facilitate winter service operations and support the resilient management of the network during severe weather events. HAWIS obtains environmental weather condition data from meteorological Environmental Sensor Stations (ESS) located on the Area 1 Network. The service is procured by the Highways Agency through the following contracts:

- Highways Agency Weather Central Service (HAWCS)
- Environmental Sensor Station Supply Framework (ESS Supply)
- Environmental Sensor Station Maintenance and Installation (TechMAC / Regional Technology Maintenance Contractor)
- Environmental Sensor Station Communication (NRTS)
- National Weather Forecasts (National Forecast Provider)
- Service Provider Weather Forecasts (MAC)

The HAWIS website can be accessed at <https://hawcs.dft.gov.uk>

EM has appointed MeteoGroup to provide the forecast requirement detailed in Appendix B.2. The contracted service is throughout the winter period (1st October to 30th April).

All EM winter service staff, including the NCC, has access to the forecast provider and HAWIS websites.

The Forecast provider will as required by the specification provide:

- 24hr forecast x 3
- 2-10 day text forecast
- Site specific temperature graphs
- Evening forecast update (before 18.00hrs)
- Forecast amendments will be emailed to the NCC at the same time as a telephone notification, they will also be sent by text to the DM & DS
- Morning summary and preliminary forecast (before 06.00hrs)
- Precipitation type radar
- A 24/7 telephone advisory service manned by experienced forecasters

ESS faults will be reported to the TechMAC by HAWIS who will be responsible for carrying out Front Line Maintenance. If the problem is more complicated then Vaisala will be contacted by the TechMAC to carry out further investigation and repairs. Faults on HAWIS must be reported as soon as possible to the appropriate maintenance contractor. Contact details can be found in Appendix A.8.

Continuous access to weather forecast information and precipitation radar is available to the NCC and all staff involved in the management of winter service through the computer network. Each DS and DM is provided with a laptop and direct dial facility to the forecast provider and HAWIS website to obtain updated information 24/7. The NCC, DS and DM are also able to contact forecast provider directly 24/7 through the Telephone Advisory Service to obtain up to date advice on projected weather conditions.

3.5.1 National Domain Network of Environmental Sensor Stations

The domain map is shown in Appendix A.3.

3.5.1.1 Domain arrangements

Domain arrangements are described in the following table.

Domain	Outstations	Routes
[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]
Bold Italics = Forecast Site		

4 RESOURCES

This section of the Severe Weather Plan contains details of the resources available for delivery of a severe weather service on the Area 1 Network including reserve / contingency arrangements.

The Highways Agency will make available compounds, vehicles, plant and equipment as appropriate to the form of contractual arrangement and may make available additional reserve resources if the Service Provider requires them due to breakdowns or operational difficulties.

EM is responsible for providing the other resources including staff, materials, and brine production equipment and storage.

EM is responsible for ensuring that all compounds, equipment, plant and vehicles operate efficiently.

4.1 Human resources

4.1.1 Key personnel

The following table identifies the key personnel responsible for delivery of the services defined within this document.

Function	Title	Name
Overall responsibility for Area 1	General Manager	[REDACTED]
Duty Managers. <i>(Duty managers with day to day overall responsibility & decision makers)</i>	Severe Weather Manager (1 st point of contact) Network Delivery Manager Construction Manager Network Construction Manager Scheme Delivery Manager (East)	[REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED]
Severe Weather Desk Communications Officers. <i>(Issuing of Sitreps and all communications during severe weather desks)</i>	Stakeholder & Customer Liaison Manager Road Safety Team Leader	[REDACTED] [REDACTED]
Duty Supervisor Devon. <i>(Weather monitoring & decision making)</i>	Area Operations Manager (Fleet Manager) Route Supervisor Route Supervisor Route Supervisor Sub Agent	[REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED]
Duty Supervisor Cornwall. <i>(Weather monitoring & decision making)</i>	Operations Support Manager Area Operations Manager (Fleet Manager) Route Supervisor Route Supervisor Route Supervisor	[REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED]
Support Winter Service Officers & Severe Weather Desk Log Keepers. <i>(Weather monitoring, recording of actions, and archiving data)</i>	NCC Operators	[REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED]
Fleet Manager	Corporate Transport Manager	[REDACTED]

4.1.1.1 Organogram

See 3.1.1 above

4.1.2 Staffing levels

[REDACTED]

4.1.2.1 Training

Decision Maker Training Records are detailed at Appendix A.14.

4.2 Compounds and facilities

An inventory relating to EM compounds and the Area Operational Winter Service Vehicles (including Operational Reserve) plus National Reserve Winter Service Vehicles is stored on an MS Access database held by the Highways Agency. This inventory requires periodic updates to reflect any changes.

EM will review and update the MS Access database inventory at intervals set out in the Service Timetable in Section 1.1.2. Details of compounds, depots and other facilities covering the Area 1 Network are provided in the compounds, depots and facilities schedule at Appendix A.15.

4.2.1 Fuel

The fuel type (including grade) and details of supply and storage arrangements including minimum stock levels and supply contingency and pump maintenance arrangements are detailed at Appendix A.16.

EM will monitor fuel stock levels regularly during the Operational Winter Period and report using the WRF1 system as per requirements in Section 0.

4.3 Treatment materials

Contextual guidance on treatment materials including storage is contained in Appendix B.3.

EM will utilise the following de-icing/anti-icing materials to deliver an effective Winter Service on the Area 1 network.

- 6mm down salt to BS3247: 1991,
- 6mm high purity salt in for brine production - brine with an optimum and maximum sodium chloride concentration of 23% and no less than 20%
- 6-8mm sharp sand

4.3.1 Material storage and brine production (see also A.15 & B3)

Material (salt / brine)			
Location:	Type	Capacity (tonnes or litres)	Min (tonnes or litres)
Exeter	Barn	2,160 tonnes	900 tonnes

Exeter	Peacock Multisol	20,000 litres	
Pridhamsleigh	Barn	1,360 tonnes	700 tonnes
Pridhamsleigh	Peacock Multisol	15,000 litres	
Notter Bridge	Barn	740 tonnes	300 tonnes
Notter Bridge	Salinity SL07	10,000 litres	
Scorrier	Barn	2,580 tonnes	400 tonnes
Scorrier	Salinity SL07	10,000 litres	
Tolpetherwin	Barn	1,240 tonnes	600 tonnes
Tolpetherwin	Salinity SL07	10,000 litres	
Bodmin (<i>Reserve depot</i>)	Barn	1700 tonnes	
Bodmin	Salinity SL07	10,000 litres	
Doublebois (<i>Reserve storage only</i>)	Barn	890 tonnes	400 tonnes

4.3.2 Supply arrangements

For the 2013/2014 winter season, rock salt will be supplied by Irish Salt Sales under a joint agreement with Devon and Cornwall Councils. Pure salt will be supplied by Peacocks. Secondary salt supplier should the need arise will be Salinity.

De-icing material stocks will be managed using the following practices:

Stock levels will be held at near to maximum level at the start of the winter season.

Stock levels will be closely monitored and when minimum levels are likely to be reached, or sooner if heavy snow is predicted and/or in high risk season, an order will be raised with the supplier.

Maintenance of minimum stock levels will allow for fluctuations in demand and prolonged periods of extreme weather conditions.

All materials are stored in purpose built salt barns. At the end of the season old stock is brought to the front of the barns and new deliveries deposited at the rear.

In depots jointly shared with CORMAC, salt used will be identified through weighbridge records.

4.3.3 Reserve / contingency arrangements

Reserve treatment materials will, if be required, be supplied under an agreement with Salt Union.

To ensure our winter maintenance service is not compromised by electrical failure, all HA depots will be supplied with backup generators for the High and Low winter periods (from 1st November to 1st April).

Some disruption is likely to occur during the normal operation of any business and will, on most occasions be resolved within the standard operational procedures; however, there could be a more significant potential impact arising from such outcome based threats such as:

- Building loss
- Building denial
- Phone loss
- Data communications loss
- System failure

- Power loss
- Staff loss

In the event of power loss or building denial at Ash House during routine winter operations or a severe weather desk then the NCC will relocate to the Avocet Road depot with the Contingency Plan Box of Reference and all winter relevant documentation.

4.4 Vehicles and plant

EM has in total 19 Area Operational Winter Service Vehicles (including Operational Reserve Vehicles) available for use of which 10 have been allocated as Operational Winter Service Vehicles to cover the planned precautionary winter service routes. The remaining 9 vehicles are designated as Operational Reserve Vehicles and, subject to need, are available for use should an area wide snow event occur - see Section 3.4.1.

In addition to the Area Operational Winter Service Vehicles, 1 vehicle is designated as a National Reserve Vehicle. Special conditions are set out in Appendix B.4 as to its usage.

There are no Snow Blowers in Area 1.

The schedules of vehicles, plant and equipment are provided in Appendix A.17.

4.4.1 Operational Reserve Winter Service Vehicle and contingency arrangements

EM will use the Operational Reserve Winter Service Vehicles allocated to their network without prior approval but will ensure the use is notified up to the National Winter Coordinator. National procedures for management of both Operational Reserve Winter Service Vehicles and National Reserve Vehicles are in Appendix B.4.

The number of Operational Reserve Winter Service Vehicles and the agreed Reserve Threshold trigger level is provided in the table below.

Number of Area 1 National Reserve	0
Number of Area 1 Operational Reserve Spreaders	0
Reserve Threshold Number	0

4.4.2 Vehicle maintenance arrangements

EM will maintain vehicles in accordance with ASC Service Information Annex 7.

The Area Operations Managers (qualified to hold an O-licence) are responsible for the vehicle maintenance. This will be implemented through programmed schedules of services, safety checks and calibrations carried out by CORMAC in the Cornwall depots and SHB 4x4 in the Devon depots. Maintenance contacts (normal hours and out of hours) for winter and all other emergency support vehicles are detailed in Appendix A.8 and listed in the cab for each vehicle.

EM will rotate use of Operational and Reserve Winter Service Vehicles to balance usage of Area Operational Winter Service Vehicles.

4.4.2.1 Vehicle breakdown and recovery arrangements

If a vehicle breaks down during operations, the driver will make arrangements for maintenance or liaise with a supervisor in the depot to arrange. Out of hours the NCC will escalate to the DS to make any arrangements for additional resources.

4.4.2.2 Vehicle preparation

All plant and equipment will be checked and in a state of readiness by 30th September each year.

All vehicles are inspected by the driver before use and any defect which may affect the safety of the vehicle will be recorded on the EM vehicle defect sheet provided in each vehicle. The completed defect report will be handed to the depot supervisor.

4.4.3 Arrangements with supply chain partners

If required and available, EM can, through their supply chain partners, mobilise up to six 4x4 tractors complete with ploughs and drivers. These will be mobilised by the Duty Manager if snow with accumulations is forecast.

5 WINTER SERVICE ROUTE PLANNING

This section of the Severe Weather Plan contains details on EM's Winter Service Routes (WSR) for use in the delivery of winter service on the Area 1 Network.

EM will plan, design and continually review the WSR to ensure they are optimised to be as efficient as possible in terms of treatment lengths and time to undertake treatment. The number of precautionary routes is 10.

An effective winter service can respond to a change in the forecast in a timely manner. For this reason the initial response time is defined as the maximum permitted time taken from the decision to treat until the winter service vehicles are loaded, manned and ready to leave the depot.

Initial response time is 1 hour.

Precautionary treatment is most effective when carried in out advance of and as close to forecast freezing time (to minimise the loss of salt due to trafficking). Therefore, the precautionary treatment and turnaround time is defined as the maximum permitted time for the following cycle: leaving the depot, treating the route, returning to the depot and preparing for the next treatment.

Precautionary Treatment and turnaround time is 3 hours. Target treatment times for each route are detailed in the table in 4.2 below, 30 minutes per vehicle has been allowed for refuelling, topping up brine tanks, reloading hoppers and if necessary a welfare break. NOTE - most of the Area 1 depots are shared with LHAs therefore there may be occasions when queuing to reload and refuel will occur.

5.1 Winter Service Route design

EM will liaise closely with adjacent Highway Authorities and other stakeholders when designing WSR for precautionary and reactive treatment to ensure consistency and continuity of Winter Service operations on all sections of the Area 1 Network and with adjacent highway networks, including footways and cycle tracks.

For carriageway marginal strips anti-icing/de-icing material coverage should be 50% at the full rate of spread. The Service Provider should give consideration to the creation of a simple database of start and finish times to enable reports to be quickly generated and provided as required by the Service Manager. Designs of WSR for anti-icing/de-icing precautionary treatment, should allow for full coverage of the specified or instructed rate of spread of anti-icing/de-icing materials over the full width of all areas of carriageway.

EM will take into consideration the impact from the following, where applicable, when designing the WSR (not exhaustive):

- Physical constraints such as tunnels, over bridges, operations near railways, solid vertical barriers, geometry and traffic calming areas;
- Potential need for different requirements on different lanes of the carriageway;
- Need for variation in anti-icing/de-icing material, application frequency, spread rates, spread patterns, free running and wastage factors;
- Major schemes;
- Route classification;
- Network Features;
- Vulnerable locations;
- Depot access problems due to localised congestion caused by severe weather; and
- Variation in traffic flow and poor weather conditions.
- Carrying snowplough blades on precautionary treatment runs.

Most of the depots in Area 1 (except Avocet Road, Exeter) have almost direct access onto the trunk road network and therefore the risk to the depot being unavailable is significantly low. Avocet Road depot is located on the Sowton Industrial Estate and approximately 1.5km from the M5. Should problems with traffic blocking access to the depot occur then EM will work with the police and TOS to clear a route through.

5.1.1 Precautionary treatment routes

EM has designed WSR for planned precautionary treatment to meet the precautionary treatment requirement (detailed in the following table). The target treatment time for each route (excluding the turnaround time) is stated on the route schedule and drawing (Appendix A 18).

Precautionary treatment requirement			
Route classification	Red	Amber	Green
Area 1 Routes	[REDACTED]	[REDACTED]	[REDACTED]
Criteria	All lanes (including slip roads) to be kept clear of ice, as far as reasonably practicable		

5.1.2 Snow Clearance Routes

Snow clearance will take longer than precautionary treatment, therefore snow routes have been designed to achieve, where possible, the clearance requirement detailed in the table below and mitigate excessive driver hours. The snow clearance plan should be coordinated with the RCC and care taken to ensure consistency across boundaries between Service Providers.

In an area wide snow event EM will endeavour to mobilise all operational, operational reserve vehicles and supply chain specialist equipment (4x4 tractors). The risk to ensuring this will be vehicle breakdowns (either significant defect – VOR - or difficulties, because of the weather, in getting fitters to the vehicles) the other risk during prolonged periods of severe snowfall will be ensuring replacement drivers for both the winter fleet and supply chain vehicles can get to their place of work. EM have available a number of 4x4 vehicles which they will utilise when possible to transport drivers when normal means are not practical.

The primary objective will be to ensure all routes remain open. However, in an area wide snow event it will not be possible, because of the length of the network and the fleet available, to keep all lanes clear all of the time. Therefore the instruction for dual carriageways will be to clear and treat lane 1 until cessation of snowfall.



The deployment identified above is, as stated, a general rule, and experience has shown that during an area wide snow event the tactical relocation of fleet to assist with problem areas and to cover when vehicles have to leave the network to refuel and reload, is necessary to effectively manage what can often be a rapidly changing situation. The decision to deploy operational and supply chain vehicles will be made by the duty managers as part of the escalation process for a severe weather desk.

Mutual aid from Area 2 and the LHAs will also be considered by the duty managers during escalation.

Snow clearance requirement							
Route classification	Red		Amber		Green		Slip and link roads
Number of existing lanes	1 or 2	3 or more	1 or 2	3 or more	1 or 2	3 or more	Not applicable
Area 1 Routes	[REDACTED]		[REDACTED]		[REDACTED]		
Criteria	minimum number of lanes to be kept clear of snow, as far as reasonably practicable						
Between the hours of 06:00 - 20:00	1	2	1	2	1	1	1
Between the hours of 20:00 - 06:00	1	2	1	1	1	1	1
Following the cessation of snow all lanes are to be clear of snow within	12 hours		18 hours		24 hours		In accordance with route classification

5.2 Winter Service Route summary

Summary of WSR for precautionary treatments is provided in the following table. The routes highlighted yellow are options for when precautionary treating parts of domains.

Winter Service Route Summary					
Route Id	Route type	Treatment type	Length	Target treatment time (Turnaround time = 30 mins)	Salt Usage (Based on 20g @ 7.3m)
[REDACTED]	Dual	Precautionary & snow	[REDACTED]	2.5 hours treatment time	[REDACTED]
[REDACTED]	Dual	Precautionary & snow	[REDACTED]	2.5 hours treatment time	[REDACTED]
[REDACTED]	Dual	Precautionary & snow	[REDACTED]	2.5 hours treatment time	[REDACTED]
[REDACTED]	Dual	Precautionary & snow	[REDACTED]	2.5 hours treatment time	[REDACTED]
[REDACTED]	Dual	Precautionary & snow	[REDACTED]	2.5 hours treatment time	[REDACTED]
[REDACTED]	Dual & single	Precautionary & snow	[REDACTED]	2.5 hours treatment time	[REDACTED]
[REDACTED]	Dual & single	Precautionary & snow	[REDACTED]	2.5 hours treatment time	[REDACTED]
[REDACTED]	Dual & single	Precautionary & snow	[REDACTED]	2.5 hours treatment time	[REDACTED]
[REDACTED]	Dual & single	Precautionary & snow	[REDACTED]	2.5 hours treatment time	[REDACTED]
[REDACTED]	A38 Dual	Snow Route			
[REDACTED]	A38 Dual	Snow Route			
[REDACTED]	A38 Dual	Snow Route			
[REDACTED]	A30 Dual	Snow Route			
[REDACTED]	A30 Dual	Snow Route			
[REDACTED]	A30 Dual	Snow Route			
[REDACTED]	A30 Dual & single	Snow Route			
[REDACTED]	A38 Dual & single	Snow Route			
[REDACTED]	A30 Dual & single	Snow Route			

The detailed schedules for each WSR including drawings are provided in Appendix A.18.

6 ACTIONS FOR WEATHER CONDITIONS

This section of the Severe Weather Plan contains decision and treatment matrices and EM's detailed operational procedures for winter service and alert procedures and actions in the event of other Severe Weather on the Area 1 Network.

6.1 Winter decision and treatment matrices

Decisions are made in the interest of service delivery and continuity, and take account of weather conditions informed by the HAWIS and decision information, where applicable, from adjacent Service Providers and relevant Local Highway Authorities.

All decisions will be subject to continuous monitoring, recording and review.

All winter service decisions are evidence based and will be made in accordance with the guidance contained within the following decision and treatment matrices.

EM will always adhere to these guidelines unless there are specific reasons not to. Any decisions taken which do not follow the guidelines must be recorded in detail giving the reasons for that decision, those involved in making the decision, what the decision is, who has been instructed and confirmation that the instruction has been carried out.

During periods of forecast severe weather EM must remain in contact with the forecast provider and should also take account of information from staff out on the Area 1 Network, Traffic Officer Service and CCTV when making decisions.

For the purpose of managing Winter Service, the Area 1 MAC is divided into 2 separate geographic areas (Devon and Cornwall) this arrangement facilitates closer co-ordination of resources between EM and the County Councils and Unitary Authorities.

Winter Service will be managed jointly between the Network Control Centre as the main communications hub and the relevant staff engaged on a duty rota. All staff involved in winter service will have appropriate training and experience.

A description of the process including forecast, decision, instruction, treatment, monitoring, record keeping and command and control arrangements can be found as a flow diagram in Appendix A.22.

EM will respond to all adverse weather conditions in a timely and appropriate manner. The levels of response and communications to severe weather conditions will vary according to the severity/duration of the conditions forecast and degree of communications required. Generally the response level will be one of the following:

- **Low level (standard) response** – Incident/weather conditions managed and controlled by the Area 1 NCC. The Duty Supervisor will be updated and he will monitor remotely, either from home or usual work place during office hours. Decision to escalate to the next stage of response and communications will be made by the Duty Manager and Communications Officer and recorded by the NCC.
- **Medium level response** – During office hours the JTR & Network Occupancy Manager/Communications Officer will manage the event within the NCC. Out of hours the Duty Supervisor will attend the NCC and manage the incident/weather response. The Duty Manager will be informed and updated. Decision to escalate to the next stage will be made and recorded by the Duty Manager.
- **High level response** – Severe Weather Desk mobilised, managed and controlled by the SWD Team at Ash House, see SWD Procedures. Decision to escalate to the next stage will be made and recorded by the Duty Manager.
- **Contingency Plan** – The incident/weather has deteriorated to such an extent that the Duty Manager has implemented the appropriate stages of the Contingency Plan.

6.1.1 Decision Matrix

Road Surface Temperature	Precipitation etc.	Predicted Road Conditions		
		Wet	Wet Patches	Dry
May fall below 1°C	No rain No hoar frost No fog	Salt before frost	Salt before frost (see note 1)	No action likely, monitor weather (see note 1)
Expected to fall below 1°C (See note 4)	No rain No hoar frost No fog			
	Expected hoar frost Expected fog			
	Expected rain BEFORE freezing	Salt after rain stops		
	Expected rain DURING freezing	Salt before frost and after rain stops (see note 3)		
	Possible rain Possible hoar frost Possible fog	Salt before frost		Monitor weather conditions
Expected snow		Salt before snow fall (see note 4)		
Freezing Rain	Before rain	Salt before rainfall (see note 3 & 4)		
	During rain	Salt during rainfall (see note 3 & 4)		
	After rain	Salt after rainfall (see note 3 & 4)		
<i>The decision to undertake precautionary treatments should, if appropriate, be adjusted to take account of residual salt or surface moisture.</i>				

- 1) Particular attention should be given to any possibility of water running across carriageways and such locations should be monitored and treated as required.
- 2) When a weather warning contains reference to expected hoarfrost considerable deposits of frost are likely to occur and close monitoring will be required. Particular attention should be given to the timing of precautionary treatments due to the possibility that salt deposited on a dry road may be dispersed before it can become effective.
- 3) Under these circumstances rain will freeze on contact with surfaces and full pre-treatment should be provided even on dry roads. This is a most serious condition and should be monitored closely and continuously throughout the danger period.
- 4) The effectiveness of salt decreases as temperatures fall and effective treatments may not be guaranteed with salt towards the lower end of the temperature band. The use of alternative treatment materials must be considered when spreading at (the lower of air or road surface) temperatures below -7°C or below -5°C in low humidity conditions (relative humidity <80%).

6.1.2 Guidance for repeat treatments for road surface temperatures expected to fall below 1°C

Possible need for repeat treatment(s)	Key information	Predicted condition	Treatment guidance
Rain after treatment but before freezing	<p>The current spread rates assume that little water is likely to be present on road surfaces in winter conditions, and this is normally the case (See Note 1)</p> <p>Water on the surface will reduce the effectiveness of salt by:</p> <ul style="list-style-type: none"> • Dilution of any brine solution formed • Causing salt wash off <p>As a guide, greater than 2mm will result in salt wash off and require retreatment. Use rainfall radar to determine and treat only effected areas where possible</p>	More than 1mm of rain based on weather station data or radar or forecast	Make repeat treatment after rain stops, allowing as much delay as practicable for water to be dispersed by drainage and traffic before freezing.
		Less than 1mm of rain based on weather station data or radar or forecast	<p>Monitor and carry out repeat treatment after rain stops if required and allowing for water to disperse when practicable.</p> <p>Road sensors can be used after rainfall to determine whether the freezing point of water on the road surface is low enough for the forecast minimum RSTs.</p> <p>Make repeat treatment as soon as practicable where roads are wetter than allowed for in current spread rates (see Note 1)</p>
Rain just before freezing	<p>See Appendix B5 of the Severe Weather Plan template for information on effectiveness of salt after rain</p> <p>Traffic aids the dispersal of water. If a road surface is well drained and has been trafficked for an hour or so after rainfall, relatively little water will be present at the road surface</p> <p>There is a lower rate of loss when salt is in solution than in solid form. Salt will enter solution rapidly when road surfaces are wet</p>	Freezing just after rain (<1 hour)	Make repeat treatment if freezing is forecast just after rainfall and roads are wetter than allowed for in current spread rates (See Note 1)
		Freezing delay after rain (>1 hour but < 3 hours)	<p>Delay initial treatment as long as practically possible after rainfall to enable trafficking to disperse surface water so spray is minimal.</p> <p>Repeat treatment should be considered in poorly drained areas, where there is run-off and where (and when) there is little trafficking (e.g. lightly trafficked areas of slip roads, lightly trafficked roads on Sunday mornings) (See Note 1)</p>
Road wetter than allowed for in current spread rates, heavy hoar frost, freezing fog (See Note 1)	Higher spread rates or repeat treatments are required when more water (and/or less residual salt) is likely to be present than allowed for in the current rates	Heavy rainfall before treatment Inadequate drainage or run-off Heavy hoar frost Freezing fog Lightly trafficked roads	<p>Increase initial spread rate (e.g. to the rate for the next temperature band) or consider making initial treatment at the specified rate and repeat treatment(s) at the same rate.</p> <p>Conditions that are most likely to require repeat treatment(s) include:</p> <ul style="list-style-type: none"> • Poorly drained surfacing or open textured surfacing after heavy rainfall • Lightly trafficked surfaces (e.g. lightly trafficked areas

Possible need for repeat treatment(s)	Key information	Predicted conditions	Treatment guidance
			<p>of slip roads, lightly trafficked roads on Sunday mornings, bank holidays etc)</p> <ul style="list-style-type: none"> Dew point above the road surface temperature: <ol style="list-style-type: none"> by several degrees for a long period e.g. over long winter nights from late November to mid-January when there is a light breeze that maintains moist air at the road surface
Change in forecast to more severe weather	A repeat treatment will be required when there is a decrease in the forecast road surface temperature and/or the forecast road surface state is wetter than was assumed for the initial treatment	Change in forecast to colder road surface temperatures or wetter road surfaces	<ul style="list-style-type: none"> Make a top-up treatment if the spread rate for the changed forecast conditions is higher than the spread rate for the initial treatment
Temperatures below freezing spanning at most one peak period	The current spread rates assume a certain percentage loss of salt from road surfaces after spreading. The rates do not allow for loss over long periods.	Freezing occurring after one peak period and for duration less than 12 hours with no precipitation	<p>Monitor conditions and only treat again before next peak traffic period if necessary.</p> <p>Delay initial treatment as long as possible to reduce salt loss before freezing but without compromising dissolution of salt by trafficking etc.</p> <p>Conditions that are most likely to required repeat treatment include when:</p> <ul style="list-style-type: none"> Road surface is wet RST below -5°C Heavy hoar frost forecast When forecast has changed following initial treatment Reports of ice on roads or hard shoulders (from patrols/Police/TSO)
Temperatures below freezing over up to 2 peak periods	The current spread rates assume a certain percentage loss of salt from road surfaces after spreading. The rates do not allow for loss over long periods. In general it should be assumed that a repeat treatment is required if an initial treatment is made just before (or during) one peak traffic period and temperatures will still be below freezing from just before to after the next peak period	Freezing from one peak period to just before or after another peak period, with no precipitation in the intervening period	<p>Make repeat treatment before second peak traffic period and within 12 hours of the initial treatment.</p> <p>Consider using a spread rate for the initial treatment for the road conditions forecast up to the time the repeat treatment has been completed.</p> <p>Where possible, time repeat treatments to avoid spreading when the road surface temperature is less than -5°C</p> <p>It may be possible to either carry out the repeat treatment at reduced rate, or omit the repeat treatment when</p> <ul style="list-style-type: none"> A number of treatments have been made over two or more days in dry weather and measured residual salt levels are high. The humidity is such that the road surface is drying, e.g. changing from wet to damp or dry (but see below) and no increase in humidity or precipitation is forecast for the period of the treatments effectiveness The minimum road surface temperature in the morning is at least one temperature band less than temperature band for the treatment made in the evening.

Possible need for repeat treatment(s)	Key information	Predicted conditions	Treatment guidance
Sustained freezing (i.e. temperatures below freezing spanning at least 3 peak periods	<p>Repeat treatments may be required when below freezing conditions are sustained over long periods. Road surfaces can be essentially dry in periods of sustained freezing because of a lack of precipitation and low humidity conditions. In such conditions, repeat treatments may not be required when residual salt levels have built up and/or the road is dry such that the risk of ice formation endangering road users is low. Treatments should be delayed if the salt that is spread will not enter solution. Accumulations of undissolved salt in sustained freezing can significantly increase chloride levels in water courses when they are dissolved during subsequent rainfall.</p>	Freezing spanning at least 3 peak periods, with no precipitation in the intervening period.	<p>Normally make treatments between each peak period so that the time between treatments is no more than 12 hours.</p> <p>Where possible, time repeat treatments to avoid spreading when the road surface temperature is less than -5°C</p> <p>Monitor the dryness/wetness of the road surface and consider reduced rate treatments or treatments more than every 12 hours when residual salt levels are high and/or the road surface is essentially dry.</p>

Note 1. To calculate spread rates, it was assumed a wet road is one where minimal spray is evident and there is no water flowing across the surface. The maximum water film thickness for a well-trafficked road is 0.05mm and for a lightly trafficked road 0.1mm. Where road sensors indicate a wet road this indicates that more water is present than the maximum water film thickness allowed for in current spread rates and the treatment effectiveness will be less than stated in the treatment matrix guide.

5.1.3 Treatment Matrix Guide

	Weather Conditions Road Surface Conditions Road Surface Temperature (RST)	Air Temp	Treatment	
			Dry Salting (g/m ²)	Pre-wetted Salting (g/m ²) (see Note 1)
1	Frost or forecast frost RST at or above -2°C (irrespective of dry, damp or wet conditions)		8	8
2	Frost or forecast frost RST below -2°C and above -5°C and dry or damp road conditions		10	9
3	Frost or forecast frost RST below -2°C and above -5°C and wet road conditions (see Note 4 if lightly trafficked)		16	15
4	Frost or forecast frost RST at or below -5°C and above -10°C and dry or damp road conditions (see Note 4 if damp and lightly trafficked and Note 6)		18	18
5	Frost or forecast frost RST at or below -5°C and above -10°C and wet road conditions (existing or anticipated) (see Note 4 if lightly trafficked and Note 6)		2 x 15	2 x 15
6	Light snow forecast <10 mm		20	18
7	Medium/heavy snow or freezing rain forecast (see note 5)		2 x 20	2 x 18
8	Freezing rain falling		20 (successive)	See Note 3 below
9	After freezing rain		20	See Note 3 below
10	Ice formed (minor accumulations)	above -5°C	20	See Note 3 below
11	Ice formed	at or below -5°C	2 x 20	See Note 3 below
12	Hard packed snow/ice	above -8°C	20 (successive)	See Note 3 below
13	Hard packed snow/ice	at or below -8°C	salt/abrasive (successive)	See Note 3 below
<p>The rate of spread for precautionary treatments may, if appropriate, be adjusted to take account of residual salt or surface moisture.</p> <p>It has been assumed that two treatments are required to achieve spread rates at or exceeding 30g/m²</p>				
<p>Notes</p> <ol style="list-style-type: none"> 1) Spread rates for pre-wetted salt is the combined weight of dry rock salt and brine combined at 70:30 proportions by weight respectively with a maximum brine concentration of 23% salt 2) Pre-wetted salt should always be the preferred treatment for all precautionary treatments whenever possible, including before snowfall. 3) When ice has formed or snow is lying dry salting is the preferred treatment unless the road is closed to traffic when pre-wetted salting may be used. Pre-wetted salting is the preferred treatment in advance of such conditions. 4) Treatments should be carried out, whenever possible, after traffic has dispersed standing water. Successive half rate treatments (for both pre-wet and dry salt operations) should be considered for lightly trafficked roads, or on more heavily trafficked roads at times of low traffic e.g. Sunday mornings, at the lower end of temperature bands indicated. 5) For snow covering forecast to exceed 30mm ploughing should be conducted early enough to ensure snow accumulations do not exceed 10mm. The rates in the table are for precautionary salt treatment prior to snowfall which is essential to form a debonding layer and aid snow clearance. 6) The effectiveness of salt decreases as temperatures fall and effective treatments may not be guaranteed with salt towards the lower end of the temperature band. The use of alternative treatment materials must be considered when spreading at (the lower of air or road surface) temperatures below -7°C or below -5°C in low humidity conditions (relative humidity <80%) 7) The spread rates are not applicable to very wet roads, when there is standing water or spray generated, or for very heavy hoar frosts. In these conditions roads should be closely monitored and consideration given to increasing the spread rate, making successive treatments or both. 				

6.1.4 Treatment Matrix Guide - Precautionary treatments, including alternative materials, when spreading in extreme cold

Alternative treatments when spreading below -7°C ^[1] (or, especially for dry salt spreading, below -5°C for low humidity conditions)							
Frost or Forecast Frost Conditions							
Dry rock salt component (% by weight)		Rock Salt (70%)	ROCK SALT (70%)	Rock Salt (70%)	Rock Salt (70%)	Rock Salt (96%)	Rock Salt (100%)
Liquid component (% by weight)		Magnesium chloride brine (30%)	Calcium chloride brine (30%)	ABP Brine ^[2] (30%)	Sodium chloride brine (30%)	Alternative liquid ^[3] added before loading (4%)	
Weather Conditions	Road Surface Conditions	PRE-WET SPREADING ^[1] (g/m ²)				DRY SPREADING (g/m ²)	
Road Surface Temperature (RST)							
Frost or forecast frost RST at or below -5°C and above -7°C Only for low humidity conditions <80%	Dry or damp road	11	11	10	13	14	14
	Wet road	18	19	17	21	22	22
RST at or below -7°C and above -10°C	Dry or damp road	16	17	16	21	20	22
	Wet road	27	28	26	35	34	37
RST at or below -10°C and above -12°C	Dry or damp road	21	22	20	29	26	30
	Wet road	35	36	34	49	43	50
RST at or below -12°C	Dry or damp road	27	29	27	41	33	41
	Wet road	46	48	45	68	56	68

Numbered notes:

[1] Spread rates for pre-wet spreading are the weight of the dry salt and brine combined in the ratio 70% dry salt to 30% liquid component.

[2] For definition of ABP Brine see Appendix B.3

[3] Alternative liquid means either: magnesium chloride brine, calcium chloride brine, ABP Brine or: magnesium chloride brine plus ABP liquid. See definitions at Appendix B.3

General notes:

- ▶ Higher spread rates may require more than one pass to achieve, which service providers should make allowance for.
- ▶ A follow up treatment of 50% of the recommended spread rate should be considered in lightly trafficked areas at the lower end of the temperature bands indicated.
- ▶ To take account of residual salt during periods of sustained freezing, when surfaces are well drained and there is no melt water or ice present rates of spread for treatments carried out within 6 hours of previous treatments may be 50% of the rates in the table.

6.1.5 Precautionary Treatment Matrix Guide - Treatments, including alternative materials, before snow and freezing rain when spreading in extreme cold

Alternative treatments when RST below -7°C at time of spreading (or, especially for dry salt spreading, when RST below -5°C at time of spreading for low humidity conditions)						
Conditions: Forecast Light Snow or Moderate / Heavy Snow and Freezing Rain ^[1]						
Dry rock salt component (% by weight)	Rock Salt (70%)	Rock salt (70%)	Rock Salt (70%)	Rock Salt (70%)	Rock Salt (96%)	Rock Salt (%)
Liquid component (% by weight)	Magnesium chloride brine (30%)	Calcium chloride brine (30%)	ABP Brine ^[3] (30%)	Sodium chloride brine (30%)	Alternative liquid ^[4] added before loading (4%)	
Weather Conditions Road Surface Temperature (RST)	PRE-WET SPREADING ^[2] (g/m²)				DRY SPREADING (g/m²)	
RST at or below -5°C and above -7°C (Only for low humidity conditions <80%)	23	24	22	28	28	28
RST at or below -7°C and above -10°C	33	35	32	40	40	43
RST at or below -10°C and above -12°C	39	41	38	47	47	52
RST at or below -12°C	47	50	47	58	58	70

Notes:

- ▶ Higher spread rates may require more than one pass to achieve, which Service Providers should make allowance for
- 1) Treatments for moderate / heavy snow and freezing rain are as for light snow plus a follow-up treatment at half the recommended spread rates when no treatments in previous six hours
- 2) Spread rates for pre-wet spreading are the weight of the dry salt and brine combined in the ratio 70% dry salt to 30% liquid component
- 3) For definition of ABP Brine see Appendix B 3
- 4) Alternative liquid means either: magnesium chloride brine; calcium chloride brine; ABP Brine or; magnesium chloride brine plus ABP liquid. See definitions at Appendix B 3

6.1.6 Reactive Treatment Matrix Guide - Treatments, including alternative materials, for compacted snow or ice when spread in extreme cold

Alternative treatments when RST below -7°C at time of spreading (or, especially for dry salt spreading, when RST below -5°C at time of spreading for low humidity conditions)							
Conditions: Compacted Snow or Ice							
Dry rock salt component (% by weight)		Rock Salt (70%)	Rock salt (70%)	Rock Salt (70%)	Rock Salt (70%)	Rock Salt (96%)	Rock Salt (100%)
Liquid component (% by weight)	Magnesium chloride brine plus ABP (100%)	Magnesium chloride brine (30%)	Calcium chloride brine (30%)	ABP Brine ^[3] (30%)	Sodium chloride brine (30%)	Alternative liquid ^[4] added before loading (4%)	
Weather Conditions Road Surface Temperature (RST)	LIQUID SPREADING ^[1] (g/m ²)	PRE-WET SPREADING ^[2] (g/m ²)			DRY SPREADING (g/m ²)		
RST at or below -5°C and above -7°C (Only for low humidity conditions <80%)	24	28	29	27	34	28	28
RST at or below -7°C and above -10°C	24	40	42	38	48	40	43
RST at or below -10°C and above -12°C	30	46	49	46	56	47	52
RST at or below -12°C	36	56	61	56	76	58	70

Notes

- ▶ Higher spread rates may require more than one pass to achieve, which Service Providers should make allowance for.
- ▶ As much material as possible should be removed by ploughing before applying de-icers.
- ▶ It may not be possible to treat and de-bond from the road surface ice / compacted snow layers exceeding 20mm thickness. Abrasives should be used until conditions become more favourable for de-icing.
- ▶ Frequent patrols should be made to determine the effectiveness of treatments and when further follow-up treatments are required.
- ▶ If the surface melts and becomes slippery an initial treatment of abrasives should be applied at a rate of 40g/m² and successive treatments at 20g/m² until an acceptable level of friction is restored. Care should be taken to make further applications where ice or snow melts and refreezes later leaving abrasives beneath the ice surface and therefore ineffective.
- ▶ The use of alternative de-icers can provide effective treatments in a shorter time scale than dry salt and salt pre-wetted with sodium chloride brine.

- 1) Liquid only treatments identified in this table must only be spread from a dribble bar in discrete lines across the carriageway. This treatment may also be used in conjunction with rock salt spread at 20g/m².
- 2) Spread rates for pre-wet spreading are the weight of the dry salt and brine combined in the ratio 70% dry salt to 30% liquid component.
- 3) For definition of ABP Brine see Appendix B.3.
- 4) Alternative liquid means either: magnesium chloride brine; calcium chloride brine; ABP Brine or; magnesium chloride brine plus ABP liquid. See definitions at Appendix B 3.

6.1.7 Footway and cycle track treatment snow clearance

Category (see 2.3.2)	Overnight Frost Conditions <i>overnight forecast temperatures below zero but not extending beyond 8am</i>	Daytime Frost Conditions <i>overnight forecast temperatures below zero extending beyond 8am</i>	Extended Frost Conditions <i>forecast temperatures remaining below zero throughout daylight hours</i>	Snow Events
1a	Precautionary treatment		Monitor and further treatment as required	Snow removal must commence when resources come available from carriageway treatments. Endeavours must be made to complete clearance within 12 hours of cessation of snowfall, subject to availability of resources
1	No treatment	Reactive treatment (by 8am of that same day)	Monitor and further treatment as required	Snow removal must commence when resources come available from carriageway treatments. Endeavours must be made to complete clearance within 24 hours of cessation of snowfall, subject to availability of resources
2	No treatment	Reactive treatment (by 8am of that same day)	Monitor and further treatment as required	Snow removal must commence when resources come available from carriageway treatments. Endeavours must be made to complete clearance within 48 hours of cessation of snowfall, subject to availability of resources
3	No treatment	No treatment	Reactive treatment (by noon of that same day)	Snow removal must commence when resources come available from carriageway treatments
4	No treatment	No treatment	Reactive treatment not normally undertaken other than in response to specific circumstances	Endeavours must be made to complete clearance within 5 days of cessation of snowfall, subject to availability of resources

Footway and cycle track routes in Area 1		
Category	From - To	Route Description
3	A38 Landrake – Between village gateway signs.	Snow removal must commence when resources come available from carriageway treatments. Endeavours must be made to complete clearance within 5 days of cessation of snowfall, subject to availability of resources
3	A38 Tideford - Between village gateway signs.	
3	A30 Crowlas - Between village gateway signs.	
3	A30 Western side of Canonstown to St Erth Rbt.	

6.2 Treatment/Actions

5.2.1 Precautionary treatment

The effectiveness of precautionary treatments can be significantly affected by how the treatment is applied. The following sections cover EM procedures for precautionary treatment using the appropriate treatment material for each part of the Area 1 Network.

Routes used by spreading vehicles will follow the appropriate WSR in Appendix A.18. EM will aim to apply treatment as close, as is practicable, to the forecast time of freezing, while allowing sufficient time for the salt to form brine. In particular applying treatments during the early evening, to protect against a forecast of ice forming in the early hours of the following morning, will be avoided. Where treatment is required the most appropriate treatment type and spreading techniques will be used.

For programmed treatments the instructed commencement time for all routes should routinely not be less than 3 hours before the onset of freezing conditions as indicated by timings indicated by the forecast.

Should freezing occur for a period exceeding 12 hours and particularly if the onset of hoar frost is forecast late in the period, then consideration should be given to retreat the network.

6.2.1.1 Treatment type

The Highways Agency's preferred treatment is pre-wetted salt, though other materials may be appropriate for specific conditions or circumstances. See 3.3 for treatment types.

The use of pre-wetted salt provides the following advantages over dry salting:

- Better salt distribution across and along the carriageway
- Lower salt loss during spreading and due to trafficking after spreading
- Increased dissolution, in particular for colder temperatures

For treatments on very wet roads and when precipitation has occurred after spreading, repeat treatments are required and spreading dry salt in these circumstances will not prevent the need for these repeat treatments.

EM will select the most appropriate material suitable for use across the Area 1 Network taking into consideration the location and forecasted weather condition to maximise the effectiveness of the precautionary treatment as detailed below.

Sections of carriageway where runoff/seepage is identified should be treated at a density of 18gm/m²; spot treatment will not routinely be undertaken. Further treatments may be required during the period if water continues to flow onto the network; in this instance spot treatment using the Blast Control may be appropriate.

Before instructing 'No Treatment' during prolonged periods of no precipitation when below freezing road surface temperatures are forecast the DS must be confident that the entire network is dry. Confirmation of dry conditions must be given by an inspection of the network. Confirmation must be recorded in the Winter Maintenance & Severe Weather Desk Log.

6.2.1.2 Spreading techniques and operational considerations

The 10 standard precautionary treatment routes are shown in Appendix A.18. As an overview treatment routes have been designed to suit the network characteristics and to optimise winter maintenance response. Treatment times will allow for normal traffic flows and timings of treatment will whenever practical avoid morning and evening peaks.

Crews will be assigned to specific routes to promote route ownership and knowledge, but drivers will have a working knowledge of other routes from their depot in case of breakdown or extreme winter conditions compromising the route assignment.

Other features of the designed precautionary treatment routes include:

- Single carriageway – Will be treated by a single pass of the salting vehicle using an asymmetric salting pattern to cover all lanes 3 lanes.
- Dual Carriageway – Each direction will be treated by the salting vehicle travelling in lane 1 using an asymmetrical spread pattern to cover both lanes. For 3 lane carriageways the spreader vehicle will salt from lane 2 using a symmetrical spread pattern
- Slip Roads - The complete length of exit and entry slip roads will be treated.
- Lay Bys - Salting vehicles to treat by boosting the spread rate as they pass.
- Set Back Lay Bys - Off line lay bys are included in salting routes and treated individually.
- Picnic Sites - Individual treatments as set back lay bys (Sourton Cross, Two Bridges, Clicker Torr)
- Saltash Tunnel – Salting only to each portal entrance.
- The Tamar Bridge is treated by CORMAC on behalf of the Tamar Bridge Authority.

EM, supplemented by operatives from supply chain partners, will carry out footway and cycleway treatment. Details of footways and cycle-ways are included in Section 5.1.6.

The treatment of sections of carriageway closed due to planned road works will be treated prior to reopening. The DS will liaise with site staff at the decision making stage to agree an appropriate time for treatment.

Appendix B5 details treatments for the following:

- *Effectiveness of salt after rain;*
- *Low temperature combined with low humidity conditions*
- *Extreme cold, when salt may not provide for an effective treatment;*
- *Freezing rain;*
- *Cross winds;*
- *Negatively textured surfacing;*
- *Porous asphalt;*
- *Areas susceptible to run off with the potential to re-freeze;*
- *Vulnerable sites.*

EM will, where feasible, treat only targeted areas of the Area 1 Network based on where ice formation is forecast.

6.2.2 Reactionary treatment for snow and ice

The effectiveness of treatments of snow and ice can be significantly affected by the method of application of the treatment. The following sections cover EM's operational techniques for the removal of snow and ice. The techniques include ploughing, together with changes to the methods of application of treatment materials when snow or ice is already present on the paved area. Guidance is provided in Appendix B.6.

It is important that all the defined routes are cleared, in accordance with the snow clearance requirement provided within section 4.1.2, and that no area is abandoned for the sake of concentrating resources to one or two problem areas. Any decision for route closure or abandonment can only be made by the HA incident commander, to be advised within the improved coordination process. In all cases therefore the defined treatment routes will be adhered to, and where conditions demand a more intensive treatment in specific areas, this will be achieved by calling out Operational Reserve Winter Service Vehicles for those areas.

6.2.2.1 Ploughing and snow clearance techniques

When a snow warning is received EM will undertake treatments in accordance with the matrix tables and the guidance detailed in B.6.

The duty manager will instruct snowploughs to be fitted as soon as practicable after any weather information is received indicating snowfall is likely. When precautionary salting has been carried out ploughing with simultaneous salting (see below) will follow as snow begins to accumulate on the carriageway.

In heavy snowfall ploughing without continuous salting must be considered until the road surface has been exposed, the reasons for this are that spreading salt on top of compacted snow has minimal benefit (salt is used to prevent a bond between the snow and carriageway surface) and maintaining a sufficient load of salt in the vehicle hopper will aid traction whilst running on snow.

Full use will be made of available supply chain 4x4 tractors to carry out tandem ploughing whilst being followed by spreaders treating the cleared carriageway.

Ploughing will continue to clear all routes including slip roads, hard strips and laybys, followed by subsequent salting.

In all ploughing conditions care will be taken to ensure that the resulting furrow does not obstruct the flow of water to highway drainage outlets.

It may not be possible to remove deep accumulations of snow or snowdrifts by normal ploughing and the use of other mechanical plant may be necessary.

A38 Marsh Mills viaduct can present particular difficulties removing accumulations during heavier snowfall. Due to the general unsuitability of temporary snow storage sites in this area, first consideration will be to reduce the number of running lanes to provide snow storage on the viaduct. Excess snow that cannot be ploughed away is to be transported to the Sailing Club slipway on Embankment road.

A visual inspection will take place after ploughing in the vicinity of the Saltash Tunnel to ensure the illuminated road studs have not been removed.

The Severe Weather Desk team will ascertain any particular requirements for snow clearance adjacent to temporary physical obstructions adjacent to the carriageway, such as TVCB and Varioguard. Short lengths of obstruction will generally be treated by pushing snow to the end of the obstruction, longer lengths by creating a taper path into lane 2 where practicable.

It is important that all the defined routes are cleared and that no area is abandoned for the sake of concentrating resources to one or two problem areas. In all cases therefore the defined treatment routes will be adhered to, and where conditions demand a more intensive treatment in specific areas, this will be achieved by calling out a reserve vehicle for those areas.

There are only very short lengths of VCB on the Area 1 network, these form pier protection at a number of structures. However, their short length is such that in the event of heavy snow any snow adjacent to these barriers will be ploughed clear without any significant problem.

6.2.2.2 Spreading techniques

See Section 5.2.1.2.

6.2.2.3 Aftercare and follow up treatments

Before spreaders and tractors are stood down the DS will carry out a patrol of the whole network and report to the Severe Weather Desk on network status.

Following a period of ploughing operations to remove exceptionally heavy snowfalls from the carriageway, it will be necessary to carry out a period of aftercare to return the network to normal. This will include some or all of the following:

First Stage:

- Removal of snow from temporary TM signs to ensure full visibility of sign faces
- DS inspections to provide feedback on any problem areas requiring additional treatment
- Full clearance of hard strips

Second stage:

- Full clearance of hatched areas, and other areas of 'dead carriageway', taking care to keep drainage paths clear.
- Removal of any packed snow from physical obstructions and barriers such as bridge parapets, TVCB, Varioguard or concrete barrier
- Removal of snow from widened central reserves, particularly if this causes a problem with visibility splays
- Lower category lay-bys, footways and cycle ways.

Removal of snow from any permanent warning sign faces if in unusual circumstances snow adheres to the face.

6.2.2.4 Arrangements for use of blowers

EM does not have any snow blowers allocated to their Network. National procedures for management of the both Operational Reserve Winter Service Vehicles and National Reserve Vehicles are in Appendix B.4.

Where the equipment is to be brought in from another area the Regional Winter Service Delivery Manager will liaise, as necessary, with the National Winter Specialist and other relevant parties.

6.2.3 Freezing rain / rain falling on extremely cold surfaces

6.2.3.1 Operational considerations – SEE APPENDIX B.5

6.2.3.2 Hazard mitigation

The nature of freezing rain means that treatments will have virtually no effect initially and ice will form on the carriageway. Rain falling on extremely cold surfaces can produce similar effects. Mitigation of the hazard is therefore a significant aspect of the actions taken in response to freezing rain or rain falling on extremely cold surfaces. The main action is to inform road users of the hazard where available fixed or mobile Variable Message Signs (VMS) will be used as detailed in Appendix B.5.

EM will liaise with Police Control Offices (PCOs) and / or RCCs to provide advance warning to recovery companies when any incidents occur as a result of the freezing rain or rain falling on extremely cold surfaces. Procedures for giving such advance warning would need to be established in advance with PCOs and RCCs and documented.

6.2.3.3 Location of Bridge decks

Listed below are the locations of bridge decks that are deemed to be long enough to fall within scope of the predicted minimum temperatures for bridge decks in the daily weather forecast.

A30 Exeter to Penzance

Structure	Route	Domain
Bakers Hill	[REDACTED]	[REDACTED]
East Okement River	[REDACTED]	[REDACTED]
West Okement River	[REDACTED]	[REDACTED]
River Thrushel	[REDACTED]	[REDACTED]
Tinhay	[REDACTED]	[REDACTED]
Dunheved	[REDACTED]	[REDACTED]
Pennygillam	[REDACTED]	[REDACTED]
Tolvaddon	[REDACTED]	[REDACTED]
Gilberts Coombe Viaduct	[REDACTED]	[REDACTED]

Blowinghouse Viaduct
Hayle Viaduct

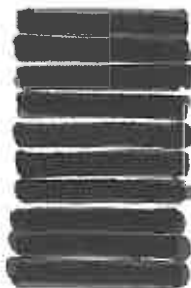


A38 Exeter to Bodmin

Structure

Harcombe
River Teign
River Dart
Mardle Viaduct
Whitecleave Viaduct
River Avon
River Erme
Marsh Mills W/B Off-slip
Marsh Mills E/B On-slip
Marsh mills Viaduct

Route



Domain



6.2.4 High winds (including Severe Gales and Storms)

High winds/severe gales can occur at any time of year but are most likely from September through to June.

Operational Considerations

DMs, DSs and NCC Operators will follow the Severe Weather Desk Escalation Flow Chart.

Managers and supervisors of any schemes on the network will be given advance warning by the NCC of impending severe weather. On receipt of this warning they must either remove or ensure all traffic management equipment is secure enough to withstand the forecast conditions; site staff must ensure that any traffic management equipment remaining is patrolled on a regular basis during the severe weather period.

The NCC will, under instruction from the DM, deploy available vehicles and chain saw crews (supply chain) to the vulnerable areas of the network where tree damage is most likely to occur. Crews will clear all storm related debris and provide the NCC with regular network condition updates.

The NCC will discuss with the NTIS activation of the M5, A38 and A30 Bodmin VMS with appropriate messages. The NCC will activate the Area 1 mobile VMS with appropriate messages.

During the period, the Severe Weather Team will monitor wind speeds at the various weather stations via HAWIS and the DM will liaise regularly with forecast providers to determine the severity, duration and extent of the severe weather. In addition to feedback from crews and staff out on the network, all available CCTV will be displayed in the NCC to help the Severe Weather Desk Team appreciate and monitor actual weather conditions.

During the period the DM will liaise with the Tamar Bridge Office who will take the following action during high winds depending on wind direction:

- Wind speeds of 45mph – closure of the centre lane.
- Wind speeds of over 65mph closure of the bridge to all high sided vehicles, caravans & motorcycles.
- Wind speeds in excess of 70mph may result in a full closure.

Any closures of the bridge will be signed only (using the A38 MS3 VMS and the Tamar Bridge VMS at Manadon, Carkeel and Trerulefoot) and vehicles turned around, there is no physical barrier to prevent drivers of such vehicles who are determined to cross the bridge against advice. Depending on the duration of the forecast conditions it may not be practical to sign any diversion routes.

If conditions begin to deteriorate to the point where EM's resource is becoming stretched, then the DM will contact adjoining areas (Area 2 & DBFO) and the LHA's to request assistance. At this point the early stages of the Contingency Plan will be implemented by the DM and the SWRCC must be informed, Police Gold Control may already be operational by this time and they will make any strategic decisions regarding the closure of parts of the network.

6.2.5 Heavy rain

6.2.5.1 Pumping, jetting and clearance techniques

DMs, DSs and NCC Operators will follow the Severe Weather Desk Escalation Flow Chart.

Managers and supervisors of any schemes on the network will be given advance warning by the Duty Manager of impending severe weather. On receipt of this warning they must either remove or ensure all traffic management equipment is secure enough to withstand the forecast conditions; site staff must ensure that any traffic management equipment remaining is patrolled on a regular basis during the severe weather period.

All depots must ensure a stock of sandbags is available for emergency use. ISUs will carry sandbags together with 'Flood Warning' boards and drainage rods.

Supply chain partners who can provide pumping equipment will have been given an early warning they may be mobilised.

Crews out on the network will provide the NCC with network condition updates.

The NCC will discuss with the NTIS activation of the M5, A38 and A30 Bodmin VMS with appropriate messages. The NCC will activate the Area 1 mobile VMS with appropriate messages. In addition to feedback from crews and staff out on the network, all available CCTV will be displayed in the NCC to help the Severe Weather Desk Team appreciate and monitor actual weather conditions.

If conditions begin to deteriorate to the point where EM's resource is becoming stretched, then the DM will contact adjoining areas (Area 2 & DBFO) and the LHAs to request assistance. At this point the early stages of the Contingency Plan will be implemented by the DM and the SWRCC must be informed, Police Gold Control may already be operational by this time and they will make any strategic decisions regarding the closure of parts of the network.

Area 1 does not have any adjacent areas specifically identified for pumping floodwaters, in the event of serious flooding the nearest most appropriate low lying or available watercourse will be used.

6.2.5.2 Operational considerations

Drainage Locations Requiring Additional Monitoring

Potential flood locations	Cause of Flood	Risk	Additional information
A30 East Okement Viaduct Okehampton	Bridge deck kerb face drainage easily blocks with debris.	High	Blockage results in standing water on the carriageway, high frequency cleaning routine (six monthly).
A38 Marsh Mills Viaduct	Bridge deck kerb face drainage easily blocks with debris.	High	Blockage results in standing water on the carriageway, high frequency cleaning routine (six monthly).
A38 Linhay WB onslip	Inadequate county road drainage.	High	Photographs of flooding taken by EM were handed to DCC at the 22/08/12 Stakeholder meeting.
A38 Glynn Valley	Inadequate drainage systems on both the trunk and county roads.	High	Bi-annual drainage cleaning carried out spring and autumn under full overnight closures of the Glynn Valley. An ongoing programme of improvements continues.
A30 Meldon	River flooding from West Okement River.	High risk 1 in 100 yr or less	Culvert on this section sometimes blocks and causes flooding of property. Monitored regularly.
A30 Palmer Bridge Bolventor WB	Risk of possible fluvial flooding	High risk 1 in 100 yr or less	EM are investigating the potential for a flood warning alarm system linked to the Area 1 NCC.
A38 Kennford – River Kenn	River Flooding from river Kenn. Drainage problems from farmer's fields in the surrounding area.	High risk 1 in 100 yr or less	Runoff from farmer's fields causes blockages of our drainage and subsequently causes flooding on carriageway. Monitored regularly.
A38 Bellamarsh EB	Risk of possible fluvial flooding	High risk 1 in 100 yr or less	
A38 Glynn Valley	Risk of possible fluvial flooding	High risk 1 in 100 yr or less	
A30 St Erth to Crowlas	Risk of possible fluvial flooding	High risk 1 in 100 yr or less	

6.2.5.3 After care and follow up treatments

EM will ensure that the entire network is resumed to normal as soon as is practicably possible following a severe weather event, the priority for clearance will be as follows:

- Main carriageways
- Slip roads and lay-bys
- Picnic sites
- Footways & cycle tracks

6.2.6 Fog

EM will undertake the following specific measures as appropriate to mitigate the hazard:

- Where available fixed or mobile VMS should be used to warn road users of the hazard. The existing established procedures for requesting VMS settings to be made should be followed well in advance. The following legend is currently the most appropriate to use – 'FOG SLOW DOWN'. This will require arrangements and protocols to be established with the SWRCC.
- National Incident Liaison Officer (NILO) and/or Highways Agency Press Officer should be contacted in order that the local media can be advised as necessary.
- Where available use of variable mandatory speed limits should be considered. This will require arrangements and protocols to be established with the appropriate Police Control office or RCC as part of the advance planning procedures.

Duty Managers, Duty Supervisors and NCC Operators will follow the Severe Weather Desk Escalation Flow Chart.

Managers and supervisors of any schemes on the network will be given advance warning by the Duty Manager of impending severe weather. On receipt of this warning they must either remove or ensure all traffic management equipment has sufficient lamps to be seen in the forecast conditions; site staff must

ensure that any traffic management equipment remaining is patrolled on a regular basis during the severe weather period.

Bodmin Moor on the A30 is particularly vulnerable to fog, should this occur then the mobile VMS between Callywith and Dunheved will be activated by the NCC with the message 'FOG SLOW DOWN'

Should the fog problem extend area wide then the NCC will request the SWRCC activate the static VMS on the M5, A38 and A30.

6.2.7 High temperatures

In the event of high temperatures where vehicles and occupants are static on the motorways and trunk roads for long periods of time, EM will if available, provide support and assistance to the RCC and the Police as requested.

EM do not anticipate any significant problems associated with 'road surface melting' in Area 1, even in relatively high temperatures. Such problems tend to be confined to roads which have been surface dressed, sometimes repeatedly, and the bitumen has leached through on to the top of the surface and then melted.

Surface course materials on the A30 & A38 in Devon and Cornwall consist of either hot rolled asphalt (HRA) with pre-coated chippings, thin surfacing/SMA type material of the negative textured variety, high friction dressings, or PQ concrete. The majority of the HRA contained 50 pen bitumen when it was laid, and this has a softening point of 50 degrees centigrade. However, the binder would have hardened over time, resulting in a higher softening point. Negative textured materials present a less dense surface, which means that the heat dissipates more readily than in HRA. Polymer modified binders are generally used, and these raise the softening point by 8 – 10% more. High friction dressings are mainly fixed with an epoxy resin spray. Whilst younger dressings may produce an odour in hot weather, other problems are not anticipated. Concrete is not affected by temperature.

In summary, even in extreme conditions, with road surface temperatures reaching in excess of 50 degrees centigrade, EM anticipate that the worst effect would be some rutting of the HRA on south facing sloped sections of carriageway which are protected from the wind.

APPENDICES & SCHEDULES

NOTE:

To reduce the size of the Severe Weather Plan, the Service Provider may include certain appendices within a box of reference and not append these directly to the plan. Where this is applicable a note has been added at the start of the Appendix. The Service Provider must agree an acceptable approach with the Service Manager and confirm the location of the box of reference.

A.1 DEFINITIONS AND ABBREVIATIONS

The National Severe Weather Warning System (NSWWS) – Providing warnings, mainly for Category 1 and 2 responders (as defined in the Civil Contingencies Act 2004), of Severe Weather	
Regional advisory of severe or extreme weather warning (Advisory)	Advisories are issued by 1300hrs daily as routine and indicate confidence of expected Severe Weather (or unusual extreme weather). Early and flash warnings supersede advisories when confidence levels are 60% or greater.
UK Advanced warning of Severe Weather (early warning)	An early warning of Severe Weather will normally be issued up to several days in advance whenever the overall risk of widespread disruption in any UK region is 60% or greater.
Regional Severe Weather warning (flash warning)	Flash warnings of Severe Weather are issued when confidence of an event reaching the Severe Weather criteria is above 80%, and should give a minimum of two hours notice. Warnings are issued for every affected county or unitary authority.
Flood Forecasting Centre (EA/Met Office) – Alerting emergency responders in England and Wales to the possibility of urban surface water flooding as a result of extreme rainfall	
Extreme Rainfall Alert (ERA)	Alert issued when there is a 20% or greater probability of exceeding the following extreme rain thresholds: 30mm per hour; 40mm in three hours or; 50mm in six hours.
The Environment Agency Flood Warning System – warnings of river and coastal flooding	
Flood watch	Flooding of low lying land and roads is expected. Be aware, be prepared, watch out.
Flood warning	Flooding of homes and businesses is expected. Act now!
Severe flood warning	Severe flooding is expected. There is extreme danger to life and property. Act now!
All clear	Flood Watches or Warnings are no longer in force for this area
Met Office Severe Weather Warnings – Flash warnings for a range of weather conditions which are not unusual. The conditions below, defined by the Met Office, give guidance concerning the weather likely and the criteria for issue of the flash warnings	
Heavy rain	Expected to persist for at least 2 hours and to give at least 15mm of rain within a 3 hour period or - More than 25mm per day on already saturated ground.
Fog	Warnings of fog are issued when visibility is expected to fall below 50 metres, at which severe disruption to transport can be expected.
Heavy snow	Snow falling at a rate of 2cm/hour or more expected for at least 2 hours.
Very heavy snow	Heavy snow which accumulates to 15cm or more
Blizzards	Moderate or heavy snow combined with winds of 30mph or more with visibility reduced to 200 metres or less; or drifting snow giving rise to similar conditions.
Severe blizzard	Heavy snow accompanied by winds of 30mph or more, reducing visibility to near zero.
Widespread icy roads, glazed frosts and freezing rain	Icy roads occur when the road surface temperature of wet roads drops below zero and ice is formed. Freezing rain occurs when rain becomes 'super-cooled' and when it hits a cold surface it freezes immediately and forms a layer of clear ice.
Severe gales	Repeated gusts of 70mph or more over inland areas, with a risk to high-sided vehicles being blown over.
Storms	Repeated gusts of 80mph or more over inland areas, which could cause cars to be blown out of their lane on the carriageway, which may cause traffic collisions.

Met Office Heat-Health Watch – this system identifies four levels of response based upon thresholds	
High temperatures, Heat wave	The temperature thresholds vary by region, but an average threshold temperature is 30°C by day and 15°C by night on at least two consecutive days and the intervening night.
Reserve Winter Service Vehicles	
Reserve Threshold	The Reserve Threshold is the point at which the number of Area Operational Reserve Winter Service Vehicles available to be utilised are reduced to a point which could make it difficult to maintain the optimum level of Winter Service on the Area Network. This threshold level is proposed by the Service Provider for agreement with the Service Manager.
Critical Incident	A Critical Incident is when the reserve winter fleet situation / reserve winter fleet availability reaches a level that seriously impacts upon the Highways Agency and its ability to maintain a safe Area Network during.
Area Operational Reserve	An Area Operational Reserve is a Winter Service Vehicle assigned to a particular Area that is in rotation and not currently designated a specific treatment route. It will be required to carry out treatments on the Area Network when a vehicle that has been designated a particular treatment route is unavailable or becomes the Operational Winter Service Vehicle as part of the rotation. The use of an Area Operational Reserve does not require specific approval from the Highways Agency.
National Reserve	A National Reserve is a Winter Service Vehicle that is held in a particular Area, but may be transferred to any part of the Highways Agency's strategic road Network to help manage Severe Weather incidents. The use of National Reserves requires specific approval from the Highways Agency.
Extra Effort Vehicles	Additional non-Highways Agency vehicles required to supplement the allocated operational, reserve vehicles and national reserve vehicles that may be required during sustained periods of snowfall or extreme cold
Salt Stock	
Operational Salt Stock	Is the salt that the Service Provider purchases, manages and uses to provide the lump sum routine Winter Service as defined in the AMOR
Current Maximum Storage Capability (CMSC)	This is the total storage capacity currently available in storage facilities provided by the Highways Agency under the contract.
Operational Salt Stock at Start of Season	Is the minimum volume of salt required to be in place within the Area concerned by 1st September each year. If this figure exceeds storage capacity as defined by the CMSC, the service provider will be required to provide the additional storage capacity.
Minimum Contractual Salt Stock Level	Is the minimum operational salt stock level that must be maintained from 1st October each year to 1st April of the following year.
Minimum Capability	Is the capability level, in days, assuming all salt storage facilities are at the Minimum Contractual Stock Levels
Reporting Threshold	Is the capability level at which point salt supplies will be considered to be approaching critical and will be the threshold for the automatic re-ordering of salt. This definition, which now relates directly to acquiring immediate salt supplies, should be considered in detail by Service Providers to ensure they set an appropriate reporting threshold profile.

Abbreviations			
CCTV	Closed Circuit Television	NTIS	National Traffic Information Service
DBFO	Design Build Finance & Operate	NVRM	National Vehicle Recovery Manager
DfT	Department for Transport	SWRCC	South West Regional Control Centre
DM	Duty Manager	SP	Service Provider
DS	Duty Supervisor	TOS	Traffic Officer Service
ESS	Environmental Sensor Station	VMS	Variable Message Sign
HA	Highways Agency	VRN	Vehicle Registration Number
HAWCS	Highways Agency Weather Central Service	WMO	Winter Maintenance Officer
HAWIS	Highways Agency Weather Information Service	WRF1	Winter Reporting Form
NILO	National Incident Liaison Officer		

A.24 SEVERE WEATHER DESK PROCEDURE

1.0 Introduction

This Severe Weather Desk procedure is an operational guide for dealing with a declared severe weather event. The purpose is to expand upon the standard Area 1 Winter Service and provides a working guide for managing the event.

This procedure will be activated when:

Severe weather conditions are those that are likely to cause disruption and substantially hinder the passage of traffic or as soon as possible in the event of un-forecast severe weather. The Duty Manager will instruct the opening of the Severe Weather Desk.

2.0 Objectives

EM's objectives are to initiate and manage procedures to provide a winter maintenance / severe weather service, which will:

- Be in accordance with the Highways Agency AMOR
- Integrate with the Area 1 Network Contingency Plan
- Operate in conjunction with the Local Authorities Winter Maintenance plans
- Operate in conjunction with adjacent Managing Agents and DBFO's
- Operate in conjunction with the Devon & Cornwall Constabulary
- Provide guidance upon route priorities.

This document will be used in conjunction with:

- Area 1 Network Contingency Plan
- Area 1 Severe Weather Plan
- Haldon Hill Severe Weather Response Plan
- NCC Winter Maintenance Procedures

3.0 Activation of Procedure

At the first indication of forecasted severe weather likely to cause disruption or substantially hinder the passage of traffic:

Duty Manager will:

- Speak to the forecast provider to expand upon the weather forecast and determine the nature of the forecasted severe weather, particularly:
 - Extent - Area expected to be affected.
 - Duration - Forecasted duration of conditions.
 - Intensity - Forecasted intensity of conditions
- Call a meeting with other Duty Managers and the Communications Officer to discuss mobilisation of the SWD.
- Consider possible implementation of the Haldon Hill Severe Weather Response Plan
- Liaise with all relevant agencies involved in the Haldon Hill Severe Weather Response Plan
- Contact staff to determine availability and prepare a SWD rota advising staff of shifts and duties.
- Liaise with adjacent Areas and Local Authority's to discuss the forecasted conditions in order to determine appropriate actions to manage a joint response to the weather event.
- Advise the Network Liaison Manager to prepare the NCC for Severe Weather Desk.
- Check the state of readiness by ensuring that other managers have completed their activation duties.
- Mobilise supply chain 4x4 tractors with snow ploughs, towing chains and GPS to be stationed at locations of highest risk.
- Mobilise supply chain teams with chain saws.

Network Operations Manager will:

- Ensure that salt stocks are adequate in all depots for a prolonged period of intensive salting and replenish if required.
- Ensure that all depots have adequate fuel reserves and replenish if required.
- Ensure depots hold sufficient supplies of sandbags for flooding events.

JTR & NOM will:

- Prepare the NCC for Severe Weather Desk operations.
- Cancel all meetings in room G3 for the anticipated period of Severe Weather Desk.
- Set up 4 workstations for Severe Weather Desk use.
- Provide 5 telephones for Severe Weather Desk use.
- Determine NCC resource to support Severe Weather Desk
- Provide Emergency Box and equipment defined in para 4.4.
- Test radio system.

Duty Winter Service Officers will:

- Ensure that Winter Maintenance fleet is fully operational and located at the correct operational depot as detailed in the Severe Weather Plan.
- Mobilise the additional snow clearance route vehicles
- Ensure that Snow Ploughs are fitted
- Ensure sufficient drivers are available to deal with the weather emergency and 24/7 shift pattern is set into place if required.
- Ensure that all loaders on station and fully functional.
- Notify the relevant service providers that fitters will be required to be stationed at operational depots.
- Ensure that depot emergency generators are operational.
- Ensure that all gritters have fully functioning mobile phones and radios.
- Provide grit stocks in all operational depots
- Provide if required sufficient 4x4 vehicles to transport drivers at shift change and undertake network inspections.
- Ensure that any available ISU's are equipped/prepared for snow duties.

4.0 Establishment of Severe Weather Desk

The Severe Weather Desk will be established at the NCC Ash House with an Operations Desk at Scorrier depot if conditions necessitate.

- Severe Weather Desk Ash House – Exeter 01392 312660
- Severe Weather Desk Facsimile number - Exeter 01392 312572
- Severe Weather Desk E-Mail address AREA1NCC@EM.com
- Operations Desk Scorrier: 01209 822053
- Operations Desk Fax Scorrier: 01209 820851

5.0 Operation of Desk

- Recording incoming calls, outgoing calls and decisions made in the Winter Maintenance & Severe Weather Action Log.
- Any decision that will have a strategic impact upon the network will be recorded in the Winter Maintenance & Severe Weather Action Log.
- Any operational decision will be recorded in the Winter Maintenance & Severe Weather Action Log.
- All entries will show the time and will be initialled by the person making the entry.
- Liaison will be maintained with the Highways Agency, Devon & Cornwall Constabulary and adjacent Highway Authorities using WRF1/Sitreps providing details of actions, progress and road conditions.

6.0 Manning Arrangements

Gold Control

Gold Control will be attended by a representative from the HA Emergency Planning Team.

The Severe Weather Desk at Ash House Exeter will be manned by:

- Duty Manager (DM)
- Duty Supervisor (DS) – x2 during snow falls forecast greater than 10cm.
- Communications Officer
- NCC Operator
- Log keeper

The Severe Weather Desk at Scorrier will if necessary be manned by:

- Area Operations Manager West
- Duty Supervisor

If further staff is required to deal with the weather event resource will be determined by the Duty Manager.

- If inspectors are required to inspect the Network during a snow event then they will use the 4X4 vehicles.
- Arrangements will be made for the transport of staff to and from the operations desk if conditions are severe and assistance is required.
- If the severe weather event is expected to last more than 12 hours shift patterns will be established immediately and second shift personnel sent home to rest.
- If the emergency is expected to last more than 24 hours those attending will take a change of clothing and other personal effects.

7.0 Shift Handover Procedures

When handing over the incoming shift will arrive at least ½ hour before the designated time and will shadow the outgoing shift until the change over time. The outgoing shift will then shadow the new shift for at least ½ hour or until they become fully conversant with all ongoing actions.

If it is possible to stagger the change of personnel then that will be the preferred method. The change over procedure will be as above.

The outgoing shift will maintain a handover sheet detailing:

- All live issues
- Status of the network including any problem areas
- Progress with snow clearing
- On-going communications
- Details of current liaison with stakeholders
- Any emergency/welfare problems with Network users.
- Status of the fleet involved in severe weather activities including all maintenance activities
- Status of severe weather operatives
- Status of depots

8.0 Set-Up Arrangements

Equipment

There will be an Emergency Box held at Ash House and Scorrier containing:

- The Area 1 Network Contingency Plan
- Area 1 Severe Weather Plan
- Haldon Hill Severe Weather Response Plan
- NCC Operational Guide
- NCC Winter Maintenance Procedure
- Computer with email address, the correct software and passwords to
 - Interrogate the HAWIS website and the forecast provider weather website.
 - Log Books
 - Stationery
 - Network Maps

9.0 Contacts

The following organisations will be informed that the Severe Weather Desk is in operation by means of the first Situation Report:

- Gold Control
- Central Office of Information
- Highways Agency Incident Liaison Officer (see Area 1 Network Contingency Plan)
- Highways Agency Area 1 Service Delivery Team Leader & Regional Director
- South West Regional Control Centre
- NTIS
- Area 1 General Manager
- Network Manager
- Deputy Network Manager
- Devon & Cornwall Constabulary – see note below
- Devon County Council – Control Room
- Cornwall Council
- Plymouth City
- Area 2 Service Provider
- Area 32 DBFO
- BBC Local Radio
- Airports – Exeter & Newquay
- Ambulance Service

- Fire Services – Devon & Cornwall
- Gemini FM
- Pirate FM
- Plymouth Port
- Tamar Bridge Office
- Traffic Ink
- Weather forecast provider

Note

When contacting the Police, contact the Middlemoor Control Room and ask for the Force Duty Officer. Explain what is happening, why the operations desk has been opened and any other information necessary to give the Police a full understanding of the conditions.

Obtain a Log Number from the Police. The Police operate a 'Cascade' to inform all other Emergency Services and Local Authorities.

Note: Telephone numbers for the above are given in the Area 1 Network Contingency Plan and must be checked at the first indication of heavy snow given by the weather forecasters.

10.0 Severe Weather Desk Operational Roles

Duty Manager

- Overall direction of EM response to weather emergency
- Liaison with forecast provider for weather advice
- Multi Agency teleconferences for Haldon Hill Severe Weather Response Plan & RAGs
- Monitor weather emergency and escalate response if required.
- Interpretation of weather forecasts
- Liaise with the DS
- Discuss strategy with Gold Control attendees
- Liaison with adjacent agents or Local Authorities for mutual aid.
- Responsible for briefing the Comms Officer prior to issuing Sitreps
- Must ensure all decisions, conversations etc are entered onto the log.

Duty Supervisors

- ***During periods of snowfall exceeding 10cm, there will be two WSOs, each taking responsibility for either the A38 & A30***
- Support the DM
- Monitor the weather conditions utilising weather stations, weather radar, CCTV, incoming reports etc.
- Liaise with and instruct winter fleet, provide feedback to the DM & CO.
- Liaise with other duty supervisors
- Liaison with Scorrier Control (if west severe weather desk is open)
- Liaison with staff on the network to assess network conditions and appraise them of operations and conditions.
- Report incidents to Communications Officer or NCC Operator.
- Must ensure all decisions, conversations etc. are entered onto the log.

Communications Officer

- Co-ordinates and manages operations within the NCC.
- Provide hourly WRF1 Situation Reports and Sit Reps as shown in Appendix B throughout the weather event and E-Mail them to parties listed in 9.0 above.
- Provide additional interim reports upon serious incidents (Flashreps) to the Police Control room, or Gold Control if opened.
- Report critical incident to the Police Control room, or Gold Control if opened.
- Communications with Gold Control
- Liaison with Area 2 and Connect Road Operators
- Liaison with Devon, Plymouth and Cornwall Highway Authorities
- Preparation of media reports for the Highways Agency as and when requested
- Brief HA/EM senior management visiting the Severe Weather Desk

NCC Operator (Log Keeper)

- Logging of all calls to Severe Weather Desk, decisions made and instructions given.
- Monitor and log all critical incidents, reporting all to officers managing the incident giving location, duration and nature of problem, duration of any entrapment + notification of closure of incidents using the report form in Appendix C.

Duty Supervisors (Based at Avocet Road Exeter and Scorrier)

- Assist with treatment and snow clearing operations as required under directions of SWD
- Maintain log of communications and instructions.
- Monitor vehicle operations
- Monitor status of fleet and arrange maintenance/repair as required advising the SWD of vehicle status.
- Ensure adequate resources, including drivers to meet to meet the required response.
- Call in additional resources from Emergency Suppliers as required.
- Liaison with Scorrier Control.

ISU and Works Crews Out on the Network (if available)

- Report network conditions to Severe Weather Desk.
- Support recovery operations if directed by Severe Weather Desk
- Report incidents, with particular emphasis to any that have or would have welfare problems and request assistance if required.
- Report the clearance of incidents, particularly those with potential welfare problems.

Salt Spreader Drivers

- Salt Spreader drivers will give feedback to the SWD of road and weather conditions, progress being made with ploughing and de-icing treatment and any additional resource if required.

11.0 Communications

Situation Reports

During the weather emergency WRF1 Situation Reports and those as shown in Appendix B will be provided hourly by the Communications Officer.

Flash Reports

In the event of a significant incident that has a severe effect upon the network, severe or fatal injuries or severe welfare issues a Flash Report will be issued. A Flash report will also be issued for the clearance of a significant incident.

Critical Incident Reports

These will accompany the hourly Situation Reports and will detail:

- Time of incident
- Nature of incident
- Location of incident
- Casualties
- Vehicle(s) involved
- Effect upon the network
- Period of entrapment
- Progress upon incident
- Expected time of closure of incident (if known)
- Time of Closure of incident

NO OTHER REPORTS WILL BE PROVIDED OTHER THAN THE SITUATION REPORTS

Communications with Devon and Cornwall Constabulary

In general communications with the Devon and Cornwall Constabulary (Gold or Silver Control) will be through the SWRCC unless directed otherwise. Sitreps will be sent to Middlemoor Control Room unless otherwise advised by the Police.

Gold Control will have overall control of the emergency at a strategic level managing all the emergency and voluntary organisations involved. The Police would also operate Silver Controls at a local level to manage the incident at a Tactical Level.

12.0 Incident Management

It is important that incidents and network conditions are monitored so that if they deteriorate a Critical or a Major Incident is recognised, as defined in the Network Contingency Plan. The DM will be responsible for the escalation process. Copies of these definitions will be kept at the Severe Weather Desk for reference.

Particular note will be taken of:

- Entrapment – Any entrapment of motorists for more than one hour must be reported to the police.
- Potential Welfare problems
- Reported welfare problems
- Route blockages, whether complete or intermittent
- Carriageway conditions, particularly if long-term problems could be expected.
- The weather scenario – i.e. forecasted duration of the period of severe weather.

If there is an escalation then staffing levels of the Desk will be reviewed to ensure that sufficient people are available.

13.0 Snow Clearance

Snow Clearing Objectives for Severe Weather Desk

Having gathered information from forecast provider and Salt Spreader Drivers, the Severe Weather Desk will determine the area(s) of heaviest snow fall. This will be monitored throughout the operation of the Severe Weather Desk.

Plant will be operated in the most efficient manner to deal with the forecasted and actual snow falls.

If appropriate the Haldon Hill Severe Weather Response Plan will be implemented.

If there are areas where no snow is forecasted, then snow spreaders with their ploughs may be deployed into areas where heavy snow falls have been forecasted, or are falling if it is believed that the salt spreaders that operate in those areas may not be able to cope.

When equipment has been moved from an area then the weather and road conditions will be monitored closely via HAWIS and radar to ensure that there is no deterioration in conditions.

In extreme conditions permission may be asked to use Highways Agency National Reserve Vehicles on the A30 and A38

If heavy snow has fallen throughout the network and the fleet is unable to cope then following discussions with Gold Control consideration may be given to a reduction in areas treated in accordance with the suggested priorities shown in 4.1.2. This is to ensure that the primary sections of the network are maintained and that priority is given to routes between population residential and work centres.

NOTE - It must be remembered that Cornwall County use the A30 and A38 to access salting routes on their own network.

14.0 Variable & Electronic Message Signs

VMS signs controlled by NTIS and the SWRCC:

- M5 southbound, south of Junction 30 – 2 x MS3.
- A30 Bodmin Eastbound prior to A38 Junction at Carminow – 1 x MS3
- A38 westbound approach to Plymouth - 2 x MS3.
- M5 southbound between Jtn 29 & 31 (EMS on gantries)

VMS signs controlled by Tamar Bridge Authority

- A38 Parkway Westbound – Approach to Manadon
- A38 Eastbound approach to Trerulefoot & Carkeel

Mobile VMS signs controlled by Area 1 NCC

- 24 x mobile VMS

15.0 Diversion Routes

All diversion routes are shown in the Area 1 Network Contingency Plan Appendix D. It should be noted that many diversion routes would not be suitable for use during snow conditions.

If a carriageway becomes blocked then the following steps should be taken.

- a) Establish suitability of diversion route – For traffic and snow clearing equipment.
- b) Contact Local Highway Authority and ask about status of diversion route roads and arrange de-icing treatment which will be by the LHA unless assistance is requested.
- c) If support is requested to maintain the diversion roads then EM will deploy gritters to plough and salt

In Devon – contact will be with the Control Room

In Cornwall – contact will be with the Duty Divisional Winter Maintenance Surveyor

In Plymouth – contact will be with the Control Room

d) The diversion will be assessed for suitability before use. If it is not suitable for use as a diversion then alternatives will be reviewed i.e. Strategic diversions, the use of VMS to give information to drivers.

e) If drivers are trapped on the network then immediate consideration will be given to their welfare provisions.

16.0 Tamar Bridge

The Tamar Bridge is not part of the Area 1 network and is treated by the Tamar Bridge Authority. They will be kept informed of any snow clearing operations in the vicinity of the Tamar Bridge.

17.0 Welfare of Road Users

A list of supermarkets adjacent to the network where bottled water can be obtained in large quantities can be found in the Area 1 Contingency Plan. However, a procedure for distributing welfare to road users on the trunk road network has not been agreed with the Highways Agency.

18.0 Snowbound Vehicles

Inspectors/TOS will provide the Severe Weather Desk of a count of trapped and abandoned vehicles giving:

- Location(s) – Geographical/Marker Post Position and
- In carriageway/Off Carriageway
- Number with occupants
- Number without occupants

This information will be recorded at the operations desk and also be passed to the Police or Gold control if it is operating. All snowbound abandoned vehicles that are in a position that will interfere with snow clearing will be reported to the Devon and Cornwall Constabulary.

If vehicles have to be moved then that will only be undertaken with the support and presence of the Police.

If necessary pass details to the SWRCC who may be able to assist with the National Vehicle Recovery Service

19.0 Stranded Drivers

Motorists will be requested to remain with their vehicle until rescue teams arrive.

Resources will be directed to extricate cars with their occupants to Rest Centres under the direction of Gold Control in accordance with the Local Authority Emergency Plans. Support to this operation will be provided if requested by Gold Control. Gold Control will assess requests for assistance and prioritise rescue/recovery. All requests for assistance through the Police will be logged.

If winter maintenance vehicles are required to travel in the wrong way along Dual Carriageways, Police approval must be requested and if necessary Police escort under a "blue light" will be used.

Note – If Police assistance is not available then permission is required to travel the wrong direction along a Dual Carriageway. There will also be a safety assessment before entering the carriageway.

20.0 Abandoned Vehicles

See Area 1 Severe Weather Plan Section 2.1.2.6.

21.0 Emergency Rest Centres

Devon County Council has in place within its Winter Maintenance Snow Plan a Severe Snow Survivor Centre Plan to deal with extreme conditions which include facilities for rest centres at:

- A30 Okehampton College
- A38 Chudleigh (Haldon Hill) Chudleigh C of E Community Primary School
- A38 Ashburton South Dartmoor Community College

Cornwall County Council has Rest Centres at:

- A30 Bodmin
- A30 Launceston

Facilities at these rest centres include:

- First Aid Equipment
- Bedding
- Clothing
- Food and Water
- Heating
- Lighting
- Toilets
- Animal welfare provisions.

If there are welfare problems and road users require shelter during extreme conditions the Devon & Cornwall Constabulary, or Gold Control if operating will be informed, so that arrangements can be made with the Devon County Council Emergency Planning Officer (see Network Contingency Plan for telephone numbers) to open the centres.

The movement of any road users to Emergency Snow Survivor Centres will be co-ordinated with the Devon & Cornwall Constabulary, Devon County Council and Cornwall Council emergency planning teams. Support will be provided as required for this operation. See the Devon County Council Severe Snow Survivor Centre Plan for further information.

22.0 Debrief

After each period of severe weather and Snow Desk operation, EM shall carry out a de-briefing.

Personnel to attend:

- Duty Managers
- Duty Supervisors
- Communications Officer
- NCC operator
- Any other staff involved in the management of the weather emergency

Discussion Topics:

- Calendar of events
- What went well
- What did not go well
- Successes
- Failures
- How procedures worked
- How procedures can be improved
- Suggested instruction for participants.

B.1 SEVERE WEATHER DESK EXERCISES AND BRIEFINGS

Severe Weather Desk Exercises

Service Provider to plan and deliver a Severe Weather Desk exercise. This will primarily be to test the delivery and resilience of the Winter Service element of this Severe Weather Plan. Planning for the exercise **must** be in consultation with Service Manager, Emergency Planning Managers and the National Winter and Severe Weather Team.

Details for each season's Severe Weather Desk exercise will be issued by the National Winter & Severe Weather team during August. This will be in the form of a guidance note. This will provide the mandatory national objectives, and include objectives identified from the previous season –

Service Provider will plan exercises to test critical and vulnerable points in their winter response, and identified objectives, and strive to identify areas for improvement. Exercises are to be delivered by the end of October.

Severe Weather Briefings

Service Provider to hold Severe Weather briefing sessions with representatives from key stakeholders, including Traffic Officer Service, RCC, Local Highway Authorities, Emergency Services and Highways Agency Regional Press Officers in the Area 1 Network.

Full details will be provided within a guidance note to be issued by the National Winter & Severe Weather team during August. Briefings to be delivered by the end of November.

A PowerPoint presentation briefing template will be made available within the guidance note.

Service Provider to submit the list of attendees at the Severe Weather briefings to the National Winter and Severe Weather Team via email [REDACTED]. An example of the attendance register is shown below.

Register of Attendees – Severe Weather Briefings			
Date of Briefing			
Briefing Carried Out By			
Name	Signature	Organisation	Position Held

Feedback and Action Planning from Exercises and Briefings

Service Provider must capture the outputs and actions from exercises and briefings into action plans / reports and return to the National Winter and Severe Weather Team via email [REDACTED]. This will ensure issues can be considered for inclusion in the National Severe Weather Programme. A sample template for the 'Summary of Actions' is provided below.

Service providers may capture this information within a Severe Weather Action Plan (SWAP) as an alternative document, and make this available for review.

Summary of Actions – Severe Weather Briefings					
Ref	Category	Summary of Issue / Finding	Proposed Action required	Owner	Date to Action

B.2 WEATHER INFORMATION

EM requires a robust information system to provide it with accurate real-time data on both weather forecasts and actual road conditions. The road weather forecasting service to be procured by the EM is detailed below.

Weather forecasting

For the avoidance of doubt, there will be no bureau, transmission, service or data management fees incurred by organisations sending, receiving or viewing data provided via HAWCS.

The name of the Forecast Provider, forecaster, the date and the time of issue must be recorded with all forecasts. All forecasts shall advise validity as a start date/time and end date/time.

MeteoGroup will provide EM the level of forecast service as detailed below.

Frequency and intensity of forecast information

Field	Frequency
Morning Summary	06:00 Daily
24 Hour Forecast (Text)	Operational Winter Period: 06:00, 12:00 and 18:00 Daily Operational Summer Period: 06:00 Daily
24 Hour Forecast (Domains)	Operational Winter Period: 06:00, 12:00 and 18:00 Daily Operational Summer Period: 06:00 Daily
2-10 Day Forecast	12:00 Daily Operational Summer Period: 06:00 Daily
Site Specific Forecast	Operational Winter Period: 12:00 Daily Operational Summer Period: None

The parameters forecast will vary between the Operational Winter and Summer Periods. The table below details which forecast parameters are to be provided.

Forecast Parameter	Winter	Summer
Minimum road surface temperature	✓	✗
Maximum road surface temperature	✗	✓
Minimum air temperature	✓	✗
Maximum air temperature	✗	✓
Dew point / Relative humidity	✓	✗
Surface state	✓	✗
Wind speed (various)	✓	✓
Wind direction	✓	✓
Accumulations of snow (depth)	✓	✗
Visibility	✓	✓
Pollen count	✗	✓
UV factor	✗	✓
Snow level (ht above sea level)	✓	✗
Hazard – Ice	✓	✗
Hazard – Heavy Rain	✓	✓
Hazard – Freezing Rain	✓	✗
Hazard – High Temperature	✗	✓
Hazard – Hoar frost	✓	✗
Hazard – Fog	✓	✓
Hazard – Snow	✓	✗
Alert Level	✓	✗

24 Hour Forecast

The 24 hour forecast consists of two parts; a 24 hour text forecast and a domain forecast in tabular format. During the Operational Winter Period a detailed 24-hour text forecast and a domain forecast should be updated and delivered at 06:00, 12:00 and 18:00.

During the Operational Summer Period a detailed 24-hour text and domain forecast shall be updated and delivered daily at 06:00 covering the 24-hour period from 06:00 to 06:00.

Additional optional elements can be included at the request of Service Providers. These may include:

- Extension of forecast periods from the forecast issue time up to thirty six hours ahead;
- Addition of a 00:00 text forecast;

Text Forecast

The 24 hour text forecast will be valid for the ensuing 24 hour period from the prescribed issue time.

The text of this forecast must include:

- **Headline weather description**
- **A general synopsis, with timings, over the following 24 hours, including:**
 - Summary of the meteorological synoptic situation with timings of significant meteorological changes during the forecast period with particular reference to hazards such as snow, ice, hail, hoarfrost, freezing rain (including supercooled and rain falling on frozen surfaces), wind, fog, lightning and rain/showers which are expected to affect any of the agreed HAWIS forecast domains.
 - Expected road surface conditions indicating whether roads are likely to be dry or wet.
 - Onset, duration and intensity of hazards such as rain, hail, sleet, snow, rain falling on frozen surfaces and freezing rain, including potential accumulations of snow on road surfaces described in centimetres (assuming no treatment has been undertaken).
 - Relative humidity and dew point, including a warning of any predicted combination of low temperature and low humidity conditions (less than 60%).
 - The likelihood and timing of any precipitation or deposition on road surfaces and the likelihood of surface water on the carriageway.
 - If snow is forecast, its timing, amount and type and the direction from which the snow will develop, the likelihood of drifting and the height above which accumulation is likely.
 - Visibility – danger of thick fog (<1000 m visibility) or freezing fog formation, the location and timing.
 - UV factor and pollen count.
- **Average wind speed, direction and maximum gust speed at six hour intervals from the time of forecast.**
- **General confidence level in the forecasts (low, medium or high as per following table)**
- **General alert level**

Level 0 (Green)	There are no expected hazards on the road surface and road surface temperatures are expected to be above +1°C when confidence is high or above +2°C for all other occasions.
Level 1 (Amber)	<ul style="list-style-type: none">• Road surface temperatures are expected to be between +1°C and +2°C when the confidence is low.• Road surface temperatures less than or equal to +1°C and greater than or equal to zero.• Road surface temperatures below zero but road surfaces are expected to remain dry.
Level 2 (Red)	Road surface temperatures are expected to be below zero and road surface hazard(s) exist. Road surface hazard include ice, snow, freezing rain and hoar frost."

Domain Forecast

The domain forecast will have a variable validity period as follows:

Winter Operational Period

- 0600 domain forecast validity period will be 1200 to 0600
- 1200 domain forecast validity period will be 1200 to 1200
- 1800 domain forecast validity period will be 1800 to 1200

Summer Operational Period

- 0600 domain forecast validity period will be 0600 to 0600

By domain, the following information shall be provided, where appropriate including an indication of confidence level as High, Medium and Low and the period of occurrence (including zero crossing point):

- Minimum and maximum road surface temperature
- Minimum and maximum air temperature
- Accumulation of snowfall on road surfaces and height above sea level
- Occurrence of ice, heavy rain, high wind, freezing rain, high temperatures, hoar frost and fog
- Alert level

Additional optional elements can be included at the request of Service Providers. These may include:

- Urban/rural road surface temperatures
- Bridge deck temperatures

2-10 Day Forecast

A 2-10 day forecast will be obtained with the 24-hour forecast. The first element of this forecast will detail anticipated conditions in 24-hour periods for days 2-5. The 24 hour periods must be 1200 to 1200 during the Winter Operational Period and 0600 to 0600 during the Summer Operational Period. The parameters to be forecast will differ between the Summer and Winter Operational Periods and should comply with the table on page B.2-2. The forecast must include:

- A general synopsis and anticipated trends over the period with particular emphasis on the following hazards: Hoar frost, ice, snow, drifting, freezing rain, rain falling on frozen surfaces, heavy rain, fog and strong wind.
- Daily general alert level
- Maximum and minimum road surface temperatures
- Maximum and minimum air temperature
- Occurrence of snow, ice, heavy rain, high wind, freezing rain, high temperatures, hoar frost and fog
- UV Factor
- Pollen count
- Confidence level in the forecasts (low, medium or high)

A second, text element of this forecast will also include a general synopsis and anticipated trends over the 6-10 day period with particular emphasis on the following hazards: Hoar frost, ice, snow, drifting, freezing rain, rain falling on frozen surfaces, heavy rain, fog and strong wind.

Site Specific Forecasts

Detailed 24-hour site specific forecasts must be delivered between 12:00 and 14:00 for all primary environmental sensor stations. These forecasts apply for the Operational Winter Period and must include on an hourly basis:

- Road surface temperature
- Air temperature
- Dew temperature
- Surface state

Additional optional elements can be included at the request of Service Providers. These include:

- Wind speed
- Rain state
- Cloud state
- Cloud amount
- Textual site specific forecasts

Further Updates of Forecasts

Forecast updates apply to 24-hour forecasts and site specific forecasts. Whenever a change to any forecast occurs the text forecast will also be re-issued with explanatory notes in the headline along with any other associated changes to the forecast.

In the event of the update criteria being met the procedure shall be to notify the client immediately whenever the change will have an impact on proposed salting operations then re-issue the amended forecasts as appropriate. Notice shall be provided by telephone to the client no more than 1 hour following the criteria being met and the updated forecast shall be issued within a further hour. Updates should only be issued between 18:00 and 06:00 or during the overall hazard period; however the following shall apply in all cases:

The Forecast Provider shall take note of proposed EM actions and in the event of a weather forecast changing or actual weather occurring that could result in a change of action by the Service Provider, the Forecast Provider shall take appropriate action to inform the Service Provider in advance of the changed weather forecast.

The standard update criteria are as follows:

A change in the forecast or an actual event occurring that could result in a change in the action taken by the client. This includes changes such as:

- When hazardous conditions are sufficiently more intense or the timing has changed by two or more hours which, in the forecast provider's opinion, may impact on salting operations.
- When road state changes or snow, ice, heavy rain, high wind, freezing rain, high temperatures, hoar frost and fog are present when they have not previously been forecast.
- A road surface temperature crossing either the one degree or zero degree threshold two hours earlier than previously forecast or when not previously forecast to do so.
- A significant difference in any precipitation forecast which, in the forecast provider's opinion, may affect the salting times, e.g. showers lasting later into the evening than originally forecast.
- A significant change in any snow forecast, e.g. a change in timing, intensity, accumulations or the level to which it will fall.

- When the actual road surface temperature is between plus 5°C and 2°C or 0°C and minus 5°C, if the forecast and actual road surface temperature deviates by 2°C or more for a sustained period of more than 1 hour.
- When the actual road surface temperature is between plus 2°C and 0°C, if the forecast and actual road surface temperature deviates by 1°C or more at any point.

In addition, exceptions to normal practice are as follows:

- In the event of forecast winter hazard, such as frost, ice or snow, during the Operational Summer Period the 24-hour forecast, domain forecast and site specific forecast will revert to that of the Operational Winter Period

In the event of a primary forecast site failing for a period of over a month, the Forecast Provider shall transfer forecast provision to the secondary environmental sensor stations within the climatic domain.

Morning Summary

A morning summary must be issued between 05:00 and 06:00. The text of this report should include:

- A brief summary of weather experienced over the previous 24 hours
- Notification of any suspected faults in the Highways Agency Weather Information Service.

Traffic Officer Service Requirements

Some mandatory and optional elements of the service may be required by the TOS in the delivery of their duties. This information will be provided, where available, through HAWCS. The Service Provider shall therefore liaise with the TOS to identify any optional requirements they need for the Service Manager to consider.

24 Hour Consultancy Service

EM shall ensure that the Forecast Provider is available by telephone 24 hours a day, 7 days a week, 365 days a year (including leap years) for consultation on the weather conditions and details of forecasts. The Service Provider should ensure that the Forecast Provider provides a response within five minutes of any Service Provider enquiry.

End of Season Analysis

At the end of each Operational Winter Period, EM should ensure that the Forecast Provider produces an Operational Assessment Report. This report will include details on the accuracy of forecasts based on information contained in HAWIS. For each forecast site, this analysis should include:

- A graphical representation of actual versus forecast minimum road surface temperatures
- A graphical representation detailing the frost prediction accuracy by comparing forecast frost against actual frost conditions (i.e. frost/frost, frost/no frost, no frost/frost or no frost/no frost)
- The bias and root mean square error in the forecast of minimum road surface temperature.
- Outline of lessons learned and particular successes from the previous season.

The Service Provider should retain copies of the analysis and make them available to the Highways Agency if required.

Level of Accuracy

The accuracy of weather forecasts is fundamental to their usage in road weather forecasting, especially when applied to the Operational Winter Period. This section defines the measures that should be recorded and target results. The responsibility for ensuring the forecast supplier is meeting accuracy targets is with the Service Provider.

The terms below should be used as defined terms for the purposes of measuring accuracy consistently:

- e = Error between the coldest actual road surface temperature and the associated forecast road surface temperature
- n = Number of nights within the forecast period
- FF = Number of occasions where a frost was forecast and frost occurred (accurate)
- FNF = Number of occasions where a frost was forecast and no frost occurred (potential wastage)
- NFF = Number of occasions where no frost was forecast and frost occurred (potential risk)
- $NFNF$ = Number of occasions where no frost was forecast and no frost occurred (accurate)
- A critical night is a night where the actual road surface temperature in degrees centigrade falls within the range: $-5 \leq T \leq +5$
- A frost on this occasion is deemed to occur when the forecast or actual road surface temperature is at or below 0°C .
- The final forecast is either the 18:00 forecast, or any ad-hoc forecast prior to 00:00.

The accuracy measures shall be:

- Percentage of forecasts not delivered before the target time, including ad-hoc forecasts within prescribed timescale for delivery following identification.
 - Number of phone calls not answered by a forecaster within 5 minutes
 - Route Mean Square Error
 - The Route Mean Square Error (RMSE) is to be assessed on all nights based on initial forecast and final forecast.
- $$\left[\frac{1}{n} \sum_{i=1}^n e_i^2 \right]$$
- The equation for calculating the RMSE is:
 - Performance should be as close to 0 as possible, and should generally be less than 2.
- Bias
 - The bias is to be assessed on all nights based on initial forecast and final forecast.
- $$\left[\frac{1}{n} \sum_{i=1}^n e_i \right]$$
- The equation for calculating the bias is:
 - Performance should be as close to -0.25 as possible, and should generally be in the range +1 to -1.
- Probability of Detection
 - Probability of Detection (PoD) is to be assessed on all nights, and also just critical nights. PoD should be assessed on initial forecast and final forecast.

- The equation for calculating PoD is: $\left[\frac{FF}{(FF + NFF)} \right]$

- o Performance should be as close to 100% as possible, and should not be less than 87%.
- False Alarm Rate

- o False Alarm Rate (FAR) is to be assessed on all nights, and also just critical nights.

- o The equation for calculating FAR is:
$$\left[\frac{FNF}{(FF + FNF)} \right]$$

- o Performance should be as close to 0% as possible, and should not be more than 30%.
- o FAR should be assessed on initial forecast and final forecast.

- Accuracy

- o Accuracy is to be assessed on all nights, and also just critical nights. Accuracy should be assessed on initial forecast and final forecast.

- o The equation for calculating accuracy is:
$$\left[\frac{(FF + NFNF)}{(FF + NFNF + FNF + NFF)} \right]$$

- o The accuracy of road weather forecasts should be no less than 90%.

Occasions where less than one observation per hour for ten out of twelve hours between 18:00 and 06:00 will not be included in calculations. For periods where a potentially faulty sensor has been identified these may be discounted from the calculations providing a fault report has been raised with the HAWCS Provider.

Precipitation Radar, Satellite Images and Forecast Mapping

HAWIS will make the following services available to all users. The information has been procured centrally via the Met Office.

- Precipitation Radar

- o Actual (current and historic) radar will be available for the previous 2 hours with images at 5 minute intervals. Forecast radar images will be available for the coming 6 hours with images at 1 hour intervals. The images will show the intensity of precipitation and provide an indication of whether the precipitation will fall as rain, freezing rain, snow or sleet.

- Satellite Images

- o Visible light and infrared images for the entire UK, displayed on a mapping system. The images from the previous 2 hours will be available at fifteen minute intervals.

- Forecast Mapping

- o Synoptic charts / forecast mapping showing pressure (including an indication of weather fronts and areas of low or high pressure), precipitation, wind speed/direction and fog risk. Visibility, wind speed and wind direction forecast maps will be available at 3 hour intervals for the upcoming 36 hours, updated every 6 hours. Surface pressure / weather front forecast maps will be available at 12 hourly intervals for the upcoming 84 hours.

The above descriptions are the minimum information to be provided. The Service Provider will consider the information available via HAWIS and if more detailed, or alternative, information is required this should be procured by the Service Provider. Any additional forecast imagery will not be displayed via HAWIS therefore arrangements will be required to access it via the forecaster provider's website.

Network Based Forecasting

Network (or route) based forecasting is an emerging technology in highway forecasting. As a tool it provides a facility similar to thermal mapping, however as forecasts are generated at a far greater intensity (typically every 50-100m) the level of detail provided to decision makers is far greater.

Service providers may procure network based forecasting however all standard forecast requirements must still be met. Not all aspects of network based forecasting can be displayed by HAWIS. Where a Service Provider procures a network based forecast service, the domain forecast will be populated with each route as a separate domain. Arrangements should be made to access the remaining network based forecast information via the forecast provider's website.

Forecast Providers shall continue to provide weather forecasts for primary environmental sensors sites to enable data accuracy assessments.

Forecast Resilience

To provide resilience in the unlikely event of HAWIS being unavailable, the Service Provider will ensure they have arrangements in place to receive forecasts by alternative means. This may be via email, fax or the forecast provider's own website.

B.3 ANTI-ICING/DE-ICING MATERIALS

Whatever anti-icing / de-icing material is selected the Service Provider must ensure Area Operational Winter Service Vehicles (including Reserve Vehicles) are calibrated for the anti-icer / de-icer to be spread, taking into account the moisture content and grading. Checks of both spread rate and profile (skew / distribution) throughout the Operational Winter Period are encouraged to confirm that Winter Service Vehicles are spreading correctly.

Salt

Although pre-wetted salting is the Highways Agency's preferred treatment dry salting still provides an effective reactive treatment should ice have formed or snow settled. It is also considered an acceptable treatment where Winter Service Vehicles capable of pre-wetted salting are not available.

Rock salt should be treated with an anti-caking agent before delivery and comply with the current British Standard (BS 3247:1991). 6.3mm down is the preferred gradation for use on the Area 1 Network for pre-wet or dry treatments. If salt of that grading is not available either 10mm rock salt or 6-8mm marine salt make for effective alternatives, although service Providers should remain mindful that the latter may contain stones exceeding 10mm that might pose a problem.

Trials have shown that an acceptable distribution can be achieved for both the 10mm salt and the 6-8mm marine salt using the standard settings for 6.3mm rock salt, although calibration for the different gradation is recommended. Standard spread rates may be utilised. Although the Schmidt and Romaquip spreaders have a controller option to spread 6-8mm marine salt this has not been calibrated. Although the marine salt is purer than indigenous rock salt, meaning more sodium chloride (NaCl) is delivered to the road, reductions to spread rate are not considered appropriate.

Salt storage

Salt should be stored in barns or covered in protective sheeting in a manner that avoids the ingress of moisture into the material as far as is practicable. Salt must not be stored within 4.5m of hedges or within the rooting area of trees. The Service Provider must ensure salt stockpiles do not become contaminated with foreign matter likely to cause damage to other road users and / or the Winter Service Vehicles.

EM should monitor the moisture content and gradation of particles in the stockpile on a regular basis to confirm that the salt remains in an acceptable condition. Details of such monitoring should be recorded. Salt handling during storage should be minimised as it can cause salt loss and particle breakdown.

As salt is removed from stockpiles a safe slope on the material must be maintained to protect operatives from the risk of collapse of the stockpiles. Exposed outdoor stockpiles should be formed into the shape of long rectangles.

Careful consideration should be given to drainage to prevent pollution. Guidelines on this are available within the Environment Agency's "Pollution prevention guidelines highway depots: PPG10". The Service Provider should consider using any recycled wash water, salt laden drainage and other salt containing liquids as part of a pre-wet or liquid brine treatment regime.

Salt Stock

Under the AMOR, Minimum Contractual Salt Stock Levels have been calculated for each Area, these are summarised in the following table. If AMOR specification is not in place, either through tender or negotiated route for the area concerned, salt stocks will be proposed by the Service Provider to the acceptance of the Service Manager. Regular completion and submission of the Salt Capability Spreadsheet, which calculates Minimum Capability, will facilitate early identification and appropriate escalation of any difficulties that emerge in individual areas relating to the supply of salt. The Service Provider must set an appropriate Reporting Threshold, which considers all known risk to salt supplies. This level is not prescribed, as it is dependent upon local circumstances.

Area	Current Maximum Storage Capability (t)	Operational Salt Stock at Start of Season (t)	Minimum Contractual Salt Stock Level (t)
1			

Brine

Recent research identified that pre-wet spreaders are able to spread brine if the spreader is set up to do so, this may require modification of the current software to bypass the solid de-icer distribution on some vehicles. Service Providers should contact the spreader manufacturer for instructions on how to set up pre-wet spreaders to spread brine with solid de-icer in the hopper. The guidance included here is for making use of this additional benefit from those spreaders and is not solely for the benefit of Service Providers with liquid spreaders.

Brine is effective immediately after spreading and unlike solid de-icers can reduce the risk of ice formation without the need for trafficking, though can be more susceptible to wash-off after rain. Therefore, brine may be considered for an additional top-up treatment, to help activate solid de-icers, for areas with little or no traffic such as lightly trafficked slip roads and for lanes that are only trafficked for parts of the day, e.g. managed motorway hard-shoulder.

In addition, brine may be considered as a top-up treatment option in low temperature low humidity conditions, where solid de-icers, especially dry salt and to a lesser extent pre-wetted salt, may not dissolve and become effective. The use of brine as a top-up treatment will not be subject to the treatment time requirement.

The salt concentration of the brine has a greater influence on the amount of salt on the carriageway when spreading brine compared to pre-wet salt. This is because pre-wet comprises a 70:30 ratio of dry salt: brine therefore; the dry salt component is the major contributor to the salt on the carriageway. For a brine only treatment a brine concentration of 20% means the amount of salt on the carriageway is reduced by 13%, compared to spreading a brine concentration of 23%. It is thus recommended that brine of the 23% optimum concentration is used.

The ability of the pre-wet spreaders to spread brine, without modification to the spinner, is limited by the capacity of their brine pump meaning a maximum spread rate of approximately 40g/m² to a single 3.6m wide lane or 20g/m² to two lanes of total width 7.2m. Assuming a brine concentration of 23%, this equates to a nominal dry salt spread rate of 9.2g/m² and 4.6g/m², respectively. Table 5.5.1 illustrates the length of route that can be treated with brine using pre-wet spreaders, assuming a carriageway width of 3.6m.

Table 5.5.1 Approximate length of route that can be treated with brine using pre-wet spreaders

Spreader	Length of treatment (km) assuming 3.6m wide carriageway			
	Nominal spread rate = 9.2g/m ²		Nominal spread rate = 4.6g/m ²	
	1 Lane	2 Lanes	1 Lane	2 Lanes
6x4 pre-wet				
4x4 pre-wet				

Brine spreading is likely to be more susceptible to the effects of wind than pre-wetted salting. It is essential that careful consideration be given to the surface condition as the presence of moisture will dilute the brine application or the residual salt present on the surface. After rainfall, untrafficked areas are likely to remain wetter for longer than trafficked areas. Furthermore, many hard shoulders are on the low side of crossfalls so large areas of carriageway can drain over them.

Consideration must be given to possible differences in temperature between the untrafficked hard shoulder of a Managed Motorway and the running lanes of the carriageway. The temperature in Lane 3 of a three lane motorway can be up to 3°C lower than Lane 1 because of the lighter traffic flows. Without the traffic the temperature difference can be even greater such that an untrafficked hard shoulder can be up to 5°C lower than Lane 1; this is particularly evident on concrete carriageways. Similar temperature differences may be evident on slip roads.

Where accurate information is available on surface temperature and surface conditions appropriate brine spread rates may be determined using Table 5.5.2 below. It shows the minimum road surface temperatures at which freezing will not occur for brine spread rates of 20g/m² and 40g/m². It should be noted that the accuracy of spread, when using pre-wet spreaders for brine spreading, reduces when treating two lanes and the table accounts for this.

Table 5.5.2 Effectiveness of brine treatments

Water Film Thickness (mm)	Lane(s) Spread and Nominal Brine Spread Rate		
	1 at 20g/m ²	1 at 40g/m ²	2 at 20g/m ²
	Minimum road surface temperature at which freezing will not occur (°C)		
(Damp)			
(Wet)			

The water film thicknesses in Table 5.5.2 apply when a road is lightly trafficked. If there is no traffic, the water film thickness may be higher in frost conditions and after rainfall. A doubling of the water film thickness will approximately halve the minimum road surface temperatures shown above. However, if more water is present solid de-icers from previous treatments are more likely to dissolve to work with the brine to help prevent ice formation. Where accurate information is not available, especially if ice formation is suspected, it is recommended that top-up treatments are made at the maximum spread rate that can be achieved with pre-wet spreaders, namely 40g/m² for one-lane spreading and 20g/m² for two-lane spreading.

Brine Storage

Brine may be obtained and delivered pre-mixed from suppliers and stored in an appropriate tank or manufactured on site using a saturator or salt station. The use of a pure white salt (typically greater than 98.5% NaCl, e.g. marine salt) within saturators is recommended. The optimum, and recommended maximum, concentration for sodium chloride brine is 23%. Lower concentrations in excess of 20% are acceptable for pre-wetting treatments. To avoid variations in concentration due to stratification in the storage tanks the solution should be mixed thoroughly. Service Providers are recommended to drain and flush the brine tanks on spreading vehicles to prevent segregation and crystallisation, which may occur if tanks are left full for some time.

It is prudent to make regular checks of brine concentration, for example by checking the density of the solution calculated by simple weighing of a known volume or by using a measurement instrument (salinity refractometer or salt hydrometer) to give a specific gravity, to ensure the concentration is as required. For a concentration of 23% the density at 15°C will be 1176 kg/m³ (or specific gravity of 1.176). Slight adjustments are required for densities measured at temperatures other than 15°C.

Pre-wetted salt

Pre-wetted salt is accomplished by wetting dry salt (at a ratio of 30% pre-wetting agent to 70% dry salt, by weight) before application to the road surface. The pre-wetting agent is usually a solution of Sodium Chloride although a solution of Calcium Chloride (CaCl₂) may be an alternative for extreme temperatures (see below).

Alternative Anti-icing/De-icing Materials

Alternative anti-icing/de-icing materials are usually more expensive than salt. It is anticipated that any use of an alternative anti-icing/de-icing material will be restricted to isolated, specific circumstances (e.g. structures susceptible to corrosion) or when salt treatment are not fully effective (e.g. during extreme cold conditions – see Appendix B.5). Alternative anti-icing/de-icing materials that may be considered are summarised in the table below.

National Winter Service Research Group (NWSRG) have developed guidance for the use of alternative treatments in extreme cold. Pertinent parts of that guide have been included within the Severe Weather Plan for ease of reference including treatment matrices for spreading materials in conjunction with rock salt. (see 5.1.2, 5.1.3, 5.1.4 and 5.1.5)

Material	Cost*	Action/Effectiveness	Environmental Effects	Health & Safety
Calcium Chloride (Solid or Solution)	X20	Effective down to -31°C, but can leave oily residue resulting in slippery surfaces.	Corrosive to steel and aluminium. Damaging to vegetation	Potential irritant to skin eyes and respiratory tract Special storage requirements due its hygroscopic nature
Magnesium Chloride (Solid or Solution)	X20	Effective down to -15°C	Potentially damaging to concrete. Damaging to vegetation.	Potential irritant to skin eyes and respiratory tract
Calcium Magnesium Acetate (Solid)	X50	Effective down to -9°C, but less effective than salt below -5°C and requires a greater application rate.	Effectively non-corrosive compared to salt Relatively environmentally benign	Gloves and eye protection are recommended
Potassium Formate (Solution)	X20	Effective down to -15°C	Moderately corrosive to galvanised steel. Slightly lower Biological Oxygen Demand (BOD) than acetates less harmful to groundwater than salt	Overexposure may cause skin or eye irritation or skin rash
Propylene Glycol (Solution).	X40	Effective down to -15°C May have slight adverse effect on skidding resistance	Moderately corrosive to galvanised steel. High BOD and Chemical Oxygen Demand (COD) can be damaging to water systems	Ensure adequate ventilation; avoid breathing vapour, mist or gas; avoid contact with eyes, skin and clothing; and wash after handling
Potassium Acetate (Solution)	X20	Immediate action Effective for up to 48 hours to -15°C in suitable weather conditions	Effectively non-corrosive compared to salt Safe to aquatic life Biodegradable	Gloves and eye protection are recommended Solutions are safe to handle
Urea (Solid)	X25	Requires agitation by traffic Effectiveness: 10% solution to -3°C 25% solution to -7°C Little worthwhile effect below -7°C and ineffective below -11.5°C Remains effective for up to 12 hours in fair weather but repeat applications need to be more frequent in rain or strong winds.	Non-aggressive, but may produce ammonia and carbon dioxide. Ammonia is toxic to aquatic life. Ammonia further decomposes to nitrate which, promotes growth of vegetation, and creates an oxygen demand. Urea solutions may be detrimental to steel, plastics and concrete in some circumstances. Vehicles should not be left full of urea for any length of time, and thoroughly washed down after use.	Ventilation, due to ammonia Safe to handle but the pellets break into powder easily which becomes very slippery due to its high hygroscopic nature. Face masks and eye protection are recommended When heated to melting (i.e. fires) urea decomposes to form toxic substances. Only trained fire fighters, properly equipped with breathing apparatus should attempt to deal with fires in urea stores. Local fire fighting services should be informed of urea stock sites.

*Approximate cost compared to rock salt

The use of urea on the Network has generally been phased out due to the associated safety and environmental considerations. However, urea dampened sharp sand may be considered for use in the event of a salt crisis. If sand is used the treated section should be swept and the drainage gullies emptied, as soon as reasonably practicable.

B.5 SPECIAL CONSIDERATIONS

Network Features or surfacing that have a thermal response that is very different to the majority of the road network may require special consideration with regard to Winter Service. In addition, certain weather conditions require special consideration. This annex highlights some Network Features and the effects of various weather conditions on Winter Service treatments which Service Providers should be mindful of.

Network Features

Negatively textured surface courses

Carriageways with negatively textured surface courses require special consideration with regard to residual salt, as much of the salt is retained in the voids 'negative texture'. The brine trapped in the pavement voids is reliant upon the action of tyres over the surface to withdraw it to the road surface which is influenced by traffic levels. On a heavily-trafficked carriageway, a reasonable degree of residual salt will be "plucked" out so as to remain on the surface of the carriageway to combat the formation of ice. On lightly-trafficked carriageways the brine is retained in the voids.

Operational experience has indicated that negatively textured surface courses do not benefit from an increase in dosage above that required for hot rolled asphalt. Negatively textured courses should be treated with caution and residual material should not be relied upon to provide protection.

Porous asphalt

Porous asphalt has different thermal characteristics, meaning it cools more rapidly and warms slower, than dense surfacing. Compared with that of dense road surfaces it will typically fall below freezing point an average of half an hour earlier and rise above freezing point an average of an hour later. In extreme weather conditions (little winds, clear skies) the surface temperature is about 1°C lower than that of comparable dense surfacing.

For heavily trafficked roads the behaviour of porous asphalt surfacing barely differs from that of dense road surfaces. At low traffic intensities the loss of thawing agent into the voids of porous asphalt results in a greater likelihood of freezing of light precipitation (condensation, freezing fog) and greater quantities of treatment material being required to treat heavy precipitation. Target spread rates for porous asphalt are recommended to be plus 25% of the selected treatment.

Care needs to be taken at interfaces between porous asphalt and dense road surfacings because the horizontal transport of the treatment material is limited from the porous asphalt. The initial length of dense surfacing can have a reduced amount of treatment material as a consequence.

Poorly drained areas with the potential to re-freeze

Particular attention should be paid to lengths of road that are known to be susceptible to 'run-off' water from verges or central reserves and at joints between porous and impermeable surfacing. Efforts should be focussed on addressing the drainage problems, given very significant quantities of salt are required to prevent ponded water from freezing. Although the road itself may be dry, accumulations of snow may melt then run onto the road and re-freeze.

Similarly, care should also be taken when considering stockpiling snow adjacent to solid vertical barriers. There is the risk of melt water running across the carriageway with the possibility of it re-freezing.

Solid Vertical Barriers

The presence of solid vertical barriers (SVBs) can present operational difficulties to snow ploughing which will potentially result in snow being stacked on lanes adjacent to them. The Service Provider should consider whether any lanes may need to be abandoned during heavy snow whilst keeping the maximum number of lanes available to traffic and maintaining access and egress. Stacked snow should be removed at the earliest opportunity.

Traffic calming features

Caution should be exercised when planning ploughing operations in the vicinity of traffic calming features. The range of traffic calming measures that may be of concern to ploughing operations include:

- Speed cushions
- Two-way chicanes
- Central refuges
- Traffic islands
- Road narrowing
- Over-run areas
- Rumble strips

Low Temperature / Low Humidity Vulnerable sites

The location of vulnerable sites should be plotted on a map of the Area Network using data compiled of past incidents and / or other network intelligence and the associated location, where the conditions were considered a contributing factor to the incident. Information comprising the following elements should be recorded for each site:

- Site location (slip road, main carriageway, sharp bend)
- Accident record (highlighting weather related events)
- Surfacing type and condition
- Climatic, geographical or other features which may affect the temperature relative to the surroundings or the performance of the anti-icing agent (e.g. the site is sheltered, in a hollow, North facing, elevated, shaded by trees, in a cutting, has a high cross fall, low traffic volumes, lanes that are not trafficked for parts of the day)
- Spreading route length affected

Weather Conditions

Salting During and After Forecasted Showers When RSTs are Forecasted below +1°C (Wet sleet/snow & rain)

Wet Sleet/snow

Precautionary treat as per the Treatment Matrix

For the duration of these showers either a DS will be in the NCC or a SWD will be in operation, the DS/DM will monitor the precipitation radar and liaise regularly with the Forecast provider for a full understanding of the possible intensity and duration of the precipitation.

For the duration of these showers spreaders will remain out and treating the network until the showers have ceased.

For the duration of these showers spreader drivers will be contacted by the NCC/DS regularly for a report on road conditions.

Any reports of wet sleet/snow must be recorded on the Winter Maintenance & Severe Weather Log or, REPORTS OF WET SLEET/SNOW MUST BE PASSED TO THE DS who will instruct the appropriate action (continue salting) to the drivers.

On cessation of the showers the effected network will be treated as per the Treatment Matrix.

Rain

Freezing rain occurs very rarely but will result in extremely hazardous conditions, it may require roads to be closed before it arrives – see Section 5.2.3

Normal rain before, during and after precautionary salting will often result in salt being washed off the carriageway.

Heavy rain prior to salting - may still leave large amounts of water on the carriageway or leave seepage from verges etc for some time after the showers have ceased, if this is expected carry out the following:

- DS will closely monitor the precipitation radar, obtain observation reports from ISUs (if available) and discuss with the forecast provider to confirm when rain will cease and salting can commence.
- It is often the case that when RSTs are already low, salting may have to commence before the rain has completely stopped so that routes can be treated as much as possible before the RSTs dip below zero and the formation of ice can occur.
- Drivers must be made aware of this prior to salting and they must report to the NCC any rain activity; this will be relayed ASAP to the DS. The DS shall instruct the re-salting of routes where there have been such reports.

Rain during salting - (forecast or not forecast), carry out the following:

Drivers (including ISUs) must report rain activity immediately to the NCC who will relay it to the DS. The DS will speak directly to the driver and if necessary instruct the route be re-salted depending on intensity of the rain (it is believed that as little as 2mm per hour is sufficient to wash salt from the road surface). Generally anything more than very light drizzle will be a problem, even then there is no guarantee that the light drizzle will not develop into rain, therefore, the supervisor must check the precipitation radar and consult with the forecast provider, a record of this conversation must be kept by the DS and passed to the NCC for entry onto the Action Log. If there is any likelihood of salt wash off then the route must be re-treated.

Hail

Although an initial hazard, hail falling during daylight hours will result in a lowering of the RST but this should not be a problem (unless there are repeated showers at the same location) as road surface temperatures should already be above zero (HAWIS data) in which case the drop should be short-lived and the hail will soon melt before a spreader can be mobilised. If available a crew should be deployed to check and confirm road conditions.

However, hail during the night may (in the winter) fall onto RSTs below zero and will therefore remain as ice for a period of time. In these circumstances resources must be deployed, the RSTs checked on HAWIS and if RSTs are below zero a spreader deployed to treat at 20gms.

Cross winds

Cross-winds can affect the distance over which treatment is spread and to compensate it may be necessary to spread from a lane upwind (if appropriate) from that normally chosen. In exceptionally strong winds, it may be necessary to undertake a second treatment run with the spreader set asymmetrically into the wind.

Effectiveness of Salt after Rain

Spreading salt while the road surface is wet will dilute the brine formed meaning it may not be sufficiently concentrated to prevent ice forming. Table B.1 below illustrates this showing how much the freezing point of water can be depressed with an 8g/m² precautionary pre-wetted salt treatment for various water film thicknesses.

Table B.1 Effect of 8g/m² Pre-Wetted Salt Treatment on Freezing Point

WATER FILM THICKNESS (mm) [Surface Condition]	FREEZING POINT (°C)
[Dry / damp – well trafficked]	-4.7
[Wet – well trafficked]	-2.9
[Wet – lightly trafficked]	-2.0

Treatments should be delayed as long as practically possible after rainfall to enable trafficking to disperse surface water, which it can quickly do after rainfall ceases especially on well drained surfaces, so spray is minimal. If freezing is forecast after heavy rainfall, where trafficking cannot significantly reduce the water at the road surface successive treatments should be conducted.

The definitions of what constitutes a wet or damp road for Winter Service are:

- a wet road is one where minimal spray is evident and there is no water flowing across the surface
- a damp road is one where water is present that clearly darkens the road surface, but there is no spray or water flowing across the surface

Re-treatments should be considered after rainfall given salt can be washed from the road, reducing any residual salt effect.

Freezing Rain

EM will give special consideration to the treatments required before during and after freezing rain and rain falling on extremely cold surfaces.

Freezing rain in this country is a rare, but exceptionally dangerous phenomenon. It occurs when rain falls through a layer of very cold air, where it becomes super cooled (remaining a liquid below the usual freezing temperature). The rain freezes immediately on contact with a surface forming "black ice". The black ice can build up very quickly completely covering the road surface (since freezing on contact does not allow run-off). Service Providers should ensure their Forecast Provider use the term "freezing rain" for such super cooled rain, rather than to describe cold rain falling on frozen surfaces – although such cold rain can result in rapid icing (especially when surfaces are extremely cold), pre-treatments provide for a more effective treatment for that condition.

Freezing rain usually occurs along the line of an incoming warm front. If possible, to ensure maximum effectiveness of the salt, the advance treatment should be made in the same direction and immediately in advance of the weather front. Use should be made of weather radar where available, to help determine the timing of treatment. Consideration should be given to stationing vehicles at the point on the route where the weather front will first hit in order that timely treatments can be undertaken. All locations within Area 1 are vulnerable to the effects of these two severe weather events and clearly should they occur during the AM or PM peak periods their effects would be significant.

Timing of spreading in accordance with the Treatment Matrix guide is paramount. Initial communications between the DS, DM and forecast provider to closely monitor incoming weather through radar images must be implemented as soon as freezing rain conditions are considered a possibility. This must be backed up by feedback from staff at the scene e.g. works crews, spreader drivers etc feeding back live weather conditions to make optimum decisions on spreading times. The DM will normally take the lead in managing freezing rain operations. When freezing rain is anticipated the DS will advise the NCC of the following:

- Proposed treatment in accordance with the Treatment Matrix Guides, including anticipated start times
- Areas likely to be affected, route cards, road sections, beginning and direction of travel of weather front (this may affect start point and route for optimum timing of treatment)
- Assistance required from Devon and Cornwall Police in accordance with any agreed protocols

Measures for dealing with the conditions fall into three main areas: advance planning, operational arrangements and hazard mitigation.

Advance planning

Risk assessments must be undertaken by Service Providers to ensure the practices expected of operatives and other members of staff on the Area Network in such conditions are adequately recognised.

Operational arrangements

Specific measures that should be considered by the Service Provider include:

1. A Severe Weather Desk/Silver Command should be established in advance of the anticipated freezing rain or rain falling on extremely cold surfaces. For a particularly widespread or severe forecast it may be necessary to establish a Gold Command Contact with the Police, RCC/Traffic Officer Service, adjoining service providers and local authorities is to be made to inform them of the proposed action.
2. Prior to the arrival of the rain a pre-treatment is to be made in the same manner as would be made prior to snow falling. Where road surfaces are extremely cold, and salt may not provide for an effective treatment, alternative treatment materials should be considered.
3. Constant monitoring of the situation is to be made and an additional treatment is to be carried out immediately the rain commences and continued, subject to the Service Provider's risk assessment confirming that the risk level of staff operating be tolerated, until such time that the rain has ceased or the temperature of the road has risen above freezing.
4. Freezing rain usually occurs along the line of an incoming warm front. If possible, to ensure maximum effectiveness of the salt or alternative treatment material as appropriate, the advance treatment should be made in the same direction and immediately in advance of the weather front. Use should be made of weather radar where available to help determine the time of treatment. Consideration should be given to positioning vehicles on the point of the route where the weather front will first hit in order that timely treatments can be undertaken.
5. Some treatment material will inevitably be lost during and following treatment and therefore careful consideration needs to be given to the requirement for continued successive treatments.

Hazard mitigation

Informing road users of the hazard is paramount and Service Providers should implement proactive measures for example closing the road as the rain arrives and holding the traffic (rather than diverting) until such time as it is deemed safe to proceed. Such considerations will need to be made on a case by case basis taking into account local circumstances.

Under instruction from the DM or DS the NCC contact the RCC and request the activation of the permanent VMS on the M5, A38 and A30 to show the approved message (see below). The NCC will also activate the most appropriate Area 1 mobile VMS with the same message.

The existing established procedures for requesting VMS settings to be made should be followed well in advance. This will include advising the RCC where and when messages are required, what message is to be set and advising when the message may be cleared.

The most appropriate for use in these circumstances, defined in the "Policy and procedures for the use of variable message signs by the Regional Control Centres" are:

Nn J+ - J+
RISK OF ICE

This message must only be used when an incidence of ice on the carriageway, which presents a significant road safety hazard due to slippery conditions combined with lack of road surface treatment, is confirmed between two junctions upon the named road, e.g. freezing rain.

RISK OF ICE
SLOW DOWN

This message must only be used when a section of carriageway(s) is subject to weather conditions that are known to form ice, e.g. a wet surface combined with freezing temperatures, and it has not been possible to re-treat said carriageway (post rain washing original treatment away) in time to prevent ice forming.

It should be noted that the previously recommended 'SKID RISK SLOW DOWN' message is not a weather related message and therefore should not be used to advise of freezing rain or ice.

National Incident Liaison Officer (NILO) and/or the Highways Agency Press Officer should be contacted in order that the local media can be advised as necessary.

Where available use of variable mandatory speed limits should be considered. This will require arrangements and protocols to be established with the appropriate Police Control office or RCC as part of the advance planning procedures.

Consideration should be given to the use of rolling blocks and convoy arrangements to either hold or slow traffic down both just prior and during the event. This will require arrangements and protocols to be established with the appropriate Police authorities or RCC as part of the advance planning procedures.

Low Temperature combined with Low Humidity Conditions

Such conditions may occur at any time during the winter period though are most likely to occur in December and January at about the time of the winter solstice. Although not such a problem for pre-wetted salt treatments spreading dry salt can be of limited effectiveness in preventing the formation of ice when low temperatures and low humidity conditions combine. This is because dry salt requires moisture to 'activate' the dissolution process, and the formation of brine from dry salt takes increasingly longer as temperatures fall below -5°C . The effectiveness of salt decreases as temperatures fall and effective treatments may not be guaranteed with salt towards the lower end of the temperature band. The use of alternative treatment materials must be considered when spreading at (the lower of air or road surface) temperatures below -7°C or below -5°C in low humidity conditions (relative humidity $<80\%$). Under low temperature and low humidity conditions it is important to ensure the anti-icing agent is wetted so that it will adhere to the road surface and be able to enter into solution even in the event that moisture is not available from the road surface or the atmosphere.

If low humidity is considered a high risk to brine formulation, Service Providers should consider supplementary measures on previously treated routes to increase the moisture content at the road surface. Such measures may include the:

- Application of additional brine solution (max 23% salt solution) through a dedicated liquid sprayer or a brine-only treatment using a pre-wet vehicle. Arrangements with adjacent areas can be considered for those areas that do not have pre-wet vehicles.
- Provision of an additional preventative treatment earlier in the day than standard treatment times to utilise the generally higher humidity levels, higher temperatures and increased traffic flows. (Note that additional treatments should not replace standard pre-wet / dry salt treatments).
- Use of alternative anti-icing / de-icing materials such as potassium acetate or pre-wet salt with a calcium chloride brine rather than sodium chloride brine.

Sustained low temperatures

Salt is generally effective at preventing the formation of ice during sustained low temperatures, provided it has time to form a brine, which is helped where traffic is reasonably heavy. The time taken to form a brine becomes increasingly lengthy as temperatures fall and can be a significant time for extreme cold temperatures. As a result, salt becomes less effective at preventing the formation of ice during extreme cold with there being a point when alternative treatments must be considered and be available for use. There is no definitive temperature at which salt becomes ineffective, as it is dependant upon the dissolution process and therefore local conditions, e.g. time available to form brine, available moisture and traffic levels, though the National Winter Service Research Group (NWSRG) consider alternative treatment materials may be justified when temperatures fall to minus 7°C or below.

NWSRG have developed guidance for the use of alternative treatments in extreme cold. Pertinent parts of that guide have been included within the Severe Weather Plan for ease of reference including treatment matrices for spreading materials in conjunction with rock salt. (see 5.1.2, 5.1.3, 5.1.4 and 5.1.5)

Snow drifts and build-up of snow

Heavy snowfall, drifting and ploughing operations may result in a build up of snow in the carriageway and hard shoulders. If snow depths reach 120mm or when tackling drifts, or when working on gradients, it may be preferable to plough without spreading, since the weight of the treatment load will aid vehicle traction. Snow blowers are particularly suited to the clearance of blockages and for the removal of accumulations from the hard shoulder and carriageway where snow may be safely directed onto the verge (or possibly a wide central reservation).

Ploughing or snow blowing is not practical in built up areas given the snow is ploughed or thrown to aside respectively. Repeated applications of de-icer can remove heavy accumulations, but this type of treatment is not recommended as it is likely to provide an unacceptable surface for traffic. In such situations, consideration should be given to the use of a snow blower with the snow being directed into an accompanying lorry, followed as soon as possible by salt spreading.

B.6 TREATMENT OPTIONS/TECHNIQUES

This annex provides instructions and guidance on treatment techniques and refers to precautionary treatment, treatment of settled snow/ice and treatment of footways and cycle tracks. To be most effective, precautionary treatment should be applied before ice forms or snow settles on the road.

Techniques for Precautionary Treatments

Dry salt used to prevent ice or frost formation must first form a solution (brine) to become effective, resulting in a time lag following spreading. Therefore, pre-wetted salting is the Highways Agency's preferred precautionary treatment.

A decision to treat will depend upon many factors generally if road surface temperatures are predicted to fall below plus 1°C a precautionary treatment should normally take place unless:

- no moisture is on or is expected to be on the road; or
- there is sufficient residual salt on the road to deal with the expected conditions.

Opportunities to conserve salt may be realised on marginal nights, by considering:

- the introduction of patrols to direct focused treatment or
- delaying the decision to treat until there is greater certainty of need, other potential impacts, e.g. rain, are better known, whilst ensuring sufficient time is allowed to treat prior to ice formats or snow settles.
- 'Standby in depot'.

Selective treatment of parts of a route may be considered provided the Service Provider complies with the Technical Requirement. Identification of problematic areas can be informed by route based forecasting or thermal mapping to ensure these areas are treated appropriately.

For forecasts of significant accumulations of snow it is essential that sufficient treatment is applied before the snow starts to stick to the road as the treatment will melt the initial snowfall and provide a debonding surface beneath subsequent snow making the work of snowploughs much easier.

Due consideration should be given to traffic conditions and the timing of Winter Service operations. Wherever possible without detriment to the effectiveness of treatment, precautionary treatment should be undertaken in off-peak periods when disruption to traffic and to proper distribution of the treatment agents will be minimised. If precautionary treatment in heavy traffic is unavoidable it may be necessary to seek assistance from the Police, Traffic Officer Service and RCC (including motorway matrix signals and variable message signs) or to consider treatment in two runs (to ensure proper distribution of the anti-icing/de-icing agents).

To be effective, anti-icing/de-icing agents should be spread evenly and at rates that suit the prevailing or expected conditions. Care should be taken to ensure spread widths are neither too wide nor too narrow. The treatment should be carried out using automatic machines, the controls of which should be calibrated and clearly marked for distinct rates of spread, up to a maximum of 40g/m². Higher spread rates are unnecessary, wasteful and environmentally harmful and should be avoided.

Care should be taken at road works so that, in addition to areas currently being trafficked, all other areas likely to be opened to traffic are treated. Traffic management equipment, including cones and cylinders, may disrupt distribution of anti-icing/de-icing agents. Contra-flow systems should be treated in both directions.

Top up precautionary treatments

Brine is effective immediately after spreading and unlike solid de-icers can reduce the risk of ice formation without the need for trafficking. Therefore, brine may be considered for an additional top-up treatment, to help activate solid de-icers, for areas with little or no traffic such as lightly trafficked slip roads.

Although pre-wet spreaders are able to spread brine this may require modification of the current software to bypass the solid de-icer distribution on some vehicles. Service Providers should contact the spreader manufacturer for instructions on how to set up pre-wet spreaders to spread brine with solid de-icer in the hopper.

Two lane slip roads may be spread with brine asymmetrically to the right, i.e. driving in Lane 1 and spreading to Lanes 1 and 2. A one lane slip road may be spread with brine by driving in the lane to be treated. In both cases, the standard spinner settings for pre-wetted salting one lane symmetrically or two lanes asymmetrically to the right can be used. Tests have shown that it is not possible to spread brine asymmetrically to the left, i.e. to a hard shoulder from Lane 1, with the standard settings for pre-wetted salting.

If brine treatments replace, rather than supplement, pre-wetted treatments the salt concentration of the brine has a greater influence on the amount of salt on the carriageway. This is because pre-wet comprises a 70:30 ratio of dry salt: brine therefore; the dry salt component is the major contributor to the salt on the carriageway. For a brine only treatment a brine concentration of 20% means the amount of salt on the carriageway is reduced by 13%, compared to spreading a brine concentration of 23%. It is thus recommended that brine of the 23% optimum concentration is used for brine-only treatments.

The ability of the pre-wet spreaders to spread brine, without modification to the spinner, is limited by the capacity of their brine pump meaning a maximum spread rate of approximately 40g/m^2 to a single 3.6m wide lane or 20g/m^2 to two lanes of total width 7.2m. Assuming a brine concentration of 23%, this equates to a nominal dry salt spread rate of 9.2g/m^2 and 4.6g/m^2 , respectively.

Treatment of Snow and Ice

The effectiveness of treatments of snow and ice on the paved areas can be significantly affected by the method of application of the treatment. The following advice covers the operational techniques for removing snow and ice from paved areas. The techniques include:

- snow ploughing
- snow blowing

In addition, snow fences can be located to prevent snow drifting on to the carriageway and snow gates utilised to close a road when it is impassable due to snow.

During snow clearance operations, any build-up of snow across rail, bridges, gateways and along fences should be promptly removed and measures taken to avoid further build up. Throughout any operation to remove snow and ice, periodic situation reports should be provided for the Service Manager and road users.

It is important to continually monitor the air temperature during clearing and, as the temperature drops, spread rates should be increased, up to 40g/m^2 if necessary. Although current vehicle mounted infrared thermometers offer reasonably high accuracy levels Road Weather Information Systems or thermometers at suitable open sites in compounds, or similar systems are generally preferred.

The density of fresh untrafficked snow is about one-tenth of that of ice and the action of traffic assists in the process of melting and dispersal. However, even light snowfalls may call for ploughing where local drifting has occurred, or where snow has not been dispersed by traffic. This may occur where the traffic is reluctant to use lanes 2 or 3, or at night when traffic flows are light. During prolonged falls of snow, ploughing should be continuous to prevent build-up.

Particular attention should be paid to lengths of road that are known to be susceptible to 'run-off' water from verges or central reserves. Although the road itself may be dry, accumulations of snow may melt, run onto the road and then re-freeze.

Snow ploughing

The Service Provider should commence snow ploughing operations early enough to ensure snow accumulations do not exceed 10mm in any lane. If road surface temperatures are at or forecast to fall below 1°C the initial pass of the plough should be supplemented by salt spread at up to 20g/m^2 to prevent the compaction of any remaining snow and to aid dispersal by traffic and

subsequent ploughing. Otherwise ploughing without continuous salting may be considered and after an area wide treatment drivers may be instructed to salt as and when required (spot salting).

The ploughs provided by the Highways Agency are designed to operate at zero height setting. The Service Provider must ensure plough heights are set in accordance with the manufacturers recommendations. Care must be taken to avoid damage to road surfaces, road studs, roadside furniture and structures. At road works, traffic management equipment must not be disrupted.

If snow depths reach 120mm or when tackling drifts, or when working on gradients, it may be preferable to plough without spreading, since the weight of the treatment load will aid vehicle traction. When conditions permit, spreading should be resumed. Use of a snow blower may also be considered for the removal of deep snow.

Ploughing or snow blowing is not practical in built up areas. Repeated applications of de-icer can remove heavy accumulations, but this type of treatment is not recommended as it is likely to provide an unacceptable surface for traffic. In such situations, consideration should be given to the use of a snow blower with the snow being directed into an accompanying lorry, followed as soon as possible by salt spreading.

The formation of hard packed snow and ice should be a rare occurrence if the performance requirements are achieved. If it does occur, provided it is no more than 20mm thick and the air temperature is above minus 5°C, removal is possible by using successive treatments of salt at rates given in the Treatment Matrix Guide.

NWSRG have developed guidance for the use of alternative treatments in extreme cold, this includes guidance on how these may be used clear hard packed snow and ice. See NWSRG's Practical Guide for Winter Service Delivery.

Great care must be taken as the use of de-icing agents on snow or ice can produce an uneven and slippery surface. If there is any danger that the surface will become unacceptably slippery as a result of using de-icing agents, then the addition of abrasives should be considered. Application of the initial treatment technique should be resumed as soon as possible since abrasives contribute little to the removal of snow/ice and may block drains and gullies upon thawing. Abrasives should not be used on structures where there is any danger of blockage to drains. If abrasives are used the treated section should be swept and drainage gullies emptied as soon as reasonably practicable.

The technique used for multi-lane carriageways should be 'clearance by lane'.

In prolonged, heavy snowfall the priority will be to maintain lanes open in accordance with the red amber green performance requirements. In the majority of cases this will be the more heavily trafficked left hand lane (lane 1) and the first operation will be to plough snow from lane 1 to the hard shoulder, with clearance of other lanes continuing as conditions improve.

An alternative technique for a 3 lane carriageway with hard shoulders, particularly suited to echelon ploughing (2 or more vehicles moving in the same direction, one behind the other, in different lanes), is clearance in the following sequence:

- First: plough lane 2 snow to lane 1
- Second: plough lane 1 to hard shoulder
- Third: plough lane 3 snow to central reserve
- Fourth: plough hard shoulder snow to verge.

More than 2 lanes ploughed onto the central reserve could be hazardous to traffic by inviting drifting and melt water problems later. When clearing 4 or more lane carriageways consideration should be given to abandoning the outermost lane(s) rather than creating problems of excess snow on the central reserve.

Irregular windrows caused by ploughing passes, especially those that weave from one lane to another, are dangerous, as they may tempt drivers to overtake by squeezing into the partly cleared lane. Lanes should be completely cleared, and the windrows of snow remaining should form a smooth and

continuous line without sudden encroachments into the cleared path. On motorways, windrows can be left on hard shoulders, but there should be intermittent clearings to provide refuge for broken down or abandoned vehicles, and these should be cleared as soon as lanes 1, 2, and 3 are cleared and should not be left indefinitely.

Under no circumstances should windrows be created across off and on slip roads where they diverge/converge with the main carriageway.

Speeds of ploughing vehicles should be regulated, particularly at features such as underbridges, where snow could be thrown over the bridge parapet, and adjacent to the central reserve, where snow could be pushed into the opposing carriageway.

The objective is to clear all lanes and hard shoulders as soon as conditions permit. Clearance work should therefore proceed continuously, since a pause during a snowfall could lead to a build-up, which would take a disproportionately long time to clear. Packed snow, glazed by the wind, can be particularly difficult to remove.

Where clearing single carriageway roads, particularly those which have more than two lanes, snow clearing operations should be carried out so as to avoid any build up of snow in the centre of the road.

Following normal snow clearing efforts carried out during snow fall, echelon ploughing to the left whilst spreading salt is an option to clear snow from those lanes sacrificed at cessation of snowfall providing sufficient resources can be made available. This will provide, when combined with a rolling road block, a relatively rapid method of removing the stored snow. Service Providers should consider the training of operatives in echelon ploughing.

A phased approach may be required for 4 or more lane carriageways. Resources may need to be diverted from other areas of the Network where clearance work is complete or considered a lower priority in order to undertake such echelon ploughing.

Assistance must be sought from Traffic Officers or the Police to provide a rolling block when clearing snow from lanes which have been abandoned during heavy snow fall.

When ploughing, motorway warning signals can be displayed, so liaison with the RCC is essential. It is not always possible to keep these signals free of snow, but every effort should be made to advise motorists of the snowploughing vehicles ahead. Suitable advance warnings must be posted to inform motorists if lanes are not available for use. Variable Message Signs or Mobile Variable Message Signs should be utilised.

Special consideration needs to be given to ploughing in areas of contra-flow or other temporary traffic management where normal techniques and equipment may not be suitable.

Snow Blowing

Heavy snowfall, drifting and ploughing operations may result in a build up of snow in the carriageway and hard shoulders. Snow blowers are particularly suited to the clearance of blockages and to the removal of accumulations from the hard shoulder and carriageway where snow may be safely directed onto the verge (or possibly a wide central reservation).