

Kent Underground Research Group:
Underground Investigation
Procedures and Safety Protocols.

Introduction

This document outlines the Kent Underground Research Group's underground investigation procedures and safety protocols.

The Kent Underground Research Group are frequently asked, at short notice, to examine, report on, and survey underground sites for various bodies including Local and County Authorities, landowners and contractors.

KURG has studied the hazards likely to be encountered during underground investigations in Kent and south-east England in some detail over many years and have produced a **General Risk Assessment and Safe Method of Operation** which covers the various types of underground features¹ to be found.

Where time is not an issue a site specific assessment will be produced. Often there are tight time constraints which do not allow a full specific site Risk Assessment and associated Safe Method of Operation document to be produced before the proposed visit.

1 Including: Deneholes and Chalkwells, Chalk mines, Chalk tunnels associated with quarries, Limestone mines, Ragstone and Sandstone mines, Sand mines, Wells, Ice-wells, Cisterns, Cess-pits, Air-raid shelters, Bunkers, Cellars, Crypts, Conduits and Drains.

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Kent Underground Research Group

The Kent Underground Research Group was founded in 1981 to promote the study of the origins, history and uses of underground sites and associated surface features, especially within the ancient county of Kent.

The members are a mix of Speleologists, Archaeologists and Mining Historians who carry out academic research as well as fieldwork. They conduct underground surveys and investigations at their own risk and do not charge for their expertise.

All investigations are carried out within the guidelines set out by the **National Association of Mining History Organisations**. (NAMHO) *See Appendix 2*

Members are covered by Public Liability Insurance of £5,000,000.

The members are a unique mixture of the practical and academic. On the active side they explore and survey underground features for which they have the necessary skills and equipment. Some projects call for technical expertise in the use of pumps, winches, timbering, etc. Safety is a very big feature in the Group's activities and new members are taught the skills by others with many years' experience. On the academic side, they carry out documentary research in local and national archives. All these skills are brought together to publish the history of sites in the Group's reports. The Group produces regular Newsletters and also larger Research Reports are occasionally produced on specific subjects where the content sufficient to warrant it.

The Group is willing, at short notice, to visit sites where they can advise on the origin and extent of an underground feature. Although they concentrate on Kent, the Group has been called to sites further afield. There are a number of experienced Field Officers who carry out the initial visit and, if further work is needed, they will arrange for other members to join them to carry out exploration and surveys.

The Group has a great deal of experience and knowledge in the field of underground exploration and have produced specialist reports for such bodies as: InterRoute Ltd, National Trust, Kent County Council (Highways), Kent County Council (Heritage Conservation,) Fort Amherst, Crossness Engine Trust, Canterbury Cathedral, Thanet District Council, Bovis Homes, University of Greenwich, Hartley Parish Council, and Maidstone Borough Council. The Group also manufactures and installs steel grills over open shafts on behalf of the Kent Bat Group.

KURG Investigations

Measured Surveys

A measured survey will be made using accepted cave survey techniques to a **British Cave Research Association** standard (*see Appendix 3*) which will plot the underground structure and any historical and archaeological features.

Note: Whilst the survey will show the general layout of the underground site, the limitations of the methods used may render the survey unsuitable for any subsequent engineering purpose.

Archaeological Survey

The underground structure and any associated surface features will be examined by a KURG archaeologist who will endeavour to date the site and determine its original and any subsequent usage.

Any artefacts found in-situ will be recorded and photographed in context and will not be removed from the site without the express permission of the landowner. Removal of artefacts would only be undertaken in extreme circumstances.

Structural Assessment

During the investigation notes will be made of any obviously unstable areas, loose or missing brickwork, roof falls etc.

Note: Whilst KURG members are experienced in investigating underground structures they are not structural engineers or engineering geologists so that any opinions given on stability will be based on simple observations only. KURG will normally suggest that a professional structural survey be carried out after the Group's visit if stability is considered an issue.

Post Investigation

As soon as practically possible KURG will draw up any measured survey and produce a report of the investigation, copies of which will be provided to the landowner, tenant or contractor.

No external publication will be made of any survey, report, or photographs without the specific permission of the landowner, tenant or contractor.

Unless otherwise agreed KURG retains the copyright of any such survey, report, photographic record etc.

General Safety Notes

Pre-Site Visit

The team leader will gather as much information as possible on the site and underground feature before the visit. This may be from the landowner, tenant, contractor or agent and from any archive research that can be accomplished in the time available.

Personnel

The Kent Underground Research Group (KURG) team are all competent speleologists with a great deal of experience in underground exploration and recording. Several members of the team are also members of the South East Cave Rescue Organisation (SECRO).

Members entering underground sites do so entirely at their own risk.

KURG members are covered by Public Liability Insurance (administered by the **British Caving Association**) for £5,000,000 covering underground activities.

All members involved with the investigation will read, and agree to comply, with the provisions of the Risk Assessment and associated Method Statement.

Members should all be up to date with anti-Tetanus injections.

Personal Protective Equipment (PPE)

High visibility vests/jackets to be worn on site where appropriate.

All members will wear safety helmets to the required BS standard. Suitable stout footwear will be worn. Electric cap-lamps will be used for personal lighting, normally of the type used by the British mining industry.

Back up lighting will be carried.

In sites in which there is a risk of contracting Wiels disease, gloves and suitable clothing must be worn at all times.

Equipment

All ladders, belays, tethers, harnesses, ropes etc. used are manufactured to the relevant BS standard and will have been regularly inspected/tested and approved by the KURG Equipment Officer.

All ladders, SRT lines etc. will be rigged by an experienced team member and checked by the climber before descent.

Ladders, SRT lines shall always use different anchor points to the lifeline.

A Mining Flame Safety Lamp will be used underground to monitor for low oxygen / explosive gases.

Winches, ventilation equipment will be under the control of an experienced member trained in their use by the KURG Engineer.

Communications

Whilst voice communications will be sufficient in most circumstances radios will be used for communicating down deep shafts. In case of radio failures an agreed system of whistle signals or tugs on lifeline to be adopted. (*See Appendix 2 - NAMHO Guidelines*)

Confined Spaces

KURG members are experienced, competent, speleologists who are used to exploring and surveying in extremely tight spaces.

Whilst the KURG is a volunteer group and members are not paid contactors or staff as applicable to the **Health and Safety at Work Act**, the KURG are mindful of the provisions of the **Confined Spaces Regulations 1997** and the guidance notes given in the **Confined Spaces Regulations 1997 Approved Code of Practice, Regulations and guidance** published by the Health and Safety Executive (Second Edition 2009) and have adopted a safe system of operation underground. (*See Appendix 1*)

General Risk Assessment – Methodology

1. Identify Hazards.
2. Identify those at risk
3. Identify potential outcome of the Hazard (**H**) and give a numerical value.
Give a numerical value to the probability of occurrence. (**P**)
Multiply the two values together to arrive at the initial risk rating. (**IR**)
4. Where the risk is medium or high, identify the control required to reduce the risk or do not proceed with investigation.
5. Repeat the calculation after controls implemented to arrive at Residual Risk Rating. (**RR**)

Those at Risk	
Landowner/Agent/Contractor (L)	
Surface Team Members	(ST)
Underground Team Members (UT)	

Potential Outcome	Numerical Value
Injury needing medical attention	2
Injury - off work 5 days	3
Serious injury/long term sickness	4
Fatality	5

Risk Rating	
1-5	Low
6-12	Medium
12+	High

Likelihood/Probability	Numerical Value
Unlikely	1
Low possibility	2
Possible	3
Probable	4
Near certainty	5

Note: If calculated Residual Risk is 12 or more investigation will not take place.

If 6 – 12 investigation may proceed but with great caution at the discretion of the team leader.

General Risk Assessment

(To be Read in Association with the General Method Statement)

Note: During any underground investigation unforeseen hazards may be encountered. If a new hazard is identified the team leader will assess the hazard and take measures to minimise the risk. If the risk cannot be controlled the investigation will be abandoned.

Identified Hazard	Possible Effect	H	P	IR	Control	H	P	RR
Surface Those at Risk: L, ST, UT								
Open Shafts or Voids	Risk of falling down open shafts	4	3	12	Surface Control Team to prevent non-essential persons from approaching the shaft. (minimum 3.0m depending on site limitations)	4	1	4
Debris, uneven ground	Risk of trips and falls	2	3	6	Visual Inspection and Safety briefing	2	1	2
Vertical Shafts Those at Risk: UT								
Oxygen Deficient Atmosphere	Geology in Kent precludes formation of Harmful gases except CO ² in disused well shafts. Risk of asphyxia or CO ² poisoning	5	2	10	Shaft air to be tested by Miner's Safety Lamp. If necessary forced air ventilation via KURG air pump to be deployed to clear shaft.	5	1	5
Loose or unstable Shaft Lining	Risk of falling debris or collapse of lining.	4	3	12	Visual inspection, careful positioning of ladders or SRT lines. If necessary lining to be secured by suitable shoring erected under the direction of the KURG Engineer.	4	1	4
Descending / ascending	Risk of falls from ladder/SRT line	4	2	8	All climbers to be life-lined under the control of a suitably experienced member.	4	1	4
Falling Debris	Risk of being hit by falling debris	3	3	9	All climbers to wear helmets to the required BS standard. All non-essential persons to be kept away from shaft top.	3	2	6

Identified Hazard	Possible Effect	H	P	IR	Control	H	P	RR
<u>Tunnels, Passages and Mine Galleries</u> Those at Risk: UT								
Oxygen deficient atmosphere.	Geology in Kent precludes formation of Harmful gases except CO ² in disused wells Shafts. Risk of asphyxia or CO ² poisoning	5	1	5	Air to be tested by Miner's safety Lamp. If Oxygen deficient atmosphere is found and underground space is larger than the KURG forced air pump can clear the investigation will be abandoned.	5	1	5
Unstable Roof, walls or old Supporting brickwork	Risk of injury from debris falling or serious collapse.	4	3	12	Visual inspection by experienced member. If considered too hazardous the investigation will be abandoned.	4	2	8
Uneven Floor, Debris	Risk of injury from trips and falls	2	2	4	Visual inspection and safety briefing	2	1	2
Old electrical cables, switchgear or plant	Risk of electrical shock from live or induced currents	5	3	15	Safety briefing. Treat all cables etc. as 'live'	5	1	5
Biological	Risk of contamination from animal carcasses, Weil's disease (Leptospirosis), etc.	3	2	6	Safety briefing and suitable PPE	3	1	3
Chemical	Risk of contamination from discarded pesticides or chemicals.	3	2	6	Safety briefing and suitable PPE	3	1	3
Asbestos	Risk of mesothelioma.	4	2	8	Safety Briefing and suitable PPE including masks if asbestos suspected	4	1	4
Ordnance	Risk of explosion and serious injury from old dumped ordnance	5	2	10	Safety briefing and visual inspection. If Ordnance found site to be evacuated immediately	5	1	5
Use of Lasers	Risk of eye discomfort if viewed directly.	2	2	4	Surveyor will clear target area of all persons and give loud warning call before Laser fired.	2	1	2
Light Failure	Risk of trips, falls in dark	2	2	4	All persons in underground team will carry secondary light source.	2	1	2

General Method Statement and Safe Operational Procedures for Underground Investigations

(See also Appendix 1 - KURG: Confined Spaces Regulations and Approved Code of Practice)

General

KURG investigations will follow the guidelines for the Underground Exploration of Old Mines published by the **National Association of Mining History Organisations (NAMHO)** See Appendix 2.

<http://www.vmine.net/namho-2010/guidelines.asp>

Procedures

Before commencement the designated team leader will give a comprehensive briefing, covering procedures and safety protocols together with any site specific issues.

Surface

At least two responsible members will be in charge of the surface operation (Surface Control) and will be equipped with fully charged mobile phones to alert the emergency services in the event of any incident. It will be prudent for members with pre-existing medical conditions to inform Surface control (i.e. Allergic to penicillin etc.)

A first aid kit will be available on the surface.

Surface Control will keep the area around the entrance / shaft clear of non-essential personnel (minimum of 3.0m depending on site limitations) Members of the public not to be allowed on site.

Surface Control will record the names and time of entry and egress of, and obtain a signature from, all those entering the underground site. Surface Control will require all members on site to provide proof of up to date Public Liability Insurance.

Note: A member's signature on the entry / exit sheet will also signify that the member has read, understood and agreed to comply with, the procedures outlined in the Risk Assessment and Method Statement.

Entry Shaft

The shaft top and any shaft lining will be carefully inspected. If necessary a platform will be erected over the shaft so that any ladders or SRT lines run down the centre of the shaft. If the condition of the lining is considered too unstable the lining to be secured by suitable shoring erected under the direction of the KURG Engineer. If such procedure unfeasible, investigation to be abandoned

The air quality in the shaft will be tested for an oxygen deficient atmosphere and if found necessary the KURG air pump will be deployed to supply forced air into the shaft to ventilate. If unable to ventilate the shaft the investigation will be abandoned.

The team leader will descend first to assess stability and check for possible unforeseen hazards.

All climbers to be securely life-lined by experienced member for any climb exceeding 2m. Standard caving commands to be used.

Only one person to be on a ladder at any one time.

Communication between surface and shaft bottom will be by radio or simple voice commands. In the case of radio failures in deep shafts agreed whistle signals to be used.

Members underground must keep clear of shaft bottom unless ready to climb.

Underground Tunnels, passages, mine galleries

Safe practise dictates that unless the site is very small in extent, the minimum number underground should be four persons. At least one member of the party shall carry a basic First Aid kit.

If poor air is suspected the team leader will enter first to test for an oxygen deficient atmosphere and will be secured to a safety line until atmosphere declared safe.

Air quality to be constantly monitored for an oxygen deficient atmosphere. If forced air ventilation is insufficient to clear any poor quality air the investigation to be abandoned.

The underground team leader will assess the stability of the roofs, walls and any supporting brickwork and will determine whether safe to continue investigation. If considered too unstable the investigation to be abandoned.

In some old shelters and bunkers asbestos can be encountered. In the damp atmosphere underground airborne fibres are extremely unlikely unless the source is disturbed. If asbestos is identified the team leader will brief the team not to touch it and to wear suitable protective masks.

If safe to do so the underground team will conduct a measured survey and will record any historical and archaeological features and make a photographic record.



Emergency Procedures

Surface control will be equipped with at least one fully charged mobile phone in order to contact Emergency Services if necessary. A First Aid kit will be available on the surface.

Accident/medical Emergency on Surface:

- For minor injuries (small cuts, grazes etc.) First Aid will be administered on scene.
- For more serious injuries or medical emergencies First Aid will be administered and Surface Control will contact Emergency Services via mobile phone giving site location and full details of injuries / medical emergency and condition of casualty. Casualty will be kept warm and condition monitored until arrival of emergency services.
- Surface Control will keep a record of the incident.

Accident/medical Emergency Underground:

- In the unlikely event of any accident or medical emergency underground first aid will be administered and surface control informed immediately.
- For minor injuries (small cuts, grazes etc.) the wound will be dressed and casualty will be assisted to the surface where further assessment will be made.
- For more serious incidents first aid will be administered at the scene and surface control will call the emergency services (Kent Fire and Rescue and Kent Ambulance plus South East Cave Rescue if necessary).
- Surface Control will pass details of locality giving site location and full details of injuries / medical emergency and any known pre-existing medical conditions or allergies and the condition of casualty and treatment given.
- Casualty will be kept warm and condition monitored until medical aid arrives.
- Unless loss of life or rapid deterioration of casualty's condition is likely the casualty should not be moved until medical aid arrives.
- Surface Control will keep a record of the incident.

Insurance Details

KURG members are insured for **Public Liability** to a limit of indemnity of **£5 million** for surface and underground activities.

The scheme is administered by the **British Caving Association**:

*BCA,
The Old Methodist Chapel,
Great Hucklow
Buxton, Derbyshire,
SK17 8RG
Tel: 01298 873810*

www.british-caving.org.uk

Kent Underground Research Group Contact Details

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Appendix 1

Compiled by Paul Thorne, KURG Chairman.

KURG: Confined Spaces Regulations and Approved Code Of Practice.

The Confined Spaces Approved Code of Practice (ACOP) gives advice and recommendations. If you follow the advice you will be doing enough to comply with the law in respect of those specific matters on which the Code gives advice. You may use alternative methods to those set out in the Code in order to comply with the law.

Under these Regulations a 'confined space' has two defining features. Firstly, it is a place which is substantially (though not always entirely) enclosed and, secondly, there will be a reasonably foreseeable risk of serious injury from hazardous substances or conditions within the space or nearby.

The Hazards

The hazards that the Confined Spaces Regulations address arise through the combination of the confined nature of the place of work and the possible presence of substances or conditions which, taken together, could increase the risk to the safety or health of people

The specified headings are listed below, together with the relevance to the activities and types of sites which KURG Field Officers are likely to investigate.

Flammable substances and oxygen enrichment

Very unlikely to be encountered on KURG investigations, residual risk very low.

Toxic gas, fume or vapour

The only hazardous gas likely to be encountered is CO² concentration above atmospheric normal. This may occur in a confined unventilated space full of rotting wood for example. KURG Field Officers are very aware of this hazard, and the effect that it has on the human physiology. This leaves a very low residual risk.

Oxygen deficiency

Occasionally encountered on KURG investigations, particularly in wells, and unventilated underground spaces with rotting wood or rusting iron. KURG are fully experienced in checking this with a flame safety lamp, and have competence in using forced ventilation equipment to remedy the risk. Residual risk very low.

The ingress or presence of liquids

Unlikely to be encountered on KURG investigations. Several KURG members are very experienced cavers, well aware of flood risk in some caves. However the sites investigated by KURG do not usually have this risk. Residual risk very low.

Solid materials which can flow

Very unlikely to be encountered on KURG investigations, residual risk very low. Risk of unstable roof could be loosely classified under this heading. KURG are experienced in assessing the stability of disused underground spaces, and would abandon investigation, or install shoring if necessary. Residual risk medium to low.

Presence of excessive heat

Extremely unlikely to be encountered in KURG investigations. Residual risk very low.

Electricity

Exposed buried power cables are sometimes encountered in roadside subsidence's or disused underground man-made structures. KURG have a qualified Electrical Engineer able to advise on safety measures. Residual risk very low.

Mechanical equipment and noise

It is sometimes desirable to undertake excavations to further investigate underground spaces. KURG have some specially made equipment for these purposes. All equipment is safety tested by a qualified engineer to ensure its suitability. Excavation methods ensure safe working practices are enforced. Residual risk very low.

Dust

KURG are aware of the risk that dust or asbestos may be present in the places that KURG might investigate. Suitable respiratory protection would be used where appropriate. Residual risk very low.

Working space

KURG investigations often gain access through very small holes or passages based on an industrial access measure. However many KURG members are experienced cavers where such small dimensions are the norm and cause no difficulty. Residual risk very low.

Risk assessment

Avoid work in confined spaces if possible to completely remove the risk. Not usually applicable or appropriate for the low residual risk sites investigated by KURG. Sometimes a remotely operated camera has been utilized by the group.

Identify the measures needed to be taken by means of a suitable and sufficient assessment of all risks. Refer to KURG detailed risk assessment and method statement documents.

Devise and operate a safe system of work to mitigate the risks. This must be undertaken by a suitably competent and experienced person:

A competent person for these purposes will be someone with sufficient experience of, and familiarity with, the relevant processes, plant and equipment so that they understand the risks involved and can devise necessary precautions to meet the requirements of the Confined Spaces Regulations.

KURG Field Officers are deemed competent persons to assess the limited scope of confined spaces which are to be expected to be met on KURG investigations. If conditions beyond the experience of KURG field officers are met, then expert advice will be obtained or the investigation will be halted.

Factors to be assessed. The hazard section of this document addresses most relevant factors. The factors listed below as referenced by the Confined Spaces Regulations are briefly commented on in their context of KURG investigations:

Is the concentration of oxygen normal – KURG will always check for oxygen deficiency.

Previous contents - Unlikely to be relevant.

Residues - Unlikely to be relevant except possible farm residues.

Contamination - Unlikely to be relevant except asbestos.

Oxygen deficiency and oxygen enrichment – deficiency always checked.

Physical dimensions - Checked where likely to be a problem.

Cleaning chemicals - Unlikely to be relevant

Sources of ignition - Unlikely to be relevant.

Ingress of substances - Unlikely to be relevant.

Roof and passage stability - (*not mentioned in Confined Spaces*) – critically important.

Need for emergency rescue – KURG are fully aware of the need for this to be considered and suitable measures to be put in place.

Safe entry into confined spaces.

Where it is not reasonably practicable to avoid entering a confined space to undertake investigation, KURG Field Officers are responsible for ensuring that a safe system of entry is used. In considering a safe system of entry, they should give priority to eliminating the source of any danger before deciding what precautions are needed for entry.

Precautions to be included in the safe system of entry:

The precautions required in a safe system of entry will depend on the nature of the confined space and the risk assessment. The Confined Spaces regulations go into various details regarding, for example use of solvents for cleaning, right up to welding inside a chemical vessel. These scenarios are irrelevant to the types of investigations undertaken by KURG.

The headings considered in the Confined Spaces Regulations are listed below and examined and commented on with relevance to the investigation activities undertaken by KURG Field Officers:

Supervision – KURGs more experienced members train those less experienced. The training includes, but is not limited to; vertical access, gas detection, ground stability assessment, and safe excavation and shoring methods.

Competence for confined spaces working – Based on 30+ years of experience. This experience includes a wide variety of situations, structures and cavities.

Communications – direct voice, radios or telephones used.

Testing/monitoring the atmosphere - Flame safety lamp used.

Gas purging – forced ventilation equipment used when necessary.

Ventilation – forced ventilation equipment used when necessary.

Removal of residues – not usually relevant.

Isolation from mechanical and electrical equipment – undertaken where necessary.

Selection and use of suitable equipment – specialist equipment is used by KURG.

Personal protective equipment (PPE) and respiratory protective – as above.

Portable gas cylinders and internal combustion engines – not relevant.

Gas supplied by pipes and hoses – not relevant.

Access and egress – competent with specialist caving equipment for vertical access. Fully equipped with safety equipment and competent with self-rescue techniques.

Fire prevention – not normally relevant.

Lighting - specialist caving lighting headsets always used for hands-free operation.

Static electricity – not relevant as we do not enter explosive atmospheres.

Smoking – not permitted underground on any KURG investigation.

Emergencies and rescue – KURG includes members of the South East Cave Rescue team.

Limited working time – not relevant.

Emergencies and rescue

The arrangements for the rescue of persons in the event of an emergency, required under regulation 5 of the Confined Spaces Regulations, need to be suitable and sufficient and, where appropriate, there will also be a need for the necessary equipment to enable rescue procedures to be carried out.

Regulation 5 Emergency arrangements

Arrangements for emergency rescue will depend on the nature of the confined space, the risks identified and the likely nature of an emergency rescue. Account needs to be taken not only of accidents arising from a specified risk, but also any other accident in which a person needs to be recovered from a confined space, for example, incapacitation following a fall. To be suitable and sufficient the arrangements for rescue and resuscitation should include consideration of:

Raising the alarm and rescue – good communications are essential.

Safeguarding the rescuers – any rescue team must be fully informed of the hazards.

Fire safety – not generally relevant to KURG investigations.

Control of plant – only relevant to specialist equipment used by KURG when needed.

First aid – KURG Field Officers and / or members with First Aid Experience will administer emergency Aid if needed.

Public emergency services – will be called if needed, including South East Cave Rescue (SECRO).

Training – Field Officers' skills are constantly reviewed and updated and members appraised of rescue techniques and emergency procedures.

Rescue equipment will usually include lifelines and lifting equipment (since even the strongest person is unlikely to be able to lift or handle an unconscious person on their own using only a rope). KURG Field Officers will have specialist knowledge so as to be able to initiate immediate self-rescue of an injured person.

Some material has of necessity been extracted from the Confined Spaces Regulations and associated ACOP, and copyright remains with the original documents and their creators; the Health and Safety Executive. The purpose of this document is to demonstrate the compliance of KURG's investigation activities with those regulations.

Paul Thorne, 23rd March 2013.

Appendix 2

NAHMO Guidelines

Underground Exploration - Novices

If you have never explored a disused mine before, remember that it can be EXCITING if done properly but LETHAL if you do not know what you are doing. Here are 12 basic rules for your survival.

1. JOIN A MINING HISTORY GROUP

There are many groups in the UK that cover the whole of the country. Unless you are attending a special course, consider joining one of these and they will teach you how to be safe underground.

2. GET THE BASIC GEAR

The basic things that you need are:-

Warm clothing and a boiler-suit
Strong boots or wellingtons
Helmet
Lamp

For simple mines a torch is OK but the best is a miner's electric headlamp. ALWAYS carry spare lighting and REMEMBER a change of clothes.

3. ALWAYS GET PERMISSION

Always ask the mine owner for permission to enter. If you don't know the owner, ask the local mining history group. Never break in, or trespass, if permission is refused. Always leave mines safe by replacing gates or lids before you leave.

4. TELL SOMEONE WHERE YOU ARE GOING

If you have an accident, you want people to know where to locate you! Leave a message with a responsible person, giving the following details:-

- name and location of the mine
- anticipated time down the mine
- anticipated time out of the mine
- time due back to the person you have told
- details of how to get the rescue service, if needed.

5. NEVER GO UNDERGROUND ALONE OR INCAPABLE

FOUR is the minimum safe number underground so that, in the case of an accident, one can stay with the casualty and two can go for help. NEVER take alcohol or drugs before or during a trip as this will reduce concentration, with potentially lethal results.

6. DO NOT EXCEED YOUR CAPABILITY

Choose easy trips at first and leave the more difficult techniques until you are used to moving underground. Ladder climbing, for instance, can be very strenuous at times and it is always harder climbing back out! If in doubt, turning back is better than having to be rescued.

7. DO NOT GET LOST

Some mines are like mazes and it is very easy to get lost. If there is a plan of the mine (your local mining history group can advise you) take a copy with you. One good idea is to cut small arrows from a brightly coloured polythene bag and, whenever you come to a junction, leave one of them pointing towards the entrance. ALWAYS pick them up on the way out.

8. NEVER CLIMB ON OLD LADDERS OR MACHINERY

You may come across old ladders, timbers, etc which were used by the miners. NEVER use these as they are of uncertain age and probably rotten. Similarly, don't climb on old machinery as it is probably rusty and may collapse.

9. NEVER CLIMB ON STACKED ROCK OR WALLS

For their convenience, miners often left waste rock in the mine. It was stacked up and supported by timbers, which have long since rotted away, leaving the rock precariously balanced. DON'T TOUCH, or climb, on these features or you may bring down tons of rock onto yourself and others.

10. NEVER FOOL AROUND WHEN UNDERGROUND

People in groups sometimes do silly things but, with the dangers underground, practical jokes can have tragic endings. Be a steadying influence on your friends. They may laugh when you say "better safe than sorry" but this is a small price to pay for your life and theirs.

11. DO NOT RUIN THE MINE ENVIRONMENT

This is what you have come to see, so leave it in a good condition for others. Don't :-

- hammer minerals in an indiscriminate manner
- destroy or remove artefacts or other archaeological features
- interfere with plant or animal life
- leave litter (this can destroy mine life without your realising)
- leave graffiti.

TAKE only photographs. LEAVE only footprints.

12. KNOW WHAT TO DO IN AN EMERGENCY

Mines are dangerous places and accidents can happen to even the most experienced people. If, however, you don't panic then the casualty stands a good chance of surviving. Learn about simple First Aid so that you can make them comfortable. Exposure is one of the most dangerous things - learn about its symptoms and treatment. Always leave someone with the casualty and send at least two people for help. The area Cave Rescue Organisations are very efficient and can be called out by dialling 999 and asking for the Police. Tell them what has happened, the location of the mine and the nature of any injuries.

These 12 rules are the most basic knowledge that you need but it will take a few years before you are anything like experienced. THE BEST WAY TO GAIN THIS EXPERIENCE IS TO JOIN A RECOGNISED MINING HISTORY GROUP AND TO GO UNDERGROUND WITH EXPERIENCED PEOPLE.

Underground Exploration - Leaders

You may be an experienced caver but disused mines contain many dangers not found in natural caves. Unless you can recognise and avoid these dangers you are playing Russian Roulette with your life (and the lives of your party).

If you intend to lead a party of novices into an old mine, you are responsible for their lives as well as your own. Training and Assessment Courses for Cave Leadership are available through the Training Committee of the National Caving Association.

The following advice has been compiled from people who have had many years experience in the exploration of disused mines. We do not claim that it is a definitive set of rules, we merely hope that you will take note of the advice and perhaps a tragedy may be avoided through a greater understanding of the dangers facing you underground.

ACCESS

The problems of access to disused mines are different from those for caves. The existence of mineral rights means that the mine owner is not necessarily the same as the land owner. Remember that it is often less trouble for a mine owner to close the entrance completely than to allow access to explorers. Mining history groups have worked for years, both nationally and locally, to get access agreements. Don't be the one to deny access for everyone through a thoughtless act. Follow these simple rules and help to keep the mines open.

1. ALWAYS get permission from the land or mine owner before exploring. If the owner is not known, ask the local mining history group.
2. OBEY the Country Code when crossing land to get to the mine.
3. NEVER break into a mine, or section thereof, if it has been sealed off and do not trespass if permission has been refused.
4. ALWAYS ensure that any gate or lid to a mine entrance is securely replaced after your visit. If you are not leaving anyone on the surface during your trip, ensure that the open entrance will not be a danger to cattle or passers-by.
5. ALWAYS ensure that you are not contravening Health & Safety Legislation. NAMHO/NCA have issued guidelines on this.

SAFETY

6. NEVER explore disused coal mines, they are prone to weak strata and bad air.
7. ALWAYS check out a mine with an experienced party before taking novices in.
8. FOUR is the minimum safe number underground in case of accident, 1 to stay with the victim and 2 to go for help.
9. NEVER have a ratio of more than 5 novices to 1 experienced person. Have an experienced person at the front and rear of the party and, with large numbers, spread the experienced persons amongst the party.
10. NEVER drink alcohol or take drugs before or during a trip. This can reduce concentration and increases the risk of exposure.
11. NEVER go underground unless properly equipped. The leader is responsible for checking everyone's equipment and should be prepared to leave anyone who is not so equipped on the surface. Disappointment is better than disaster.
12. ALWAYS wear a helmet and check that it fits securely before going underground. It should have a chinstrap and be comfortable. The easiest way to check is to shake the head up and down and from side to side - if the helmet moves it is too loose.
13. ALWAYS wear strong boots or wellingtons with a good tread. Never use boots with lace hooks since these can catch on electron ladders.
14. EVERY person must have a light. A miner's-type electric headlamp is best but a strong torch with spare batteries is acceptable in easy mines. Carbide lamps are not recommended. If any vertical climbing is involved, a headlamp is essential.
15. EVERY party should carry spare lighting for emergencies, even if only candles.
16. ALWAYS wear warm clothing, preferably with a boiler suit on top. Remember to have a change of dry clothes on surface.
17. ALWAYS tell a responsible person where you are going. Ideally you should give them a written message showing :-

- a) location, grid reference and name of the mine.
- b) time down (anticipated).
- c) time due out (anticipated).
- d) time due back at base (for cancellation of message).

Ensure that the person with this message knows what to do if you are overdue and that you contact them when you exit from the mine.

18. IN EMERGENCY you should dial 999 for the POLICE and ask them for CAVE RESCUE. Give them full details of the location of the mine, the extent of injury to the victim and whereabouts in the mine they are. Stay by the telephone unless they say otherwise.

19. Carry some high-calorific food (eg Mars Bars) and a drink in case of emergency.

20. Carry a plan of the mine, if available. Your local mining history group can advise you if there is a plan of the mine.

21. ALWAYS count the number of persons in a party before going underground and check regularly during the trip, especially on exit. With absolute novices, allocate a place in the line and tell them to keep their position, to be patient and not to overtake.

22. Just inside the entrance, wait 5 minutes to allow the eyes to get accustomed to the dark. During this time, check that everyone's lamp is working.

23. The helmet will protect your head from a low roof but not against dangers on the floor like rocks or open holes. When moving, keep your eyes mainly on the floor to avoid these dangers. If you want to look around - STOP.

24. Ensure that the party does not become separated. If anyone lags behind, the person in front of them should stop and shout ahead for the party to wait.

25. When you come to a junction, look back and memorise the way out as it can look different from the other way. Better still, leave a marker such as coloured polythene arrows (remember to remove them on the way out) or a line of stones.

26. If someone's light fails, there should be a spare. In emergency, however, you can get someone to walk just behind and to one side and, proceeding slowly, there should be sufficient light for both to see ahead. If all lights fail, be patient and sit it out until rescued. Feeling the way in the dark is courting disaster.

27. NEVER use a mining trip to test endurance and stamina. If someone feels claustrophobic or tired DON'T make them carry on - take them out. Novices should be told that there is no shame in turning back, there will be less embarrassment over this than pushing on and risking an accident.

ABANDONED MINES ARE MAN-MADE AND HAVE MANY FEATURES NEVER ENCOUNTERED IN CAVES. THIS HAS BEEN MENTIONED BEFORE AND CANNOT BE OVER-STRESSED. THE FOLLOWING SECTION DRAWS YOUR ATTENTION TO SPECIFIC HAZARDS FOUND IN MINES.

28. NEVER touch anything that looks like explosives or detonators. These may be unstable through age and extremely dangerous. Make a note of their position and tell your local mining history group.

29. Miners often made false floors by building timber roadways over a stope (a large open working). These are not always obvious since they may have been covered by mud and even hold water. When the timbers rot you risk falling through into the stope below. If the floor feels shaky or hollow - TURN BACK.

30. Miners often drove through soft ground for speed, erecting roof supports which may have now rotted. NEVER disturb roof supports.

31. Miners often left waste rock underground to save the trouble of taking it to the surface and sometimes used it to support the roof. This rock, called "Deads", was often stacked on timbers in the roof or sides of passages but, over the years, the timber rots and leaves the deads jammed together. NEVER touch or climb on deads anywhere in a mine or you may bring down tons of rock onto the heads of yourself and others.

32. Hoppers were used to draw off rock from stopes into wagons on levels below. There is often a great deal of loose rock jammed in these hoppers. NEVER interfere with hoppers or you may release tons of rock.

33. When wading through water, beware of flooded shafts in the floor. After the first person has passed, the water becomes muddy and you cannot see anything. Shafts are often to one side of a passage so you may miss them on the way in but find them unexpectedly on the way out! The first person should pass a warning back along the line and mark the position for the trip out.

34. In deep water, keep to the sides of the passage where it is often shallower and (if in solid rock) you can steady yourself on the walls. Beware of submerged rocks on the floor - if you find one, pass a message back. Go at the pace of the slowest person. NEVER race and NEVER swim underground.

35. The edges of shafts can be loose so NEVER stand on the edge. If you must look down then get someone to lifeline you, lie on the floor and peer over the edge. The tops of large shafts can also be timbered over leaving a small access hole. Beware of standing on this timber which may be rotten.

36. Shafts often have drystone walling at the top called "Ginging". When descending, beware of touching this in case you cause it to collapse on people below.

37. NEVER climb on or over old machinery, since it may be severely weakened by rust. Apart from the safety considerations, you may spoil the mine environment for others.

38. In some mines, ladders were used to get from one level to another, with wooden platforms at intervals. In other mines, timbers called "Stemples" were jammed across shafts to climb on. ALL such structures are now suspect through age so NEVER climb on old ladders, platforms or stemples left in a mine.

39. Beware of gas underground. Although it is rare in non-coal mines, it can be lethal. The commonest gases are :-

a) Hydrogen Sulphide

Found in shaly areas (especially where pyrites are present) or recently drained levels. It has a characteristic "bad eggs" smell.

b) Carbon Dioxide

Found where there is no air flow and, being heavier than air, is often found in blind shafts. It is tasteless and the first signs will be rapid breathing and headaches.

c) Methane

Found in coal or shale strata. It is tasteless but highly explosive.

Atmospheric conditions can affect the quantity of gas in a mine and it may be found one day but not the next. If you suspect gas - TURN BACK. Better still, carry an oxygen meter or a miner's flame lamp. When exploring a shaft, test for gas at the bottom before descending.

40. NEVER light fires underground. Combustion will produce gases which are difficult to detect and lethal.

41. In unventilated mines with no air flow, there is a possible danger of Radon gas which is radioactive. This changes to minute particles which are carried in the air and can be absorbed into the lungs, possibly causing cancer. It is recommended that you do not explore unventilated mines. If you must, it is recommended that you wear a dust mask which absorbs most of these particles.

42. It is recommended that you do not smoke underground because :-

a) there may be inflammable gas present.

b) Radon particles (if present) are absorbed in smoke particles.

c) it is anti-social if there is little air flow.

d) it disturbs bats.

43. Beware of chemicals dumped down shafts - some of these are poisonous.

THE PREVIOUS SECTIONS HAVE DEALT WITH DANGERS SPECIFIC TO MINES. THE FOLLOWING SECTIONS DEAL WITH GENERAL DANGERS AND APPLY EQUALLY TO CAVING AS WELL AS MINE EXPLORATION. LADDER CLIMBING, ROPEWORK AND ESPECIALLY SINGLE ROPE TECHNIQUES ARE COMPLEX AND CONTINUALLY DEVELOPING. YOU ARE RECOMMENDED TO TAKE LESSONS FROM THOSE ALREADY PROFICIENT IN THE TECHNIQUES. THE NATIONAL CAVING ASSOCIATION CAN PROVIDE INFORMATION ABOUT SUITABLE COURSES.

44. If the party gets wet or cold, beware of exposure. The warning signs are slowness of movement, unreasonable or irritable behaviour, slurred speech, cramps, shivers and (in more extreme cases) the smell of peardrops on the breath. STOP IMMEDIATELY and take the victim to a suitable spot where they can be kept warm and dry. Give warm drinks, food, glucose tablets and extra clothing if available but NOT alcohol. Place victim in a survival bag and get another person to share body heat by "cuddling". If no improvement after a short rest - GET HELP. NEVER attempt to walk a badly exposed person out under their own steam as this can be fatal.

45. Exposure can set in after an accident and can often be a greater danger than broken bones. If an accident happens in a wet or cold place, it is better to risk further injury by moving the victim to a dry spot out of the direct air flow. Warm drinks should be given since an anaesthetist can deal with a full stomach if a later operation is necessary. In an underground environment, preventing loss of body heat is much more important.

46. ALWAYS use a lifeline when negotiating a vertical descent or ascent and make sure that the lifeline is securely tied onto a separate belay from the ladder, if used. On scrambles, remember to move only one foot or hand at a time.

47. Apart from short, easy scrambles, an electron ladder should be used. Novices should learn how to use an electron ladder on the surface first.

48. NEVER tread on ropes, you may cause damage inside. When cleaning ropes, check that no mud or grit has got inside since this acts as a very good abrasive, shortening the life of the rope and possibly yourself!

49. Check the wire of electron ladders for cuts, snapped strands or rust. Check the rungs for damage. NEVER use ladders with hemp-cored wire.

50. Clean mud out of the hinges and screw threads of carabiners. If a carabiner has been dropped onto a hard surface, discard it. Invisible hairline cracks can occur which may cause it to break under load.

51. Clean and check all your equipment after each trip and, if in doubt about the safety of anything, replace it. It is foolish economy to risk your life.

52. All persons using a ladder must be able to tie a bowline and figure-of-eight knot in case of emergency, when help may not be available.

53. NEVER approach the top of a ladder pitch unless you are lifelined. It is good practice to keep away until you are ready to descend, otherwise you may accidentally knock rocks down onto a person climbing the ladder.

54. NEVER have more than one person on a ladder at a time.

55. Deep shafts can distort sound. Before descending, arrange signals such as a whistle blast or tug on the rope, eg

- 1 - STOP
- 2 - UP
- 3 - DOWN

56. ALWAYS send an experienced person down a ladder first. At the bottom, untie and move away from the ladder in case of falling rocks.

57. If you ever knock an object down a shaft, shout "BELOW". If you ever hear this shout - NEVER LOOK UP. Get under cover or stand flat against the wall with your head hunched into your shoulders.

58. If you want to look up a shaft, peer up from under the brim of your helmet which will protect you from any stones falling down.

59. NEVER carry extra equipment down a shaft - lower it separately.

60. NEVER trust old rings, timbers, etc. as belay points.

61. If your party is to separate after descending a shaft, agree some form of message so that the first group back leaves the ladder in place.

62. NEVER remove another party's ladder, etc. - one day it might be you stuck at the bottom! If a pitch is already rigged and there is no space for your ladder, use the one in place and leave your tackle at the top. When the other party ascends, they should lower your ladder for you.

63. NEVER use single rope techniques underground unless you are already well-practiced on the surface. Muddy ropes can affect the friction on descendeurs and cause ascenders to slip or jam up.

PRESERVATION

People explore disused mines for a number of reasons. You might only be interested in a tourist trip but remember that others have different interests, eg history, geology, biology, photography, etc. Please follow these guidelines.

64. NEVER interfere with old mine buildings or equipment whether underground or on the surface. Removing old tools, etc is a specialised art and best left to the experts for display in a mining museum. If you find artefacts in a mine, tell the local mining history group.

65. NEVER hammer rock formations indiscriminately. This not only destroys the scenery but can be dangerous in unstable areas. Take only a few specimens for personal use.

66. NEVER interfere with roosting bats underground, they are protected by the Wildlife & Countryside Act 1981. Try to avoid visits to known bat hibernation sites between November and March. Report any bats seen to the local bat group, the Nature Conservancy Council or the Flora & Fauna Preservation Society. See "Bats in Caves: a Conservation Code", published by the FFPS, c/o Zoological Society of London, Regents Park, London NW1 4RY.

67. Many insects and even smaller animals live in mines, often in pools. Some of these animals are rare and damaging their environment can kill the whole population. NEVER dump carbide in a mine and avoid muddying pools wherever possible.

68. Many forms of fungus are found in mines where they live on old timber, etc. Some of these are rare and should NEVER be damaged.

69. Mine water is sometimes used as a water supply. NEVER pollute underground water and NEVER drink it.

70. Remember - TAKE only photographs. LEAVE only footprints.

IN THE INTERESTS OF SAFETY THESE GUIDELINES
ARE FREE OF ALL COPYRIGHT RESTRICTIONS

Appendix 3

Table 1: BCRA grading for a cave line survey

- Grade 1** Sketch of low accuracy where no measurements have been made
- Grade 2** (use only if necessary, see note 7)
May be used, if necessary, to describe a sketch that is intermediate in accuracy between Grade 1 & 3
- Grade 3** A rough magnetic survey. Horizontal & vertical angles measured to $\pm 2.5^\circ$; distances measured to ± 50 cm; station position error less than 50cm.
- Grade 4** (use only if necessary, see note 7)
May be used, if necessary, to describe a survey that fails to attain all the requirements of Grade 5 but is more accurate than a Grade 3 survey.
- Grade 5** A Magnetic survey. Horizontal and vertical angles measured to $\pm 1^\circ$; distances should be observed and recorded to the nearest centimetre and station positions identified to less than 10cm.
- Grade 6** A magnetic survey that is more accurate than grade 5, (see note 5).
- Grade X** A survey that is based primarily on the use of a theodolite or total station instead of a compass, (see notes 6 and 10 below).

Notes

1. The above table is a summary and is intended only as an *aide memoire*; the definitions of the survey grades given above must be read in conjunction with these notes.
2. In all cases it is necessary to follow the spirit of the definition and not just the letter.
3. To attain Grade 3 it is necessary to use a clinometer in passages having appreciable slope.
4. To attain Grade 5 it is essential for instruments to be properly calibrated, and all measurements must be taken from a point within a 10cm diameter sphere centred on the survey station.
5. A Grade 6 survey requires the compass to be used at the limit of possible accuracy, i.e. accurate to $\pm 0.5^\circ$; clinometer readings must be to the same accuracy. Station position error must be less than ± 2.5 cm, which will require the use of tripods at all stations or other fixed station markers ('roofhooks').
6. A Grade X survey must include on the drawing notes descriptions of the instruments and techniques used, together with an estimate of the probable accuracy of the survey compared with Grade 3, 5 or 6 surveys.
7. Grades 2 and 4 are for use only when, at some stage of the survey, physical conditions have prevented the survey from attaining all the requirements for the next higher grade and it is not practical to re-survey.
8. Caving organisations etc. are encouraged to reproduce Table 1 and Table 2 in their own publications; permission is not required from BCRA to do so, **but the tables must not be reprinted without these notes.**
9. Grade X is only **potentially** more accurate than Grade 6. It should never be forgotten that the theodolite/Total Station is a complex precision instrument that requires considerable training and regular practice if serious errors are not to be made through its use!
10. In drawing up, the survey co-ordinates **must** be calculated and not hand-drawn with scale rule and protractor to obtain Grade 5.

Table 2: BCRA grading for recording cave passage detail

Class A All passage details based on memory

Class B Passage details estimated and recorded in the cave.

Class C Measurements of detail made at survey stations only.

Class D Measurements of detail made at survey stations and wherever else needed to show significant changes in passage dimensions.

Notes

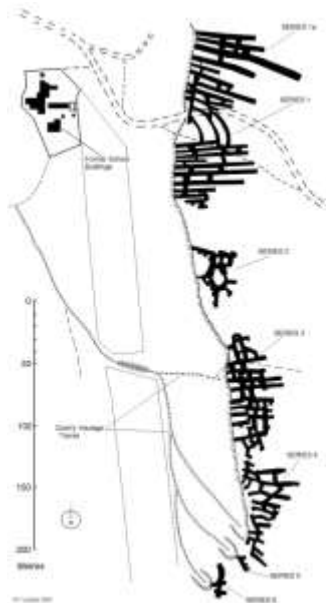
- 1 The accuracy of the detail should be similar to the accuracy of the line.
- 2 Normally only one of the following combinations of survey grades should be used:

1A,
3B or 3C,
5C or 5D,
6D,
XA, XB, XC or XD.

British Cave Research Association (UK registered charity 267828). Registered Office:
The Old Methodist Chapel, Great Hucklow, BUXTON, SK17 8RG

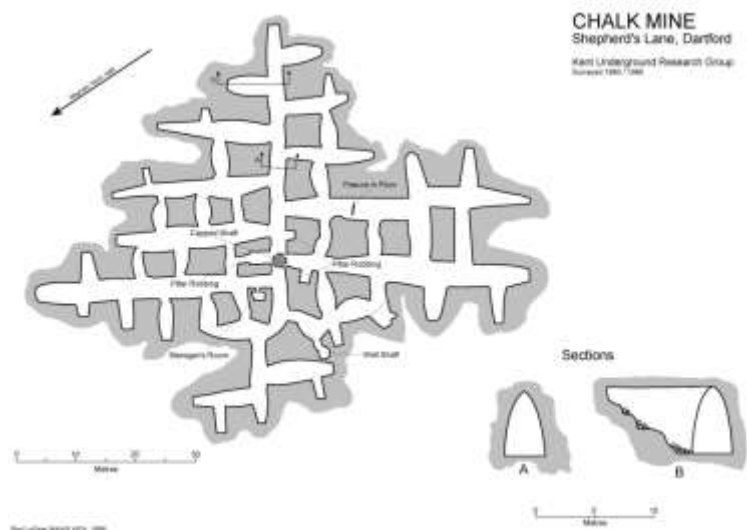
Appendix 4

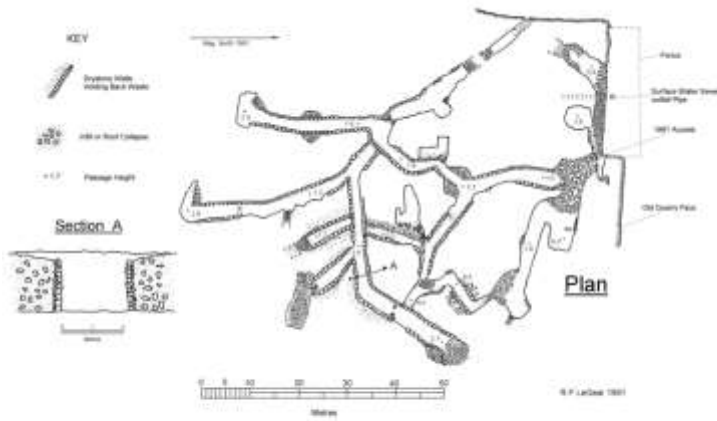
Example Surveys and Photographs



Survey of Underground Ragstone Quarry at Hosey Common, Westerham

Survey of Chalk Mine at Dartford





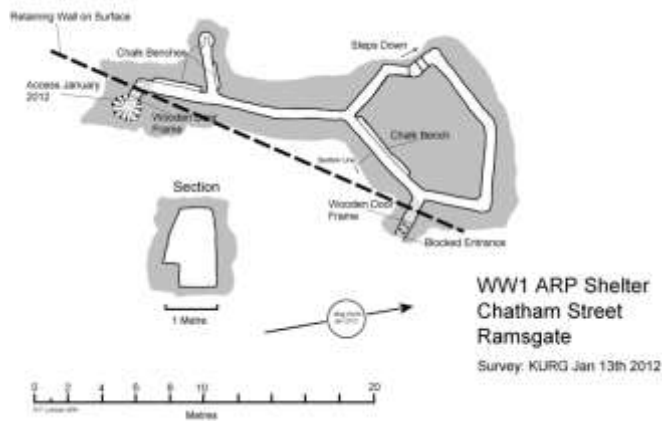
Survey of Underground Ragstone Quarry at Mote Park, Maidstone.

Surveying in a Sand Mine at Chipstead, Kent



Surveying Tudor Drain at Roydon Hall, East Peckham





Examination of World War 1 Shelter at Ramsgate



Descent into Ironstone mine shaft in Sussex

Descending shored shaft during excavation of a Limestone mine in Sussex.

