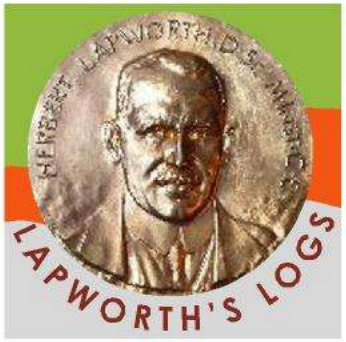

The Geological Society

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Welcome to

LAPWORTH'S LOGS™

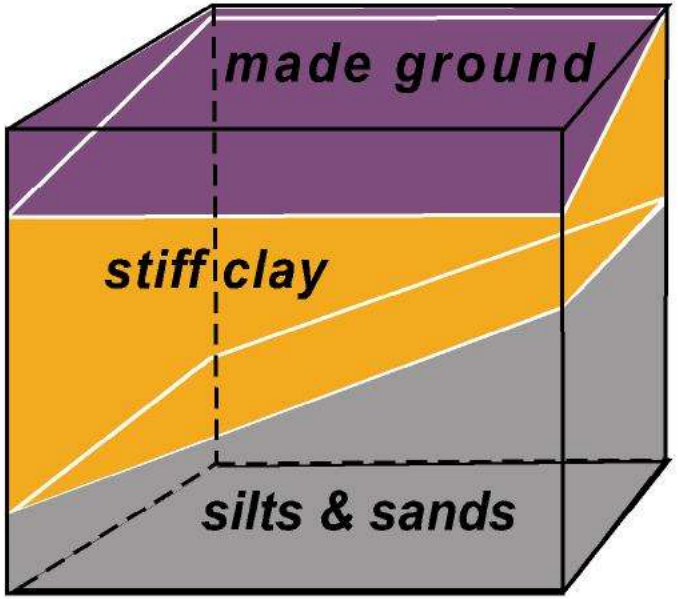
An adaptable learning platform for applied Earth Sciences that prepares students for the commercial use of geo-data and data banks

Lapworth's Logs were inspired by the teaching of
Dr Herbert Lapworth at the Institution of Civil Engineers.
They are devised and produced by

The Geological Society

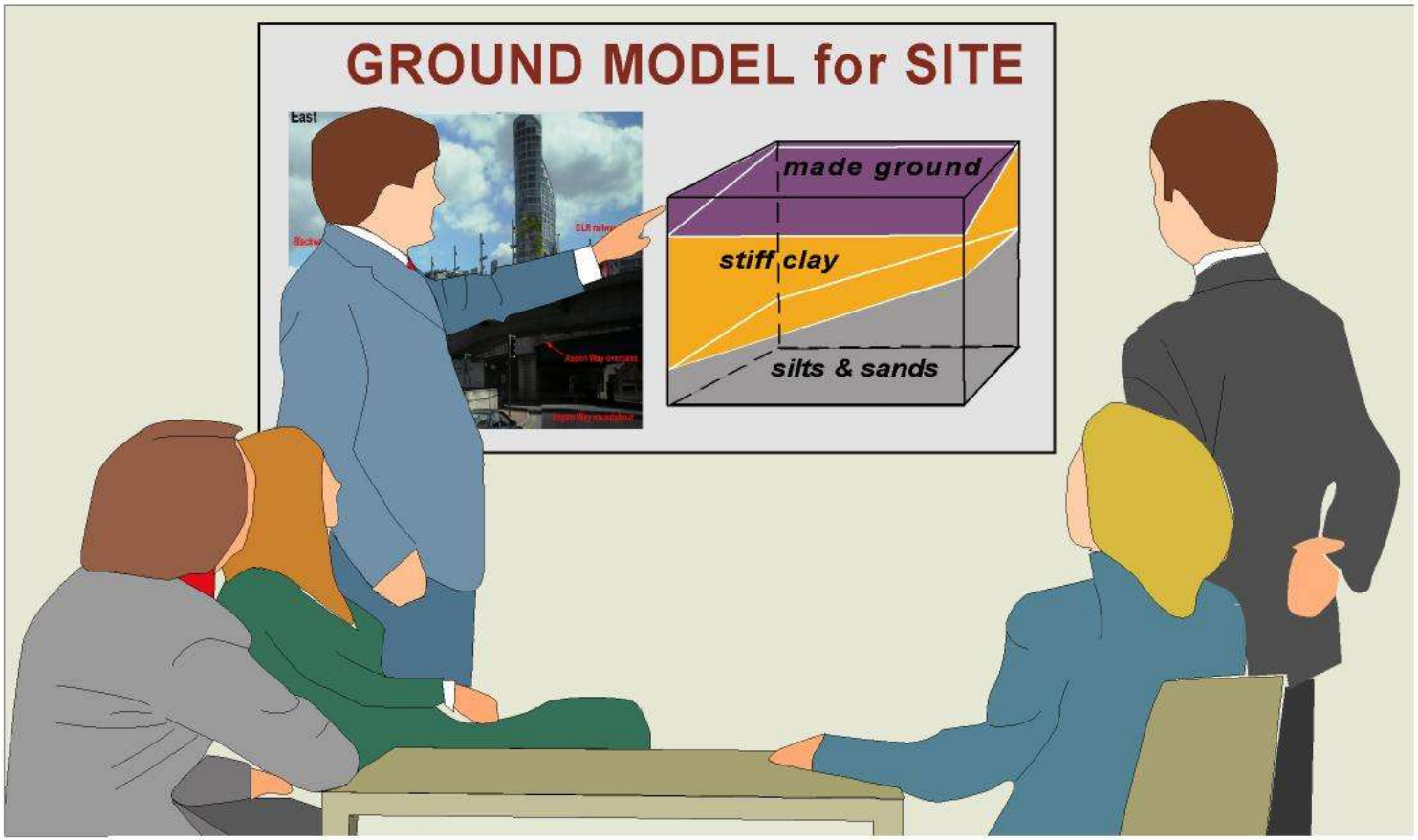
endorsed training course

LAPWORTH'S LOGS™

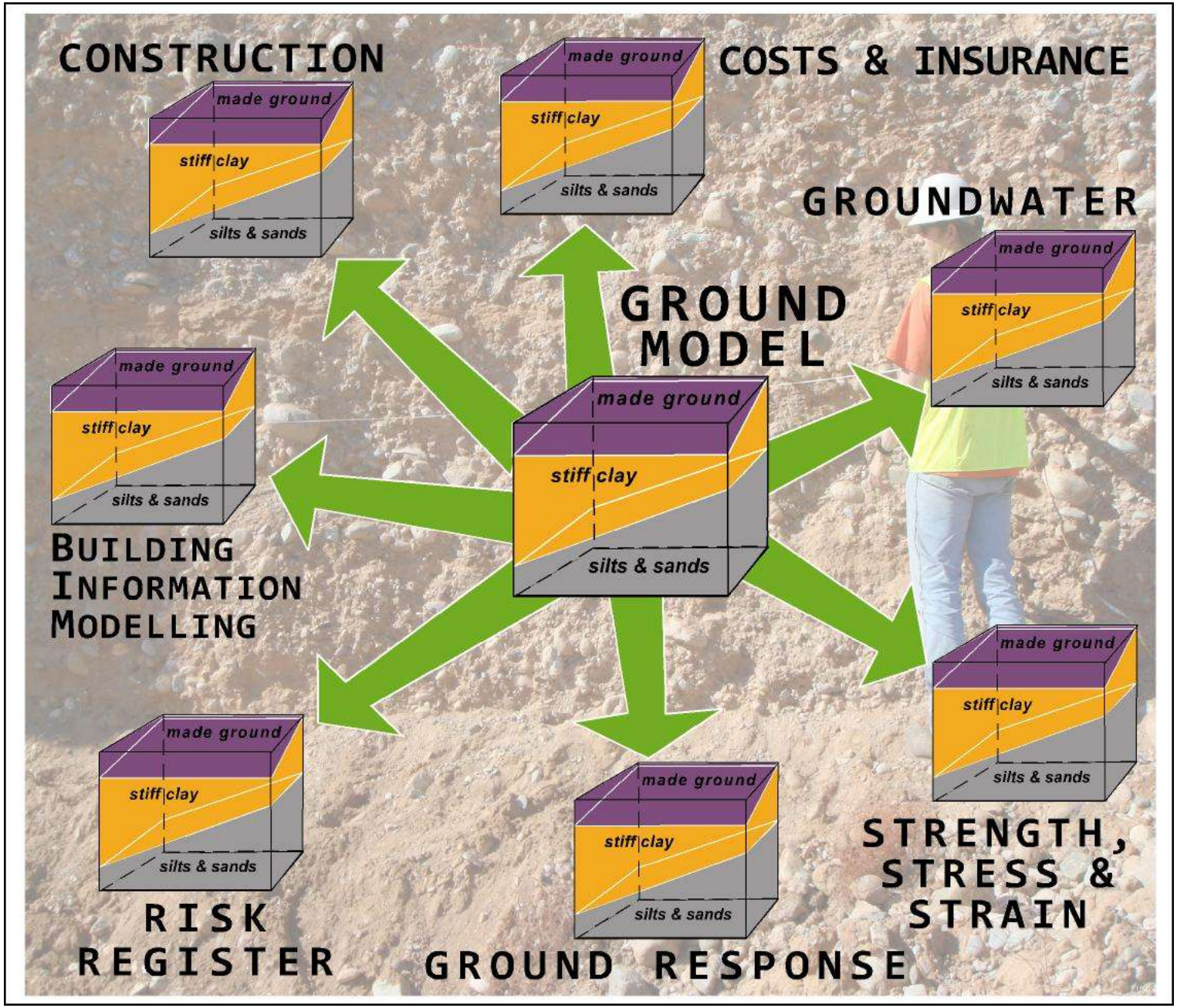


Ground Modelling

The Ground Model is everything!



Make sure your team can talk to each other in an informed way.


CONSTRUCTION
made ground
stiff clay
silts & sands
made ground
COSTS & INSURANCE
stiff clay
silts & sands
GROUNDWATER
made ground
stiff clay
silts & sands
GROUND MODEL
made ground
stiff clay
silts & sands
made ground
stiff clay
silts & sands
BUILDING INFORMATION MODELLING
made ground
stiff clay
silts & sands
made ground
stiff clay
silts & sands
STRENGTH, STRESS & STRAIN
made ground
stiff clay
silts & sands
RISK REGISTER
GROUND RESPONSE

4 Models
4 Sites

SITE 1 -
Tenupy Bridge

SITE 2 -
Brean's Landing

SITE 3 -
Iya Farm

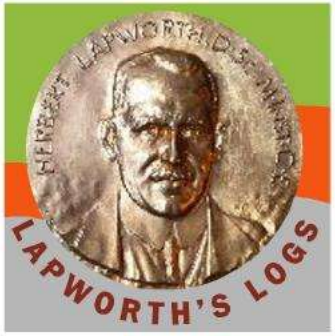
SITE 4 -
Kausworth

Risk Assessment

RISK
REGISTER

5 Technical backgrounds

For each site a Problem is described and three Questions to be Answered



ENGINEERING GEOLOGY

The site is to be excavated to a depth of 15m and requires the top 20m of ground to be defined.

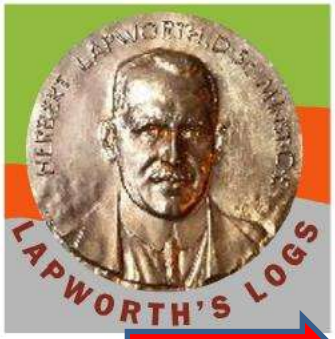
Ground level on site is horizontal, and the Geological Survey map suggests it should be Quaternary alluvium overlying Carboniferous sandstone and chalk.
BH data available extends to GL- 40m.

1. ***Establish the 3D geology for the site and present this as a 3D model for the ground either as a dimensioned sketch or a series of related vertical cross-sections.***
2. ***Quantify the volume of alluvium that will be removed when the site is excavated to a depth of 7m.***
3. ***Calculate the vertical effective stress at 12m below ground level at GR 10:9 if the bulk unit weight of the deposits above the sandstone = 16kN/m³, and the sandstone = 20kN/m³, when the water level is at the ground surface.***

Can be tailored

Can be modified

Can be adapted



There are Help files relevant to each exercise

HELP *for IYA FARM* EG4E13H

Q. How do I quantify a volume of ground?
Multiply its vertical thickness by its area. If the thickness of the layer is not uniform produce contour maps for its upper and lower boundary, using a 3-Point solution. These boundaries may be in different directions. Use a cross section drawn in the direction of dip of a boundary to guide you.
Subject prompts; Strike line maps, 3-Point solution, vertical cross sections.

Q. How do I calculate the volume of irregular strata?
Not all strata have a uniform thickness because their upper and lower surfaces are not parallel. This requires you to first define the shape of the volume and then to subdivide that shape into regular bodies whose volume can be calculated (wedges, prisms, cubes, etc). This is done using vertical sections at right angles to strike, i.e. in the direction of dip.

Q. How is an interface located?
An interface is a boundary and can be located using bore hole data and a 3-Point solution using strike lines.

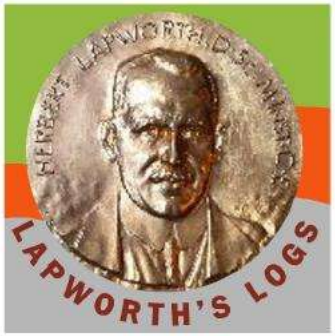
Q. What is a strike line?
This is a contour for a geological surface joining points on it of equal elevation, like contours for ground surface on a topographic map.
The direction of maximum dip of a surface is 90° to its strike lines and pointing in the direction of decreasing elevation.
The direction of strike is the angle between a strike line and magnetic north; it can be measured clockwise or anticlockwise. Thus the direction of an E-W strike line is either N090° or N270°.
Subject prompt; Strike lines.

Q. How do I produce a map of strike lines?
By triangulation of known data points, often provided by BH logs, following the principle of the 3-Point solution.

Q. What is the 3-Point solution?
This is a graphical procedure based on triangulation.
The position of a plane intersected by 3 vertical BH's can be recreated in space from the elevation of the plane relative to a datum common to each of those 3 BH's.
Thus the method presumes continuity of the plane and uniformity of its dip and strike.
The principle does not apply to curved surfaces but usually provides a reasonable prediction for surfaces that are not precisely planar over the dimensions of most sites.
Subject prompt; 3-Point construction or solution.

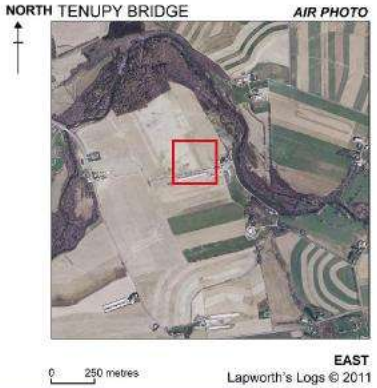
Q. How do I produce an engineering cross section?
Use squared paper. Make the horizontal and vertical scales equal. Mark on your section a datum from which to measure everything; this is a horizontal reference plane, and that usually makes ground level an inappropriate surface to use; sea level is ideal.
Locate your BH's along the line of the section at their correct spacing; use straight section lines. Plot your geology relative to datum.Join common boundaries but think; is there more than one way of joining these?
You can now predict the elevation of a surface at any place on the section; does such a prediction agree with other evidence?
Subject prompt; Drawing cross-sections.

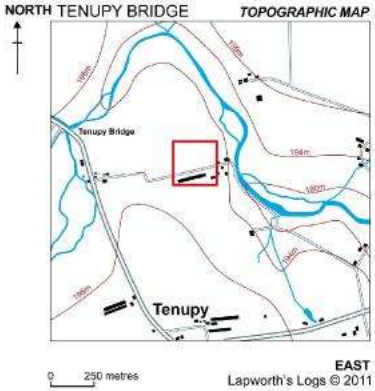
Q. Calculation of ground water pressure at depth.
The pore water pressure (u) at depth (z) = unit weight of water ($9.81 kN/m^3$) x pressure head at z (m) = kN/m^2
Pressure head at (z) = height of the column of water supported by the pressure of water at (z).
Subject prompts; mass, acceleration, force, weight, total weight = bulk weight, saturated weight, submerged weight = buoyant weight, hydraulic head, hydrostatic head, pressure head.

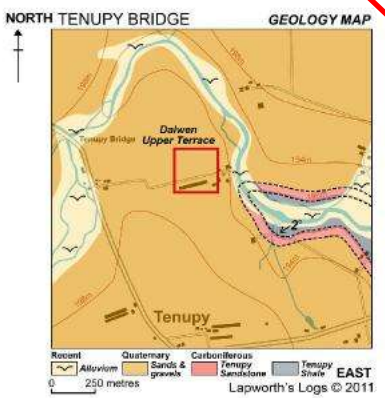


Each exercise has maps, reports and photos to help you solve them

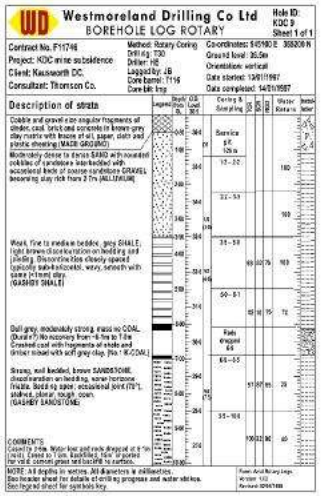
Resources can be Changed to suite purpose

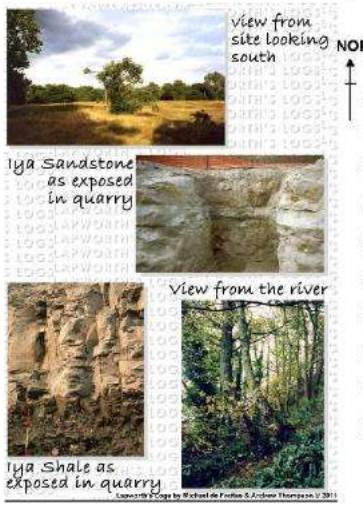


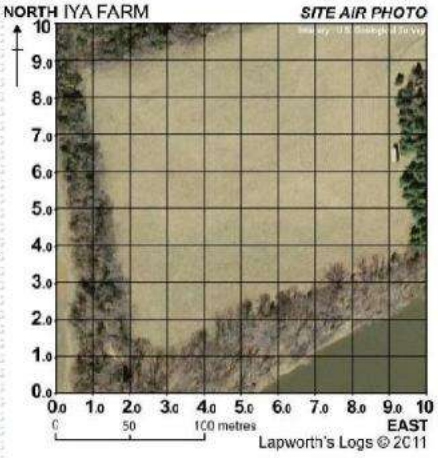


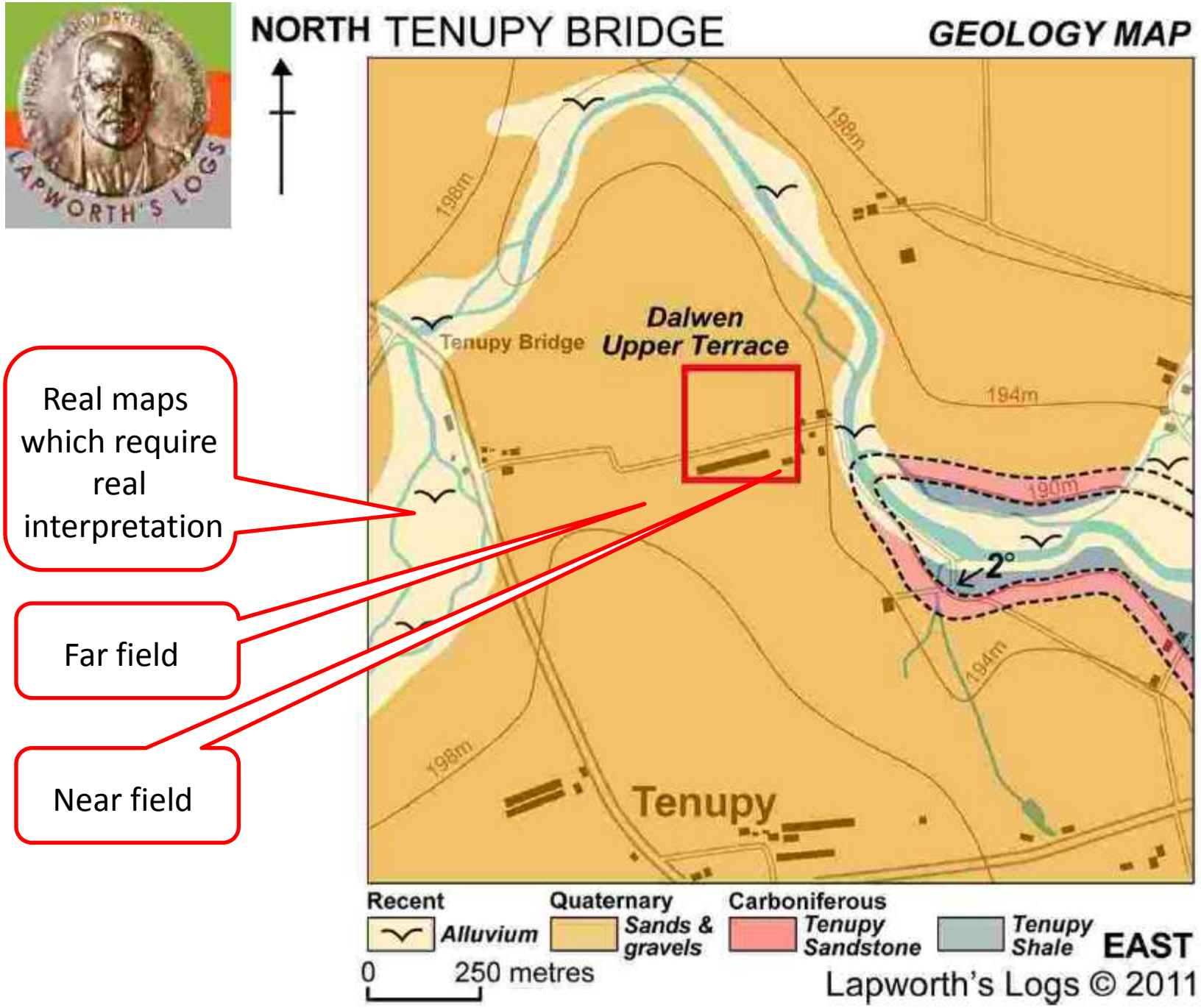


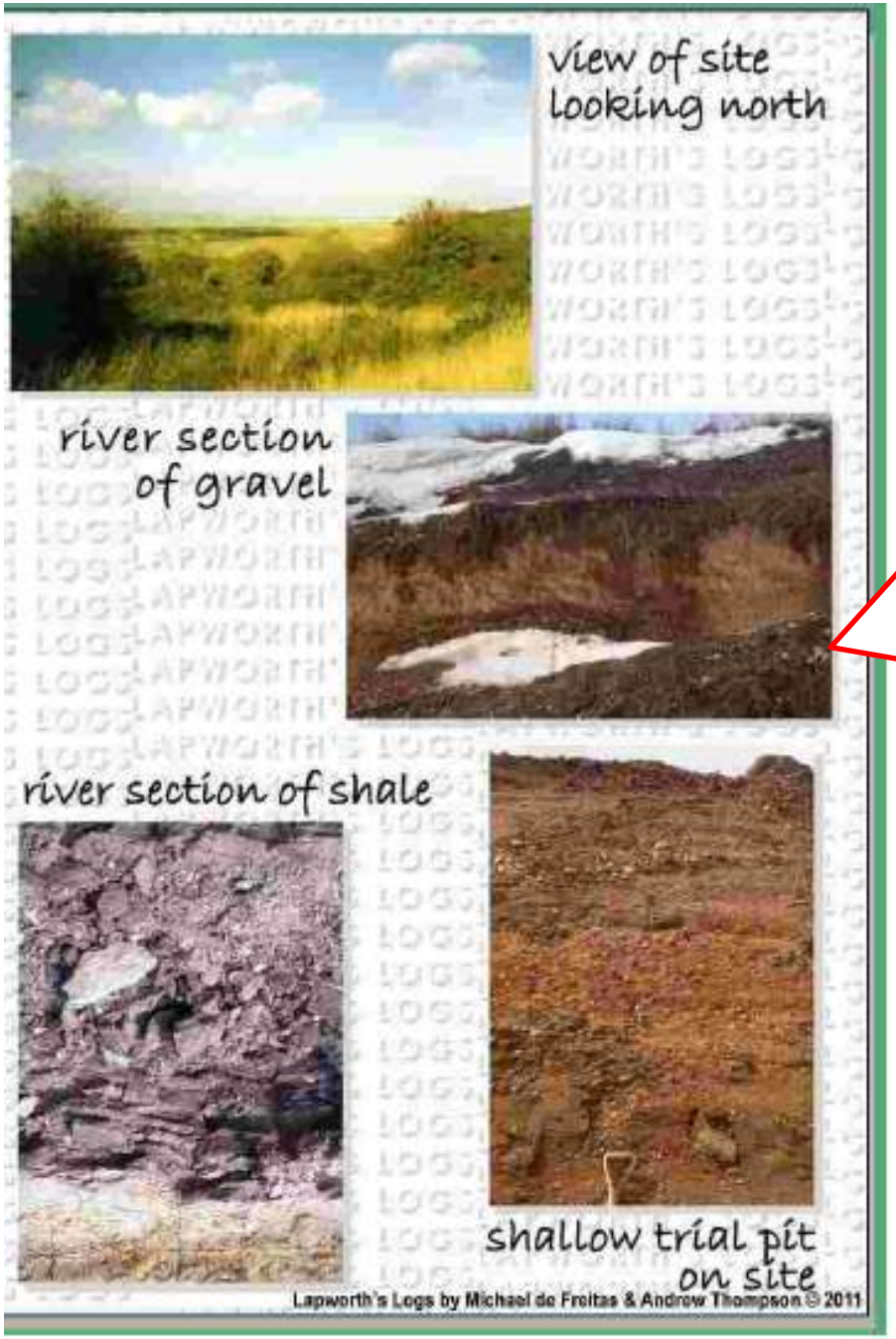
IYA FARM WALK OVER BY M. T. P 23.03.2011
WEATHER: SUNNY, DRY & WINDY
CATTLE IN FIELD BUT THESE WILL BE CLEARED BEFORE GROUND INVESTIGATION STARTS.
GRASS COVER AND FIRM UNDERFOOT.
RAY M. P. DOLLAR = OWNER, BUT LIVES ABROAD
DICK WAYLAND = LAND AGENT (–5892048)
ACCESS THROUGH FARM
JOHN GROGGINS –9494893)
SITE BASICALLY FLAT; VERY GENTLE SLOPE TOWARDS RIVER VALLEY WITH SLIGHT CHANGE IN SLOPE ABOUT HALFWAY TOWARDS RIVER.
RIVER BANKS LOOK UNSTABLE AND EXPOSE SAND & GRAVEL WITH SOME CLAY. ALLUVIUM ON RIVER BANKS CONTAINS GRAVEL AND SAND OF BROWN QUARTZ & CHERT (!), WITH COBBLES OF SHALE AND SMALLER SHALE PARTICLES DOWN TO GRIT SIZE.
WATER SEEPING FROM THE SANDS AND GRAVELS EXPOSED ON THE VALLEY SIDE, INTO THE RIVER.








NORTH
TENUPY BRIDGE
GEOLOGY MAP
Real maps which require real interpretation
Far field
Near field
198m
198m
Tenupy Bridge
Dalwen
Upper Terrace
194m
190m
2°
194m
198m
Tenupy
Recent
Alluvium
Quaternary
Sands & gravels
Carboniferous
Tenupy Sandstone
Tenupy Shale
EAST
0
250 metres
Lapworth's Logs © 2011



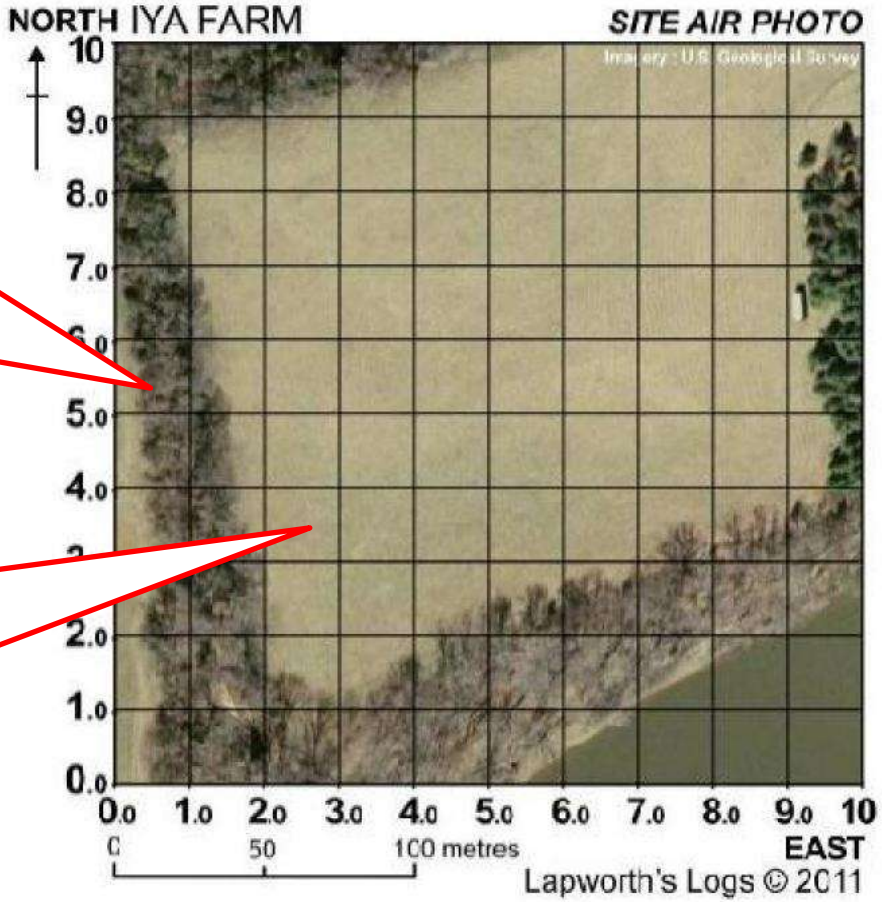
Virtual Field trips!

Can have views and materials to suite

....and a Geobrowser to get Bore Hole data

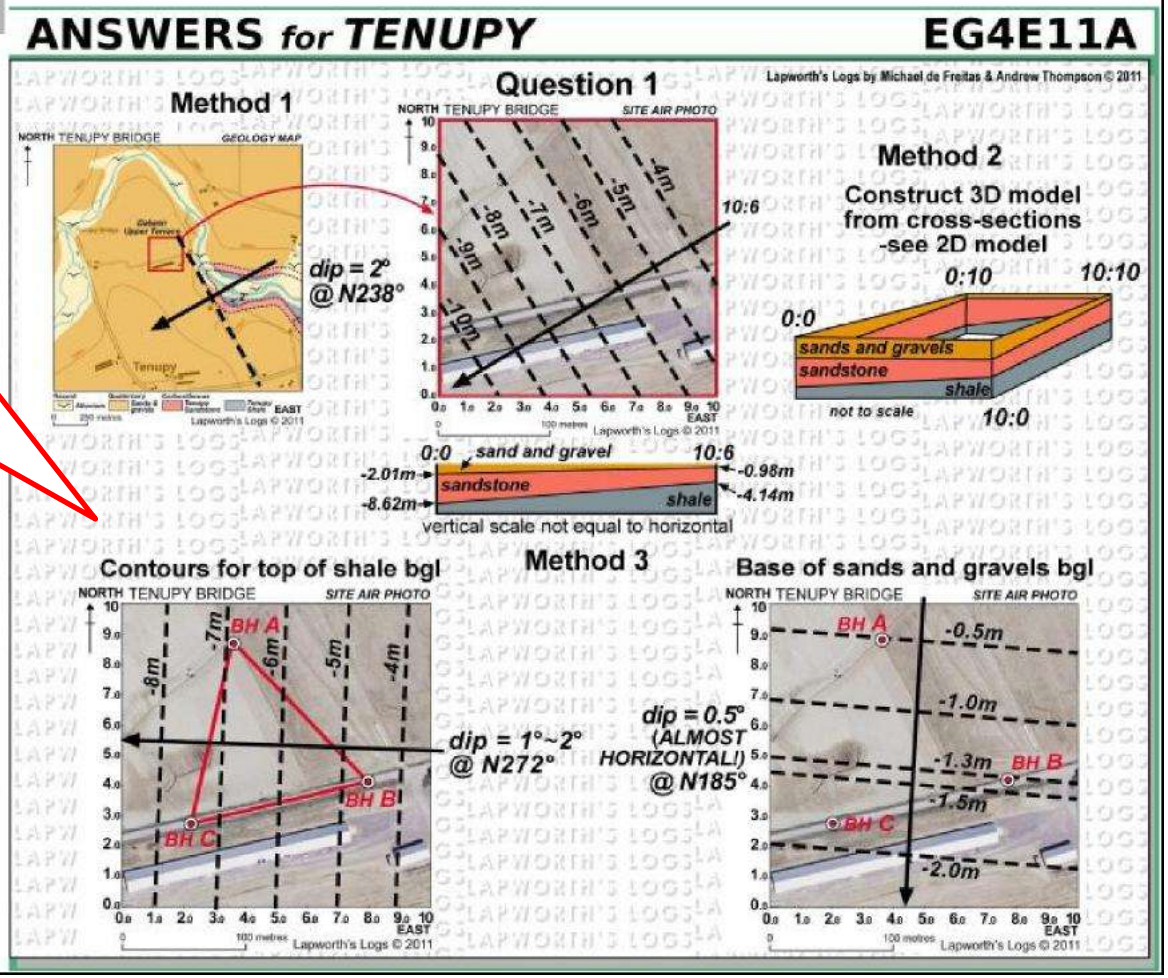
This is where the learning is done !

Have the resources been used to design the investigation

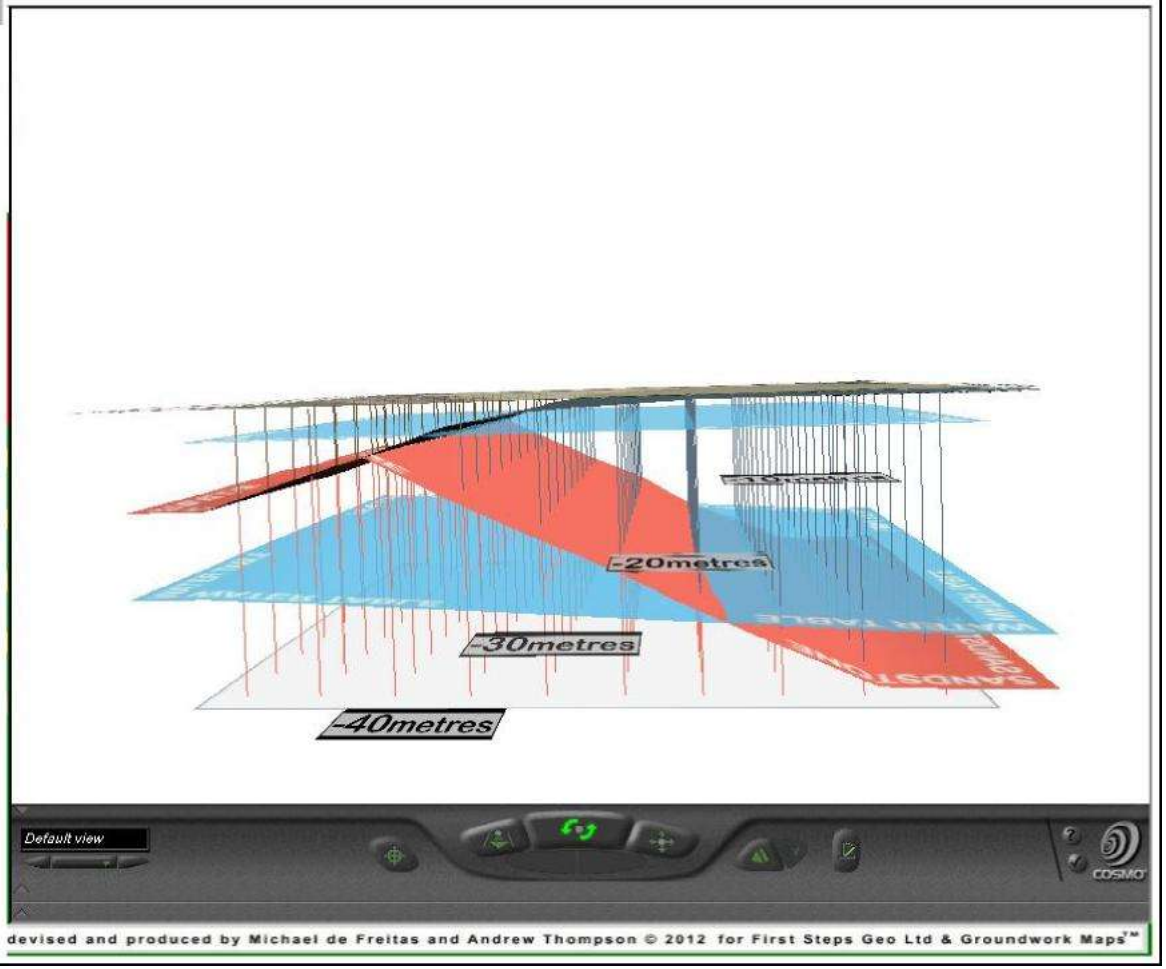


… and graphic answers for each problem

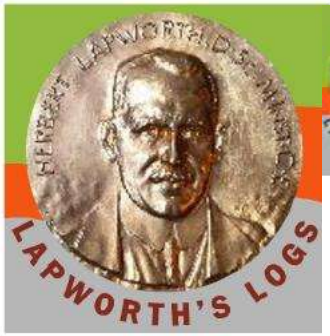
At Last!
Proof that geologists need two hands!



There is a 3D ground model for each site



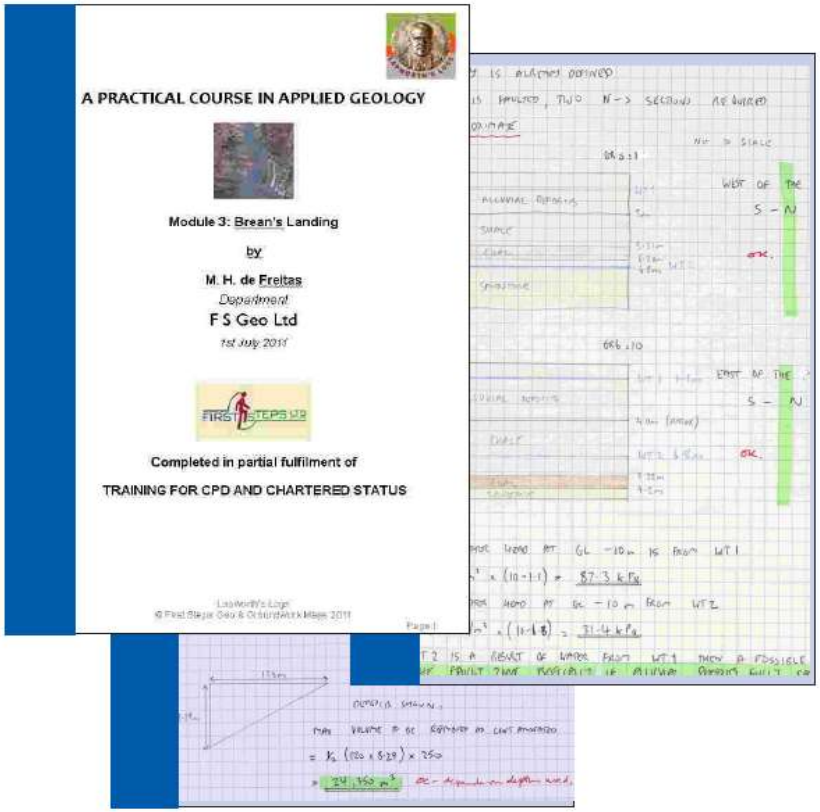
devised and produced by Michael de Freitas and Andrew Thompson © 2012 for First Steps Geo Ltd & Groundwork Maps™

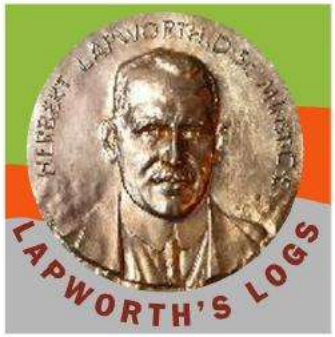


e-Learning designed to develop practical skills in Ground Modelling

Your Report

When completed your report should contain all the data you have collected, the diagrams you have drawn and the calculations you have made when answering the questions.





Unknowns, Risks, and Risk Register

	E1	E2	E3
C1	*H1*	*H2*	*H3*
C2	*H4*	*H5*	*H6*
C3	*H7*	*H8*	*H9*

Have they ever thought about their assumptions?

LIKELIHOOD	HAZARD		
	Minor	*Significant*	*Major*
Infrequent	R1	R2	R3
Occasional	R4	R5	R6
Frequent	R7	R8	R9

… and Risk Assessment explanations

The 5 backgrounds

BREANS LANDING — RISK ASSESSMENT GALLERY-1

YOU MUST USE YOUR EDUCATION & EXPERIENCE TO PRODUCE SOUND JUDGEMENT, JUSTIFIED CONCLUSIONS & A SENSIBLE PLAN OF ACTION

- C *Civil Engineering*
- ES *Environmental Science*
- G *Engineering Geology*
- GE *Geotechnical Engineering*
- H *Hydrogeology*

There is a pattern on the outcrop of the Chalk; could it be reflecting some unknown aspect of geology? C ES G GE H

NORTH BREAN'S LANDING — *AIR PHOTO*

Much detail shown over site that is not shown on topographical and geological maps; what can it mean and is it likely to be significant? C ES G GE H

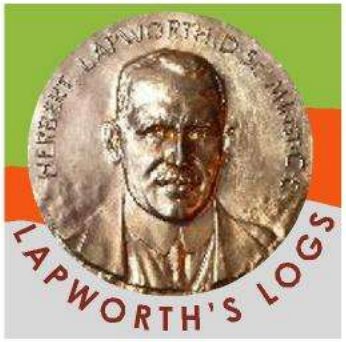
Is this river tidal?
If it is what could be expected?
What influence might it have on groundwater?

Low dips = uncertainties with predicting strike (see Tenupy).
Is the nature of the boundary between the superficial materials and the Chalk known? (see Walk-Over photos).
If this site is 3km from the sea what problems could this raise?

NORTH BREAN'S LANDING — *GEOLOGY MAP*

Does the river have a buried channel that connects with bedrock?
If so what will this do to groundwater? C ES G GE H

Lapworth's Logs by Michael de Freitas & Andrew Thompson © 2012

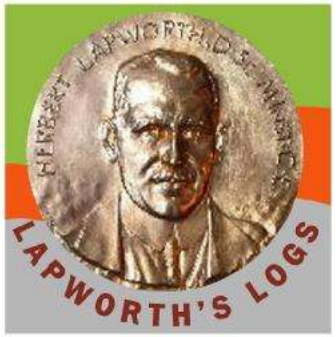


Learning Outcomes

* **Basic tools**
  - verifiable 3D model

* **Logic working scientifically**
  - conceptual model / theory
  - make a prediction
  - test the prediction
  - learn from the answer
  - adjust the concept/theory

* **Presentation of a solution to others**



For Further Information

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