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Preliminary Land Hazard Assessment

An Aid for Non-Specialists

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Acronym List

BGS British Geological Survey

USGS U.S. Geological Survey

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Introduction

This document has been prepared to provide non-specialist personnel (the assessor) with some simple indicators to screen out hazardous land from use for housing or short-term settlements, or to identify land that requires mitigating measures before it can be safely used. The document presents observations typically made in environmental site assessments, as well as geomorphology and engineering geology assessments, to provide a simple but structured approach to gathering information that may allow preliminary land-use decisions to be made.

Proper hazard assessment and environmental risk management require considerable expertise from specialists, usually from a multi-disciplinary team. This guide does not eliminate the need for specialists' advice before any final land-use decisions are made, but may help to identify the sort of advice most needed.

The hazards to look out for include those relating to water, land stability, and chemical exposure. Water can be a hazard because of flooding or poor drainage, because there is no safe drinking water available, or because sanitary wastewater cannot be safely disposed of. Land instability can result from unstable slopes, which have been undermined by natural or man-made causes, or by earthquakes and volcanoes. Avalanches, falling debris, and landslides in hilly terrain or mining areas have had devastating effects on settlements through time, and, in retrospect, often could have been predicted easily. Chemical hazards are usually thought of as being man-made, but can also result from natural causes (for example, high arsenic levels in groundwater or sulphates in soil). Most of these hazards leave recognizable signs on the land surface or have, at one time, been experienced by local inhabitants. It is, therefore, important that part of any land-use decisions includes discussions with local community members, where this question is asked: "Why is that area of flat land vacant?"

The majority of the following questions have yes/no answers—if the answer to a question is "yes," this means that you may need to obtain specialists' advice or consider alternatives. To help further investigation and decision making, the questions are also designed to prompt the assessor to compile notes on particular features and to take photographs. In this age of digital cameras, there is no such thing as too many photos. Take detailed photographs of anything

unusual or anything elicited by these questions. Try to take panoramic photos that cover the whole site area from multiple angles so that the land setting is clearly shown.

Before You Go

Use Google Earth, satellite imagery, and any available old or new topographic maps to build a picture of the site and its surroundings, and use that imagery to start answering some of the questions. Ideally, try to build a picture of the site history using old maps and photos. Check local and regional sources for geologic information (the U.S. Geological Survey [USGS], the British Geological Survey [BGS], and many national geological societies have considerable geologic map databases, some of which are now online). Ask local authorities for any environmental, planning, or site-use records that they may have. If available, use phone directories or even tax records to gain an understanding of site use or the use of a particular area. If you can, download topographic and geologic maps so that you can annotate them in the field. You may be able to identify unacceptable hazards at certain sites by just using information available in your office.

Time Elapsed Since Possible Hazardous Events Occurred

The more recent, or the more frequent, the hazard, the more readily the land surface shows the evidence of the hazardous event.

1. Estimate the age of vegetation: is it less than 10 years old (that may indicate a high return-rate hazardous event)?
2. Estimate the age of buildings: are they less than 10 years, more than 50 years, more than 100 years old?
3. Are all existing buildings (older than 50 years) away from water bodies, slopes, and embankments?

Slopes

The higher the angle of the slope, the higher the risk of slope instability: anything higher than 2 degrees may require engineering expertise to allow stable structures to be built. Steep slopes (anything higher than 10 degrees) near an area (either uphill or downhill) suggest increased

potential for hazardous events from flooding, landslides, falling debris, and avalanches. Land contained between steep slopes may be at risk from flash flooding, while open land downhill from a canyon-like feature could be at risk from flash flooding and falling debris.

1. Is the slope angle higher than 2 degrees?
2. Are there steep slopes near the area (either above or below)?
3. Are there deep canyons uphill from the area?
4. Is the area confined between steep hillsides or canyon walls?
5. Are there dry channels covered with gravel or cobbles?
6. Are there out-of-place large boulders?
7. Are there dead trees or trees with significant limb damage?
8. Are trees that typically grow vertically growing at inclined angles or apparently changing angles?

Water

Standing water, high groundwater tables, and actively eroding streams or rivers can lead to land instability or flooding, and make disposing of water (including sewage) difficult. If groundwater is used as a water resource, it will be at high risk of pollution under these circumstances.

1. When did it last rain?
2. Is there standing water (puddles, pools, ponds)?
3. How far is it to the nearest surface water?
4. Are there stream channels (either dry or with running water) running through or near the site?
5. Are the stream channels frequent, and do they interweave?
6. What is the relative elevation between the site and the nearest surface water? (If they are close together, the groundwater may be shallow and the risk of flooding is higher. If the site is near open water, the risk from storm events or tsunamis is greater.)

7. Are drains or open ditches transporting wastewater or sewage onto the site or into channels crossing the site?

Land Forms

Slow, steady, low-hazard, landforming processes tend to create even, gently sloping landforms. Sudden changes in topography indicate uneven (in geologic terms) earth movements such as those caused by erosion from rapidly flowing streams (even if there may be no water in the bottom of that gully today), landslides, earthquakes, or man.

1. Is the ground flat when surrounding land is not?
2. Is the terrain hummocky (numerous depressions, holes, ponds)?
3. Are there abrupt embankments or breaks in the slope?
4. Are there large boulders or cobbles on or near the ground surface?

Industrial Hazards

Evidence of industrial activity, mining, or waste disposal indicates possible chemical contaminant hazards. Visual inspections will only rarely result in an assessment of whether chemical exposure is a significant risk; therefore, if an industrial use is suspected, more detailed investigations and engineering controls should be strongly considered. Industrial hazards may also be physical: stockpiled wastes, even if chemically inert, can be unstable; underground fires can occur in mines and landfills, and undermine surface stability.

1. Are there industrial buildings (in use or out of use) on or near the property?
2. Is the land flat where surrounding land is hilly, or mounded where surrounding land is flat?
3. Is there any evidence of chimneys?
4. Is there evidence of backfilled excavations (different soil color, patched tarmac, or cement)?
5. Are there areas of discolored soil or hard cover?
6. Are there any signs of dead vegetation or patches where plants do not grow?

7. Are there any stockpiles of materials, including soil?
8. Are there any unusual odors in the air, soil, or water?
9. Is there any colored or oily water, either standing or flowing?
10. Have plastic or steel drums been left in the area, either on the surface or buried?
11. Are there piles of tires?
12. Is there active industry less than one mile away?
13. Are there mines or quarries?
14. If there are mines or quarries, what is extracted?
15. Is the substance being mined hazardous?
16. How and where are mine wastes stockpiled?
17. Are there mine wastes within 150m of the site?
18. Are any mine wastes stockpiled at a higher elevation than that of the site?
19. Is the land involving mines or quarries restored by backfilling?
20. Is there any evidence of underground fires or gas releases (smoke or steam rising from the ground, charred soil, patches of warm soil, “soil vents,” “pits” in the land)?

History and Local Knowledge

No preliminary inspection can be expected to result in all of the information that is relevant to a particular piece of land; therefore, if possible, take advantage of local knowledge. That local knowledge can be both immediate (from interviews with long-term residents) and indirect (how is the land portrayed by local names and stories?).

1. Does the local population have an unusual name for the area?
2. Does the name indicate a potentially hazardous past use (e.g., Tanner’s Lane) or event (e.g., Les Eboulements)?
3. Are the names out of keeping with the area (e.g., a new development on Willow Lane in a commercial area with no willows)?

4. Are there local planning restrictions or customs restricting a particular site use?
5. Where are the local cemeteries?

What can the locals tell you? Ask long-term locals any of the questions listed in previous sections of this survey—but particularly:

1. What was the land used for?
2. Have there been buildings on the land previously? If not, why not? If “yes,” why are there none now?
3. Do the locals have any memory of floods or land movement?
4. If there is a stream, how high has the water risen?
5. If there are trees, when were they planted?
6. If there are no trees now, were there ever any? What happened to them?
7. Has anybody ever grown food on the land? If not, why not? If they stopped, why did they stop?
8. Are there wells in the area? Is the water good to drink? Is it good for cleaning clothes? What does it taste like? Any smell? Does it change color if stored?