HILLSIDE DEVELOPMENT MANUAL FOR JAMAICA

Presenter
Norman Harris
Mines and Geology Division
Ministry of Energy and Mining

June 9, 2011
Presented at JIE Seminar on
Taking Responsibility to Protect Jamaica's Infrastructure

CONTENTS OF PRESENTATION

- Introduction (Background, Purpose etc)
- Hillside Development Process
- Current Practices
- Hillside Development Guidelines
- Requirements for Hillside Development

INTRODUCTION

BACKGROUND

- Pressure for housing in Jamaica.
- Increase in urban population leading movement along the urban fringe
- Preferred choice for developers and home owners because it is an attractive place to live .
- Increase in number of subdivision/building applications for Hillside Development

INTRODUCTION CONT'D

Why a Hillside Development Manual

- Rapid expansion of hillside development has led to geo-hazard and environmental problems
- Hillside development brought a number of challenges not anticipated in the planning and development process.
- Hillsides often characterized by weak rocks, steep slopes, geological faults and prone to landslides, debris flood/flows, erosion and flooding.

INTRODUCTION CONT'D

Why a Hillside Manual?

- Existing planning regulations and development guidelines expose gaps/weaknesses exploited by developers.
- Change paradigm - follow global trends in viewing hillsides as a natural resource to be protected.

INTRODUCTION CONT'D

Purpose

- Reduce the incidence of geo-hazards due to inappropriate development on hillsides
- Promote public health and safety through creative planning and design.
- Protect the natural and topographic character of the land.
- Preserve the scenic beauty and aesthetic quality of hillsides.
- Ensure that hillsides are developed in harmony with the natural environment

DEFINITION OF HILLSIDE

- Hillside area is defined as land in all zoning districts with an average slope of 17 percent (10 degrees) or greater.

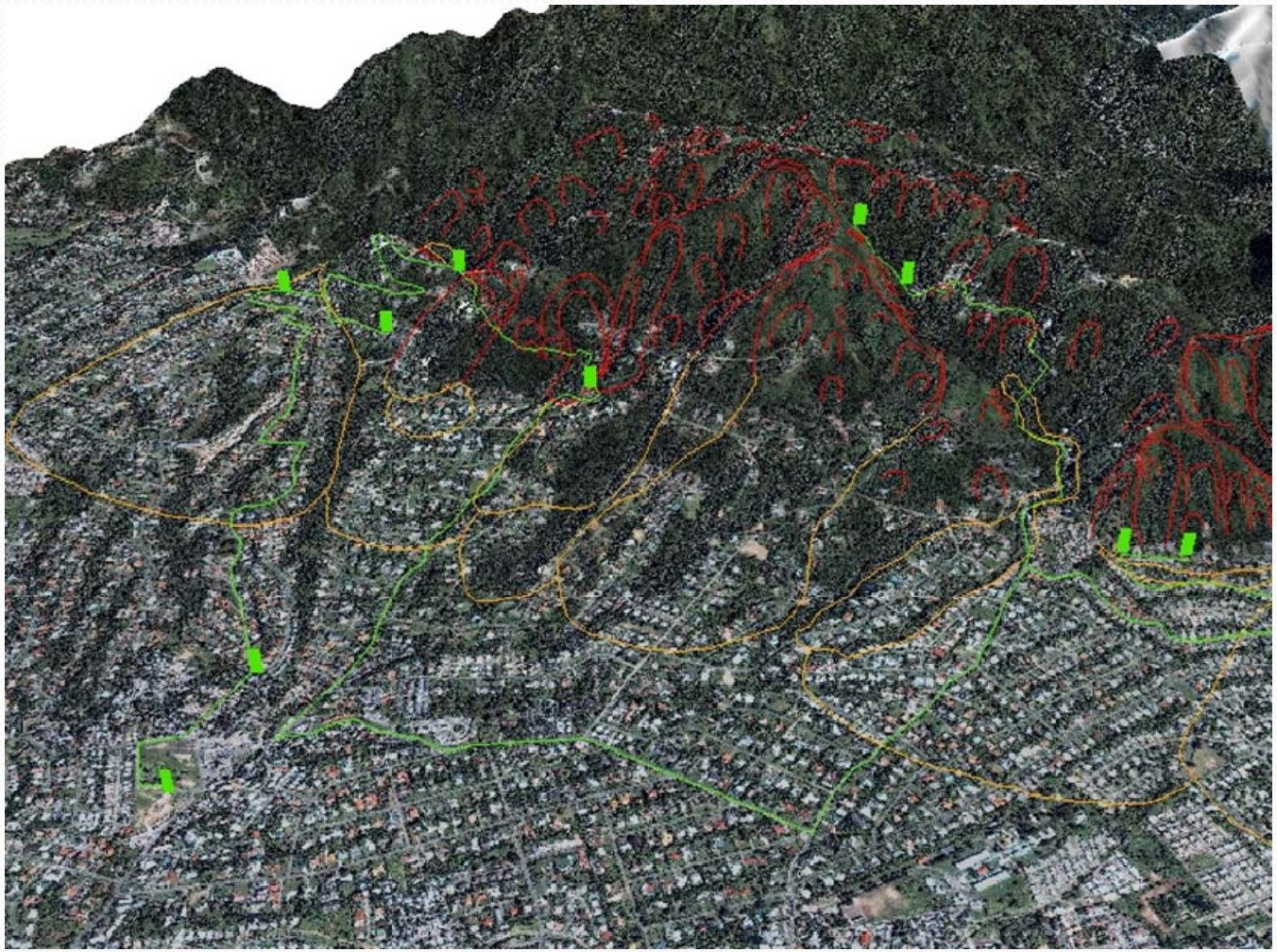
- This is based on most common threshold values for hillside ordinances in other jurisdictions.

HILLSIDE DEVELOPMENT GUIDELINE PROCESS

- Review of Hillside Ordinances and best practices in other jurisdictions (USA & Far Eastern Countries)
- Review of Existing Planning regulations for J/ca
- Examine current practices for Hillside Development
- Hillside development as part of a Multi-disciplinary process
- Project team/Working Group

Physical Characteristics

Topography: 3-D model of Jacks Hill area, St. Andrew



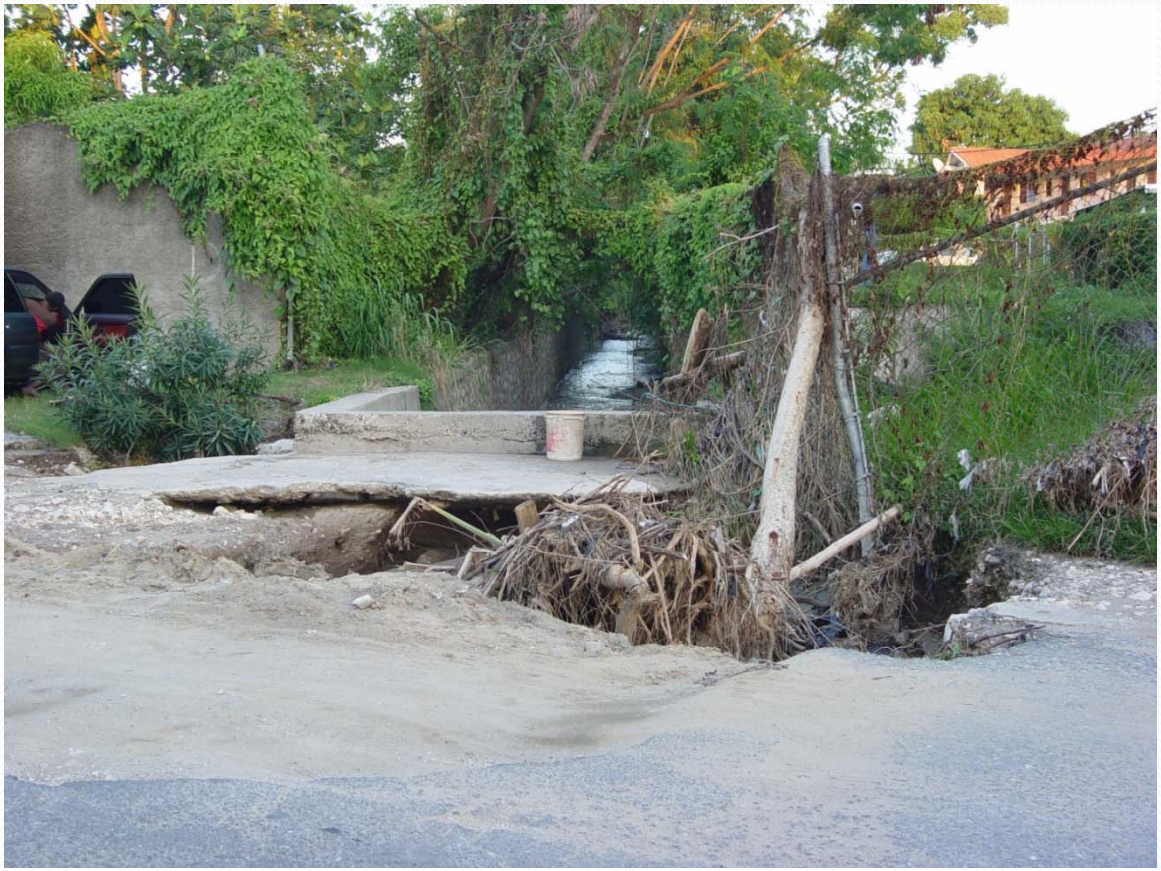
Source: Courtesy of Lyew Ayee & R Ahmad

CURRENT PRACTICES

1. No Criteria for Maximum Slope Gradients for hillside development

CURRENT PRACTICES CONT'D

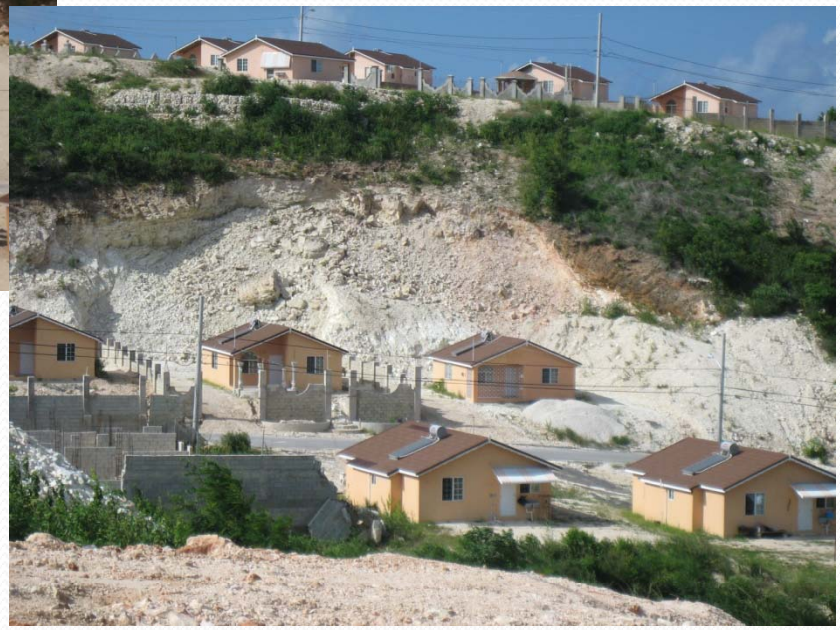
2. Existing drains inadequate –designed for pure water flood and not debris flood



CURRENT PRACTICES CONT'D

3. No Standard/Guidelines for Cut and Fill

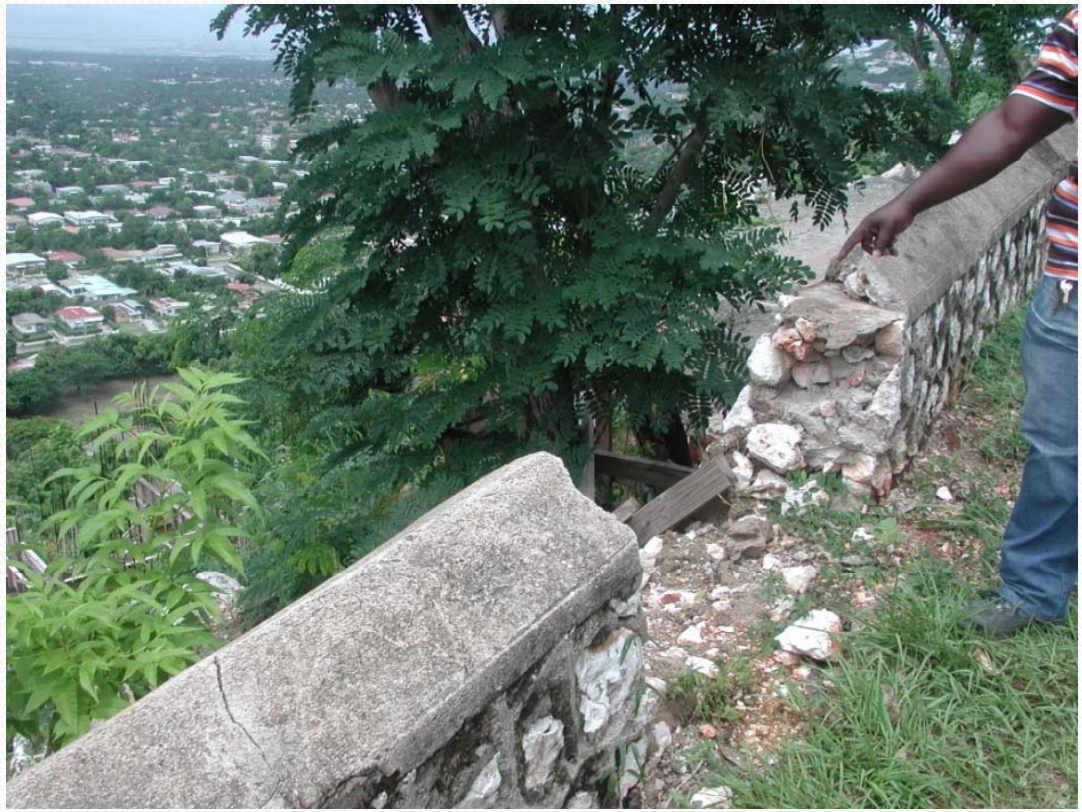
Deep excavation cut on weak rock slopes - St James - (2008)



Failure of cut slope - 2010

Current Practices Cont'd

4. Problem of Access into Hillside Property



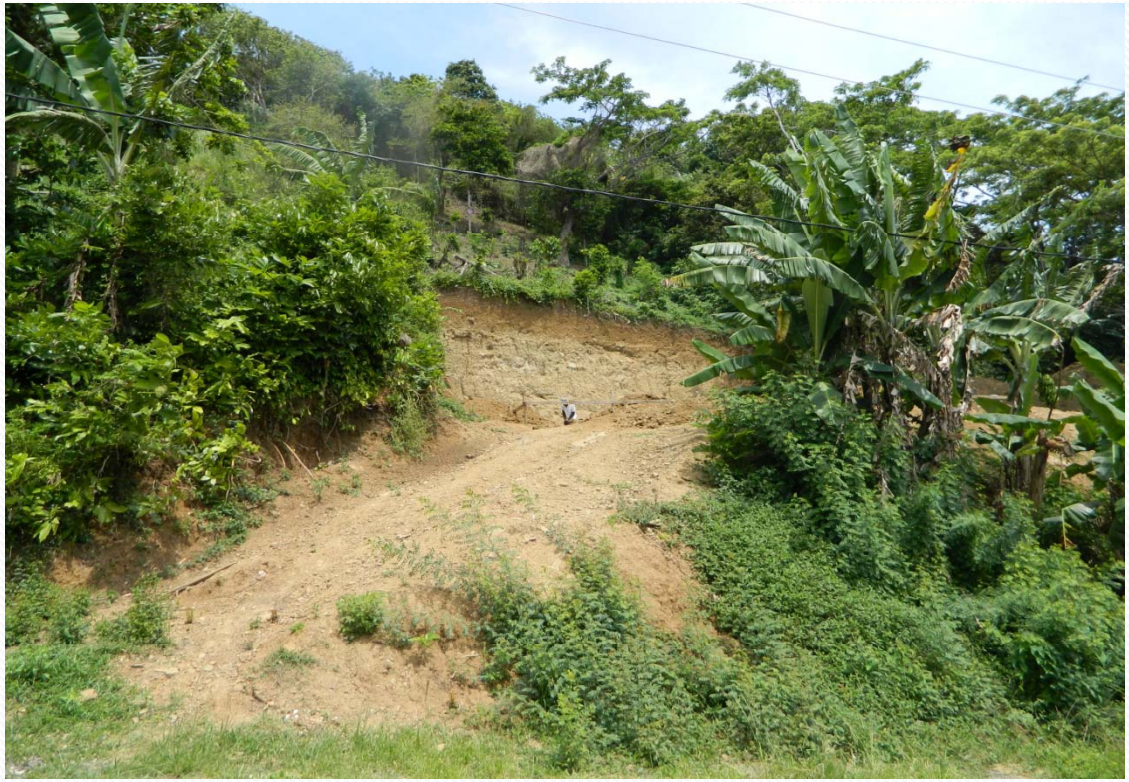
Road retaining wall damaged to access property

CURRENT PRACTICE CONT'D

5. Inadequate lot sizes

Lot size not adequate for terracing and easy access

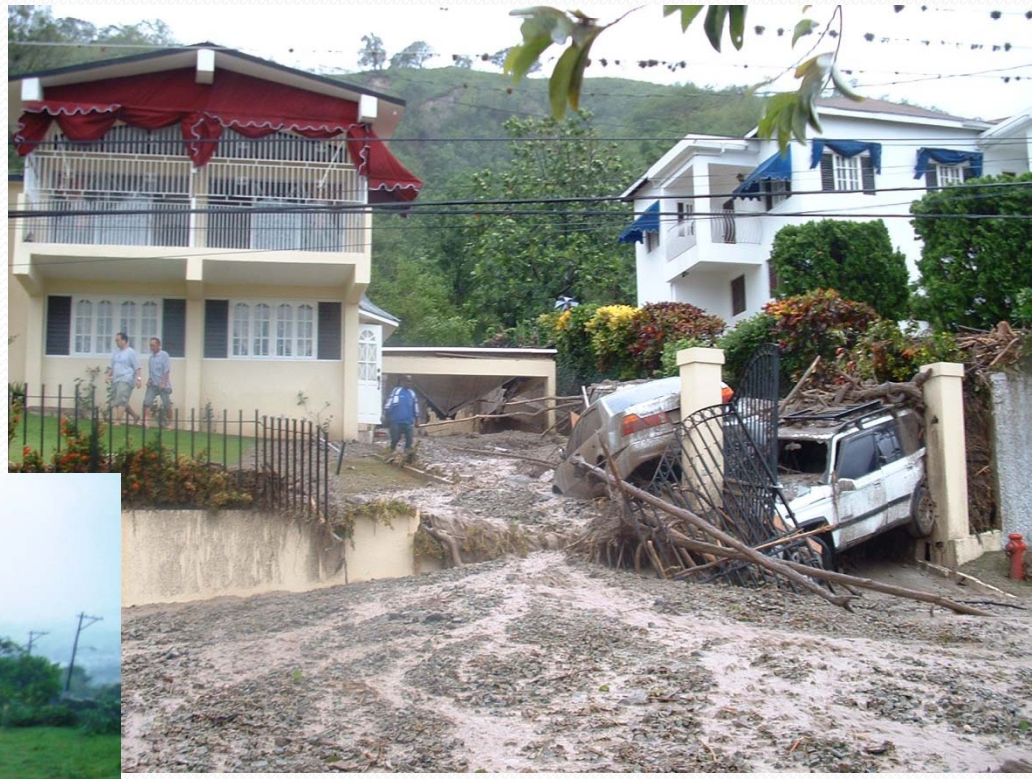
Deep cuts (>5m) in weak rock/soil to prepare building site

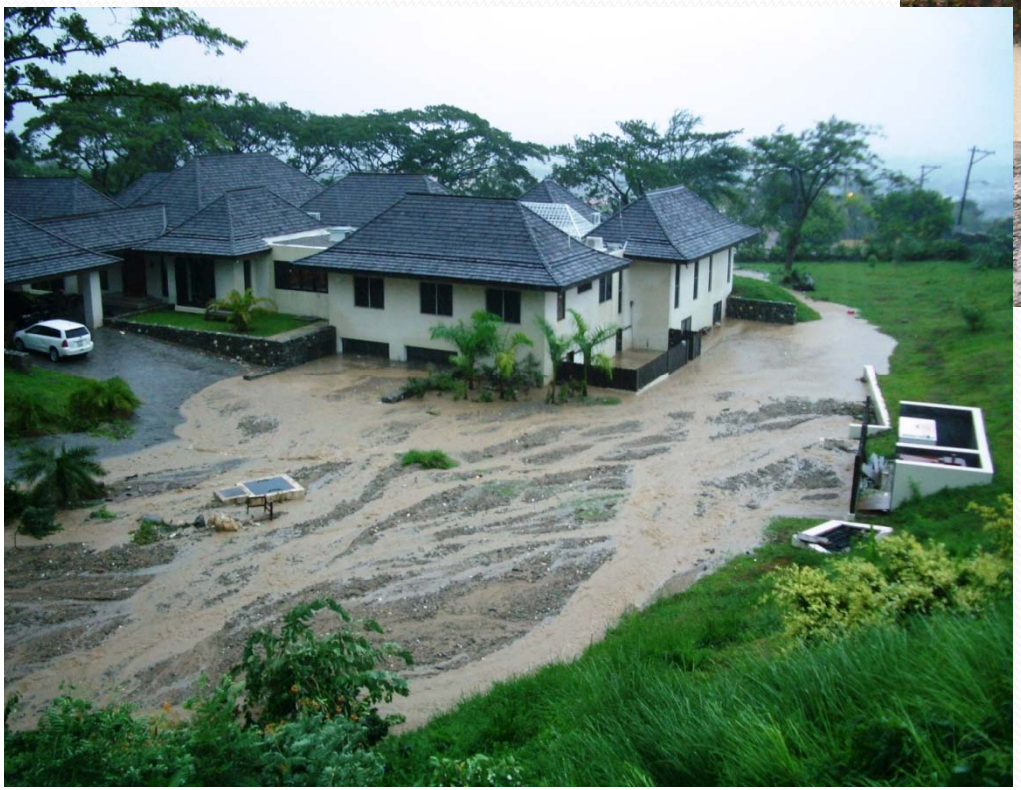


Natural Hazard

Debris Floods/Flows

Debris Flood, Wilmington Drive, Jacks Hill. Photo: Maurice Jones (Gustav 2008)





Debris Flow, Hope Pastures Hurricane Ivan 2004

Natural Hazard Cont'd

Rock Falls

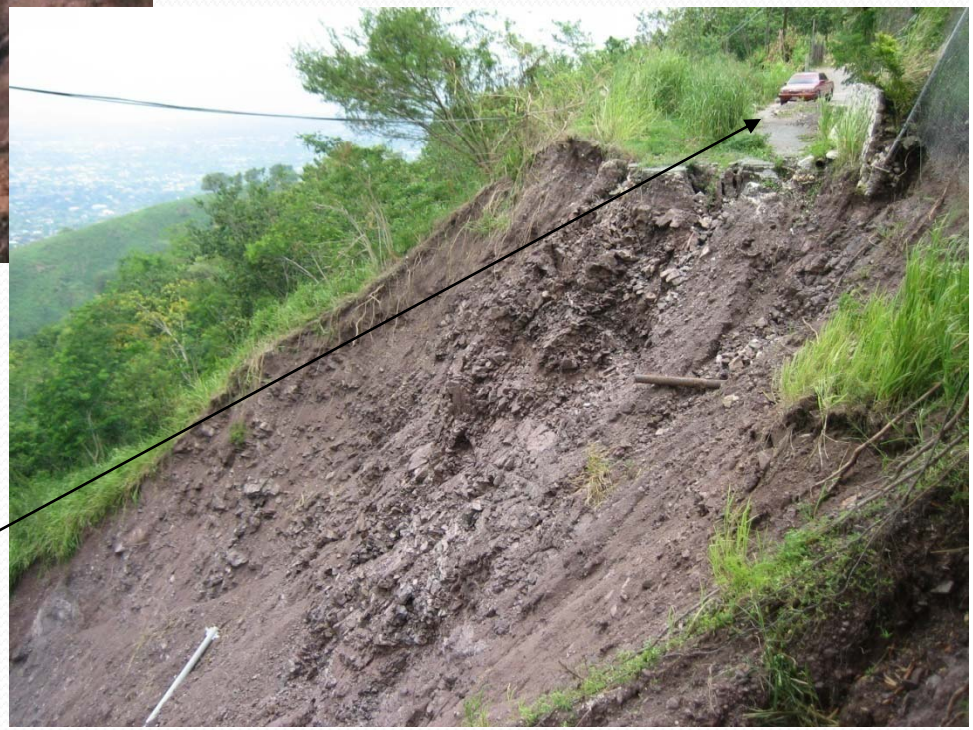
Loose rocks on steep hillside proposed for residential development

Rock Fall - RedGate, Westmoreland

Natural Hazards Cont'd

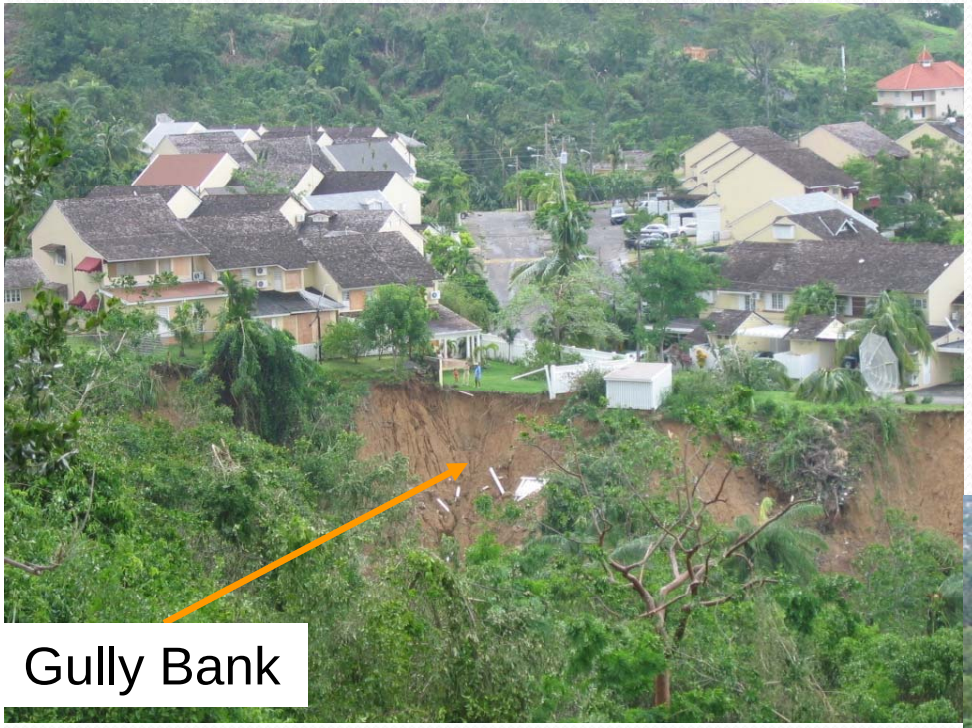
Collapsing house caused by Landslide, Jacks Hill Road Nov.1988

Road Failure caused by landslide, Skyline Drive Jacks Hill area. Photo E James



Skyline Drive

Natural Hazards Cont'd



Erosion on the bank of the Wilmington Gully –Jacks Hill. Photo Maurice Jones

Material from excavation of hillside dumped into gully below –Jacks Hill area. Photo Maurice Jones

PROPOSED HILLSIDE DEVELOPMENT GUIDELINES

- Guidelines for Slope Steepness
- Guidelines for Slope Stabilization
- Guidelines for Earthworks (Cut and Fill)
- Guidelines for Hillside Erosion and Sediment Control
- Hydrology and Surface Drainage
- Residential Densities and Lot Sizes.
- Developments in Karst/Limestone Terrain

Guidelines Cont.d

- Guidelines in Colluvial Soils (Geological material derived from Old Landslide deposits)

- Visual Impact and Character of Hillsides

Hillside Development Guidelines Cont'd

Slope Steepness/Slope Gradient Categories

Class	Slope Category	Slope Gradient	
		%	Degrees(°)
1	Gently Sloping	1-16	1-9
2	Moderately Sloping	17-33	10-17
3	Steeply Sloping	34-50	18-25
4	Steep-very steeply sloping	50-59	26-30
5	Very steep – near vertical slopes	>59	>30

HILLSIDE GUIDELINES CONT'D

Slope Steepness

Development on slopes >30 deg (59%) not permitted.

Development on slopes 26 deg-30 deg (50% -58% slope) permitted if slopes are stable.

Difficulty of access an important consideration on steep slopes.

Collapse section of building at Lawrence Tavern - St. Andrew

HILLSIDE GUIDELINES CONT'D

Guidelines for Cut and Fill

No cut and fill on slopes >30 degrees (59% slope)

Limit cut and Fill. Avoid mass grading

Grading plans for 'design and build' is required

Levelling of land not permitted.

Potentially unstable cuts for housing development

Hillside Guidelines Cont'd

Slope Stability

No development on slopes that are active

High landslide prone areas shall be avoided

Height of retaining walls shall not exceed 3m

Failure of Retaining wall at Norbrook Heights, St Andrew

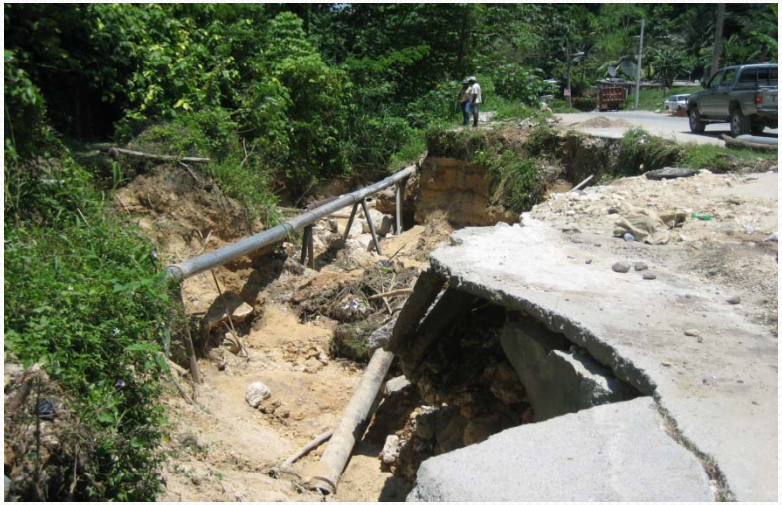
HILLSIDE POLICY CONT'D

LOT SIZES AND DENSITY

TERRAIN	SLOPE GRADIENT (Degree)	LOT FRONTAGE (m)	LOT SIZES					
			RURAL TOWNS		SUB-URBAN		RURAL AREAS	
			Sq.m	Sq.ft	Sq.m	Sq.ft	Sq.m	Sq.ft
Flat -Gentle Sloping	0-10	12	550	5,914	750	8,064	1,100	11,828
Moderately Sloping	11 – 18	17	850	9,140	1000	10,752	1,300	13,978
Steeply Sloping	19 – 26	22	1,250	13,440	1,300	13,978	1,500	16,130
Steep –very steeply Sloping	27 - 30	28	N/A	N/A	1,600	17,204	1,800	19,354
Very Steeply Sloping	>30	*N/A	N/A	N/A	N/A	N/A	N/A	N/A

Hillside Development Cont'd

Erosion and Sediment Control

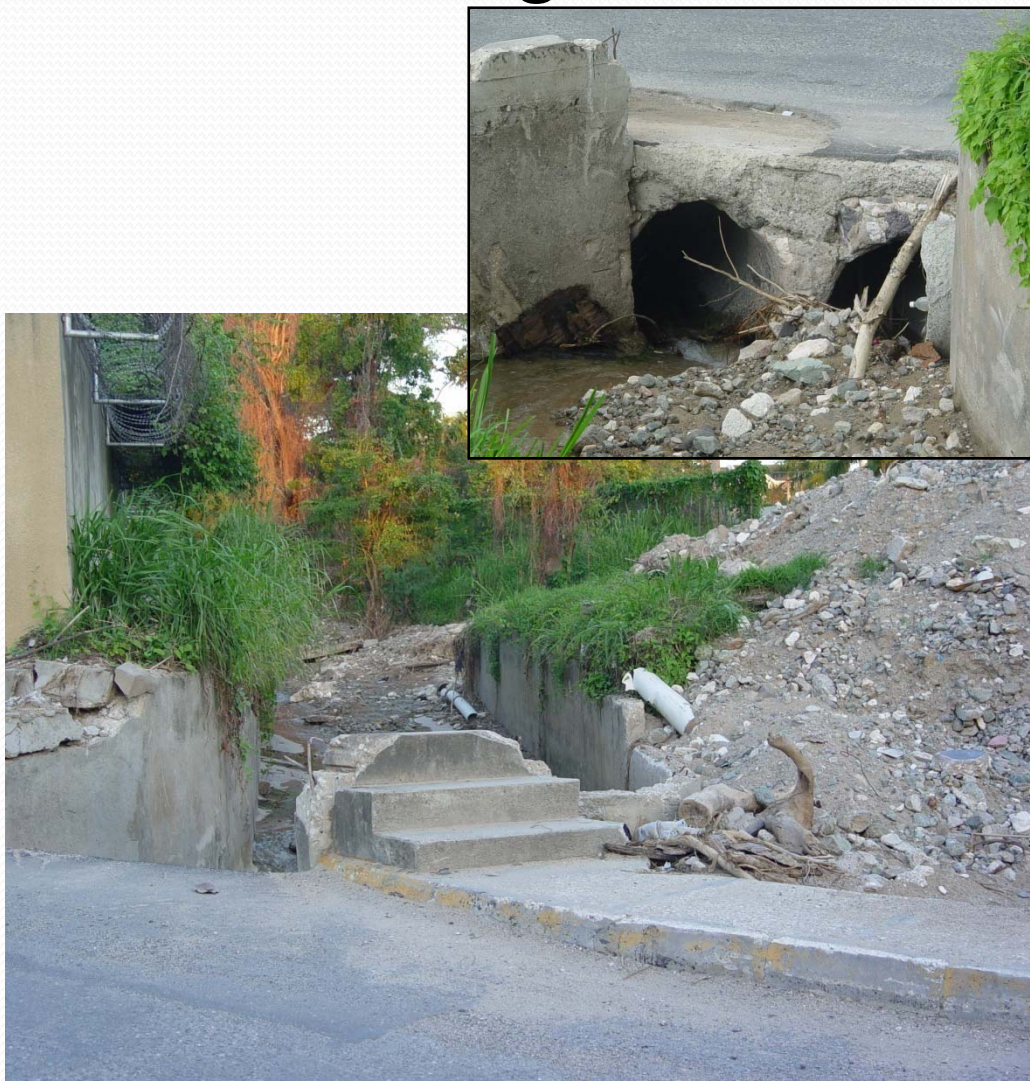


- Maintaining natural vegetation cover
- Establish permanent vegetation on graded slopes
- Use of rip rap, gabions, erosion control mats (erosion structural control)
- Berms, silt fences, sediment control basins, storm drain inlet protection etc.(sediment structural control)

HILLSIDE GUIDELINES CONT'D

Guidelines for Hillside Drainage

- Preserving natural drains (open vs buried drains)
- Preserve natural vegetation
- Walkways, parking lots, low traffic areas to be constructed with permeable surfaces.
- Catch basins, soak away pits, detention ponds to reduce peak flow discharge
- Design drainage structures for debris floods



HILLSIDE GUIDELINES CONT'D

Development in Limestone Karst Terrain

- Scarp slopes with high rock fall potential not permitted for development
- Hydrological studies for subdivisions using sinkholes as partial/final outfall.
- Sinkholes to be fenced and protected
- Limestone cavities/sinkholes, not to be covered or buried

Entrance to limestone cavity/cave in karst terrain

HILLSIDE GUIDELINES CONT'D

Visual Impact and Character of Hillsides

- Developments to blend with natural environment
- Developments must not dominate the hillside – maintain open space character
- Architectural styles that are massive and bulky should be avoided
- Stepping of building foundations and roofs with the natural slope shall be encouraged

REQUIREMENTS FOR HILLSIDE DEVELOPMENT

- Pre-consultation (MGD, DAC)
- Contour plans, max. 2-3 m contour intervals
- Grading Plan as a critical requirement for development applications, particularly building applications (original and finished grades of all engineering structures to be included)
- Road Gradient Profiles
- Geotechnical/ engineering geology reports, particularly for developments on problematic rocks/soils

Requirements for Hillside development

- Geology/Geo-hazard statement/report for smaller developments with slope stability issues

Stakeholder Participation/ Working Group

- Working Group (Architects, engineers, planners, developers, geologists/ geo-hazard specialist, land surveyors etc) as stakeholders to assist with Hillside Development Manual
- Work Closely with NEPA to complete final document

THANK YOU