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INTEGRATED ENVIRONMENTAL MANAGEMENT FOR SUSTAINED DEVELOPMENT

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ABSTRACT: Lowland problems are many. Many urban settlements are on the coastal belt, worldwide. In the past, many urban areas grew in an uncontrolled manner. The urban populations experienced increased risks, a poorer quality of life, and health problems. However, in general, there has been increasing management of many urban environments through Land use planning, building, environmental, health and safety regulations and management of emergencies, collectively balancing social, economic and environmental requirements. In this paper the complexities of urban cities are illustrated through many examples without naming any particular city. Since in modern times, globalization has created an environment where economic borders only exist. The systems are usually administered by separate authorities, which need to act together to secure sustainable urban management. Therefore actions and responses are frequently disconnected and are sometimes conflicting. To attain sustainable growth common sources of information are necessary. To emphasize the following eleven illustrative examples of some urban cities and their issues are discussed.

Keywords: Environmental Geology, Aquifer, Sustained development, Geomorphology.

1. INTRODUCTION

Urban areas are extreme cases where human activities have the greatest impacts on the local environment, and environmental processes can affect the greatest numbers of people. They need separate attention. Decisions made by developers and urban authorities have major implications for health, safety, the economy and the environment. Since ground processes and the nature of the underlying materials influence the occurrences of geological resources and hazards, it is important that these should be properly understood so that appropriate actions are taken to safeguard natural resources, reduce risk to people. In this paper the need for good communication between urban authorities developers and geoscientists.

2. GROWTH AND RENEWAL IN URBAN AREAS

The geographical origins of towns and cities are diverse. Most develop in response to natural and local conditions. The following factors influence settlements:

1. Convenient stopping places on routes such as passes between hills, convenient points on rivers, or at water sources in arid areas.
2. Ports on sea coasts, rivers or lakes.
3. Location in farming areas where routes meet allowing the development of markets.
4. Defensive sites, often on rocky prominences with areas below that could be used for building dwellings.
5. Administrative centres normally at prosperous settlements developed for other reasons but sometimes separately, for instance to refocus activity by removing administration from a coastal town to a site in the interior to promote development. All but the last of the above mentioned factors are associated with specific Geo-morphological settings that reflect underlying geology.

3. MANAGEMENT OF THE URBAN ENVIRONMENT

In the past, in many countries, especially in developing countries urban areas grew in an uncontrolled manner. The urban population experienced increased risks, a poorer quality of life, and increased health problems. This trend continues where migration from rural to urban areas is very rapid. However, there has been increasing management of many urban environments through a variety of regulatory regimes.

1. Land use planning – which is concerned essentially with locating development in the most appropriate places, while protecting areas worthy of conservation, so that development is undertaken at the best balance of social, economic and environmental cost.
2. Building regulations- which aim to ensure that built structures are properly constructed and are fit for use.
3. Environmental regulations- regulating the operation and occupancy of sites, ensuring that waste and emissions are properly controlled and dealt with and that air and water are protected, so as to minimize social and environmental damage, including risks to health, conserving natural habitats and maintaining biodiversity.

4. Health and safety regulations – to ensure that employees, and other people entering places of employment, are safeguarded from unnecessary risks.
5. Environmental health regulation – to ensure that people are not exposed to potential hazards to health.
6. Management of emergencies – setting out and disseminating procedures for protection, evacuation and relief, making provision for emergencies services in relatively low hazards locations, and minimizing the likelihood of major accidents.

EXAMPLES OF URBAN ISSUES

4.1 The City Scenario 1

In a city an industrial centre grew on the basis of local coal and ironstone mining that supported heavy industry. The uncontrolled outcome is shown in Fig. 1 (Case I).

4.2 The City Scenario 2

In the initial stage small quarries were opened for the extraction of limestone many years ago. The stones were used in the construction of major local buildings. The quarries were then abandoned. The buildings became part of the cultural heritage. The city expanded over the stone resource area. The uncontrolled outcome is shown in Fig.2 (Case II).

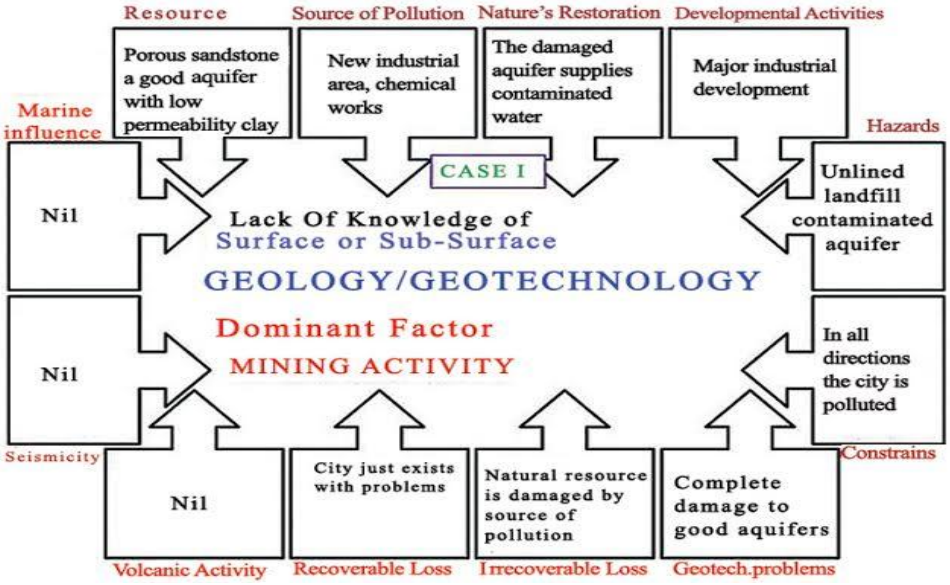

Fig.1 uncontrolled Outcome Case I

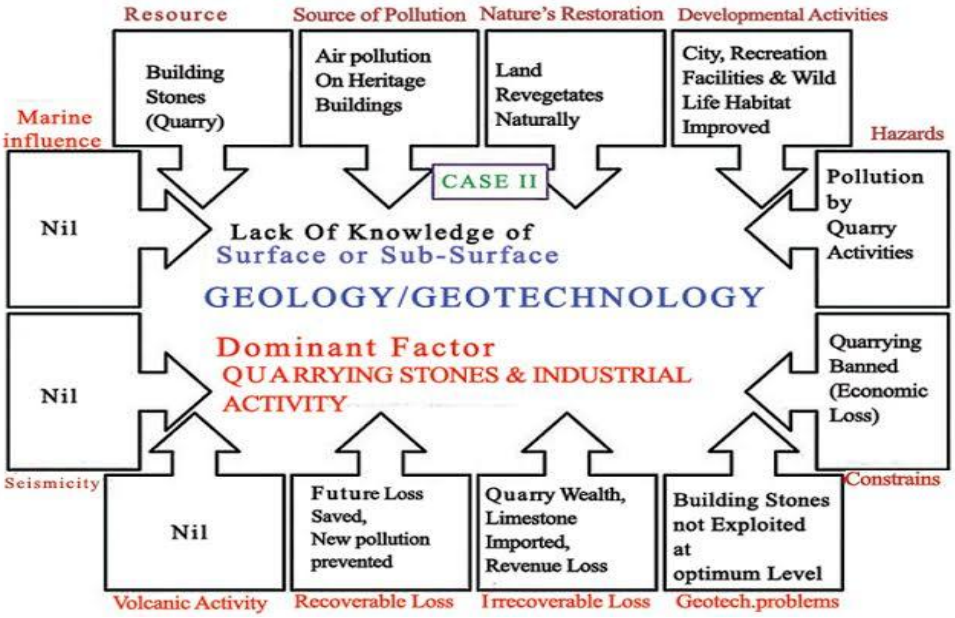

Fig.2 Uncontrolled Outcome Case II

4.3 The City Scenario 3

A major manufacturing city was linked to a sea port by an aging railway that had been constructed through a range of hills, along a river valley. Because of poor maintenance and increase in traffic the uncontrolled outcome is shown in Fig.3.(Case III).

4.4 The City Scenario 4

A city is located beside a bay with a narrow coastal plain backed by mountains. It was a port but expanded along the coast as housing, industry and tourism developed. Because of dredging the uncontrolled outcome is shown in Fig.4 (Case IV).

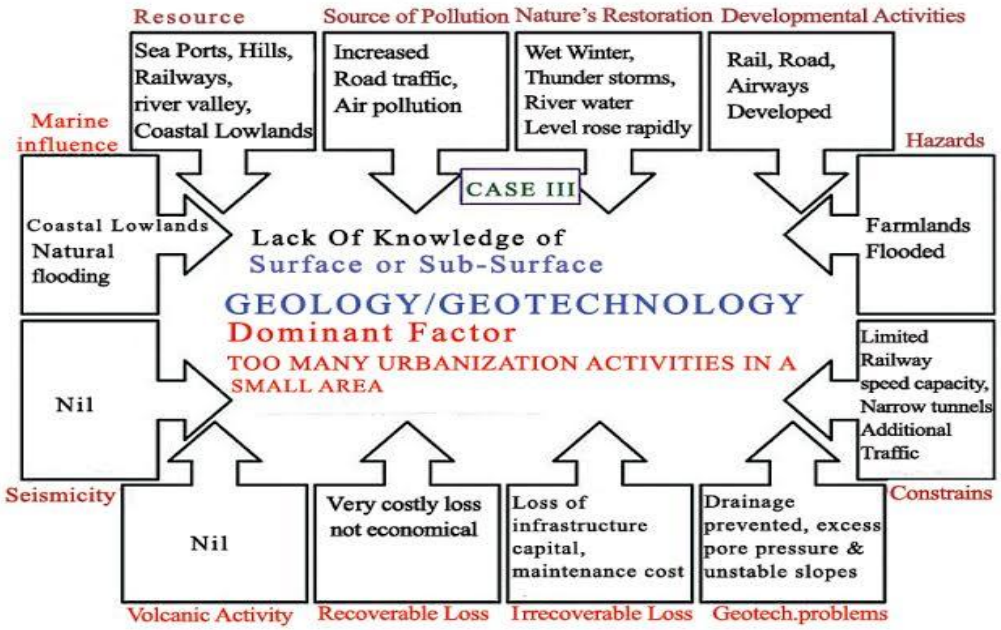

Fig.3 Uncontrolled Outcome Case III

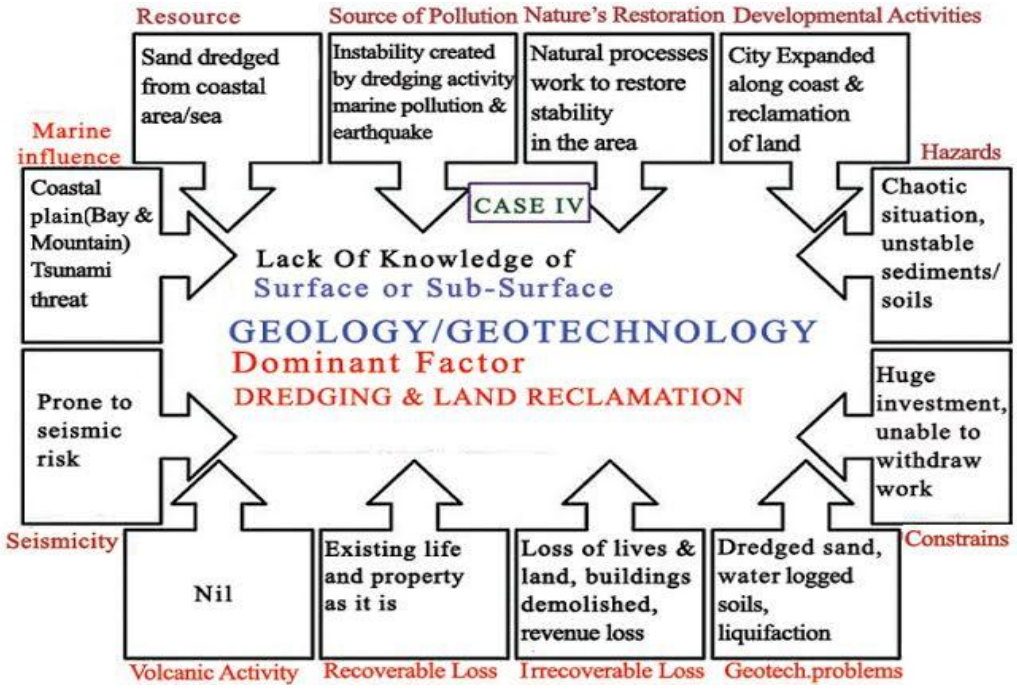

Fig.4 uncontrolled Outcome Case IV

4.5 The City Scenario 5

A city had been a major manufacturing centre. More recently, traditional industries had declined and a thriving service sector was now the main employer. The excess ground water created uncontrolled outcome as shown in Fig.5 (CaseV).

4.6 The City Scenario 6

A major industrial area developed in and around a city. The complex was powered by coal and by manufacturing of gas and coke. Ash was tipped on areas between the factories and gave rise to localized contamination. This contamination caused uncontrolled outcome as shown in Fig.6 (Case VI).

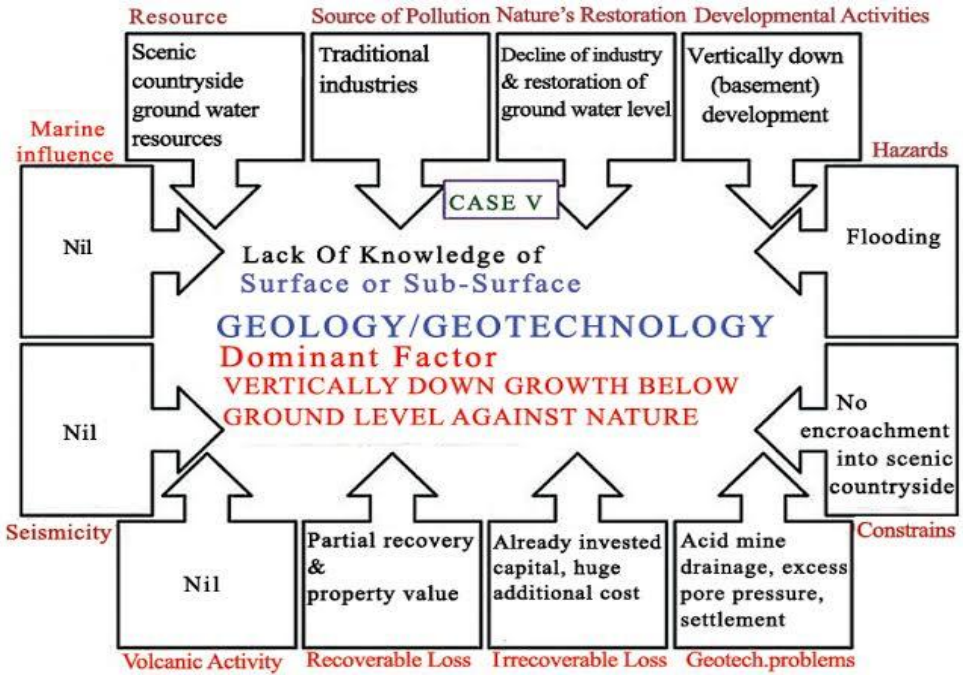

Fig.5 Uncontrolled Outcome Case V

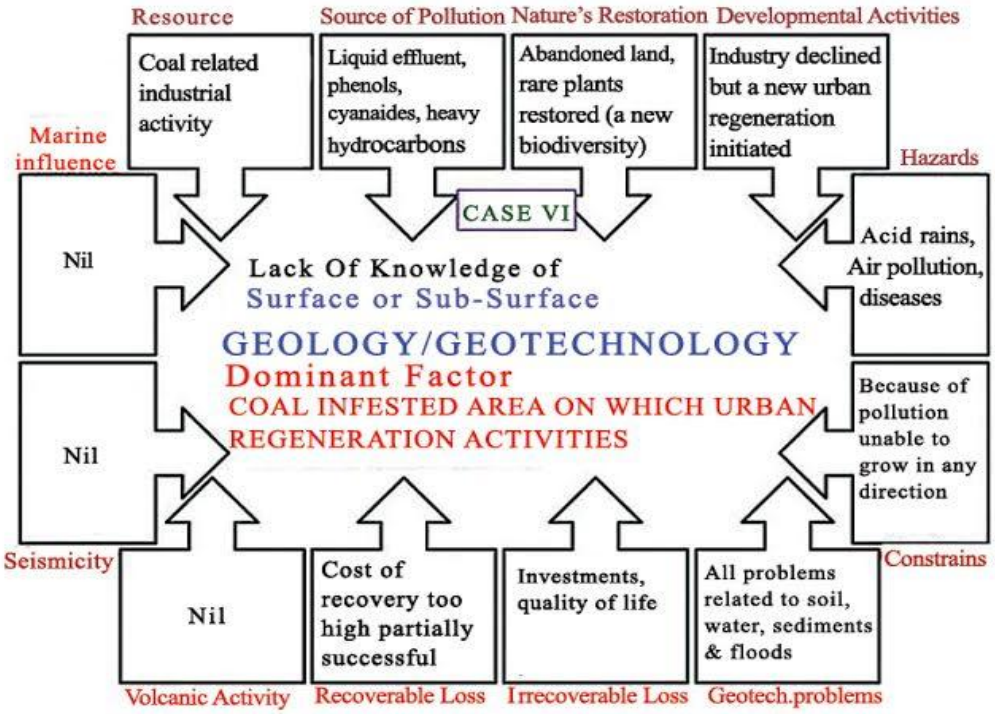

Fig. 6 uncontrolled Outcome Case VI

4.7 The City Scenario 7

Porous sandstone beneath part of a city is the major source of local water supply. The aquifer is overlying in places by sand and gravel and elsewhere by low permeability clay. A major chemical works contributed uncontrolled outcome as shown in Fig.7 (Case VII).

4.8 The City Scenario 8

An area of uplands was rich in timber of high commercial value. Because of the need to earn foreign currency the government licensed major logging concessions. The logging company wished to maximize its profits and undertook rapid tree felling over a few years. Cutting of trees created uncontrolled outcome as shown in Fig.8 (Case VIII).

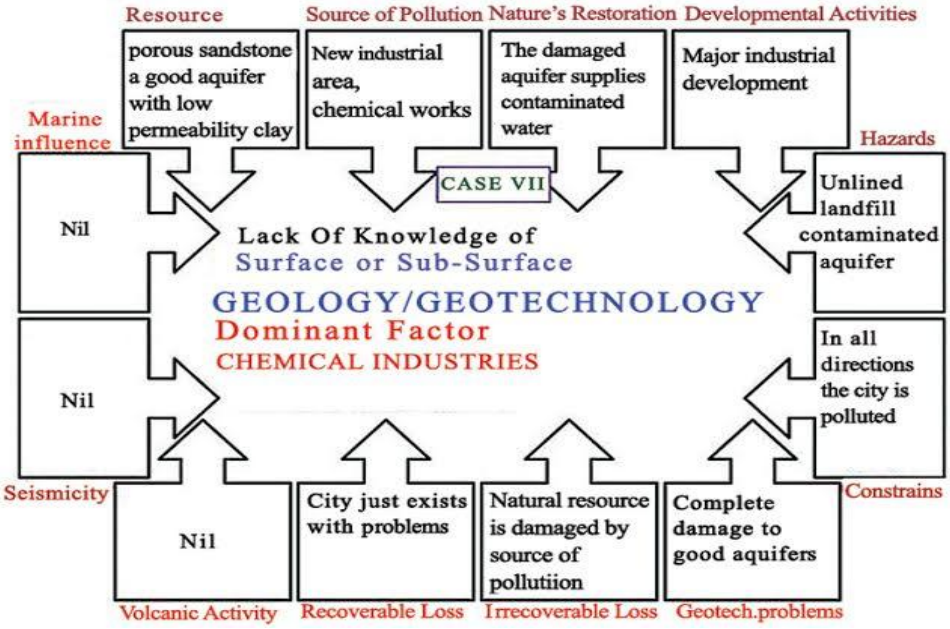

Fig.7 Uncontrolled Outcome Case VII

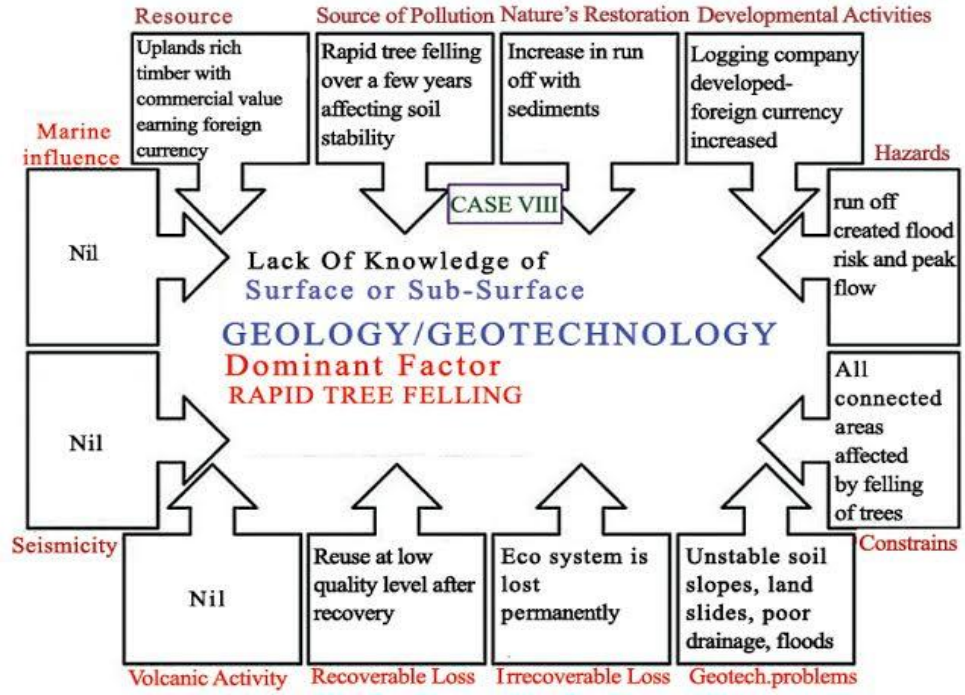

Fig.8 Uncontrolled Outcome Case VIII

4.9 The City Scenario 9

The low lying coastal area, lined by dunes, marshes and areas of mangroves was located to the west of a major port that had been designated for expansion. This involved the building of a breakwater to the east of the undeveloped coast and the dredging of a deeper access channel. The breakwater and the dredging operations created uncontrolled outcome as shown in Fig.9 (Case IX).

4.10 The City Scenario 10

Major population growth took place in a city before mains drainage was constructed severe pollution of surface water and wells by sewage occurred. The unplanned expansion and population explosion created uncontrolled outcome as shown in Fig.10 (Case X).

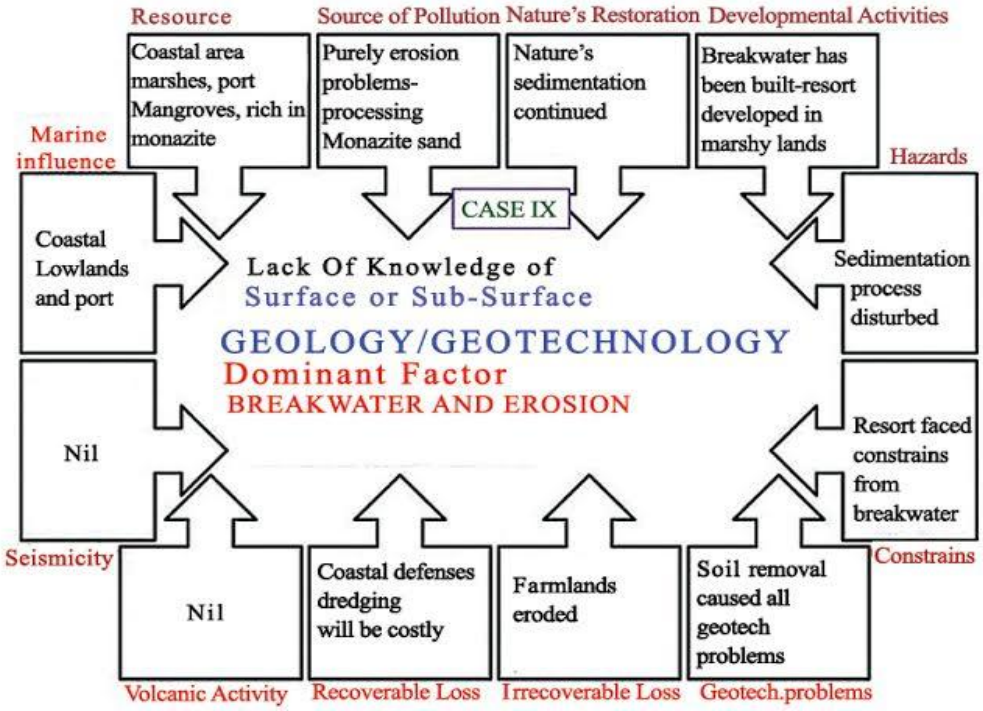

Fig. 9 Uncontrolled Outcome Case IX

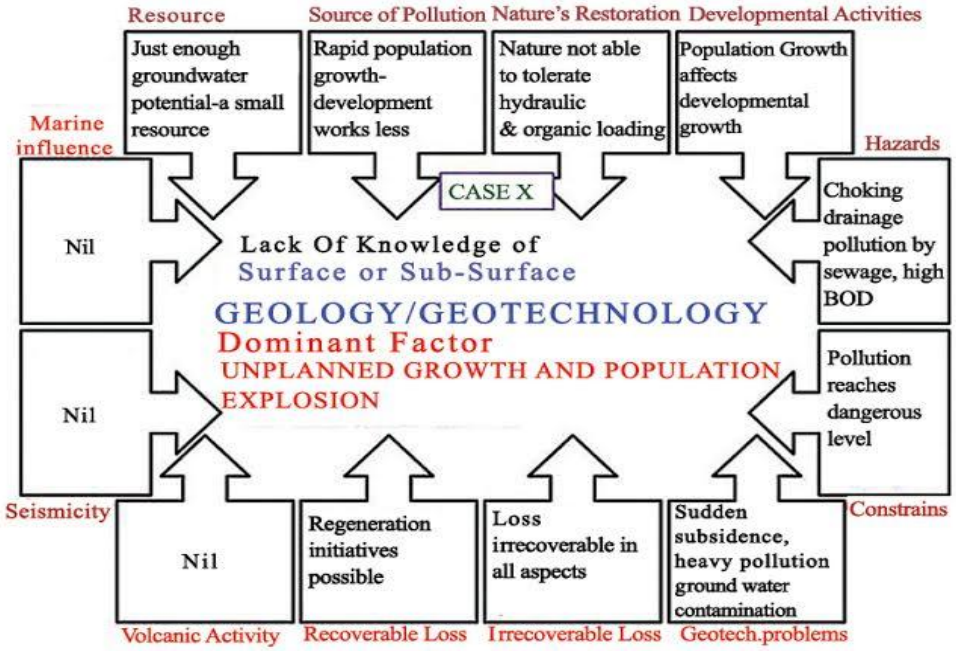

Fig. 10 Uncontrolled Outcome Case X

4.11 The City Scenario 11

An important town grew several hundred years ago on the slopes of the mountain. It was initially a market center for farming based on rich local soils and plentiful rainfall on the slope. From time to time, there were volcanic eruptions but most of these were limited to small scale ash falls. But the volcanic eruptions were very active over the past few hundred years. The scientists found that many of these cities key emergency services and a key evacuation route for the population were located in the area that was at greatest risk. The volcanic eruptions, seismicity and ground movements contributed to uncontrolled outcome as shown in Fig.11 (Case XI).

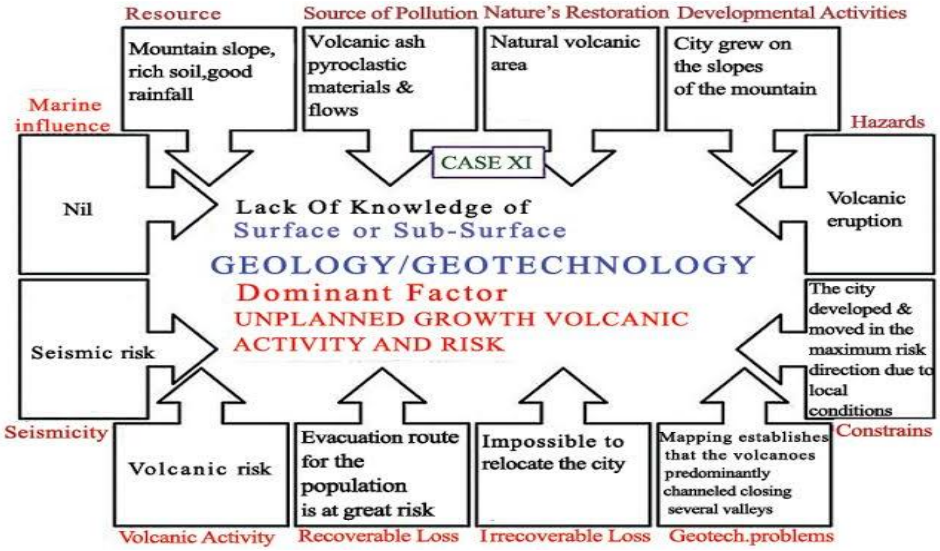

Fig.11 Uncontrolled Outcome Case XI

6. INFORMATION, GUIDANCE AND COMMUNICATION

The eleven city examples discussed bring together the need for coordination by authorities responsible for land use planning, environmental protection including catchment management, health and safety at work, and environmental health. In some cases land use and emergency planning are required to solve the problem. In some special cases shoreline management is also needed to regulate the activities.In many cases the information necessarily comes from many disciplines but main focus is on Geosciences. Therefore the following are particularly relevant:

1). Resources – minerals, water, soils, landscape, good building land- types, extent, quality and significance (safeguarding and potential).

Many more examples could be cited throughout the world. These examples make clear the diversity of issues that may affect urban areas and the nature of the information that is needed to address them. The information comes from many sub-disciplines, some of which are rooted in Geoscience but others extend, to Ecology, Economics, Sociology, Architecture, and Archaeology. Multi-disciplinary studies are needed. In some cases communication may be straight forward but often there are barriers of unfamiliarity and technical complexity that can stand in the way of prompt and effective action. To achieve satisfactory results it is necessary to understand the implications of the Geology and Earth surface processes of the area and to explain them clearly in terms that can be understood widely. This needs adequate, easily accessible, and readily understood information, advice, guidance and training on how to deal with these issues.

2) Hazards and constrains – subsidence, slope instability, flooding, storms, natural and manmade contamination, erosion, volcanic activity, seismicity- types, extent and relative significance. Information is needed on all environmental issues that are relevant to a particular area at both the regional and more detailed levels. It is important that adequate basic Geological, Hydro geological, Geo morphological, Geotechnical studies is undertaken at the strategic and more local level in order that applied outputs and modeling procedures can be securely based.

The complex entanglement between man – made activities and consequences is shown in Fig.12 in Table format.

Example	Activity (MANMADE)	Basis of growth	Growth	Consequences
1.	coal iron stone mining	Labour	Temporary growth	Damage to ground water aquifer, low river capacity, disappearance of natural springs
2.	Building castle, major local buildings	Heritage	The city expanded.	The vemaining potential of building stones cannot be utilized because the city is above the stone reserves
3.	Rail and Road Transport system	Transportation	Rapid Transport system	Flooding,run off water stagnant, no drainage system
4.	Land reclamation	real estate, land value	urban	Unstable geology, soil losses natural compaction
5.	Vertically down expansion (basement) near health resort	Tourism	Land use improved	Aquifers damaged, deterioration of public health
6.	Coal, gas and coke industries	Industrial	urban	water resources lost
7.	Chemical industries	Horizontal expansion	Expected growth but not sustainable	Ground water contamination,air pollution, land fill leakage
8.	standing timber felling and timber products	Export	Economic	Loss due to floods, destruction of farm lands, damage to aquifers
9.	construction of break water	Employment	Urban employment surge	Severe erosional problems, increasing dredging cost
10.	civil works not keeping pace with need based growth	Urbanization	Growth with risk	River capacity reduced, subsidence of buildings, ground water loss
11.	Normal slope urban activity	Need based	Growth with risk	The city right on severe seismic zone with high risk.

Fig.12 Man-Made Activities and Consequences

7. CONCLUSIONS

1. Traditionally Geosciences information has been presented on paper maps. These maps are essentially in two dimensional representations that can be interpreted in three dimensions by specialist users but not readily by non-specialists. Environmental and engineering Geology Mapping will help to overcome the barriers with some success.

2. The urban area has often been regarded as if it intrudes within and is therefore separate from the Eco-System. But in practice urban areas have major effects on their surroundings and processes in nearby areas have impacts on towns and cities. Therefore the urban area should be regarded as an integral part of the overall functioning of the Eco-System if environmental issues are to be properly analyzed and resolved.

3. There is a considerable diversity of environmental issues that have a Geosciences element and many problems involve multi-disciplinary consideration within a variety of management systems, often administered by different authorities.

4. These authorities often need to draw on the same body of knowledge with varying degrees of emphasis but they can only do so if they are aware of the relevant issues and significance and availability of the necessary information.

5. In practice, there is commonly a communication gap between varies groups of administrators and specialists, as well as with the general public and politicians.

6. This arises partly from limitations on education in the Geosciences and a lack of dialogue and mutual learning.

7. A key aspect is for stakeholders to know who to ask, when to ask, and what to ask when problems arise.

8. A key to sound urban management is the compilation and maintenance of data bases not ly for the urban area but also for its regional surroundings. These are particularly valuable if linked to GIS, Environmental information systems and software for modeling potential outcomes of possible decisions.

9. Experience shows that authorities are often unwilling to invest in research even though the outlay can lead to considerable savings in the future.

10. In addition it is often difficult to secure funds for maintenance of the data system. Often public authorities are underprepared to meet the challenges though the initial investment is low compared to the benefits.

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