Sustainability Beyond Buildings

Mohan Rao & Dr Vinod Gupta

In the architecture and planning industry, the notion of development is synonymous and almost exclusively limited to the idea of building construction. As a direct consequence, the notion of sustainability remains focused on buildings. While this view of sustainability may seem justified at a smaller scale, actual project evaluations of large projects have shown that even in well-conceived projects, improvements in efficiency of buildings alone seldom result in more than 5% reduction in carbon footprint (Beyond green buildings: creating different ways of living, An interview with Pooran Desai in the Guardian Nov.2, 2011). Parameters for evaluating sustainable development need to be re-examined and reinforced specially for large-scale projects where socio-economic issues are as important as environmental ones and where the proportion of non-built habitat far exceeds the built envelope. In addition to ensuring that the buildings are properly oriented, insulated, energy efficient, day-lit, water conserving, etc, it is critical to address integration of food security, social equity and economic sustainability within the development framework. While building envelopes allow application of more accurate parameters and solutions, the complexity and contextual nature of factors governing large sites do not allow a formulation of a simple set of rules that can be applied across board for a holistic development.

The critical departure in addressing sustainability for large-scale projects is the understanding and appreciation of the site as a land with inherent characteristics linked closely with the larger ecosystem. While its physical demarcation is derived from the ownership, its intrinsic character can only be understood as part of a larger ecosystem and in that light should be understood as a boundary for the physical extent of development and not a definition of factors that influence it or what it can influence. Second, the inherent capabilities and potentials of the land need to be measured, accounted for and engaged with, to develop an

Classical master plans tend to be heavily driven by form and pattern-making using the built mass as the defining parameter. What is rarely recognised is that most large-scale developments have less than 10% of the site covered by built form. In an attempt to impart visual 'order', designer master plans invariably treat the entire site as a canvas for pattern making. Whether it is a limited (gated) housing/corporate development or an extensive township, the accent is on creating 'legible' (read as 'strongly visual' in plan) imprints. Such processes invariably negate critical aspects of the site, such as topography, drainage, soil and relation to environmental systems both within and outside the physical bounds of the site. While the master 'plan' itself remains the most visible manner through which ideas are communicated, the master plan process itself should result in a comprehensive process document that effectively captures the vision, challenges and solutions for the development that effectively integrates long-term social, environmental and economic factors.

LAND COMPATIBILITY MATRIX

MAXIMUM COMPATIBILITY · MEDIUM COMPATIBILITY · LOW COMPATIBILITY · INCOMPATIBLE · NOT RELEVANT

CONSEQUENCES \ FACTORS	ABIOTIC																			BIOTIC										CULTURAL			VISUAL					REGIONAL		
	Climate				Geology		Physiography			Slope			Soil type						Hydrology		Flora							Fauna													
	Temperature	Rainfall	Rainfall-Intensity	Wind	Crystalline granite	Faulted rocks	Ridge	Valley	Rocky outcrop	Gently sloping	Moderately-sloping	Sloping	Yellow sandy gravel	Sandy	Sandy clay	Clayey gravel	Sandy loam	Red loam	Surface water	Ground water	Agriculture	Orchard	Grove	Plantation	Woodland	Grassland	Terrestial	Avian	Aquatic	Agricultural practice	Water systems	Heritage structures	A	B	C	D	E	Development activities	Settlement pattern	Tourism
ENERGY: Solar Energy	●	◐	◐	◐	○	○	●	◐	●	●	◐	◐	○	○	○	○	○	○	○	○	◐	◐	◐	◐	◐	●	○	○	○	◐	◐	○	○	○	●	○	○	●	●	●
ENERGY: Wind Energy	◐	◐	◐	◐	○	○	●	◐	●	◐	◐	◐	○	○	○	○	○	○	○	○	●	◐	◐	◐	◐	●	○	○	○	●	●	◐	○	●	○	○	○	●	◐	●
ENERGY: Bio gas	◐	◐	◐	◐	○	○	◐	◐	◐	◐	◐	◐	○	○	○	○	○	○	○	○	●	●	●	●	◐	◐	●	◐	◐	●	○	○	○	○	○	●	○	●	●	●
WATER: Water retention	○	◐	◐	○	●	◐	◐	●	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	●	○	◐	◐	●	◐	●	●	○	○	○	◐	●	○	●	○	○	○	○	○	○	○
WATER: Percolation	○	◐	◐	○	◐	●	◐	●	◐	◐	◐	◐	●	●	◐	◐	◐	◐	●	○	◐	◐	●	◐	●	●	○	○	○	◐	●	○	○	○	●	○	○	○	○	○
LAND: Soil erosion	◐	◐	◐	◐	○	○	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	●	◐	◐	◐	◐	◐	◐	●	●	○	○	○	◐	●	○	○	○	○	○	●	○	○	○
LAND: Buildability	●	◐	◐	◐	○	○	●	◐	◐	●	◐	◐	●	●	◐	◐	◐	●	●	◐	●	◐	◐	◐	◐	●	◐	◐	◐	◐	◐	◐	○	●	○	○	○	○	○	○
LAND: Productivity	●	◐	◐	◐	○	○	◐	●	◐	●	●	◐	◐	◐	●	●	●	●	●	●	●	●	●	●	●	◐	●	●	●	◐	●	◐	●	○	○	○	○	○	○	○
LAND: Stream Sedimentation	○	○	○	○	○	○	●	◐	◐	●	●	◐	●	●	●	●	●	●	●	●	○	○	○	○	○	○	○	○	○	◐	●	◐	○	○	○	○	●	○	○	○
ACCESSIBILITY: Pedestrian	●	◐	◐	●	○	○	●	●	◐	●	●	◐	●	●	◐	◐	◐	◐	◐	●	●	●	●	●	●	●	○	○	○	○	○	○	●	○	○	○	○	○	○	○
ACCESSIBILITY: Vehicular	●	◐	◐	●	○	○	●	◐	◐	●	●	◐	●	●	◐	◐	◐	◐	◐	●	◐	◐	◐	●	◐	●	○	○	○	○	○	●	○	○	●	○	○	○	○	○
ACCESSIBILITY: Bicycle	●	◐	◐	●	○	○	●	◐	◐	●	●	◐	●	●	◐	◐	◐	◐	◐	●	●	●	●	●	●	●	○	○	○	○	○	○	●	○	○	○	○	○	○	○
LANDUSE: Agriculture	●	●	◐	●	○	○	◐	●	◐	●	●	◐	◐	◐	◐	●	●	●	●	◐	●	○	○	○	○	○	●	●	○	●	●	●	○	●	○	○	○	○	○	○
LANDUSE: Orchard	●	●	◐	●	○	○	◐	●	◐	●	●	●	◐	◐	◐	●	●	●	●	◐	●	●	○	○	○	○	●	●	○	●	●	○	●	○	○	○	○	○	○	○
LANDUSE: Grove	●	●	●	●	○	○	◐	●	◐	●	●	●	◐	◐	●	●	●	●	●	◐	●	●	●	○	○	○	●	●	○	●	●	○	●	○	○	○	○	○	○	○
LANDUSE: Plantation	●	●	●	●	○	○	●	●	◐	●	●	●	◐	◐	◐	●	●	●	●	◐	●	●	●	●	○	○	●	●	○	●	●	○	○	●	○	○	○	○	○	○
LANDUSE: Woodland	●	●	●	●	○	○	◐	●	◐	●	●	●	◐	◐	●	●	●	●	●	◐	◐	◐	●	●	●	○	●	●	○	●	●	○	●	○	○	○	○	○	○	○
LANDUSE: Grassland	●	●	●	●	○	○	●	●	●	●	●	●	●	●	●	●	●	●	●	◐	◐	◐	●	●	●	●	●	◐	○	●	●	○	○	●	○	○	○	○	○	○
LANDUSE: Wetland	●	●	●	●	○	○	◐	●	●	●	●	●	●	●	◐	◐	◐	◐	●	●	◐	◐	◐	◐	◐	●	●	●	●	●	●	○	●	○	○	○	○	○	○	○
LANDUSE: Reservior	●	●	●	●	○	○	◐	●	●	●	●	●	●	●	●	◐	◐	◐	●	●	◐	◐	◐	◐	◐	◐	●	●	●	●	●	○	●	○	○	○	○	○	○	○
LANDUSE: Community spaces	◐	◐	◐	●	○	○	●	●	●	●	●	●	●	●	◐	◐	◐	◐	◐	◐	◐	◐	◐	●	●	●	○	○	○	●	●	○	○	●	○	○	○	○	○	○
RECREATION: General Recreation	◐	◐	◐	●	○	○	◐	●	●	●	●	●	◐	◐	◐	●	●	●	●	◐	◐	●	●	●	●	●	●	●	●	●	●	●	●	○	○	○	○	○	○	●
RECREATION: Cultural Recreation	◐	◐	●	●	○	○	●	●	●	●	●	●	◐	◐	◐	●	●	●	●	◐	◐	◐	◐	●	●	◐	○	○	○	●	●	●	●	○	○	○	○	○	○	●
RECREATION: Water oriented	●	●	●	●	○	○	◐	●	●	●	●	●	◐	◐	◐	●	●	●	●	◐	○	○	○	○	○	○	◐	◐	●	●	●	●	●	○	○	○	○	○	○	○
RECREATION: Wilderness	●	●	●	●	○	○	◐	●	●	●	●	●	◐	◐	◐	●	●	●	●	◐	●	●	●	●	●	●	●	●	●	●	●	●	●	○	○	○	○	○	○	●
RECREATION: Walking for pleasure	●	●	●	●	○	○	●	●	●	●	●	●	●	●	◐	◐	◐	◐	◐	◐	◐	●	●	●	●	●	●	●	●	●	●	●	●	○	○	○	○	○	○	●

MASTER PLAN STRATEGY DOCUMENT FOR SITE @ CHIKBALLAPUR

SITE INVENTORY & DOCUMENTATION REPORT

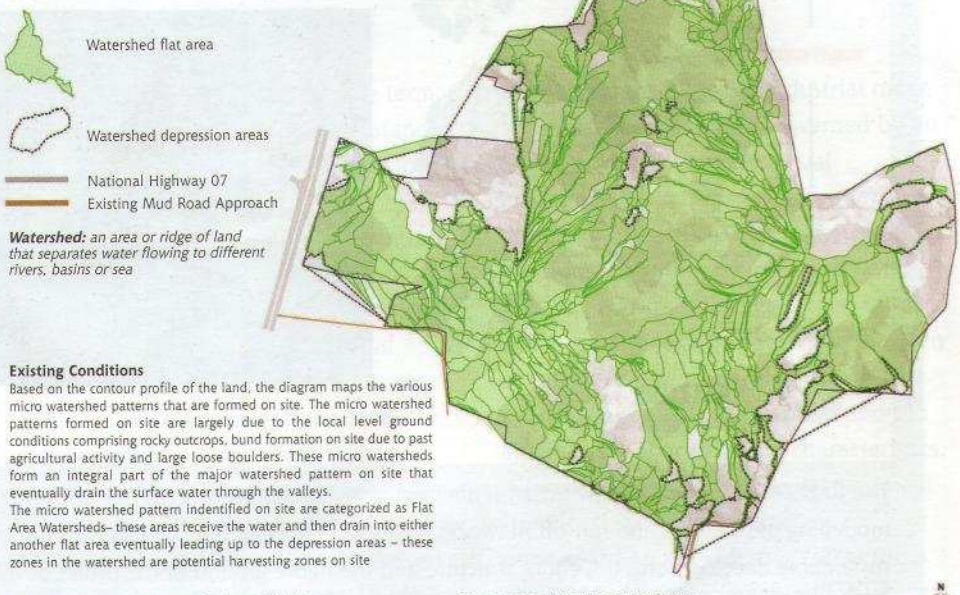
SITE CONTEXT S1

inherently sustainable programme distribution for the development irrespective of its typological demands. The programme matrix thus formulated taking into account topography, geomorphology, watersheds, biodiversity, etc, and overlapped with overarching issues of food security, land resilience, water conservation, etc, should be the thickened surface onto which the open space demands of the project, infrastructure needs and the building envelope should be situated. Coupled with the above approach, it is imperative that large developments should be dealt as a process-driven mechanism rather than a purely form-driven art appreciation.

Buildings, roads and parking remain the most striking, often the only, structuring elements of a typical master 'plan'. All other aspects of the land, however critical, are seen as subservient to this built fabric and herein lies the problem. Natural aspects of the site, whether limited to the site boundary or integral with the larger region, are seen as problems to be solved rather than as formative parameters of the

Micro Watershed Mapping

Watershed flat area



Watershed: *an area or ridge of land that separates water flowing to different rivers, basins or sea*

Existing Conditions

Based on the contour profile of the land, the diagram maps the various micro watershed patterns that are formed on site. The micro watershed patterns formed on site are largely due to the local level ground conditions comprising rocky outcrops, bund formation on site due to past agricultural activity and large loose boulders. These micro watersheds form an integral part of the major watershed pattern on site that eventually drain the surface water through the valleys.

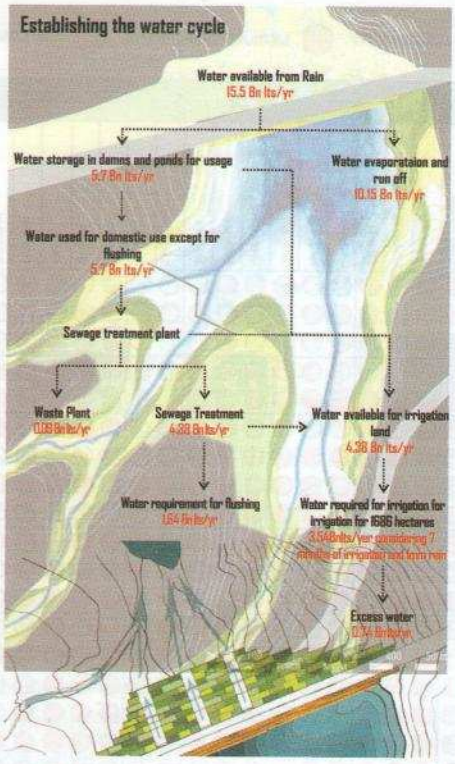
The micro watershed pattern indentified on site are categorized as Flat Area Watersheds– these areas receive the water and then drain into either another flat area eventually leading up to the depression areas – these zones in the watershed are potential harvesting zones on site

Masterplan Strategy Document for site at Chikballapur

Site Inventory & Documentation Report

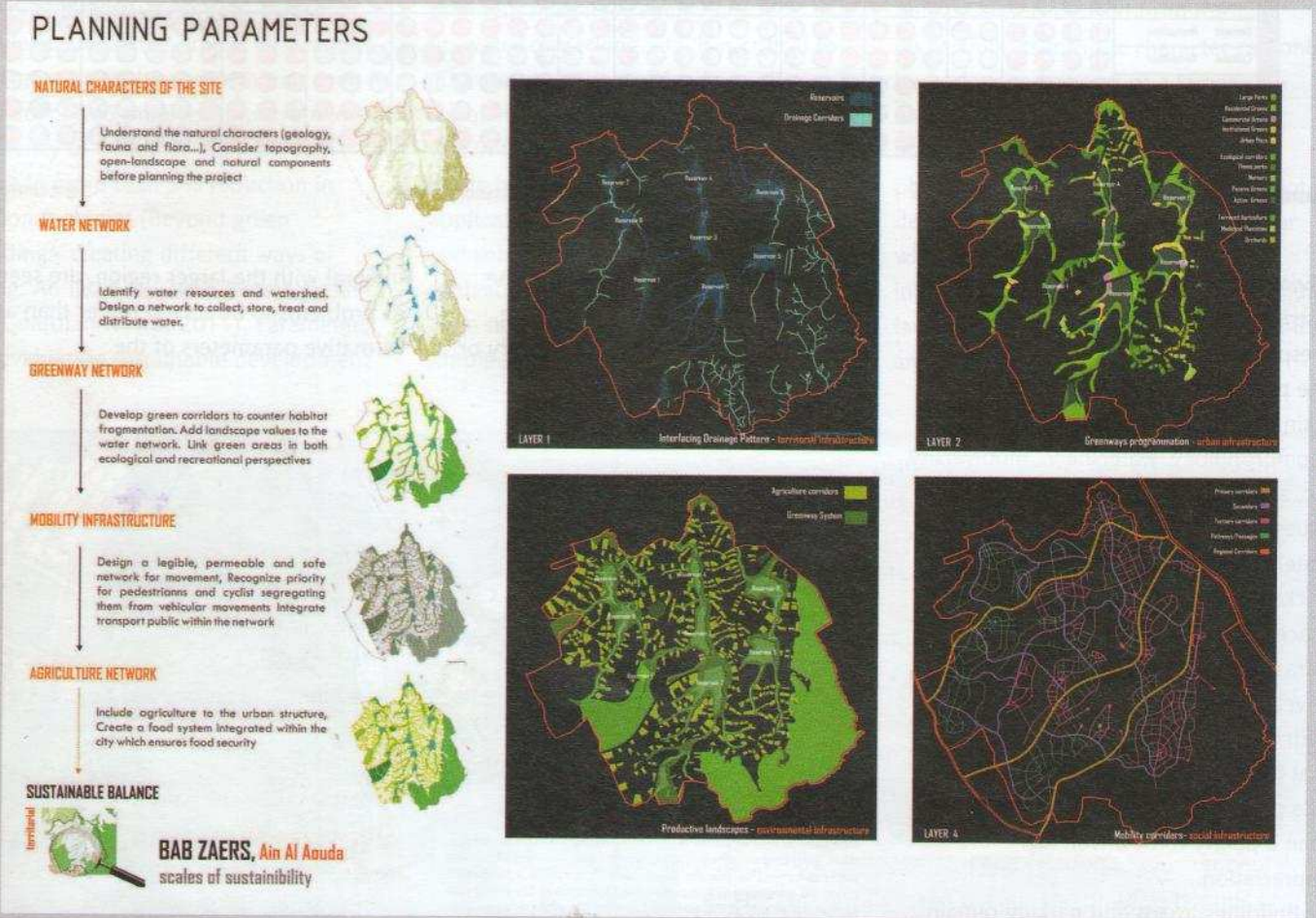
development. If one were to address resources based on their longevity and renewability, one would accord primacy to geology, hydrology and climate and only then articulate relatively short-lived components such as buildings, roads and amenities. Active engagement with land potential situates the process more firmly in addressing sustainability as a larger goal, rather than one limited to creation of Green Buildings.

Understanding Land Capacity: Every time a parcel of land is earmarked for development, its inherent capacity as a productive ecosystem is irrevocably compromised. The capacity of each site is distinct and at times even intangible. This includes its capacity to produce food, sequester water, moderate the microclimate and as a habitat for

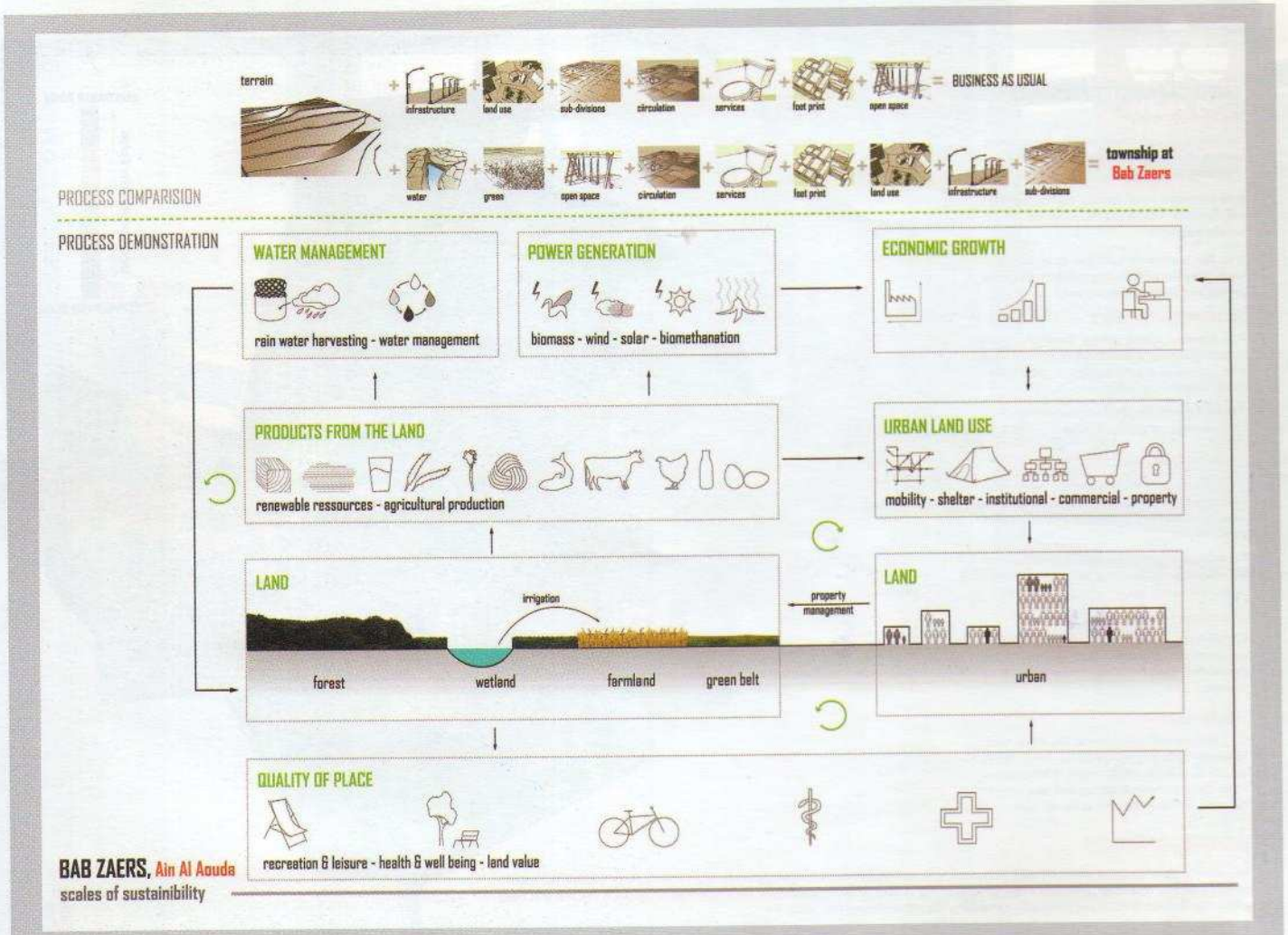


biodiversity, amongst others. Any attempt at creating a sustainable development should necessarily address the capacity of the land and equally so its linkages with the larger natural environment. While such a stand may seem anti-development, it need not be so. Innumerable case studies are available that effectively demonstrate integration of natural systems within the master plan that expressly protect, conserve and nurture natural resources and processes adding immense value —both tangible and intangible — to the development without compromising its spatial or economic frameworks.

Consider the possibility where land capacity becomes the chief determinant of development in terms of densities and demand on resources. Current practice uses FSI as the primary determinant in



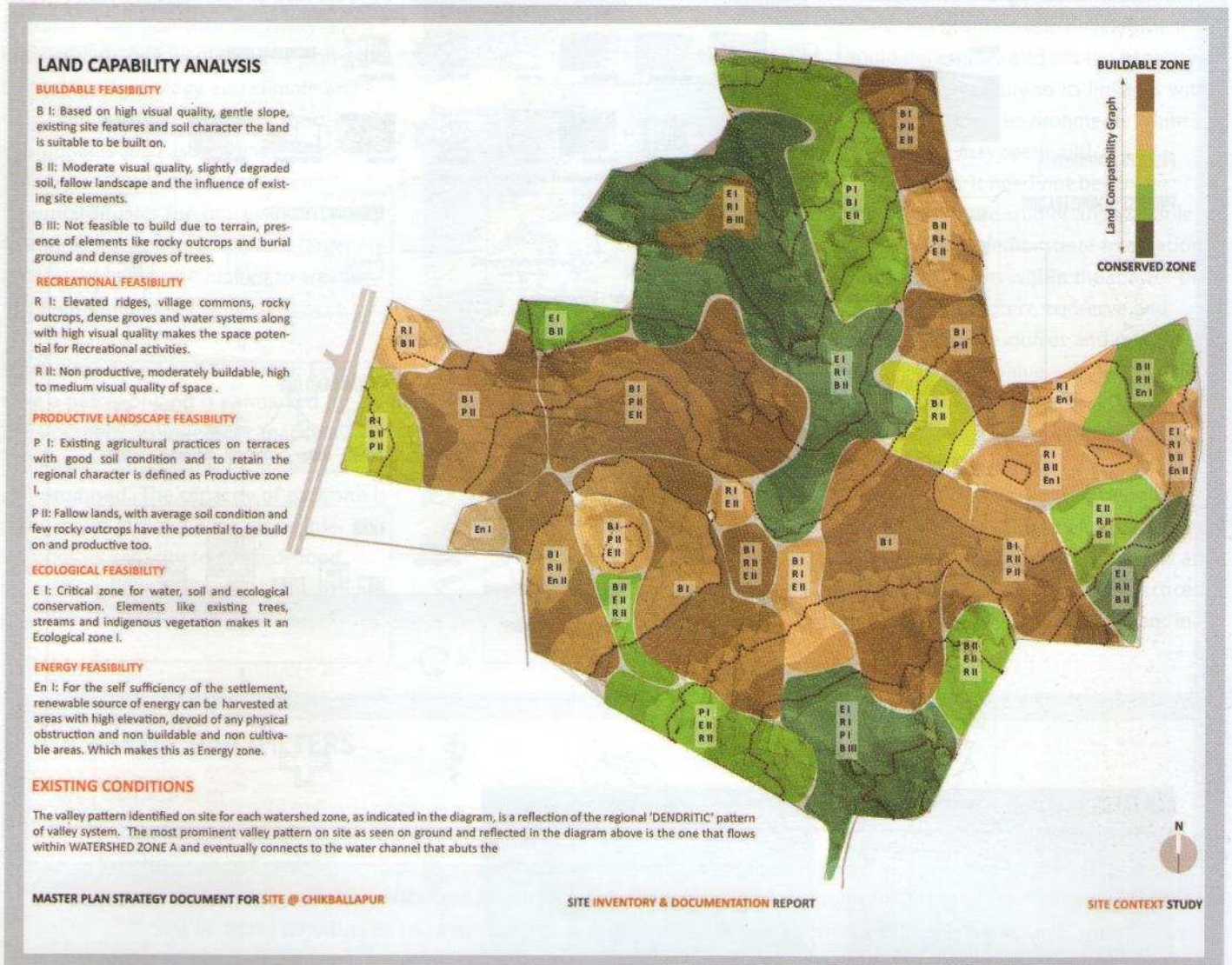
The BAB ZAERS project, a new urban settlement near Rabat in Morocco, positions this land capacity process through extensive modelling of drainage and run-off networks analysis on site. Within the broader framework of the project oriented around sustainable development, the entire structure and the figure ground of the urban development is based on the identification and passive modulation of run-off patterns on site. This pattern, when thickened as a surface, accommodates all ecosystem services and is translated as the primary infrastructure of the development. The 'pattern' is used to orient and position built parcels, inform the transport infrastructure to develop hierarchical urban nodes, develop pedestrian linkages, extend and integrate food productivity zones within the urban realm and continuously inform and guide the land use of the development.



The process demonstrated is certainly not exhaustive in addressing all aspects of land capacity as the primary focus remains water-centric; but it is enough to demonstrate that any intervention or development can be anchored based on soil, geomorphology, vegetation, water resources and other natural parameters– each implying a significant response based on its specific attributes. This is not to say that only one or few of the parameters are to be considered for a development while neglecting others; each site with specific land potential will highlight natural patterns that have a distinct hierarchical and ecological relationship that is to be negotiated so as to position the design intervention better.

urban lands that in turn define the number of users, energy, mobility and water demand, waste generated and so on in a linear sequence. While this rationale may still hold true for small sites, larger developments cannot continue to use this rationale. Rather, carrying capacity of the land should lead the emergent non-linear process. Each site being unique, will throw up differing and at times contrasting capacities. This can include (but not limited to) capacity to generate, produce energy, contribute towards food security, impact mobility and the neighbourhood, etc.

Land Capacity as a Process: The term land capacity in its generic understanding is the evaluation of land, both tangible and intangible in expression. This may include but is not limited to an inter-relationship study and analysis of topographical conditions, hydrogeology patterns, watershed systems, visual qualities, existing natural features, etc. Such a study often reveals the land's inherent demands for conservation, suitability for building, judicious exploitation, and so on– emergence of an inherent site use pattern contextualised within the regional landscape. An ideal approach transcends the industrial mode of urbanisation, typically governed by an engineered and non-contextual infrastructure. Vehicular road patterns determine the structured geometry of the development, while all other networks such as pedestrian linkages, open space structure, drainage, services, etc. are seen as subsystems of this artificial layer laid over the landscape with little relation to either land capacity or site characteristics. Alternatively, positioning a development from the lens of land capacity understanding immediately forces the process of development to address larger

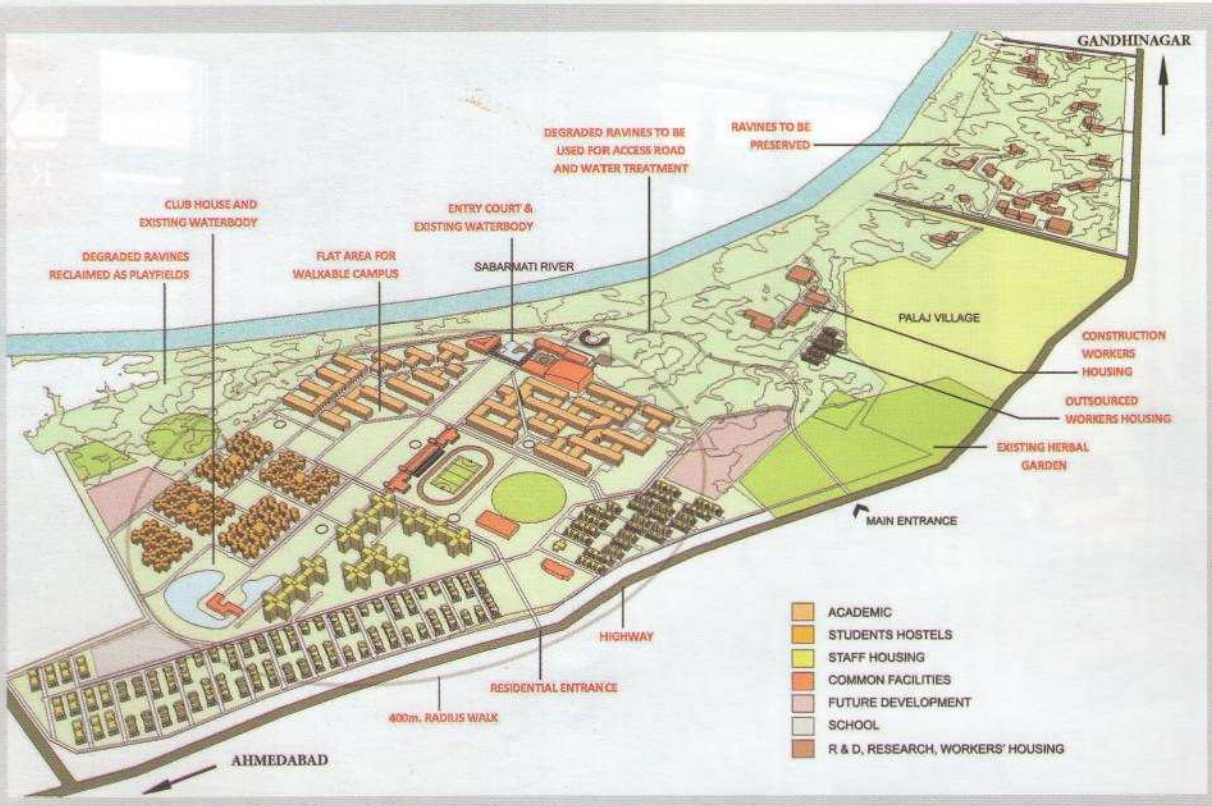


Landscape infrastructure challenges the very notion of surface water management as is currently practiced. Typically, drainage has been treated as a subsystem of vehicular networks as a means of draining the roads as well as the development. Irrespective of the nature of site or the typology of development, this is considered standard practice. The origin of the practice has of course been to achieve the fastest time to clear all incident rainwater from both the road surface as well as the property itself. Sustainable goals demand that all incident rainwater be conserved, managed, harvested and utilised within the site with zero run off; thereby reducing the need to import water into the site as well as increase water security for the development.

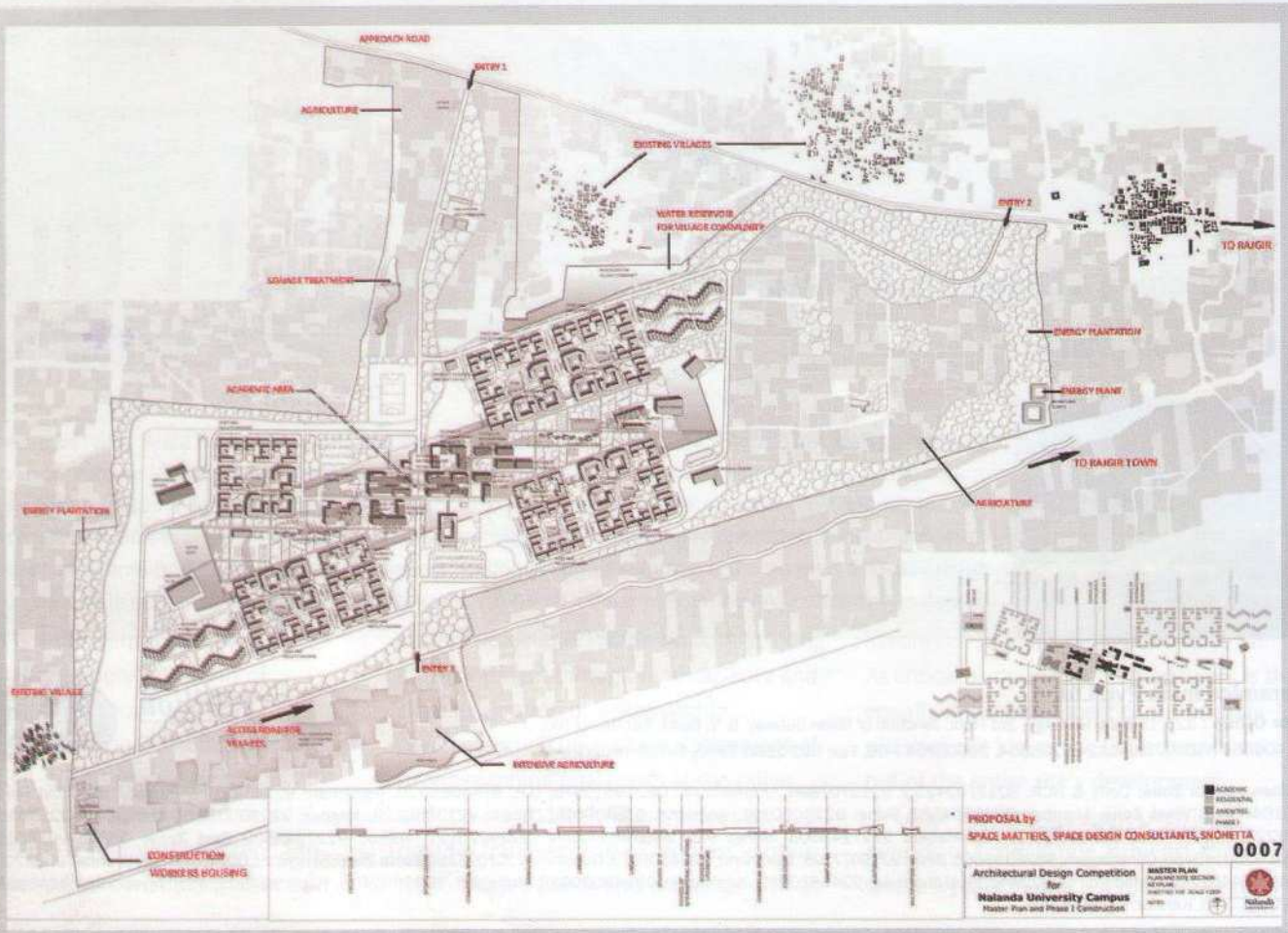
and inter-related issues of resource flows and territorial agencies. Engagement with the territory and application of land process is what determines the (sustainable) nature and form of development without any prior assumptions, visionary notions or individual-driven expressions. Appropriation of site systems thus becomes the foregrounded agenda to articulate spatial dynamics that in turn generate organisational patterns and propose cultural inhabitation.

Larger Goals and Framework: Anchoring a development through land capacity and close integration of sustainability parameters will necessitate a statement of strong planning goals both at the micro and the macro level. These goals can, at a broader framework level, address various project-based needs and demands such as reduction of vehicular transport and emphasising pedestrian and alternate modes of transport; food security, energy, livelihood, security, resilience and so on. As critical as the designed framework is the equally important aspect of an inclusive phasing; not just of the built components but of the entire site's development.

Large projects are built over long periods of time. While a township can take 25 years to reach a mature stage, a



Transportation is a major consumer of resources and large projects offer opportunities for changing the conventional approach of automatically providing excessive roads and parking. At IITGn, the plan has been specially configured for promoting walking and cycling as the main means of mobility within the campus. Resident faculty may use cars to connect to other parts of Gandhinagar but IITGn will provide buses for students. In larger projects, it would be possible to reduce vehicular transport even further. Also, the plan provides for a permanent place for labour colony close to the existing village settlement. Fortunately, the villagers were not deprived of their agricultural fields by this project, only of land for grazing. A large part of the land has been left as a biodiversity reserve, where existing fauna can continue to thrive and where cattle could also graze.



Large-scale projects create new opportunities. At Nalanda University campus there was a single solution for the problem of rainwater management and procuring material for building. This was achieved in a proposal by using existing soil as material for building walls (rammed earth and stabilised earth blocks) and the excavated pits for rainwater management

university campus can take 10 years. The long construction period enables the use of new strategies that are otherwise impossible to use in smaller projects. Project implementation requires labour, energy, water and materials. During the construction phase there is excess land available for generation of energy, collection of rainwater, production of food and for housing for labour. Most projects do not provide for any of these factors that affect environmental and social sustainability of the project. Most projects in India begin by acquisition of agricultural land, creating in the process a new kind of social caste that had been engaged in agriculture but suddenly finds money but no occupation. This is not a desirable or socially sustainable situation that needs attention while initiating large projects.

Addressing sustainability beyond buildings is a complex process that does not lend itself to a standard set of rules, something far more easily done for stand-alone buildings. Each development throws up unique set of challenges that is defined by its geophysical context, social setting, gestation period, and so on. The potential offered or the constraints posed by each site require a sensitive and a holistic approach that may not allow standardisation of approaches and solutions. Specific responses to the geo-climatic or social context makes it all the more difficult to address a standard list of sustainability parameters and also, unlike standalone architectural projects, expressions of such a framework of sustainability may not always result in a tangible design expression. But what must be understood while addressing sustainable development frameworks for large scale projects is the fact that there are larger inter-related systems that operate at different scales– each independent, varied and yet having a relational identity that precipitates the role of the other– topography, water demand, food security, human habitat, employment patterns, larger resource sequestration– each connected in a non-linear ecology of lifecycle. Only when the development paradigm of such large scales has a symbiotic relation with these networks can it strive towards establishing a sustainable order. Such an aspirational development model would establish unique benchmarks on the basis of which negotiations can set up between the sometimes-dubious demands of established practice, economic pressures of development and complex social and environmental concerns.

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Delhi-based architect Dr Vinod Gupta has a keen interest in sustainable architecture.