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Environmental Implications of Urban Land Development in India

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I. ENVIRONMENTAL IMPLICATIONS OF URBAN LAND DEVELOPMENT

A. LISTING OF ENVIRONMENTAL ISSUES

Following is a listing of environmental impact issues associated with the development of urban land for residential use. The discussion of each issue includes an indication of potential lines of inquiry which might be followed in preparing an environmental impact assessment study.

The listing is intended to identify key impact issues, with particular reference to conditions in India. It is recognized that a generic listing, such as provided below, can only be a point of departure for an impact assessment study. Such a list may contain items of limited relevance to a given location, or may overlook an issue of prime significance, and thus must be adapted by the analyst to suit the needs of the specific task at hand.

- 1. NATURAL RESOURCES**
 - a) Land Development Suitability
 - b) Water Resources
 - c) Land Use Preemption
 - d) Construction Materials

- 2. ENVIRONMENTAL RISKS AND HAZARDS**
 - a) Flood Hazards
 - b) Seismic Risk
 - c) Extreme Weather Events
 - d) Toxic and Hazardous Materials
 - e) Extreme Noise Conditions

- 3. RESIDUALS GENERATION**
 - a) Air Pollution
 - b) Water Pollution
 - c) Solid Waste

- 4. PHYSICAL INFRASTRUCTURE NEEDS**
 - a) Roads and Public Transport
 - b) Water Treatment and Distribution
 - c) Sewage Collection and Treatment
 - d) Storm Drainage Systems
 - e) Solid Waste Disposal/Recycling Facilities
 - f) Electric Power Supply and Other Energy Needs
 - g) Community Facilities and Services

- 5. OTHER COMMUNITY VALUES**
 - a) Access to Markets and Employment Centers
 - b) Historic and Archaeological Resources
 - c) Visual Quality and Amenity

B. POTENTIAL LINES OF INQUIRY

1.a) LAND DEVELOPMENT SUITABILITY

Issues: The topic of land development suitability addresses the many factors which define the physical capacity of soils types and land forms to support urban land uses. To be readily suitable for building, for example, soils must be capable of adequately supporting foundations without settling or cracking. Soil depth is an important factor, and should be sufficient to allow for excavation of basements and utility trenches for water, sewer and other utility lines without the need for excessive blasting and removal of rock material. Depth to groundwater is also an important factor which can affect the ease of construction activity, and may create long-term urban management problems. Steep slopes, particularly when accompanied by unstable soils, pose a variety of constraints on urban development.

Assessment Questions:

- 1) Can soils and land forms in the area proposed for development accommodate anticipated land uses and building types?
- 2) Will groundwater levels pose problems for site drainage, on-site wastewater disposal?
- 3) Will expected development be located in areas of risk due to slope instability, and/or will expected development exacerbate existing slope instability potential?

Base Data Requirements:

- Soil type and characteristics, including drainage/permeability factors, moisture content, shrink/swell potential, high frost action potential, etc., as may be relevant to a particular location.
- Typical depth to bedrock.
- Typical depth to groundwater (average annual maximum and minimum depths).
- Steepness of terrain.
- Evidence of previous instability (landslides, mudslides, noticeable slumping, history of broken or cracked utility lines or structures, etc.).

Mitigation: Where development in unsuitable areas cannot be avoided, various mitigation measures may be available, consisting of improved site preparation and building construction techniques. In general, these measures will require additional expense in order to overcome the risks imposed, and should be weighed against the benefits obtained.

1.b) WATER RESOURCES

Issues: An adequate, year-round supply of potable water is perhaps the primary requirement of an urban residential community. At the regional or municipal scale, the assessment should determine the likely long-term availability of surface-water and groundwater resources, and should address competing uses that may need to draw upon the same resource base, including agricultural, industrial uses, as well as water needed to maintain an acceptable ecological balance in natural areas.

At the project or site scale, particularly if needs are to be met through the use of on-site wells or surface waters, the effect of the proposed and any neighboring developments on the local resource base should also be examined.

Infrastructure needs related to water supply -- collection, storage, treatment and distribution systems -- are discussed separately in a subsequent section.

Assessment Questions:

- 1) Is the water supply resource base sufficient to support anticipated levels of residential and other urban development on a consistent, long-term basis? Is there evidence of susceptibility to excessive drawdown, salt water intrusion, contamination from industrial or agricultural activities, or other major intervening factors?
- 2) Has there been a history of extreme seasonal variations in the quantity or quality of drinking water, and/or a history of reliance on "trucked in" water supplies?

Base Data Requirements:

- Potential safe yields from available aquifer/water basin areas.
- Actual total and per capita water usage, by user type: residential, commercial/industrial, agricultural.
- Identification of water-dependent natural areas or systems that require protection.
- Proposed (or "ideal") per capita water supply for residential use.

Mitigation: Water supply is one facet of a comprehensive water resources management program. Proper treatment and disposal of sanitary and other wastes, and avoidance of contamination of existing water supply sources, is a necessary step in preserving available water supplies for future use. Open space buffer zones around water supply reservoirs will help reduce contaminated agricultural run-off.

The above mitigation measures are not applicable at the residential community scale. However, installation of low-flow toilets and showerheads and proper maintenance of distribution systems can help reduce water demand. Metering and fees, either at the household or the community level, can also be effective, provided the political support is present to administer the system and to guard against illegal connections.

In the event of water emergencies, plans for instituting temporary use bans and for providing trucked in supplies may be needed.

1.c) LAND USE PREEMPTION

Issues: Development of an urban residential community will displace and preclude alternative land uses for decades, even centuries. Often, the trade-offs that may be presented at the project or community scale have not been considered in depth at the master plan level.

Assessment Questions:

- 1) Is the residential community site presently being used for another use (e.g., agricultural)? Is the site providing other benefits (e.g., public open space, or wildlife habitat) which will be lost or compromised due to development?
- 2) Are there any unique or significant natural or man-made features on the site that will be lost due to development?

Base Data Requirements:

- Characterize current site usage.
- Identify significant natural or man-made features, such as wetlands, vegetation, wildlife habitat, threatened or endangered species, cultural resources, etc.
- Assess whether competing uses, such as agricultural or open space use, might be a more appropriate long-term use of the site in order to preserve and protect existing significant natural or man-made features.

Mitigation: Depending on the type and scale of the feature or competing land use, the residential project might be redesigned, downsized, or relocated to a more suitable site.

1.d) CONSTRUCTION MATERIALS

Issues: Construction of an urban residential community will require a variety of building materials. While this issue is primarily one of economics, the use of certain building materials (such as wood products) may deplete important natural resources, and suggest a need to search for acceptable substitutes. In addition, the use of available local, rather than imported, building materials can provide an important source of economic activity and employment.

Building type may also have important environmental ramifications, with high-rise, elevator buildings generally requiring more expensive materials and systems, and placing additional burdens on municipal systems, such as the need for increased water pressure for domestic and fire-flow use.

Assessment Questions:

- 1) Are key building materials in short supply?
- 2) Can greater reliance be placed on the use of locally-produced building materials?
- 3) Does the provision of building materials cause an excessive depletion of regionally or locally important natural resources of any type?

Base Data Requirements:

- Characterize and quantify the building types and materials needs that will result from increased residential development.
- Develop a profile of building materials production and usage in the metropolitan region, and relate those factors to the region's base of natural resources.

Mitigation: The final report of India's National Commission on Urbanization has recommended that future residential developments be designed, where feasible, as high-density, low-rise communities. In addition to utilizing less expensive, "low tech" building materials, many of which can be locally produced or assembled, such construction requires a lesser degree of skill and thus would provide employment opportunities for a wider range of workers.

2.a) FLOOD HAZARDS

Issues: Flood prone areas have often been utilized for informal housing developments since such areas tend not to be used by groups which can afford to locate in safer areas. Obviously, known flood prone areas should never be used for residential development. Problems do arise, however, where such areas have not been properly delineated, and/or where prior delineations have been rendered obsolete by changed land use and other conditions upstream (and even downstream) which may increase the risk of flooding at the residential development site.

Assessment Questions:

- 1) Are accurate delineations of flood prone areas available for the proposed residential development site and its environs, and have they been reviewed for possible changes in upstream conditions which may place the site at risk for flooding?
- 2) Will the residential development site itself contribute to an increased risk of downstream or coastal flooding?

Base Data Requirements:

- Obtain records of prior riverine and coastal flooding events.
- Identify any prior studies of projected flood levels. (Where areawide studies are unavailable, useful information can often be obtained from engineering plans for nearby highway and railroad bridges.)
- Review plans for other proposed developments upstream or in the near vicinity of the development site.

Mitigation: The proper way to mitigate known flood risks is to avoid development in the zone of significant risk (i.e., the 100-year floodplain), and above all in the actual floodway. Even where physically feasible, the cost of constructing effective flood control structures is usually prohibitive, except where needed to protect pre-existing residential and other uses. Emergency preparedness plans and supplies would also help mitigate the damage caused by flooding. Such plans should be prepared at both the regional and the neighborhood scales.

2.b) SEISMIC RISK

Issues: Earthquakes and other seismic activity pose substantial risks to human safety and property, especially in areas of soil and slope instability (see Item 1.a).

Assessment Questions:

- 1) Is accurate subsurface geology mapping available, and are seismic risk area delineations available for the proposed residential development site and its environs?

Base Data Requirements:

- Obtain subsurface geology maps for the vicinity of the project area.
- Obtain records of prior seismic activity in the vicinity of the project area.
- Obtain seismic risk maps, if available.

Mitigation: Construction over or near known fault lines should be avoided, particularly where there is a history of significant seismic activity. Particular attention must be given to the design of foundations and structures in areas adjacent to known fault zones. Emergency preparedness plans and supplies would also help mitigate the damage caused by significant earthquakes. Such plans should be prepared at both the regional and the neighborhood scales.

2.c) EXTREME WEATHER EVENTS

Issues: Extreme weather events are commonplace in India, where the monsoon season alternates with extended periods of dryness. Extreme weather events can be sudden and episodic, such as a major storm, or prolonged, such as a period of drought. In either case, potential harm to human health, property and convenience can result. This issue is closely related to a variety of other issues, such as flooding (Item 2.a) and water supply (Item 1.b). Coastal communities and settlements in constricted valleys are especially susceptible to extreme weather events.

Assessment Questions:

- 1) Has the site and its environs been subject to a history of extreme weather events? Have these events led to other problems, such as flooding and slope failures?

Base Data Requirements:

- Obtain meteorological data for the vicinity of the project area. (If not otherwise available, airport operators generally are an excellent source of historic data.)

Mitigation: Since extreme weather events can be expected to recur with some regularity, at least over the long-term, many of the worst effects will have been accounted for in the impact assessment of flooding or water supply restrictions. Since an extreme event can occur at any given time, however, emergency preparedness plans and supplies should be an essential component of any mitigation strategy designed to minimize damage to health, safety, and property.

2.d) TOXIC AND HAZARDOUS MATERIALS

Issues: Residential communities are unlikely to be primary generators of toxic and hazardous materials. Nevertheless, residential communities can suffer from the effects of materials produced by nearby industrial, commercial, or agricultural generators. In addition, if small-scale commercial or industrial uses are allowed to exist within the residential community, there is a possibility that locally significant quantities of toxic and hazardous material can be produced. Such generators are especially difficult to identify and manage, because of their size and the frequently informal nature of the business itself.

As a specialized form of gaseous, liquid or solid wastes, this issue must be considered in conjunction with air quality (Item 3.a), sewage treatment (Items 3.b and 4.c) and solid waste disposal (Items 3.c and 4.e.)

Assessment Questions:

- 1) Have the site and its environs been used, or are they currently or proposed to be used in the future, by a toxic and hazardous material generator?
- 2) Are nearby roads, railroads or waterways used to transport toxic or hazardous materials of any kind?
- 3) Are toxic or hazardous materials present in the soils or groundwater of the site?

Base Data Requirements:

- Review available land use records to determine whether the site and its environs have had a history of toxic and hazardous materials generation and/or disposal. (In the absence of alternative sources, World Bank and US EPA standards can be used to define "toxic and hazardous" materials and levels.)
- If the site or its near environs have a history of such usage, consider whether a soils testing and analysis program is indicated to characterize the presence or absence of risk.
- Consult with public works officials and major shippers and manufacturers to assess whether such materials are commonly transported near the site.

Mitigation: Identified on-site contamination should be remediated by stabilization and containment, or by the removal and proper disposal of material. Permission for small-scale industrial or commercial uses within a proposed residential community should be carefully considered in terms of their potential for generating contaminants. Emergency preparedness plans should consider the implications of any spills or releases of toxic and hazardous materials from nearby industrial or transportation facilities, including evacuation and medical response plans.

2.e) EXTREME NOISE CONDITIONS

Issues: Noise is a natural companion of urban life. Extreme noise, however, can have both physical and psychological effects. Particular care must be taken to avoid extreme noise conditions in the vicinity of "sensitive receptors" such as schools and hospitals.

Assessment Questions:

- 1) Is the site located in the vicinity of major highways, railroad corridors or aircraft flight paths?

Base Data Requirements:

- Review available land use records and planning documents and determine whether the site is, or will be, located near existing or proposed major noise generators.
- If so, consider whether a noise monitoring program is indicated to characterize the presence or absence of unacceptable noise levels.

Mitigation: Structural solutions for extreme noise conditions are often physically feasible, but costly. The least-cost mitigation strategy is to provide a buffer of open space next to major transportation corridors, coupled with an earth berm if possible, and to avoid construction in aircraft approach zones. Particular care must be taken in locating schools, hospitals and religious buildings.

3.a) AIR POLLUTION

Issues: Residential communities produce significant volumes of air pollutants, from sources such as the combustion of fuels for heating and cooking. Generally, the lower quality the fuel, the more severe the air quality impact. Residential communities also suffer from air pollution produced off-site by all forms of land users and vehicles, sometimes located at considerable distances from the site.

Assessment Questions:

- 1) What are the background levels of air pollution in the metropolitan region? Are there particularly noxious forms of air pollution being generated in the area?
- 2) How many vehicle trips will be generated by the community, by vehicle type?
- 3) What kinds and quantities of fuel will be used by project residents for space heating and cooking purposes?
- 4) What contribution will the proposed community make to regional air pollutant levels?

Base Data Requirements:

- Review available air quality monitoring records and future planning documents to determine whether the site is, or will be, located near existing or proposed major generators of air pollutants.
- Estimate vehicle trips to, from and within the community, by vehicle type, time of day, average speed, etc. (This or comparable data is generally available from metropolitan transportation planning offices.)
- Determine the kinds of fuels likely to be used for domestic purposes, and estimate the probable quantities to be consumed.

Mitigation: Sites directly downwind of major off-site air pollution generators should not be used for residential development, if acceptable alternatives exist. The planning and design of an individual residential community will not by itself solve regional air quality problems, but it can be an important contributor towards an areawide pollution abatement strategy. In particular, the specification of heating and cooking equipment can influence the types of fuels used in the community, while proper insulation and building design can reduce heating (and cooling) demands. Solar energy potentials should be exploited to the maximum possible extent.

When regional air quality levels deteriorate to the point where health and safety are seriously threatened, short-term cessation of the activities of major polluters may be required.

3.b) WATER POLLUTION

Issues: Water pollution caused by residential communities includes both sanitary sewage, as well as urban storm run-off containing considerable quantities of solids, animal excreta, and other waste materials. Approximately 80 to 90 percent of water used for domestic purposes is discharged as sanitary sewage. Proper collection, treatment and discharge of all forms of water-borne pollution, from whatever source, are essential to the continued health and sustainability of urban residential environments.

Assessment Questions:

- 1) What are the background levels of water pollution in the vicinity of the site, and in the metropolitan region's surface and groundwaters? Are there particularly noxious forms of water pollution being generated near the residential community? (In the absence of local standards, US EPA water quality standards can be used to define chemical and biological pollution levels.)
- 2) What are the estimated quantities and (in the case of storm run-off) the likely composition of water pollution flows from the residential community? (As noted above, 80 to 90% of the water supplied to the community can be expected to be discharged to the sewer system as sanitary sewage.)
- 3) What contribution will the proposed community make to regional water pollution levels?

Base Data Requirements:

- Review available water quality monitoring records and future planning documents to determine whether the site is, or will be, located near existing or proposed major generators of water pollution.
- Estimate storm frequency and run-off volumes from available meteorological records.

Mitigation: Water conservation measures will necessarily reduce the volume of sanitary sewage (see Item 1.b) while proper collection and disposal of solid waste will reduce contaminants in storm water run-off (see Items 2.a and 3.c).

3.c) SOLID WASTE

Issues: When improperly disposed of, solid waste creates severe health hazards, and degrades the amenity level of the urban environment. Significant levels of informal recycling of trash does take place in India, but the remaining (largely organic) waste material is frequently left behind to rot away. As is the case with other residuals, proper collection, treatment and disposal of all forms of solid waste pollution, from whatever source, are essential to the continued health and sustainability of urban residential environments (see Item 4.e). Particular care must be taken with the management and disposal of toxic and hazardous materials (see Item 2.d).

Assessment Questions:

- 1) What are the estimated quantities of solid waste likely to be generated by the residential community?

Base Data Requirements:

- Review available solid waste generation factors for similarly situated urban residential areas to determine the likely quantities of solid waste that will be generated.

Mitigation: Unlike many environmental impacts -- where regional-scale solutions are required -- local community residents can make a major contribution to the mitigation of solid waste problems. Proper storage and disposal of waste products and locally organized and managed recycling programs may offer a vehicle for increasing local citizen awareness and participation in environmental betterment opportunities.

4.a) ROADS AND PUBLIC TRANSPORT

Issues: As one of the major physical infrastructure elements supporting an urban residential community, transportation facilities provide the means of access to and from jobs, cultural opportunities and for other personal needs. At the same time, transportation facilities consume large areas of land, and contribute indirectly to air pollution, noise, and storm run-off pollution (see Items 2.3, 3.1 and 3.b).

Assessment Questions:

- 1) Is or will the residential community be provided with convenient access to serviceable regional transportation facilities (including public mass transportation services) that serve likely work commutation patterns and other travel desires?
- 2) Are the internal streets and other transportation facilities and services located and designed to provide safe and convenient access to all residents and other uses in the community?

Base Data Requirements:

- Review available regional-scale transportation systems plans to ascertain existing and proposed transportation facilities and services serving the site.
- Review origin/destination data, if available, to assess the match between travel desires and existing/proposed facilities and services.
- Assess whether project-related additions to use of such facilities and services will create localized congestion, or localized traffic/pedestrian safety problems.

Mitigation: Once the need for transportation facilities is established, mitigation efforts can be directed towards maintaining the service and safety performance levels despite the addition of traffic loads, and towards design of landscaping improvements that will enhance the visual appearance and amenity of the facility. As noted earlier, landscaping incorporating earthen berms may also be utilized to reduce noise impacts.

As a supplement to formal public transit services, local residents may wish to organize car pooling arrangements to provide access to out-of-the-way destinations.

4.b) WATER TREATMENT AND DISTRIBUTION

Issues: Assuming an adequate supply of water is available (see Item 1.b), the storage, treatment, and delivery of water to the user must be considered.

Assessment Questions:

- 1) Is or will the residential community be provided with adequate connections to the regional water supply network?
- 2) Are internal distribution lines located and designed to provide convenient service to all residents and other uses in the community, and to avoid contamination of supplies?
- 3) Has adequate provision been made for fire hydrants and sufficient pressure for fire fighting purposes?

Base Data Requirements:

- Review available regional-scale water supply systems plans to ascertain existing and proposed water services to the site.
- Compare system-wide and internal water supply plans with the volumes of water likely to be required by the community (see Item 1.b).

Mitigation: If properly located and engineered, water supply facilities present few impacts requiring mitigation. In the long term, proper maintenance of the system will help minimize loss to leakage, and contamination of the treated water.

4.c) SEWAGE COLLECTION AND TREATMENT

Issues: Sanitary sewage should be collected by a system of on-site and regional mains, and given (at a minimum) primary treatment before discharge to receiving bodies. Since it is not normally feasible to treat storm run-off, despite seriously high levels of contamination, discharge points should be selected to minimize impacts.

Assessment Questions:

- 1) Is or will the residential community be provided with adequate connections to the regional sanitary sewage collection and treatment system?
- 2) Are internal collection lines located and designed to provide convenient service to all residents and other uses in the community?

Base Data Requirements:

- Review available regional-scale sanitary sewage systems plans to ascertain existing and proposed services to the site.
- Compare city-wide and internal community sewage handling capacity with the volumes of sanitary sewage likely to be generated by the community (see Item 3.b).

Mitigation: If properly located and engineered, sewage treatment facilities present few impacts requiring mitigation. However, if only primary treatment is provided, care must be taken in selecting points of discharge. As with any infrastructure system, proper, long term maintenance will help avoid future breakdowns of the system.

4.d) STORM DRAINAGE SYSTEMS

Issues: Storm sewers are essential to properly dispose of stormwater run-off. By removing permeable surfaces, urbanization increases the quantity and speeds up the flow of storm water runoff. Moreover, the storm water can pick up significant levels of waste material, and this can be a serious threat to the quality of the receiving bodies. However, it is not normally feasible to treat storm run-off, despite seriously high levels of contamination, and discharge points should therefore be carefully selected to minimize impacts.

Assessment Questions:

- 1) Is or will the residential community be provided with adequate connections to a storm water sewage collection system?
- 2) Are internal collection lines located and designed to provide adequate service to the community?
- 3) Will holding basins be required to retard the peak flows of storm drainage from the community?

Base Data Requirements:

- Review available storm water collection lines to ascertain existing and proposed services to the site.
- Compare system plans with the volumes of storm water flow likely to be generated by the community (see Items 2.a and 2.c).

Mitigation: If properly located and engineered, storm drainage facilities present few impacts requiring mitigation. However, since no treatment of storm runoff is provided, care should be taken in selecting points of discharge. As with any infrastructure system, proper, long term maintenance will help avoid future breakdowns of the system.

4.e) SOLID WASTE DISPOSAL/RECYCLING FACILITIES

Issues: Effective solid waste disposal systems require a coordinated program of temporary waste storage, periodic pick-up and transport, and proper disposal. Recycling of waste involves even greater levels of community involvement, and can include reuse of selected materials (e.g., glass, metal paper, etc.) or the conversion of waste materials (e.g., waste-to-energy programs, composting and reuse of organic wastes, etc.).

Assessment Questions:

- 1) Do adequately located, sized, and operated solid waste disposal facilities exist to service the residential community?
- 2) Have recycling potentials been identified? Have they been realized?

Base Data Requirements:

- Estimate likely solid waste generation volumes (see Item 3.c).
- Identify available solid waste disposal facilities.

Mitigation: Proper collection and disposal of solid wastes, especially if combined with significant recycling of waste material, is itself an important mitigation activity which can greatly improve the health and attractiveness of urban residential communities.

4.f) ELECTRIC POWER SUPPLY AND OTHER ENERGY NEEDS

Issues: Energy needs of urban residential communities include electric power for lighting and a variety of other uses. As urban residents increase their reliance on electric appliances for such purposes as food storage, space heating, and lighting, service interruptions can become more than an inconvenience.

Alternative fuel sources may frequently be used for heating and cooking purposes. Multiple point sources of pollution due to the use of wood, coal, and other such fuels can be a major contribution to areawide pollution levels and resultant health effects (see Item 3.a).

Assessment Questions:

- 1) Do adequate electric power generation facilities exist to serve the needs of the metropolitan region?
- 2) Has adequate provision been made to extend service to the proposed residential community development site?
- 3) Are alternative fuels likely to be used for heating and cooking purposes by community residents?

Base Data Requirements:

- Determine availability of electric power and other energy sources at the regional scale.
- Estimate likely demands for electric power and other fuel usage.
- Assess the adequacy of local connections to the regional supply system.

Mitigation: Increased utilization of solar energy potentials at the regional, community and household scales can be an effective way to reduce demand for fuels, and will also reduce potential secondary impacts on air quality.

4.g) **COMMUNITY FACILITIES AND SERVICES**

Issues: In addition to the basic infrastructure requirements discussed above (see Items 4.a to 4.f), a residential community requires a variety of other facilities and services, including police and fire protection, health care, education, recreation/open space, and religious institutions.

Assessment Questions:

- 1) Do basic community facilities and services required to serve the proposed residential community already exist? Have plans been made to provide or expand such facilities and services as needed in the future?
- 2) Are adequate financial and administrative arrangements in place to assure the continued operation of needed facilities and services?

Base Data Requirements:

- Estimate the demands likely to be placed on community facilities and services by the residents of the proposed residential development.
- Identify existing or proposed facilities and services, their service areas, and assess the likelihood of their continued viability.

Mitigation: Community-based "self help" programs may need to be organized to substitute for the lack of publicly funded and operated facilities and services.

5.a) ACCESS TO MARKETS AND EMPLOYMENT CENTERS

Issues: The quality of the social environment is, in part, a function of the availability of basic public facilities and services (see Item 4.g) and the existence of a convenient means of access to those facilities and services (see Item 4.a). In addition, the quality of the social environment assumes the ability of community residents to have effective access to centers of private economic activity, for the purpose of buying and selling goods and services, and for securing gainful employment. In the case of access to employment, effective access may involve the need to provide sufficient job training opportunities as well as adequate transportation services.

Assessment Questions:

- 1) Is the proposed residential community well located in terms of existing or proposed market (shopping) areas?
- 2) Is the proposed residential community well located in terms of existing or proposed employment centers?

Base Data Requirements:

- Identify the size and variety of existing or proposed market areas.
- Identify existing or proposed employment centers, the need for specialized employment training, and the availability of transportation service to and from the proposed residential community.

Mitigation: Community-organized "farmers' markets" utilizing available open spaces, and informal "jitney" and other shared-ride services are two means to increase access to these economic necessities.

5.b) HISTORIC AND ARCHAEOLOGICAL RESOURCES

Issues: Historic, archaeological, and other cultural resources have an important role to play in establishing a society's cultural identity, providing meaningful linkages between the present and the past, and helping to create a distinctive physical environment. Most nations recognize the need to identify and protect sites and structures of national and worldwide significance. Less attention is given, however, to the retention of the physical structure and fabric of existing urban areas.

Assessment Questions:

- 1) Does the proposed development site contain cultural resources of major (national) significance?
- 2) Does the proposed development site contain cultural resources of local importance, even if not of major (national) significance?
- 3) Can identified cultural resources be integrated into the proposed development without compromising their intrinsic value?

Base Data Requirements:

- Identify and characterize all important cultural resources that may exist on the development site.
- Identify techniques and related funding sources for assuring the preservation of such resources.

Mitigation: Educational programs at the community level may be needed to make property owners and residents aware of the nature and importance of existing cultural resources, and of techniques for assuring their continued use and preservation.

b.c) VISUAL QUALITY AND AMENITY

Issues: The visual quality of a residential community is determined by the location, massing, height, and materials of buildings, streets, open spaces, landscaping, and other features of its physical environment. Although difficult to quantify, the provision of proper landscaping, street lighting, seating, and other urban amenities is a major factor in determining how a community is experienced and enjoyed by its residents, including their sense of personal comfort and security.

Assessment Questions:

- 1) Does the proposed development present opportunities to preserve, enhance, or create views and other visual opportunities?
- 2) Will the proposed development include a variety of public amenities, particularly in open space and pedestrian areas?

Base Data Requirements:

- Review project plans to determine whether adequate care has been given to the design of public spaces and buildings, and to the inclusion of appropriate amenities.
- If the proposed development is an extension or expansion of an existing community, conduct a photographic survey of successful and unsuccessful public spaces and buildings.

Mitigation: Development plans should be prepared by qualified architects and landscape architects to assure proper consideration of visual quality and amenity factors. All public buildings and facilities should be designed to enhance the visual character and quality of the community. Good design does not necessarily cost more money, and in many cases can be less expensive, both in terms of initial investment and long-term operations, than poorly-designed environments.

II. TRAINING ANALYSIS RECOMMENDATIONS

A. BASIC CHALLENGE

One of the major challenges facing urban policy makers and managers throughout the world is how to deal effectively with environmental resource and impact issues in rapidly urbanizing areas. A fundamental prerequisite to the development of effective policy and programmatic responses to urban environmental concerns is the availability and widespread dissemination of appropriate skills and technologies.

Educational needs must be addressed at two basic levels:

- Providing technical and analytical skills necessary to support the development of appropriate macroeconomic and sector policy responses; and
- Providing training for technicians and professionals at all levels of urban systems planning and administration in order to develop and maintain skills essential for sustainable environmental management.

As noted in the draft **India Urban Strategy Statement** (USAID/India and RHUDO/Asia, May, 1989), there is widespread recognition and acceptance at national levels of the need for reform of urban development policies and practices. However,

"Acceptance of these principles in New Delhi does not mean that they are universally understood and accepted, and even less that they are being put into practice at state level."

B. TRAINING FOCUS

With respect to achieving the objectives of the **Study of Environmental Implications of Urban Land Development in India**, primary emphasis should be placed on efforts to increase awareness of urban environmental issues and to improve environmental planning and management skills at state and municipal levels, and among NGOs with an active interest in urban development and environmental enhancement.

In particular, major support should be given to programs with a strong "hands on" component, where "on board" Indian professionals and technicians can meet to exchange information on urban management problems among themselves, as well as with experts from India and abroad. This approach will have a greater impact in the short-term than would a more broadly focussed effort at increasing environmental awareness in public school curricula, or sponsoring basic research and analysis of underlying urban environmental problems.

Vehicles for accomplishing these training objectives can include:

- Newsletters and other methods of information exchange;
- Workshops, seminars, and conferences;
- "Twinning" arrangements where Indian professionals spend time working in comparable organizations in other states or countries, or where representatives from such organizations spend time in Indian agencies;
- Short courses designed to upgrade specific skills; and
- Longer-term professional certificate or degree programs.

Regardless of the vehicle or vehicles selected, the following subject and skill areas should be included:

- Data collection and management, including GIS applications;
- Methodologies for policy research and analysis;
- Environmental monitoring procedures;
- Environmental enforcement mechanisms;
- Management of critical urban environmental systems, such as water supply, solid waste, wastewater treatment, air quality control;
- Public health implications of environmental degradation; and
- Resource economics and valuation techniques.

C. AVAILABLE TRAINING RESOURCES

A compendium of urban environmental training courses offered by educational and professional institutions in the United States is being assembled for USAID, Office of Housing and Urban Programs, by Steve McCoy-Thompson. A draft report, titled *Urban Environmental Training Courses*, was circulated for review in August 1990, and provides a valuable directory to five categories of training opportunities:

- University Seminar Courses,
- University Short Courses,
- Accreditation Courses offered by professional associations and institutions,
- Training Courses for Environmental Trainers, and
- Network Centers for Environmental Education.

The report includes a brief description of each program, including issues addressed, training objectives, target groups, and costs and other logistical considerations.

However, after consultation with the Operations Research Group (ORG) project team, it is recommended that primary emphasis be placed on utilization of in-country training institutions, with U.S. involvement coming in the form of guest lecturers and "twinning" experts. A variety of in-country training resources exists, including the National Environmental Engineering Research Institute (NEERI), located in Nagpur.

NEERI is an institution under the aegis of the Council on Scientific and Industrial Research (CSIR), an autonomous body of the Government of India. NEERI's current activities are heavily concentrated in the areas of urban environmental research and training, including:

- Environmental monitoring and collection of baseline data,
- Research and development of methods and techniques for environmental management,
- Development of low cost sanitation and wastewater utilization methods,
- Environmental impact assessment methods and practice,
- Solid/hazardous waste management,
- Participation in the Ganga Action Plan, and
- Short-term training courses for scientists, engineers and technicians.

In this last capacity, NEERI is in a position to help organize and coordinate training activities in cooperation with other educational and action-oriented groups throughout India. It is therefore recommended that USAID explore possible means of assisting and encouraging NEERI to undertake an expanded program of training, focussed research, and individual exchanges.

III. ADDITIONAL COMMENTARY

A. CITY-SCALE AND SITE-SCALE PLANNING GUIDELINES FOR URBAN RESIDENTIAL DEVELOPMENTS

Planning and design standards now applicable to town planning and site design activities in India are frequently acknowledged in theory, but disregarded in practice. Although there may be many reasons why legal standards are ignored in an individual case, including ineffective or corrupt administration, it is also widely believed that the prevailing standards are often inappropriate to the needs of public safety, welfare and environmental protection.

For example, a recently published *Review of Planning Standards for Preparation of City and Area Development Plans for Different Size Cities in Madhya Pradesh (Poona, 1988 [?])* concluded:

"The study is based on the implicit assumption that existing legal standards are too high to achieve efficiencies in the use of urban land. They are so high that they price land and services beyond the reach of the urban poor. They often spread infrastructure too widely to efficiently maintain and manage. Given the demand for land and the unreachable goals implied by standards, these mechanisms are to a great extent responsible for physical development which disregards legal provisions and operates outside of a manageable framework. Thus, we embark on a search for an efficient, affordable, equitable and manageable urban land system." [page 4; emphasis added.]

Thus, although theoretically desirable, planning and design standards may be disregarded if the costs of attaining them are deemed to be unreasonable. Informal and unregulated modes of development then occur, which may or may not provide decent, safe and sanitary housing.

Moreover, in order to initiate and properly administer a housing finance program, which is one of USAID's ultimate program objectives, a set of **Minimum Property Standards**, or guidelines, will be required in order to review and evaluate the proposed residential development projects, and to assure that the value of the project (both financial and social) is commensurate with the level of financing to be granted. A useful start in this direction has been made by the Indian National Housing Bank's **Guidelines for Land Development and Shelter Projects by Professional Developers**, issued in April 1989.

B. STRATEGY FOR DEVELOPING A SET OF MINIMUM PROPERTY STANDARDS

Neither a detailed, critical review of existing planning and design standards currently in use in India, nor an outline of proposed standards is within the scope of this memorandum. However, the environmental impact assessment topics listed and discussed in Section I of this memorandum do indicate many of the key issues which should also be reflected in a set of minimum property standards.

In brief, criteria should be developed which address:

1. Site location factors, and
2. Site design factors.

The first cluster of criteria should deal with the appropriateness of the proposed development site in terms of regional or municipal facilities and services -- both existing and planned -- for water supply, sanitation, transportation, solid waste disposal, and the like. Compatibility with adjacent land uses and land values, income and population distribution patterns, access to employment centers, and similar factors should also be considered in addition to the review of the adequacy of the regional infrastructure framework.

The second cluster of criteria will reflect the architectural, engineering and urban design considerations that should be incorporated into the project plans. Plot size, dwelling size and construction standards, environmental design factors (e.g., recognition of climatic, cultural or other "intangible" design issues), utility connections, roads and streets, and provision for other community facilities and services should all be considered at this scale.

A useful sourcebook which can be used as a point of departure for developing a detailed listing of property standards, or guidelines, is Caminos and Goethert, **Urbanization Primer: Project Assessment, Site Analysis, Design Criteria for Site and Services or Similar Dwelling Environments in Developing Areas**, M.I.T. Press, 1978.

In their discussion of site design criteria, Caminos and Goethert provide a useful distinction between acceptable "minimum levels" and "standard levels" in the provision of public facilities and services. This treatment of site design standards will be especially relevant in India, where the financing of programs for the upgrading of existing informal settlements may be as important as the design of new projects.