THE DEVELOPMENT OF A SITE SANITATION PLANNING AND REPORTING AID (SSPRA) FOR THE SELECTION OF APPROPRIATE SANITATION TECHNOLOGIES FOR DEVELOPING COMMUNITIES

Report to the Water Research Commission

by

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UMGENI WATER

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EXECUTIVE SUMMARY

BACKGROUND AND MOTIVATION FOR THE PROJECT

Local and international experience over several decades has shown that the provision of sanitation facilities is a complex task dependent on many different variables. These include affordability on the part of both the users and the service providers, willingness of the users to pay for both the capital development and maintenance of systems, technical suitability and responsibilities and capacities for operation and maintenance. Cultural norms and the perceptions and preferences of the users have seldom been integral to decision making with users largely being excluded from the planning and decision making process. Failure to successfully integrate all the variables into the planning of sanitation projects and in selecting sanitation technologies provides the background to many failed attempts at sanitation delivery, which are cited in the local and international literature.

The lack of provision of adequate and appropriate sanitation facilities in developing communities has direct and serious effects on the quality of surface and ground water resources. Umgeni Water, a water supply organisation in KwaZulu-Natal, is concerned about the increasing pressures arising from the lack of provision of adequate and appropriate sanitation facilities in their operational area. Increased nutrient loading and faecal bacterial contamination are resulting in gradually deteriorating water quality of the water resources of the area and attendant treatment costs. Umgeni Water is pursuing an integrated catchment management approach within its operational area, to enable the coordinated and integrated management of water resources and thereby ensure sustained water yields of acceptable quality. Informed, consistent sanitation planning and implementation is a critical component of this approach.

Another major aspect of the failure of delivery of adequate sanitation facilities is the health of the communities, dependent on the abovementioned water resources for drinking and domestic purposes. Surveys[2] undertaken in the early '90s indicated that up to 95% of people living in the rural areas or in transitional areas adjacent to urban areas do not have access to adequate sanitation facilities. This situation demonstrates a critically urgent need for successful sanitation delivery in these areas.

Whereas there exists a significant amount of political will to address the inadequacy of supply of sanitation services as rapidly as possible, there is a risk of repeating the mistakes of the past and providing inappropriate facilities in many places due to a lack of consideration of all the relevant variables. Furthermore, the process of reconstruction and development

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2 Palmer Development Group and Makhetha Development Consultants (1995) *Review of Rural Sanitation In South Africa*, Mvula Trust and Water Research Commission, WRC Report No.: KV71/95

calls for participation, transparency and accountability in planning and decision-making. Sanitation planning procedures of the past were unable to satisfy these requirements.

A comprehensive planning tool that integrates all the relevant variables and at the same time provides for transparency and accountability in decision-making, is clearly needed to enable the pragmatic delivery of sanitation services to the many people who do not currently have access to such facilities.

The SSPRA has been developed to attempt to fulfil this need.

The SSPRA is the result of research into the "development of a decision support system for the selection of the most appropriate sanitation technology for developing communities". As such, the tool developed was originally called the **Sanitation Decision Support System** or **SDSS**. Through the process of extensive consultation which formed an integral part of the research process, it became clear that there was a misperception that the system was designed to provide the solution or final decision, rather than to provide a consistent and comprehensive manner in which to organise and present information for decision making. Rather than to perpetuate this misunderstanding and to have to provide qualifying statements with regard to the legitimacy of the tool, the researchers decided with the approval of the Steering Committee that the name of the decision support system would be changed to the **Site Sanitation Planning and Reporting Aid** or **SSPRA** - a name which more accurately describes the purpose of the tool.

The research into the development of the SSPRA commenced in January 1993 and was largely completed during 1996. However, significant changes in government structures and policy took place during this period. More recently (1996-1998) the manner in which sanitation planning is undertaken has also changed significantly. These changes had to be accommodated in the research project and the implications for the relevance of the SSPRA are discussed in Chapters 2 and 3.

RESULTS & KEY ISSUES

Major findings

Context of the SSPRA within broader planning of sanitation upgrades
The planning and provision of sanitation facilities in developing communities is a complex and multifaceted process. No single tool can hope to address all the issues which need to be taken into account in such a complex process, particularly where decision making is always to some extent based on the subjective judgement of several different parties and on incomplete information. In addition, there are several players in sanitation development projects, whose goals in sanitation provision may be vastly different. The SSPRA has been developed for a very specific purpose which is to assist service organisations, development agencies, local authorities and the like in formalising their contribution to the process of appropriate and acceptable sanitation technology selection, for particular development projects within their jurisdictional areas or to which they may be contributing to in some way.

The primary purpose of the SSPRA is therefore to provide the abovementioned agencies with a framework within which information can be recorded in a consistent manner for the purposes of decision-making. Since the tool is focused on assisting with technology selection, it makes a limited but important contribution to the overall sanitation planning process. **It must not be seen as a decision making tool, nor as a replacement of the much broader sanitation planning process.** It must also be borne in mind that the four technology groups used in the SSPRA have been used for illustrative purposes, i.e. they represent permutations of the types of sewage treatment (wet or dry, on-site or off-site) that are possible rather than specific technologies (e.g. VIP's, urine diversion systems, waterborne sewerage). The tool thus provides a foundation upon which further discussion and investigation must take place to come to decisions about specific technologies for specific sites.

The SSPRA may be seen as merely one tool to undertake a specific task within the broader planning process or, more specifically, within particular projects for the provision of sanitation. Sound sanitation planning, requires that there is continuity between planning at a regional level (catchment), through to planning at a project level and within projects, planning at a site specific level. The model in the table below *(Table 7.1)* illustrates the possible context for the two main components of the SSPRA *viz.* a Regional Zoning Map and a computer based Planning and Reporting Aid that provides support for technology selection.

Table (7.1): Context of the SSPRA in the broader sanitation planning process

LEVEL OF PLANNING	*METHODOLOGY / TOOL*	*CONTEXT*
1 Regional (catchment)	Regional Zoning Map	INPUT to development planning and implementation process
2 Local (project)	Project Cycle Management Approach incorporating PHAST	MANAGEMENT of overall process of development planning and implementation
3 Site (household plot / group of plots)	SSPRA technology	INPUT to development planning and implementation process

The essential link between the two components is the approach taken to managing the planning and implementation of sanitation upgrades in user communities. It is proposed that this link be made by using the Project Cycle Management (PCM) approach and positioning the use of the SSPRA computer based tool within this process, as one of a range of tasks and inputs which contribute to the overall implementation of a sanitation project.

The PCM approach is particularly useful for low cost sanitation programmes. The literature review undertaken for the research project as well as current debates on sanitation decision making processes reveal that successful water and sanitation programmes have not focused solely on infrastructure provision. Community participation in a) identifying the social costs of poor water and sanitation behaviours and facilities, b) developing locally specific awareness campaigns, c) identifying appropriate technologies, d) contributing to the building of these facilities and e) playing an active and ongoing role in the operation and maintenance of the facilities, define the difference between success or failure in the improvement of public health.

PCM places the implementing agent (local authority, development agency, service organisation) in a supporting role to community led sanitation development projects. The SSPRA can be used within this context by the implementing agent to provide organised information to user communities, on technology options and the implications of each, to facilitate their decision-making. There are a number of different project management approaches that could be used for the planning and implementation of sanitation projects and to which the SSPRA could contribute. The Participatory Health and Sanitation Transformation (PHAST) approach is suggested as probably the most appropriate in the context of the SSPRA. If the PHAST approach is to be formally adopted as the project

management approach within which the SSPRA should fit, a mechanism will need to be put in place to ensure that the two processes are compatible and that the PHAST approach informs any future refinements of the SSPRA. An outline of the main elements of the PHAST Programme is given in the Literature Review [3].

The ultimate goal of the upgrading of sanitation in developing communities is to provide barriers to contamination pathways for the purposes of protecting or improving public and environmental health. Only by examining sanitation technology choice as part of an integrated planning and implementation process which takes place from regional through to local level, will it be possible to realise this goal. For the SSPRA to contribute to improvements in public and environmental health, it must also be contextualised within the broader sanitation planning process. Improved infrastructure alone will not necessarily bring about the desired improvements. The relationship is reciprocal: whereas the broader planning process (the regional planning base and the project management approach) provides a mechanism for the SSPRA to contribute to an improvement in public and environmental health, the SSPRA provides information and therefore promotes understanding, which can contribute to informed decision making within the broader planning process.

Application and Efficacy of the SSPRA for Technology Selection

The efficacy of the SSPRA as a tool to contribute to consistency in sanitation planning efforts in general and assist with technology choice in particular is evaluated below in terms of its strengths and limitations. The evaluation is based on the findings of the Literature Review, considerable discussion with development professionals and specialists in the field of sanitation provision, as well as the results of a scenario testing exercise. The current planning, policy and institutional environment has also been taken into account in the evaluation.

<u>Strengths</u>

- The SSPRA integrates the consideration of all relevant factors (socio-economic, environmental, technical, financial, political) in the sanitation technology selection process and at the same time assists with broader planning of sanitation projects. The majority of urban local authorities oppose VIPs of any description, on public health and political grounds, and view alternatives to water-borne sanitation as problematic interim measures. Wherever they have the means, local authorities are installing water-borne sanitation, regardless of residents' ability to meet the cost of servicing it. Given the growing polarisation of the sanitation delivery debate into urban: waterborne and rural: VIPs, the SSPRA acts as a necessary reminder of the range of issues essential to sound planning of sanitation.

- Exclusive use of the SSPRA will assist in focusing the data collection efforts of planning

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[3] Kathy Eales and Shirlane Douglas *Selecting Sanitation Technology: Approaches to decision-making - a review of the international literature and an assessment of current practice in South Africa*, Counterpoint Development cc., June 1998.

authorities. Furthermore this will promote the establishment of a consistent database for use by the relevant authorities and service providers that will in turn facilitate data exchange between these parties.

- The system provides and promotes transparency in planning and decision making by encouraging full user community participation.

- The SSPRA contributes to consistency in planning and decision making across a range of sanitation projects under the jurisdiction of the same authority or service organisation but in different environments, by introducing the range of factors that need to be taken into consideration. The system provides the planning context for the structured introduction of community based participatory methodologies in achieving the purposes of information gathering and local planning.

- A written record of the technology assessment process is provided in a consistent manner from project to project.

- The SSPRA is robust and comprehensive. It has been designed to assist the user though the technology selection process entirely i.e. to ensure that it is possible in the end to select a suitable technology or modify the design for a unique set of circumstances. By taking the user through a logical series of steps each of which depends on the completion of the step before it, the user is guided to a decision at the end of the process. The tool can therefore be considered highly effective in achieving its purpose.

- The SSPRA provides for integrated planning of sanitation provision on a catchment basis through the use of the RZM.

- Although the SSPRA is constrained by its data requirements, the system can be used iteratively as and when better or more accurate data become available for the project area.

Limitations

- The data requirements of the SSPRA are quite substantial and the system is dependent on the quality and comprehensiveness of the data input into the system. The level of support provided for decision-making diminishes in proportion to the availability and accuracy of data. However, a list of data requirements is provided in the User Manual as a guide to users. The need for adequately trained field workers to undertake surveys in communities is stressed in the User Manual and guidelines and recommendations are provided for the collection of the necessary information. The data required for input into the SSPRA comprise information sets that are fundamental to basic planning. Attention should be focused on the gathering of accurate and comprehensive data for the SSPRA and therefore the sound planning of sanitation projects. Failure to address the range of key issues incorporated into the SSPRA will mean that planning is based on incomplete information. The use of community-based approaches to gathering data beyond

standard survey/questionnaire methods needs to be explored. Socio-economic surveys and technical pre-feasibility studies can be enhanced through the generation and integration of local knowledge. The range of factors considered and the data field construction of the SSPRA would enable the utilisation of community based data collection methods.

- The SSPRA, in particular the PC based component and the RZM, presupposes the possession by the planner/service provider of the necessary technology to run the system or a GIS. However this problem can be overcome by the better equipped service providers and local authorities offering a bureau service for the use of the SSPRA.

- Should planning authorities or other service providers using the SSPRA have access to GIS facilities as well as high resolution data, there is a risk that they may skip the remaining stages and components of the SSPRA or neglect to incorporate community based decision making processes into their planning, consider the RZM as a complete planning tool rather than a support for technology selection within the broader sanitation planning context.

- Planning according to the RZM on a catchment basis could only be meaningful for areas where communities reside within the boundaries of the catchment, precluding consideration of conditions across catchment boundaries e.g. the proximity of sewer reticulation just outside the catchment boundary but within reach of a community just within the boundary.

- In the context of recent developments in sanitation planning approaches as well as an increased understanding of the issues that are key to technology selection, there are problems with the current knowledge construction of some of the data fields and / or indices in the SSPRA User Interface. These will have to be addressed before the tool can be used to support decision making around sanitation technologies. The reader is referred to *Appendix 1* for printouts of the user screens in the SSPRA. Examples of some of the problems referred to above include:

  (i) The User Awareness checklist confuses exposure to sanitation technologies with health and hygiene awareness. Information on exposure to technologies needs to form part of a data field on selecting sanitation design principles. The technology needs to be seen as one contamination barrier amongst many, the most effective contamination barriers being changes in hygiene behaviour. Assessing the perceptions of the community residents to contamination routes and barriers would provide a more meaningful assessment of user awareness.

  (ii) The User Awareness checklist asks about the "levels of awareness" in the community of the link between "public health" and "adequate hygiene". However, none of these terms are defined. What is an acceptable level of awareness and how is this defined in practice? What is meant by public health and adequate hygiene? Who defines these terms and who is asked? There is no methodology for determining the answers to these questions and they will therefore be based

on the subjective judgement of the SSPRA user and the responses of a few community members. The question should rather be focused on hygiene practices and one method of obtaining this information is through the use of observation surveys. Issues such as the number of users per facility, evidence of hand washing facilities, general cleanliness of the existing facilities, materials used for anal cleansing, children's usage of the facilities and disposal practices for nightsoil will provide some indication of hygiene practices. Levels of awareness can then be extrapolated from existing hygiene practices. However, observation surveys, although more accurate than questionnaires, should not be used in place of community led exploration into household hygiene practices.

(iii) The Institutional Readiness checklist exhibits the same problems regarding the use of subjective terminology. Again, observations and queries on how many times the community structure holds meetings, reports back to the broader community, number and demographics of participants at these meetings will give a limited idea of institutional readiness. These types of questions usually produce very differing responses depending on the situation of the respondent.

(iv) Institutional Readiness as the only indicator of a community's capacity to manage a project is inadequate. In many cases, problems experienced in a community with leadership structures do not translate into a lack of resources, willingness and capacity to manage a sanitation project. Many of the poorest households (usually single female headed households), do not have the time to attend meetings and are generally alienated by predominantly wealthier and male leadership. Assessment of the readiness of these households and the capacity of the "informal" institutional networks that support these households should be accounted for in the data field.

(v) The willingness of residents to contribute to Operation and Maintenance (in the Operation and Maintenance Index) is only calculated in terms of a financial contribution. There may be other forms of contribution that should be accounted for.

This is not an exhaustive list of potential problem areas in the SSPRA, and is merely provided for illustrative purposes. To improve the usefulness of the tool it will be necessary to review the indices and data fields in the SSPRA in the context of project management to identify problem areas in the current tool and suggest ways in which these can be overcome to better serve an effective sanitation planning and implementation programme.

Data Requirements and Implications for Data Collection

The output and level of assistance provided to the planner or service provider using the SSPRA are entirely dependent on the comprehensiveness, accuracy and level of detail of

the required data input into the system. Some of the data requirements for the SSPRA and the RZM are not easy to satisfy. However, comprehensive guidelines and data collection instruments have been provided in the User Manual to assist the user in obtaining the necessary data.

The user is also encouraged to obtain assistance in collection of the data for non-technical fields from adequately trained practitioners in this field. The participatory tools developed in WATSAN community based methodologies (PHAST in particular), readily allow for data input as they are based on matrices, ladders and diagrams. Degrees of health awareness, prioritisation of sanitation issues, organisational readiness and available resources may consequently be clearly expressed.

Although there may be considerable demands on the user in terms of data collection requirements for the SSPRA, the issues incorporated into the SSPRA are **key data fields only** and do not represent a comprehensive set of all issues pertaining to sanitation planning. Addressing at least the key data fields is absolutely critical to sound sanitation planning and technology choice and the input of accurate and complete data should not be compromised. However, as the SSPRA stands at present, the data fields for the socio economic, organisational and financial factors are perhaps too thin for meaningful interpretation. These data fields need to be reconstructed on the basis of data collected for the purposes of overall project management and implementation, not only for the limited purpose of technology selection. An appropriate method for collection of the data for input into the SSPRA that is in line with the goals of the overall project, therefore needs to be adopted.

The PHAST approach has developed tools based on Adult Education principles that encourage households to take responsibility for the reduction of the disease burden and improvements in community health, by improving their sanitation situation. The use of tools such as this, could provide the necessary information to reconstruct the data fields so that they become more meaningful.

Synopsis

There is growing acknowledgment that upgrading sanitation is considerably more than a technical exercise; increasingly, the technical questions - slope, depth of water-table, distance from a water source - are being regarded as a kind of pre-feasibility assessment, with the real decision about technology type resting on a range of people-centered issues.

In some circles, this realisation is prompting an important shift in the approach of development planners. It is no longer sufficient to assess the physical feasibility of a particular technology type at a given site. The level of support and preparedness of individual users must be assessed, and, where inadequate, targeted initiatives will be required to assess how or whether to proceed.

In view of this, re-orientation among a growing number of development professionals, it is

appropriate to question the validity of an SSPRA which attempts to anticipate the full range of non-technical considerations which may present themselves, albeit through identified key decision factors, and then assign a weighting to them. Aspects such as the validity of local perceptions and knowledge are difficult to assign a weight to. Understanding local knowledge and establishing a common format for input into the data fields of the SSPRA is very difficult. However, an attempt was made to incorporate the difficult task of understanding the communities' concerns, experiences and priorities.

These concerns may be laid to rest by stressing that the SSPRA does not aspire to present the user with a decision. The final decision rests with those members of the community who will use the sanitation facilities. What the SSPRA does do is to present the user with a number of issues for consideration in a structured way, and to inter-relate them. Where the user does not have the necessary information to assess a particular situation or factor, the SSPRA highlights this, and offers suggestions as to how the information gap might be bridged. As such it supports decision making, without relieving the user of responsibility for the outcome.

In situations where residents must be sensitised to the implications of their technology choice, the SSPRA may prove valuable in underlining the range of variables that must be considered. This would allow for continual re-evaluation of the data gathering and planning methods facilitated by the planner/service provider, in dealing with the range of issues needed to arrive at acceptable technologies. Moreover, the SSPRA's ability to record all responses to data requests may prove useful in defending contentious decisions, and in proving that the full range of possible alternatives and their implications were considered.

ACHIEVEMENT OF PROJECT OBJECTIVES

In general, the objectives of the research have been met. The original objectives are reproduced here for the convenience of the reader:

Research Objectives

1 Synthesis of relevant available information in the local and international literature and from other sources such as unpublished documentation on appropriate sanitation for developing communities in general, and on selection of technological options in particular. In addition, identification of gaps in the existing information and formulation of recommendations for further research.

2 Identification of experts in the fields of provision of appropriate sanitation to developing communities, and in the development of decision support systems, as well as other interested parties and community representatives, and inviting their participation/input in building the SSPRA.

3 Evaluating the potential physical environmental impact of different sanitation technologies with specific reference to ground and surface water quality.

4 Designing a planning and reporting aid that is PC-based and can be linked to a GIS, with a structure and content compatible with the requirements of the end user(s) i.e. a practical and workable tool.

5 Ensuring that the technology developed is transferred effectively to the end user(s) and that the planning and reporting aid can be effectively implemented.

6 Delivering recommendations for the required support structures for the planning and reporting aid.

7 Establishing communication with other groups involved in research into or implementation of appropriate sanitation technology in developing communities, to prevent duplication of effort and for mutual benefit to such groups and the project.

The extensive Literature Review undertaken of the local and international literature has provided a perspective on the importance of the issue of appropriate technology selection and the lack of adequate and comprehensive procedures to undertake this task.

Opinion on the application and utility of an SSPRA for sanitation technology selection was canvassed from a wide range of individuals and organisations. The contributions of these people convinced the researchers that there are a large number of highly experienced people in the field of sanitation planning and provision. Key individuals have been identified for participation in a Specialist Consultation Network. In addition, valuable contact has been made with other groups, institutions and individuals involved in research into the provision of appropriate sanitation to developing communities.

Some work has already been done by others in assessing the environmental impact of different technologies. This work was not taken further, but summarised for inclusion into the SSPRA User Manual for reference purposes.

A functional, robust and effective PC-based tool has been developed to assist planners and decision makers in the selection of appropriate technologies. The system is not formally linked to a GIS but has been provided with a spatial dimension in the form of the RZM. This map also provides a contextual basis for site based sanitation selection. The structure and contents of the tool were workshopped and tested on a number of occasions with many potential users and people active in the field of sanitation planning as a whole. This has hopefully ensured that the tool is both pragmatic and user friendly.

The SSPRA is accompanied by a comprehensive User Manual to provide the user with as much information as is required to use the system effectively. The user is also provided with backup in the form of a network of specialists who can provide additional support. There should be no reason why users should have difficulty in implementing the SSPRA system.

RECOMMENDATIONS & THE WAY FORWARD

The objectives of the research have been met in the development of the SSPRA.

1 However, the system remains to be tested in real situations and it is therefore recommended that a testing phase of approximately 6 months be completed.

- *Further testing may be conducted by other service providers across the country to ensure that the tool is ultimately applicable to other provinces and takes account of variations in local conditions.*

- *The system must also be tested by e.g. postgraduate students in engineering, planning and geographical (GIS) disciplines.*

2. For the SSPRA to reach its objective of protecting the quality of both ground and surface water resources from the potential impacts of sanitation, as well as to promote transparency and consistency in sanitation planning and technology selection.

- *It is recommended that concurrent with and following the period of testing and refinement referred to above, that the SSPRA be marketed widely as a practical tool to assist service providers in their sanitation planning and technology selection efforts*

Initial discussions with the Department of Water Affairs and Forestry indicated that there is considerable interest in the utility of such a tool, particularly since the structure and contents thereof are clearly in line with the principles outlined in the Draft White Paper on Sanitation Policy.

Many other organisations worldwide have expressed interest in the SSPRA, notably WEDC in the United Kingdom. This suggests that the SSPRA may be marketable beyond the boundaries of South Africa in other developing countries.

3 Coherent, consistent and appropriate methodologies should be identified to solicit information on socio-economic, environmental, technical, financial and political factors. Both the methodologies employed, and the type of information generated using a given methodology, would inform what data fields were selected and how data were captured within them.

- *It is recommended that the PHAST approach be adopted for data collection and community based planning, especially for the socio-economic and some of the environmental factors. Responses to the use of specific PHAST tools – for example, three pile sorting or a sanitation ladder - could then be reflected in the data fields of these factors. The adoption of a particular community-based methodology by the planning agent for a given geographical area, would then allow for a consistent approach to the assembly of baseline data, and allow for helpful comparisons between different settlements, communities and projects.*

- *In projects where there is neither a structured nor a participatory approach to decision-making around sanitation, it is recommended that SSPRA be used as the tool to guide decision-making. As the SSPRA provides information on alternative technologies and the range of factors that need to be taken into consideration when planning sanitation implementation, the use of the tool by peri-urban and urban planners would enhance their decision-making process. The emphasis in many of the peri-urban and urban local structures on water-borne sewerage needs review. The SSPRA would reinforce awareness of the need for such review.*

4 The SSPRA's location in the planning and decision-making process needs clarification.

- *It is recommended that the Project Cycle Management (PCM) approach be adopted. The appropriate place for technical information and planning tools is as a support to implementing agents, not as an externally determined framework for information and planning. The role of the implementing agent is to support and, if necessary, facilitate community-managed development initiatives. The community managed decision-making process would indicate where technical inputs and support were required. The SSPRA, in this context, would be defined as a support and management tool for the extension/field officers of planning agencies, local authorities, service organisations and the like. The tool would provide extension/field officers with a checklist of technical issues to raise and explore with community members, and facilitate further investigation of locally appropriate technical options within the community managed development process.*

  Again, in situations where decisions on sanitation implementation are solely made by planners outside a participatory framework, the SSPRA could play an important role in outlining the range of factors that should be considered, so as to expand discussion beyond the assumption that only full water-borne sewerage is relevant.

5 The contents and data requirements of the SSPRA should be determined within the context of the project management approach and method selected. As such:

- *Construction of the SSPRA checklists, index factors and data fields should be reviewed to reflect a specific adopted project management approach and method. The socio-economic factors need to provide meaningful, although limited, analysis.*

6 In order for the SSPRA tool to provide a range of possible appropriate technical options to a user community:

- *Access to relevant information must be provided through the methods described above and the information must be organised in a meaningful way that allows for local understanding. The above selection of a method that encourages this is highly recommended. However, the ability of a computer based tool to do this is limited, but if the limitations are acknowledged and openly understood by the operator, this will not hinder the process, but rather provide a support to an existing information gathering process. The multi-level nature of sanitation programme decision-making makes the selection and construction of all appropriate information needed for external experts virtually impossible. However, decisions need to be made on what is 'good enough' information, particularly in relation to the socio-economic factors. The UNICEF 'Better Sanitation Programme', PHAST 'Fieldworker's Handbook', and the many web sites available all provide guidelines on how to make this particular judgement. The Department of Water Affairs and Forestry Groundwater Protocol is recommended for settlement density issues.*

- *In addition it would be useful to have access to a database of alternative technologies that are organised according to design principles. By recommending a technology design principle or type, the SSPRA encourages local variations and the incorporation of site specific design requirements. The SSPRA could cross reference to other support tools for information on specific sanitation technologies.*

7 It may be feasible to produce additional supporting material to the User Manual that accompanies the SSPRA system.

- *It is recommended that a pocket guide to the development of sanitation projects according to sound principles and the key issues determining technology choice be developed for wider distribution. This would ensure that the lessons learned in the process of developing the SSPRA are shared as widely as possible, since the user group for the SSPRA will be limited to a relatively small number within a broader audience of people involved in sanitation development planning.*

8 The process of development of the SSPRA and in particular the data requirements of the system, identified a number of areas where further research is required to provide a comprehensive technical data set *inter alia* soil permeability and the environmental impact of individual systems.

- *It is recommended that these aspects be afforded the attention and funding to enable the collection of relevant data.*

9 The SSPRA, changing nature of sanitation planning and the continual improvement of available data, will require that the contents of and recommendations generated in the SSPRA PC based system are continually updated.

- *It is recommended that a custodian be identified for the updating and maintenance of the SSPRA.*

Concluding remarks

The process of developing the SSPRA has been extremely helpful in clarifying the role of implementing agencies in sanitation upgrading programmes as well as to contextualise technology selection within the broader sanitation planning framework. The SSPRA should not seen as a tool which can be used in isolation of broader sanitation process. It constitutes one of several tools that can be used to promote sustainable and acceptable solutions to public and environmental health challenges resulting from inadequate sanitation.

The SSPRA itself requires substantial review and further development to bring it in line with current policy and the sanitation planning process. However, the tool provides a sound basis

upon which to build future revisions. It also has a key role to play in integrating the development efforts of different local authorities and to promote consistency in the approaches of these authorities to sanitation planning.

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LIST OF ACRONYMS AND TERMINOLOGY

DSS	Decision Support System *(Defn.* *A decision support system is a structured means of analysing critical information in order to reach a justifiable decision.)*
DWAF	Department of Water Affairs and Forestry
GIS	Geographical Information System
LOFLOS	Low flush sanitation system
LOGFRAM	Logical Framework (a participatory project management approach)
NGO	Non-Government Organisation
NSTT	National Sanitation Task Team
PCM	Project Cycle Management
PHAST	Participatory Health and Sanitation Transformation
PROWWESS	Promotion of the Role of Women in Water and Environmental Sanitation (a participatory project management approach)
RDP	Reconstruction and Development Programme
RZM	Regional Sanitation Zoning Map

SARAR	Self-esteem, Associative Strength, Resourcefulness, Action-Planning and Responsibility-for-follow-through (a participatory project management approach)
SDSS	Sanitation Decision Support System
SANEX	Sanitation Expert System - as designed by Thomas Loetscher, University of Brisbane, Australia
SSPRA	Site Sanitation Planning and Reporting Aid
UWSA	Umgeni Water Supply Area
VIP	Ventilated Improved Pit Latrine
WASP	Waste Aquifer Separation Principle
WEDC	Water Engineering and Development Centre, Loughborough University, UK
ZOPP	Objectives-Oriented Planning (from the German)

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INTRODUCTION

1.1 BACKGROUND TO THE PROJECT

Local and international experience over several decades has shown that the provision of sanitation facilities is a complex task dependent on many different variables. These include affordability on the part of both the users and the service providers, willingness of the users to pay for both the capital development and maintenance of systems, technical suitability and responsibilities and capacities for operation and maintenance. Cultural norms and the perceptions and preferences of the users have seldom been integral to decision-making with users largely being excluded from the planning and decision making process. Failure to successfully integrate all the variables into the planning of sanitation projects and in selecting sanitation technologies provides the background to many failed attempts at sanitation delivery, which are cited in the local and international literature.

The lack of provision of adequate and appropriate sanitation facilities in developing communities has direct and serious effects on the quality of surface and ground water resources. Umgeni Water, a water supply organisation in KwaZulu-Natal, is concerned about the increasing pressures arising from the lack of provision of adequate and appropriate sanitation facilities in their operational area. Increased nutrient loading and faecal bacterial contamination are resulting in gradually deteriorating water quality of the water resources of the area and attendant treatment costs. Umgeni Water is pursuing an integrated catchment management approach within its operational area, to enable the coordinated and integrated management of water resources and thereby ensure sustained water yields of acceptable quality. Informed, consistent sanitation planning and implementation is a critical component of this approach.

Another major aspect of the failure of delivery of adequate sanitation facilities is the health of the communities dependent on the abovementioned water resources for drinking and domestic purposes. Surveys[4] undertaken in the early '90s indicated that up to 95% of people living in the rural areas or in transitional areas adjacent to urban areas, do not have access to adequate sanitation facilities. This situation demonstrates a critically urgent need for successful sanitation delivery in these areas.

Whereas there exists a significant amount of political will to address the inadequacy of supply of sanitation services as rapidly as possible, there is a risk of repeating the mistakes of the past and providing inappropriate facilities in many places due to a lack of consideration of all the relevant variables. Furthermore, the process of reconstruction and development calls for participation, transparency and accountability in planning and decision-making. Sanitation planning procedures of the past were unable to satisfy these requirements.

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[4] Palmer Development Group and Makhetha Development Consultants (1995) *Review of Rural Sanitation in South Africa*, Mvula Trust and Water Research Commission, WRC Report No.: KV71/95

A comprehensive planning tool that integrates all the relevant variables and at the same time provides for transparency and accountability in decision-making, is clearly needed to enable the pragmatic delivery of sanitation services to the many people who do not currently have access to such facilities.

The SSPRA has been developed to attempt to fulfil this need.

The SSPRA is the result of research into the "development of a decision support system for the selection of the most appropriate sanitation technology for developing communities". As such, the tool developed was originally called the **Sanitation Decision Support System** or **SDSS**. Through the process of extensive consultation which formed an integral part of the research process, it became clear that there was a misperception that the system was designed to provide the solution or final decision, rather than to provide a consistent and comprehensive manner in which to organise and present information for decision making. Rather than to perpetuate this misunderstanding and to have to provide qualifying statements with regard to the legitimacy of the tool, the researchers decided with the approval of the Steering Committee that the name of the decision support system (DSS) would be changed to the **Site Sanitation Planning and Reporting Aid** or **SSPRA** - a name which more accurately describes the purpose of the tool.

The research into the development of the SSPRA commenced in January 1993 and was largely completed during 1996. However, significant changes in government structures and policy took place during this period. More recently (1996-1998) the manner in which sanitation planning is undertaken has also changed significantly. These changes had to be accommodated in the research project and the implications for the relevance of the SSPRA are further discussed in Chapters 2 and 3.

1.2 AIMS, ASSUMPTIONS AND OBJECTIVES

The aims of the SSPRA Project and the assumptions on which the research was based are outlined below.

Research Aims:

- To develop a prototype decision support system (DSS) for selection of appropriate sanitation for developing communities within the Umgeni Water Supply Area to address the need for sound decision making in this field.

- To enable refinement and updating of the DSS as better information becomes available and ensure that it could be used by other organisations providing services for sanitation throughout the country.

- To make recommendations for overall planning of sanitation in the UWSA.

The research was based on the following assumptions:

i. That the DSS would be developed for use by service organisations (primarily Umgeni Water, but also including others) providing sanitation facilities to developing communities, and not the communities themselves.

ii. That although the communities and other interested and affected parties would not use the DSS themselves, they would be fundamentally involved in providing information for input into the DSS.

iii. That the developing communities referred to could be urban, transitional or rural.

iv. That the issues of short, medium and long term planning would be accounted for in the DSS, and the DSS could be applied both proactively and reactively.

Bearing in mind the above assumptions, it was envisaged that the aims would be achieved by meeting the following **objectives**:

1 Synthesis of relevant available information in the local and international literature and from other sources such as unpublished documentation on appropriate sanitation for developing communities in general, and on selection of technological options in particular. In addition, identification of gaps in the existing information and formulation of recommendations for further research.

2 Identification of experts in the fields of provision of appropriate sanitation to developing communities, and in the development of decision support systems, as well as other interested parties and community representatives, and inviting their participation/input in building the DSS.

3 Evaluating the potential physical environmental impact of different sanitation technologies with specific reference to ground and surface water quality.

4 Designing a decision support system which is PC-based and can be linked to a GIS, with a structure and content which is compatible with the requirements of the end user(s) i.e. a practical and workable tool.

5 Ensuring that the technology developed is transferred effectively to the end user(s) and that the DSS can be effectively implemented.

6 Making recommendations for the required support structures (such as Integrated Water Planning and an Education Campaign) for the DSS.

7 Establishing communication with other groups involved in research into or implementation of appropriate sanitation technology in developing communities, to prevent duplication of effort and for mutual benefit to such groups and the sanitation DSS project.

1.3 STRUCTURE OF THE REPORT

The primary purpose of the report is to document the process of developing the SSPRA over a period of four years, from the development of a first prototype through to later versions, testing and the production of a final version of the SSPRA. The local planning and policy background that provides the context for the SSPRA as well as the local and international experience as documented in the literature, are outlined in Chapters 2 and 3. Chapter 4 comprises a detailed description of the development of the SSPRA by the researchers with the assistance and contributions of many individuals, including members of the Steering Committee. The final version of the SSPRA is outlined in Chapter 5 and the methods by which the system has been and will be tested in the future are discussed thereafter in Chapter 6. The strengths and limitations of the SSPRA are outlined in Chapter 7 and a number of conclusions and recommendations for the way forward presented. An assessment of the extent to which each of the research objectives have been met is also given in the final chapter.

2 LITERATURE REVIEW & CONTEXT OF SANITATION TECHNOLOGY CHOICE IN PLANNING

2.1 LITERATURE REVIEW

2.1.1 Introduction: The key debates in Sanitation Planning

Current debates on how to manage household sanitation programmes and projects in developing countries has shifted the focus from decision-making by planners and project managers based on professional knowledge, to exploring local initiatives and local solutions. The WATSAN decade of the 1980's and extensive literature on programme experiences has outlined two basic principles for successful domestic sanitation programmes.

- The provision of an enabling environment by development/government staff to foster local decision-making and local management of the programme.
- The development of local perceptions of the social costs of poor sanitation, and locally driven health awareness initiatives.

Understanding of the need to foster collaborative decision-making, build on local knowledge and strengths and effect changes in behaviour has shifted the debate from larger scale infrastructure development as the solution to inadequate sanitation facilities, to questions around the micro-management of local projects and initiatives.

There are two broad approaches to these questions, namely: structured decision-making by experts, and locally specific community-based decision-making. These methodological approaches are not necessarily mutually exclusive or easily separated. The proponents of structured decision-making acknowledge, and attempt to incorporate, local knowledge and locally specific socio-economic variables. Structured decision-making formats are generally seen by their proponents as tools that assist the process of community-based decision-making by making accessible the technical options available, and assessing these in the light of local environmental and socio-economic conditions.

Community-based methodologies generally regard the use of structured decision-making tools as having an appropriate place in the array of planning tools needed to arrive at acceptable local solutions, especially with regard to appropriate technology choices. The methodological issues that arise in the debates regarding the function of expert-based planning tools includes: at what place, for what purpose and in whose hands?

2.1.2 Decision making in the context of project management

To implement a development initiative in a given community/geographical area, the project cycle still comprises, at its most basic –

- information gathering;
- planning of implementation on the basis of the information;

- management of the implementation and;
- an evaluation of whether the project met its objectives or not.

In the past – although still used widely - the Linear Stages approach dominated project management: pre-planning, information gathering, planning, implementation, finally evaluation and end of the project. Control of the entire process rests in the hands of external experts, who have resources, money, knowledge and power. Much literature and experience in the development field has expounded on the futility of top-down attempts to manage complex inter-relations at the local level. More and better surveys are conducted to collect more and better data, allowing more and better surveys to be conducted to collect more and better data, allowing more and better planning, leading to more and better implementation – all of which frequently leads to high costs, dependency, resentment and misinformation.

The linear stages approach to project and programme management has given way to a more cyclical approach.

The principle of accessing local knowledge and understanding of the development "problem" has been acknowledged as critical to the success of development initiatives. The outsider's role is to gather and extract data expressed and analysed by local people. Subsequent planning and decision-making is then performed by the external experts based on 'authentic' information. As participatory methods for information gathering have developed, recognition has grown that the information expressed and analysed by local people belongs to them. This information provides the context for community ownership and management of the necessary planning, implementation and evaluation phases of the project cycle.

Increasingly, the proponents of the community-based methodologies maintain that sustainable development is only possible if there is a fundamental methodological shift from the top down external expert approach, to the bottom up learning approach. Empowerment, the key rationale behind 'participation', begins at the knowledge or information gathering phase. How one obtains and uses the information required, impacts on the rest of the cycle dramatically. This is particularly significant in the context of a tool like the SSPRA. It is at this initial stage of the development project that the integrity of the methodological principles and the *locus* of power are established.

The phases in community managed projects are not necessary linear, and are dependent on the community's priorities, constructs of their management and organisation of the implementation. Evaluations are a key component of all of these phases, and provide ongoing learning, reflection and re-planning. Projects are not ends in themselves but a means to strengthen people's organisational capacity.

This approach is particularly important for sanitation programmes, as increased health awareness, behavioural change and the decision to invest in improved facilities all lie with individual households.

There has been, and still is, a tendency to use different methods for different phases in the project cycle: participation for information gathering, but external experts for decision-making. Often, community members are asked to participate in planning existing decisions made externally to give the semblance of participation. More often than not, this is seen as a co-option tactic to achieve community acquiescence. Planning is often seen as a separate, objective exercise in achieving identified goals. Whether these goals were identified by the external expert or in a participatory manner, planning is often taken out of the hands of the community members and done by the outsider. Often, the selection of 'appropriate' technologies has already been made by the external expert. Unless real decision-making lies throughout the programme or project with the individuals whose lives the development initiative is meant to improve, proponents of the community-based methodologies argue, the costs in time, money and building trust will increase, with resulting negative impacts on the success of the project.

As participatory methodologies have become more sophisticated and effective, they have highlighted the problems in the structured decision-making approach's struggle with the almost unmanageable number of variables that need to be taken into account at local level for effective decision-making. It is a daunting task to develop a planning tool that integrates and structures socio-economic information, gathered from the community, with available technical options, in an accessible manner. Information gathered from a given community for extractive purposes (research, planning and so on) has been shown to have negative impacts on community participation. The structured decision-making approach, in consequence, straddles the external expert and community-based methodologies, at times quite uncomfortably.

The dearth of literature on locally based structured decision-making reflects the complex challenges facing this approach in the current participatory context. Only a few works exist, based on Kalbermatten and revisions of his work. The apparent contradictions between expert and participatory based information gathering and planning inherent in the structured decision-making approach have not yet been resolved. As the methodology develops, these issues will warrant further exploration.

2.1.3 Sanitation planning in the South African context

The emphasis on community participation in sanitation delivery runs through the constitutional approach to development initiatives, subsequent policy documents, legislation and provincial and national implementation responsibilities and guidelines. This radical shift in direction, from top-down to community centred planning, in the context of new implementation structures and tight budgetary concerns, has resulted in service delivery being a highly charged question in contemporary South Africa. At issue is which sites are prioritised for sanitation upgrades, what level of service is installed, what level of subsidy is made available, who makes the final decision about technology choice, on what criteria, and by what process.

The style of decision-making in South Africa has changed profoundly in recent years. User communities are claiming a significant role in decision-making, and are demanding access to the skills and resources they need to make informed decisions. The demand-driven approach is a key theme running through the methodological guidelines for implementing agents.

Project finance, especially that provided by the major development funding agencies, is increasingly contingent on comprehensive consultation with the user community, and engineers, planners and project officers are having to develop a very different approach to the way they interact with the beneficiaries of the projects they work on.

Technical issues - topography, proximity to water sources, existing infrastructure - are no longer the only considerations. A wide range of concerns are now acknowledged as pertinent, many of which challenge the core competencies of the conventional decision-makers in the sanitation field - engineers and physical planners.

2.2 CLASSIFYING THE LITERATURE

This survey reviewed a substantial volume of documents, which may be categorized broadly as follows:

- case studies of project experiences.
- practical manuals designed to assist development agents and project officers.
- reviews of the international experience, aimed at policy makers.
- reviews of South African experiences, aimed at policy makers.
- specific policy interventions - such as the White Paper on Water Supply and Sanitation Policy and the Draft White Paper on Sanitation Policy.

These categorizations are not particularly helpful in themselves, as project planning and technology choice is implicit in all of them. More significant is the fact that very few have anything to contribute to a discussion of *structured* decision-making.

2.2.1 Approaches to decision-making

There are two broad approaches to decision-making in the WATSAN sector outlined in the available literature: structured decision-making, and collaborative decision-making, using community-based methods.

2.2.2 Structured Decision-Making

This falls broadly into two information formats, which are often used in combination.

- Tables

  Tables summarize the attributes and requirements of the various technical options. Decision-makers start with a particular technology, and work backwards to see which is appropriate for a given site. Potential options are initially excluded on the basis of technical reasons. Social factors are then considered on the basis of consultation with the community. The information gathered would result in the exclusion of some of the

remaining options, and finally cost considerations would narrow down the field to the choices available.

- Algorithms
  With algorithms, questions are outlined in a flow-chart, generally characterized by yes/no options. Responses lead to a recommendation for a particular technology. This recommendation is then assessed in the light of other variables not accommodated by the algorithm.

  At least four algorithms have been developed, which address different organizing questions.
  Kalbermatten poses three key questions:
  How much water is available on site?
  Is there a demand for composted human waste?
  Can plot sizes accommodate two pits?

  User preferences are not explored directly, except in so far as certain options are excluded (such as composting systems which require users to handle matured excrement).

  Broome provides three distinct algorithms for three distinct levels of water supply: by bucket, yard tap and house connection. Sullage disposal is a key concern for Broome, even in areas that rely on bucket supplies. He does not address sanitation selection.

  Winblad and Kilama offer a two part framework, with just two choices: a flush or drop system. If a drop system is preferred, should it be a pit or compost latrine? Other factors are referred elsewhere for consideration.

  WEDC starts with the method of anal cleansing, as hard materials (stones, dense vegetable matter or hard papers) preclude all flushing options, regardless of water availability. This model looks exclusively at technical considerations, except for the final question that checks whether the choice is acceptable to users.

  The only South African model identified was that of consulting engineers Van Wyk and Louw developed in 1986. It focuses exclusively on technical issues, and is designed for on-site systems only. This model is allegedly used only as a rough guide for junior engineers.

  None of the algorithms are presented as offering a recipe for decision-making; they are meant as a guide. Each calls for sensitivity to site-specific variables, and the preferences of users. Recommendations in the literature as to how one approaches site-specific variables and incorporates these into decision-making, are generally weak. Questionnaires, the use of behavioural scientists, and other extractive information-gathering approaches are suggested in the earlier literature. The recent thinking emphasizes the role of the extension officer/community development agent in information-gathering and project facilitation.

- Software algorithms

Thomas Loetscher: SANEX

SANEX[5] – the Sanitation Expert System is a decision support system for evaluating sanitation projects, aimed at 'the special circumstances present in developing countries'. The software was developed by Thomas Loetscher, a chemical engineer based at the University of Queensland in Australia.

Sanitation technology selection is approached in two sequential stages in the software:
- A **screening stage** during which questions relating to the community are asked (e.g. location, community profile, demographics and pollution control activities.); and
- A **comparison stage** during which questions relating to operation, costing and construction are asked.

The user is taken through a hierarchical structure of topics, each of which comprise a number of aspects, which in turn comprise a number of criteria or variables for selection. An example illustrating the hierarchical structure is given below:

STAGE	TOPIC	ASPECT	CRITERIA
Screening	→Community profile	→Demographics	→persons per household →population size →population density →population growth

The user is presented with the criteria in a user front end where data are input in the process of determining a suitable technology. During the screening stage the user tests each sanitation technology option to determine whether it passes the predefined minimum requirements of each of the criteria. Only those alternatives passing through the screening stage are taken further into the comparative assessment stage. The comparative assessment considers the relative suitability of each sanitation system in relation to the circumstances in which the beneficiaries live. Each alternative receives a ranking in terms of sustainability and implementability and the alternatives can then be compared on this basis. Sustainability is defined as the likelihood that a project will provide satisfactory service during its design life. An estimate of capital costs is calculated during the comparative stage.

From a software point of view, SANEX is extremely attractive: well laid out, clearly presented with structured logic, easy to use and with a range of supplementary information tools. The software algorithm applies over 40 evaluation criteria (technical, socio-cultural and financial) to approximately 80 sanitation alternatives, which range from simple latrines to conventional off-site treatment.

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5 http://daisy.cheque.uq.edu.au/awm/manage/thomasl.htm Thomas Loetscher, Appropriate Sanitation In Developing Countries: The Computer-based Decision Support System SANEX, 1998.

SANEX has a number of strengths:

- It allows the user to adjust the weighting given to a particular issue.
- It can readily incorporate additional sanitation technologies.
- It includes an excellent encyclopaedia of sanitation technologies, which in itself offers an extremely useful tool for illustrating the range of options and explaining their key features, advantages and limitations.
- It proposes permutations of the various technologies, rather than stark generic types.

The SANEX model also has a number of limitations. In Loetscher's view, 'Appropriate sanitation in '[developing countries] is a selection problem', and consequently, selecting the right technology is what determines the success of a sanitation project. Drawing on World Bank studies that surveyed project sustainability and the reasons for project failure, Loetscher argues that technological 'inappropriateness' is the key variable. He concludes that

...success of sanitation projects in developing countries can basically be improved by facilitating access to expertise to those in need of it (penetration) and by more profound evaluation of the individual project (dedication).

Loetscher maintains that SANEX supports more effective decision-making around technology choice, and thus addresses both concerns. This suggests that sanitation is regarded as an issue of infrastructure provision, rather than a complex amalgam of attitudes, awareness, behaviour and amenities, in which personal hygiene behaviours, rather than latrine types, are key.

Ironically, the perception is that SANEX is too easy to use. The tool was developed initially as an application of mathematical modelling; the logic being linear, with many of the complexities of sanitation selection defined out of consideration. For example, Loetscher writes that 'data obtained from literature and a survey [of sanitation experts] were sufficient to build the required knowledge base'. This statement supports the old notion that sanitation is primarily an issue of infrastructure, and that external technical experts have the tools needed to identify an appropriate technology for a given group of users.

Central to the SANEX project is Loetscher's premise that -

Decision-makers should know the range of alternatives available and make a well-informed choice based on the circumstances in which project beneficiaries live.

Yet the factors SANEX deems relevant to decision-making are very limited, and there is limited capacity for would-be sanitation end-users to identify issues which may concern them, or which may directly affect the circumstances in which they live.

Included in the SANEX package is a section entitled 'Providing SANEX with input'. It explains how to engage with the software, and where to enter data. There is no discussion of the context in which the tool might be used. These issues are explored in detail elsewhere in this report; in brief, the way a tool such as this is used is critical in determining how credible it is as a guide to decision-making. For example, what is the relationship of the external expert to the user community?

In the absence of any explicit discussion of where and how SANEX would be used, by whom and in what context, it is likely that end-users will be marginalised in this approach to decision-making.

SANEX is considered to be rigorous, with 40 evaluation criteria, 80 sanitation alternatives, costing models and so on. However, closer examination reveals limited attention to the wider context in which choices are formed and made. For example, the Community Profile focuses exclusively on 'Requirements'. Here it poses just three questions:

- Are public latrine facilities acceptable?
- What methods of anal cleansing are used?
- What kind of resource recovery is needed? For example, will the waste be needed for composting or soil conditioning?

There are several other considerations that should be captured here, in terms of community needs, demands, aspirations, concerns and resources, which have a direct bearing both on 'implementability' and 'sustainability'.

It is likely that Loetscher may have found it difficult to anticipate and include a range of socio-economic considerations that cannot readily be accommodated in a structured software tool of this kind. However, this is not stated explicitly. The net effect discounts the fact that effective sanitation requires the active involvement of the end-user, at every stage of the project, from planning to long-term operation and maintenance.

While space does not permit a detailed analysis of the SANEX model here, three further brief points should nonetheless be made:

The ratings do not include an assessment of affordability, as Loetscher accepts that 'judgement on this is best left to the users'. Nonetheless, the tool is able to calculate returns on investment, which raises questions as to whose information needs are being considered.

There is no further discussion of users' means or willingness to pay and there no distinction made between capital and recurrent costs.

Loetscher's definition of 'sustainability' as 'the likelihood that a project will provide satisfactory service during its design life', reduces good sanitation to a function of technology, and fails to address the range of human variables that underpin or undermine its value or effectiveness. A facility may be technologically robust and well suited to the physical circumstances of a given environment; however, if users do not like the technology and do not use it, or do not use it in the way it was designed to be used, any other formulations of sustainability are irrelevant.

The model does not attempt to engage with local community concerns or dynamics, nor does it propose a methodology to engage with issues which local users might consider relevant in decision-making and which could impact decisively on the recommendations of the SANEX model.

On the basis of limited data on 'the circumstances in which a community lives', as interpreted by external experts, SANEX enables decision-makers to identify and compare a number of possible technology options, and provide a sophisticated justification for that choice.

A more appropriate use of the tool would be to assist sanitation end-users to make their own decisions, by supplementing their own knowledge of local circumstances with a better understanding of a range of technical considerations. SANEX does not explore this approach, and nor does it offer any caveats to its users – expert or otherwise - about the limitations of relying exclusively on the software for decision support.

Further technical analysis of SANEX has been undertaken by the Water Quality Section at Umgeni Water[6].

2.2.3 Collaborative Decision-Making Community-Based Methods

Survey of methodologies

Participatory Rural Appraisal, Logical Framework (LOGFRAM), ZOPP, or Objectives-Oriented Planning, Project Cycle Management (PCM), Planning for Real, focus groups and numerous variations on workshop techniques have all developed out of the emphasis on local knowledge and local decision-making. Methodologies that focus specifically on domestic water and sanitation programmes include PROWWESS, SARAR and the recent derivation, PHAST.

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6 Rene Voller *An Evaluation of the Sanitation Expert System (SANEX) developed by the University of Queensland, Australia*, June 1998, GIS Section, Water Quality Department, Umgeni Water.

- **PROWWESS** stands for Promotion of the Role of Women in Water and Environmental Sanitation. PROWWESS developed out of the participatory methodologies in the early 1990's and utilises specific participatory techniques to address the empowerment of women in water and sanitation programmes. SARAR is a derivation of PROWWESS.

- **SARAR** techniques build upon the community planning and empowerment aspects of WATSAN programmes through the use of Adult Education principles that optimize group processes. Hence the Self-Esteem, Associative Strength, Resourcefulness, Action-Planning and Responsibility for follow through acronym.

- **PHAST** is a "fast" version of SARAR that stands for Participatory Health and Sanitation Transformation. The aim of the methodology is to provide accessible tools for extension workers to enable community participation in low-cost sanitation programmes .

PROWWESS, SARAR and PHAST methodologies are based on the principle that self-esteem is critical to developing impoverished communities' belief that they are able to find, manage and implement development solutions to their problems. The Adult Education approach provides an enabling environment for realization and development of these capabilities. A range of tools have been developed that are visual, easy to understand, and allow for the expression of different responses and concerns.

These include, but are not limited to:

- Community mapping and sanitation ladders, which provide good baseline data.
- Faecal routes, three pile sorting and faecal barriers, which provide contexts for discussions on behaviours.
- Story with a gap and other forms of ranking and diagramming that encourage prioritization.
- Cross-checking in open forums and various methods of strategic and tactical planning.

PHAST techniques enable groups and individuals to express, share and analyse the complex and diverse realities of their conditions, to gain confidence to plan and act.

- Application to South African Conditions

  The available structured approaches have limited technical application in rural settlements in South Africa, where limited water availability and acute cost constraints skew the choice away from most off-site options. In areas where water is available, little provision is made for settlement density. Questions about plot size look at the site's physical capacity to accommodate two alternating pit sites, for example, rather than the cumulative impact of multiple pits and/or soakaways in close proximity.

The current emphasis, both in the WATSAN field and in the new policy guidelines, on community participation and empowerment in development initiatives, raises critical methodological questions as to the usefulness of a structured approach as a tool for decision-making. Because user customs, preferences and institutional linkages vary widely, there seems to be an emerging consensus that it is not necessarily feasible to anticipate all the factors which will influence the final decision, or to try to accommodate them in a pre-defined and closed-ended decision-support tool.

2.3 FACTORS INFLUENCING DECISION MAKING

Based on a review of the available literature and discussions with a range of South African development professionals, this survey identified a wide range of factors influencing decision-making on sanitation technologies. These range from geo-technical considerations, to socio-economic issues, to environmental and institutional concerns, cultural questions, cost and affordability.

As stated previously, the approach implementing agents use to gather the information needed to utilize and weight these variables, is critical to the method and success of the project/programme. If the data generation within the project is extracted purely for outsiders and/or community leaders to utilize in making decisions for the rest of the community, the commitment of users to the initiative will decrease.

The inherent external expert bias in this form of information-gathering needs to be assessed critically.

The methodological shift away from information-gathering to information giving and sharing raises a number of questions which impact on the conception and design of the SSPRA:

- What role does information play? Is information seen merely as a range of factors that need to be taken into consideration for decision-making, or is the process of developing information with the community, a planning and decision-making tool in itself?
- Can an SSPRA which engages with non-technical issues hope to anticipate all possible considerations?
- Which methods of developing information with the community are to be used?
- How is the information developed by the community to be transformed into a format that reflects the community's understanding of their information? How does this impact on community ownership of planning and decision-making?
- What weighting is given to this information? Who decides on the weighting?

If non-technical concerns differ in priority from site to site and from area to area, is it feasible to use the SSPRA as a tool designed to promote consistency in the decision-making process?

Clear guidelines as to the method/s of information generation and their translation into the information format need to be developed and defined. Information generation, it is suggested, is not a separate introduction to decision-making, but rather informs the approach to and process of decision-making.

Whose decision?
The literature is virtually unanimous in stating that the final choice of sanitation technology should lie with the people who will use it and who will be responsible for operating and maintaining it. Comprehensive literature on how planning/implementing agents facilitate this process of decision-making in low-cost sanitation programmes has been written in the last decade. The key themes that run through the literature include the importance of facilitating the involvement of all sectors of the community, with particular reference to the poorest households and women, in information generation, prioritization, planning, organizing and evaluating. Acceptance of improved facilities, changes in behaviour and effective operation and maintenance are not achievable without participation. The methods used in facilitation should empower the users and provide a context for continuous capacity-building.

This again has implications for the way the SSPRA is conceived, designed and used. For example:

- What method of decision-making will be used in the projects/programme? What role will SSPRA play in this decision-making process?
- Who will use SSPRA?
- How will decisions or recommendations be reported? To whom?

2.4 CONCLUSION

There is growing acknowledgment that upgrading sanitation is considerably more than a technical exercise; increasingly, the technical questions - slope, depth of water-table, distance from a water source - are being regarded as a pre-feasibility assessment, with the real decision about technology type resting on a range of people-centred issues. Even the method of establishing the pre-feasibility assessment as expert-based has come under scrutiny. Frequently, outsiders assess irrelevant, or too few, factors, based on little or no local knowledge. Community-based information generation is not only about socio-economic factors, but also concerns the 'given' technical data required. Many of the low-cost technologies have been developed as a result of an open-ended approach to technical issues.

This realization is prompting an important shift in the approach of many development planners. It is no longer sufficient to assess the physical feasibility of a particular technology type at a given site. The level of support and preparedness of individual users must be assessed, and, where inadequate, targeted initiatives will be required to assess how or whether to proceed.

The SSPRA should not aspire to present the user with a decision. The final decision should rest with those who will use the technology locally. What the SSPRA can do is provide a support tool for the community development agent with a number of issues for consideration in a structured way, and to inter-relate them. The role of the planning/implementation agent is to support the development initiative. Consequently, technical expertise is there to support the planning agent's facilitation, not decision making, role. Where the user does not have the necessary information to assess a particular situation or factor, the SSPRA should highlight this. In so doing it should support decision-making, without relieving the user of responsibility for the outcome.

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3. THE CONTEXT OF SANITATION PLANNING AND DECISION-MAKING IN SOUTH AFRICA.

3.1 INTRODUCTION

All too often, sanitation planning is still seen primarily as an issue of infrastructure provision covering toilets, sewerage and sludge treatment and disposal. While improved access to sound facilities is essential for improved sanitation, the physical infrastructure is only part of the picture. Far more important are people's perceptions, attitudes and behaviours in relation to health and hygiene practices. Promoting and facilitating the necessary shifts at the level of individual households requires a very different approach to project planning and implementation, and development agents in South Africa are only now beginning to integrate this awareness into sanitation programming.

Gross racial and spatial discrimination in South Africa has distorted the debate around appropriate sanitation technologies for this country. Even in affluent, water-rich developed countries, sanitation did not progress from pit-latrines to water-borne sewage in one step; a range of permutations evolved, which were introduced and refined over a long period, and users were afforded the opportunity to upgrade their infrastructure at different rates as their needs and income changed. In South Africa, though, the scale of the infrastructural backlog puts enormous pressure on government to assign funds for rapid delivery, and there is a widespread assumption that provision of full water borne sanitation is the only real option, and merits little debate.

Informal and rural settlements frequently have no formal sanitation at all; bucket systems – which fall far below what the RDP defines as an acceptable basic level of service - are still being installed in some parts of the country. Yet few white South Africans in urban areas utilise anything less than a flush toilet, regardless of their income. Not altogether surprisingly, full flush sanitation is regarded by many as the norm, as a right, and as an issue of equity and social justice, rather than one among several contending technical options.[7] This perception is shared by potential users, planners and developers. For many, consideration of anything less than a fully water-borne system within an urban context is construed as racist, by definition, because urban whites have fully water-borne sewerage systems, and the days of discrimination are officially over. Ironically, this approach has the potential to perpetuate disadvantage, by removing the decision over technology choice from the reach of those who will use it and who will have to meet its attendant costs.

[7] Julian Baskin, Interviewed, December 1994.

3.2 THE SANITATION POLICY ENVIRONMENT

3.2 The Sanitation Policy Environment 3.2 The Sanitation Policy Environment The Draft White Paper on Sanitation was published in November 1995 following nearly five years of policy investigation. It is premised on ten policy principles:

i. development should be demand driven and community based
ii. basic services are a human right
iii. 'some for all' rather than 'all for some'
iv. equitable regional allocation of development resources
v. water has an economic value
vi. the user pays
vii. integrated development
viii. environmental integrity
ix. sanitation is about health
x. sanitation is a social responsibility

The draft White Paper prioritises the provision of at least basic sanitation services - which it defines as VIP toilets - to all before embarking on higher levels of servicing, and to approach sanitation as an integrated demand-driven development issue, requiring the active support of a wide range of government departments and, most importantly, of the user communities themselves.

The draft Sanitation White Paper addressed technology choice explicitly. Commenting on the tendency to regard sanitation choice as the exclusive preserve of engineers, it stressed the need to consider "numerous factors ... in a transparent manner in close contact with prospective consumers".[8] It suggested a preliminary list of factors that need to be addressed:

- affordability
- institutional requirements
- environmental impact
- social issues
- water supply service levels
- reliability
- upgradability
- physical site-specific issues
- use of local resources
- settlement patterns

The value of these indicators is being vindicated.

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[8] Draft White Paper on Sanitation Policy, p.17.

3.3 INSTITUTIONAL RESPONSIBILITIES

Within government, responsibility for promoting and funding better sanitation is shared between six national departments: Health, Housing, Constitutional Development, Water Affairs and Forestry, Environment and Tourism, and Education. Along with the Mvula Trust and Development Bank of Southern Africa, these six departments comprise the National Sanitation Task Team (NSTT) that was formed in mid-1995 to co-ordinate implementation of the policies outlined in the White Paper on Water Supply and Sanitation and subsequently the draft Sanitation White Paper. In practice, decisions around support and funding for sanitation are taken at provincial, rather than national level, and co-ordination at provincial level outside the rural sector remains weak.

Departmental jurisdiction has been defined both functionally and spatially, and prime responsibility for sanitation support has been assigned as follows:

- Rural areas: the Department of Water Affairs and Forestry
- Urban fringe: the Department of Constitutional Development
- Urban core: the Department of Housing and Department of Constitutional Development.

The Constitution assigns responsibility for actual service delivery to local government, and understanding of the premises of the draft Sanitation White Paper in this sphere is uneven. Most local authorities continue to regard full water borne sanitation as the default, and project implementation as an exercise in engineering. Serious engagement with funding and affordability concerns, and an integrated approach to health awareness, tends to be deferred.

The scale of the sanitation backlog is greatest in the former homelands and on commercial farmlands; one estimate is that 21 million South Africans have inadequate sanitation. The sheer cost of providing support on this scale has forced some stark choices, and government has been obliged to weigh its priorities. On the basis of a careful review of experiences elsewhere in the world, combined with meticulous financial modeling, government has committed itself to providing a capital subsidy of R600 to every household with sanitation below the RDP-defined basic level of service, to ensure access to adequate sanitation for all by the year 2011. To date, DWAF is the only department that consistently applies this policy approach within the context of a coherent health-oriented sanitation programme.

3.4 SECTORAL APPROACHES TO SANITATION PROGRAMMING

3.4.1 Introduction

Approaches to decision-making around sanitation programming, project options and technical choice differ markedly in rural and urban areas. In rural areas, households are the primary focus of a sanitation project, and each household is responsible for choosing, co-funding and constructing its own latrine. In urban and peri-urban areas, the emphasis is on

bulk delivery by the local authority, generally of a single technology type, and the end-users have virtually no input or role in the planning or implementation process. Discussion of the range of technical options has been supplanted by bitter debate around appropriate levels of service for low income households. VIPs and full water-borne sanitation mark the two extremes – yet there is little consideration of other options and permutations in between.

The distinction in the approach taken in rural, as opposed to urban and peri-urban, areas is not unrelated to finance. In the DWAF programme, government funds the first R600 of the capital cost, and households contribute the balance of the funds or materials. Thus the DWAF programme emphasises raising health and hygiene awareness and promoting sanitation, so as to mobilise community demand and initiative. In peri-urban and urban projects, local authorities often have the option of pooling resources from a number of sources, including their own revenue and loan finance. The approach is thus almost exclusively technicist.

3.4.2 Urban sanitation

Funding is by far the most significant determinant in the choice of technology, often outweighing sound technical principles and questions of affordability and management. Where grant finance is available, local authorities tend to install full water borne sanitation. Where funds are limited, decision-making tends to be unstructured and often poorly informed. Vigorous marketing by the promoters of proprietary systems skews careful consideration of all options further.

In greenfields developments in urban areas, decisions around sanitation technology tend to be taken entirely by housing developers. Households with a maximum monthly income of R1 500 are entitled to a housing subsidy of R15 000; those earning more are eligible for grant finance according to a sliding scale, with a maximum grant of R5 000 available to those earning under R3 500 per month. In theory, would-be occupants can elect to spend a minimum on servicing, and retain as much of their subsidy as possible for building a house; alternatively, they can elect to maximise spending on services, and make their own arrangements about financing construction of a dwelling.

Despite elaborate rhetoric around community involvement in the planning of low cost housing developments, the reality is that water borne toilets are generally installed as a matter of course, with the decision taken by the developer exclusively. The fact that retail banks will not grant bond finance to home-owners whose homes do not have full water-borne sanitation reinforces the public perception that this should be the norm, and further tips the balance away from any careful consideration of other options.

Within the national Department of Housing, the tension between providing more houses or a higher level of service is acute. In many housing developments, the recipients receive a well-serviced stand, replete with good roads, street lightings, electrical connections, a household water connection and a flush toilet – yet the 'house' amounts to little more than a modest shed. Under pressure to honour its promises of mass housing delivery, government is seriously reviewing current approaches to housing delivery, and may well insist on delivery of

houses with a minimum area of 30 m^2, while stipulating a ceiling on service levels. Given the pervasive bias against anything except full water borne services in urban areas, this approach is likely to prove extremely unpopular.

What this conundrum illustrates is the importance of shifting the focus of decision making to the people who will occupy those houses and utilise those services. People need to be made aware of the range of options open to them, and the implications of the various choices.

For as long as local authorities continue to approach sanitation as an issue of hardware installation, as opposed to a complex mix of health and hygiene considerations that require the support and understanding of the end users, technology choice will continue to be premised on the wrong assumptions and decided by the wrong people.

3.4.3 Rural sanitation: The DWAF approach

The potential for sustained improvements to sanitation is greatest when individual households assume personal responsibility for effecting health and hygiene improvements, and when improved sanitation is regarded as more than an issue of construction or engineering.

The DWAF community sanitation programme is premised on this approach, and on the recognition that rural local government's institutional capacity is generally weak, and its revenue base is limited.

The DWAF rural community sanitation programme has now been underway since late 1996, and integrates many of the projects and experiences of the Mvula Trust's pilot sanitation programme. It marks a significant shift away from infrastructure delivery initiatives, and to increasing emphasis on support for integrated and sustainable development. The emphasis on integrated planning, promotion of local institutional capacity, informed local decision-making, and an increasingly prominent role for Environmental Health Officers.

The national programme is dynamic, and subject to ongoing modifications and refinements at programme and project level. An important revision in the way that sanitation projects are conceived and implemented is currently underway – and this has important implications for sanitation technology selection. Several factors underpin this shift.

Achieving lasting improvements in sanitation have less to do with improved infrastructure – 'the engineering approach' – than with shifting people's awareness and understanding. Better latrines enable people to act on that understanding, but it is people who are the focus of the project. This calls for a very different approach to engaging with the people living in project settlements.

One of the most prominent methodologies used to support a more participatory approach to project definition, planning and implementation is PHAST – Participatory Health Awareness and Sanitation Transformation, described elsewhere in this report.

- Integrating PHAST methodologies into the project cycle

  A major national PHAST training initiative got underway in early 1998, in an effort to equip field practitioners with the methodological skills needed to facilitate local decision-making and identification of key problems, and to mobilise local knowledge and resources to plan, prioritise and implement appropriate responses. The benefits are obvious, and are not discussed here. More important for this discussion is the way a participatory methodology premised on PHAST impacts on the project development process.

  PHAST offers a range of tools, geared to support and facilitate a number of community-based activities. It enables community members to identify and define their key health and sanitation concerns, explore possible remedial actions, and select appropriate technical options. Much of this work can be described as planning and thus planning shifts decisively from being defined as a pre-project activity, to being an integral part of the project. PHAST approaches can be utilized right from the very beginning of the project.

  PHAST methodologies have a decisive impact on defining and framing the issues that a project's mini business plan addresses, and offer the potential to resolve a number of issues that previously were not appropriately dealt with between planning and delivery.

  The process of building demonstration toilets illustrates this problem well. In most sanitation projects, three to five demonstration toilets are built before sanitation delivery takes place to demonstrate locally-appropriate technical options. For example, several permutations of a VIP would be built – models with a 'zinc' superstructure, block spiral and cement blocks; a 'Phungalutho'; a double pit VIP; and, if local demand and affordability levels warranted it, a septic tank and soakaway as well. The purpose of these demo toilets is to allow householders to physically inspect, cost and assess their options, based on working models. This begs the question about what process of pre-selection and decision-making led to the construction of those particular technology options. Whose decision was it to exclude other possible options, such as a urine diversion system, an aqua-privy or any one of a range of proprietary systems?

  Demonstration toilets are frequently built long before community members (as opposed to a handful of Project Steering Committee members) have the information needed to identify and weigh their options, and short-list a number of locally-appropriate technical options suitable for demonstration. Frequently it is the site engineer or builder who decides which technical options are feasible, and illustrates them by constructing demo toilets. These tend to be variations on the theme of VIPs. All too often household choices are made on the basis of the appearance and affordability of the superstructure, rather than the merits of the underlying sanitation technology. In reality, householders are presented with few choices, and very limited information on the implications of their choices.

By contrast, PHAST offers people a number of techniques to explore and appraise their choices. A recent field report from a Namaqualand case study[9] illustrates the potential of tools known as the sanitation ladder and the modified matrix for decision-making. In particular, PHAST methodologies allow for a range of technical options that are potentially feasible in a given settlement to be explored on the basis of locally credible information – information that residents themselves have provided and endorse. In a context where the affordability of infrastructure and willingness to pay for services can be extremely contentious, the locus of decision-making is situated firmly where it belongs – with the end-users.

3.5 CONCLUDING COMMENTS

Lesotho's rural sanitation programme has worked extremely well on the basis of a zero subsidy. South Africa's complex recent history, gross inequalities and overt backlogs rules out this option. Yet national and provincial infrastructural subsidy programmes carry a heavy price tag, and are acutely vulnerable to funding cuts. The funds currently available fall far below requirements and demand.

In response to the complete lack of funding for projects in many areas, some provincial and district programmes are concentrating solely on raising people's awareness of the health benefits of improved sanitation, with little mention of the possibility of government funding assistance for household sanitation. There is every reason to believe that the lessons of international experience will apply in South Africa too: limited funds are better spent on awareness raising, user education and support for informed-decision making by the end-user - rather than on hardware delivery.

If this does indeed prove true, the health benefits of sanitation promotion may prove more significant in poorly funded rural environments than in extremely costly urban and peri-urban sanitation projects, where the emphasis is on infrastructure provision and where the sustainability of high levels of service is questionable beyond the very short term. In this context, the importance of locally-facilitated decision-making around technology choice is even greater.

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9 N Breslin, B Netshiswinzhe and R Holden, *'Lessons from the Field: PHAST - South Africa'*. Unpublished Mvula Trust report, May 1998.

4. RESEARCH METHOD: DEVELOPMENT OF THE SSPRA

The initial methodology that was designed for the development of the Site Sanitation Planning and Reporting Aid incorporated a number of necessary steps. While the methodology provided an overall framework for the research, the development of the SSPRA has been a dynamic process that evolved throughout the research period. The complexity of the issue under scrutiny and the need for extensive consultation and discussion with service providers, experts in the various disciplines, planners, engineers and user groups, meant that there had to be a certain amount of flexibility within the methodology, and the structure and contents of the SSPRA were rationalised over time as important issues were raised in discussion with the different people involved or became evident through the review of the literature.

4.1 PHASE I - PROJECT START-UP: FAMILIARISATION WITH THE PROBLEMS OF SANITATION DELIVERY & TECHNOLOGY SELECTION

4.1.1 Field Visits

Several field visits were undertaken during the first phase of the research to familiarise the researchers with the realities of sanitation delivery to developing communities. In addition the field visits served to familiarise the researchers with some of the available sanitation technologies.

4.1.2 Interviews

The field visits were in many cases combined with interviews of key staff of local authorities and other service providers as well as organisations providing funding for such development. Many other interviews of service providers, consultants in the field of sanitation delivery and other researchers were also undertaken during the first phase. The interviews were held to

establish which decision-making frameworks or procedures were being applied at various levels of government or by NGO's and on what basis sanitation technologies were being chosen. Details of the individuals/organisations interviewed during this phase form part of *Appendix 1A*.

4.1.3 Initial Literature review

An initial literature review of available decision procedures, flowcharts or decision support systems for sanitation technology choice was undertaken during the first phase of the research. This review served to highlight some of the key issues that should be included in the SSPRA but not many comprehensive procedures were found to exist. A more extensive literature review was undertaken during later phases of the project.

4.1.4 Extended Literature Review and Review of Current Decision Making Frameworks

An extensive literature review was undertaken during phase 2 of the project in conjunction with a second round of interviews of key individuals. The literature review was updated to address the latest developments in the field both as reflected in the literature and with regard to the current policy and institutional frameworks. A summary of the extended literature review is given in chapter 2 of this report. The full review can be obtained on request from the Water Research Commission[10].

Many of those interviewed during later phases of the project were consulting engineers who regularly undertake the planning and implementation of water supply and sanitation projects, as well as other development professionals. It was hoped that this would provide a broader perspective on the issues critical to the successful planning and implementation of sanitation projects and in particular technology choice.

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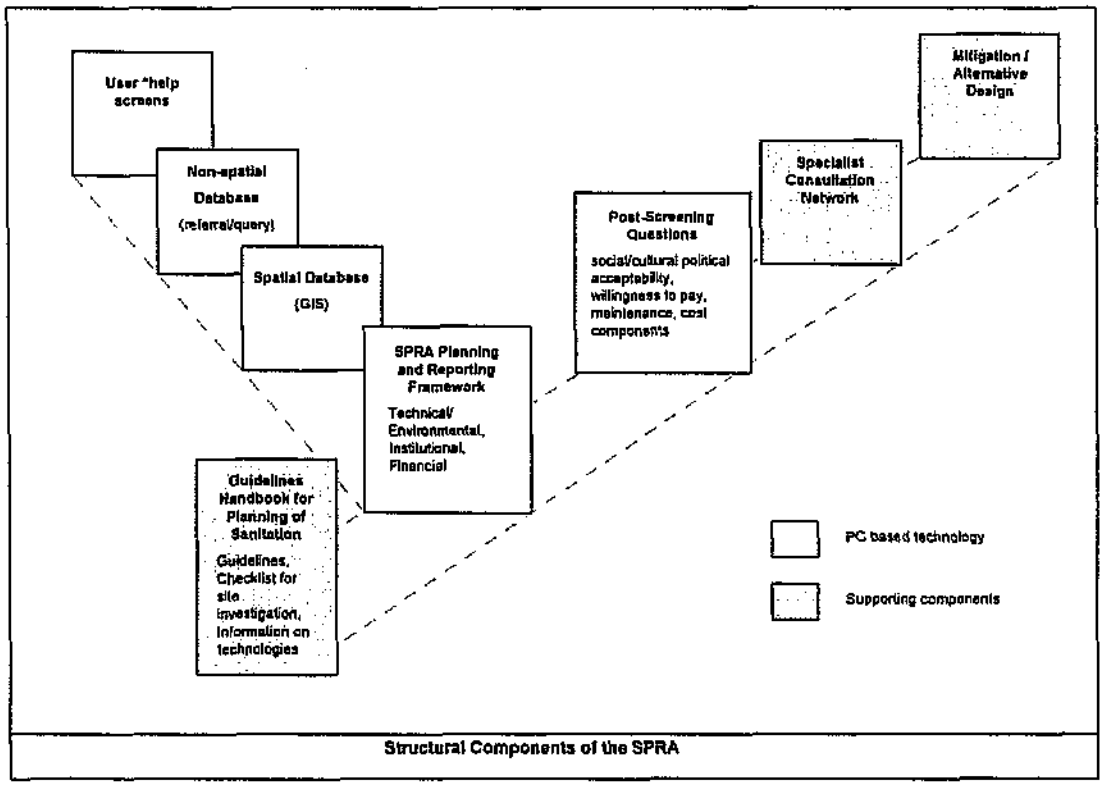
[10] Kathy Eales and Shirlane Douglas *Selecting Sanitation Technology: Approaches to Decision-making, A review of the International literature and an assessment of current practice in South Africa*, June 1998, Counterpoint Development cc.

4.2 PHASE II : DEVELOPMENT OF SSPRA

4.2.1 Design of the structure of the SSPRA

Once the researchers had gained an understanding of the issues relevant to sanitation planning and technology selection, a preliminary structure of the SSPRA was designed. The system comprised two parts *(figure 4.1) viz.* a group of components that were paper-based and a group that were PC based, being consistent with the original project objectives.

FIGURE 4.1: Preliminary Structure of the SSPRA (November 1993)



The former group comprised a guidelines handbook for sanitation planning, a specialist consultation network and a process of design modification. The PC-based group comprised the decision framework, spatial (GIS) and referral databases for enquiry purposes, on-line help and a series of post-selection questions.

The initial structure and envisaged contents of the SSPRA were discussed at a workshop (*Workshop 1*) during the last quarter of 1993, the results of which would be used to develop a prototype of the SSPRA. Participants were selected to represent a broad spectrum of experience and specialisations in the fields of sanitation planning and delivery. The list of participants in this workshop is given in *Appendix 1B*. The preliminary structure was accepted in principle by all participants and remained almost unchanged in the development of the final structure throughout the research period. The proposed contents of the SSPRA and in particular the key issues which would determine technology choice, were discussed in detail. The results of the workshop enabled the researchers to commence with development of the prototype SSPRA.

At this stage of the project it was agreed that it would not be practical or necessary to include all available technology options in the SSPRA. A number of representative groups of technologies exhibiting similar characteristics were selected for use in the SSPRA. From the literature review and discussion with various experts in the field, it was clear that both wet and dry systems would have to be represented in some form and that the two treatment options would have to be represented *viz.* on-site and off-site. The options selected remained unchanged throughout the development of the SSPRA and are as follows:

- ventilated improved pit latrine VIP
- low flush system with soakaway LOFLOS
- septic tank system with soakaway ST&SA
- full waterborne sewerage WB

The SSPRA system is structured in such a way that the addition of any number of specific technologies could easily be accomplished.

4.2.2 Development of a Prototype SSPRA

Development of the prototype was initially focused around the design of the user interface or computer based components. The prototype version was produced during the first half of 1994 and addressed mainly the technical issues that would determine technology choice. Examples of such issues include soil characteristics, slope, proximity of water sources and plot size.

A number of so called "soft" or non-technical issues that were less easily quantifiable, were also incorporated at this stage. It was decided that since the decision framework by its nature required the input of quantifiable data for the output to be meaningful, most of the non-technical issues would be addressed in the post screening questions (*Figure 4.1*).

The purpose of the prototype decision support system was to provide a working example of the type of interface which could be developed, provide an indication of the range of issues which could be included in a decision support system, and demonstrate the manner in which predetermined ratings and weightings could be used to assist in selecting the most appropriate technology. Basic criteria for the prototype were determined to be:

- user friendly environment
- sufficient help to guide the user
- Windows based programming language
- program should be structured so that it is easy to update
- approach should be applicable to a wide range of systems

The prototype decision support system consisted of six indices which were primarily technically oriented :

(i) Water Availability Index

The purpose of this index was to assess the availability and reliability of the water source in relation to the operational requirements of each of the four generic types of sanitation. Key questions were the source of the water, distance to the water source and the daily per capita water use.

(ii) Operation and Maintenance Index

The rationale for this index was to establish whether or not sufficient capacity and infrastructure exists at a site for adequate maintenance and operation of the various sanitation systems. Key questions included a rating of the capacity of the local authority to manage and maintain the system, whether there was vehicle access to individual plots for sludge removal and whether an existing sewer reticulation network was nearby. Also included in this index were issues related to the practices, knowledge and understanding of potential users, such as the method of anal cleansing and the level of public health education with regard to the maintenance of sanitation systems.

(iii) Economic Index

The purpose of the Economic Index was to establish whether the possibility of subsidisation of capital costs existed and if not, which of the systems would be affordable given a mean monthly per capita income and a monthly percentage of this which could be used to contribute to paying off the capital costs. Also included in this index was an estimate of the willingness and ability to pay monthly maintenance costs. An additional question attempted to evaluate the permanence and tenure of the community in relation to each of the sanitation types. For example, if more than 75% of the residents were not permanent residents all but the cheapest systems were considered to be less desirable.

(iv) Site Suitability Index

The Site Suitability Index consisted of two groups of questions, focusing on site specific soil factors in the first group and more general landscape factors in the second. Site specific soil factors included the depth and drainage characteristics of the soil and subsoil, while the regional factors included the average slope and size of the site. Additional questions included road access and the potential for flooding.

(v) Ground and Surface Water Pollution Index

The potential for ground and surface water pollution was evaluated on the basis of the depth to the water table, the proximity of the site to an open water surface, the rate of ground water recharge and the predominant slope of the landform on which the site is situated.

(vi) Future Planning Index

The purpose of the future planning index was to avoid foreclosure on options that could be developed in the medium term future. If the likelihood of additional infrastructure such as a water supply or improved roads becoming available was high,

greater importance was attached to technologies with a possible upgrade path. Issues included in this index were the possibility of new roads or water supplies, the rate of growth of the settlement, and whether the settlement had been identified as part of an RDP initiative.

Each of the above indices consisted of a screen of questions with option buttons or boxes for entry of numbers and an associated button for help on each question. The help button attempted to describe the rationale for each question to prevent misinterpretation of the purpose of the question. Users were required to answer all questions and then press a calculate button which then displayed a score for each of the generic sanitation types. A colour block immediately adjacent to the score classified the result as either a poor option (red), possible option (yellow) or a desirable option (green). An example of the manner in which the various technologies were scored on a scale of 0 (not suitable) to 10 (highly suitable) is given below:

TABLE 4.1: Scores for each of four Generic Sanitation Systems

	SITE SUITABILITY INDEX	VIP	LOFLOS	STS	WBS
1.	**What is the depth of the soil?**				
	• <50cm	0	0	0	10
	• 50 to 100 cm	5	1	1	10
	• 100 to 150 cm	10	8	8	10
	• 150 to 200 cm	10	10	10	10
	• > 200 cm	10	10	10	10
2.	**What is the depth of the excavatable material?**				
	• <50cm	0	0	0	10
	• 50 to 100 cm	5	1	1	10
	• 100 to 150 cm	10	8	8	10
	• 150 to 200 cm	10	10	10	10
	• > 200 cm	10	10	10	10
3.	**What is the textural class of the soil at the site?**				
	• Sand	0	0	0	10
	• Loamy sand	10	2	2	10
	• Sandy loam	10	4	4	10
	• Loam	10	10	10	10
	• Silt loam	10	10	10	10
	• Silty clay loam	10	10	10	10
	• Silty clay	10	10	10	10
	• Clay	0	10	10	10
4.	**Indicate the primary characteristics of the subsoil material**				
	• Moderately well draining, semi-consolidated	10	10	10	10
	• Rapidly draining, sandy or unconsolidated	8	3	4	10
	• Consolidated material, rock with fissures or fractures	8	3	4	10
	• Poorly draining , weathered material with high clay content	7	2	2	10
		4	0	0	0

	• Shallow bedrock				
5.	**What is the average slope at the site?**				
	• < 0.5°	10	10	10	0
	• 0.5 to 15°	10	10	10	10
	• 15 to 25°	10	0	0	10
	• > 25°	3	0	0	0
6.	**Is there an access road within 500m of the site?**				
	• Yes	10	10	10	10
	• No	10	10	10	10
7.	**Indicate the size of the plot**				
	• 0 to 200m²	0	0	0	10
	• 200 to 400m²	10	10	0	10
	• > 400m²	10	10	10	10
8.	**Is the site subject to periodic flooding?**				
	• Yes	0	5	10	10
	• No	10	10	10	10

The above Table represents the scores of each of the sanitation systems in relation to a particular answer within a question. Final scores are calculated in the following manner:

SITE SUITABILITY INDEX = (0.3*soilIndex)+(0.2*Q5)+(0.15*Q6)+(0.25*Q7)+(0.1*Q8)
where,

soilindex=(0.5*Q2)+(0.5{(soilfac1*Q3)+(soilfac2*Q4)}
soilfac1=Q1/Q2
soilfac2=(1-soilfac1)

where,

Q1 to Q8 represent the scores for each of the sanitation systems

(vii) Final Screen

The final screen of the decision support system presented a summary of the results of each of the six indices against the four generic sanitation systems. In addition to the score the colour coding referred to above was included. The system user could thus determine for which types of sanitation problems existed and which appeared viable.

The prototype SSPRA was presented to the Steering Committee and discussed at a meeting held during May 1994. Printouts of the prototype were distributed to the Committee and other interested parties for comment and review. Some comment was received on the technical issues.

4.2.3 Development of Guidelines for Sanitation

It became evident during the first phase of the research that none of the organisations interviewed had a formalised procedure according to which decisions were made about sanitation technologies for development projects. In addition, the people in planning and decision making roles within service organisations very often did not have the background nor experience to make informed decisions about the most appropriate sanitation technology for a particular site. The multifaceted nature of sanitation planning and technology selection complicates this situation considerably. Since people responsible for sanitation planning and decision making are generally orientated towards a particular aspect of sanitation delivery (for example civil engineering or project financing), it is unlikely that any one individual would be sufficiently well equipped to comprehensively deal with the issue of sanitation delivery without accessible and concise information on all aspects being readily available for this purpose. Although there is a large body of documentation available on sanitation planning and technology selection, this information is often not easily and rapidly accessible. There is also no single document in which all aspects of sanitation planning are addressed together. Whereas institutional and financial factors alone may be addressed in some, technical and environmental issues are addressed in others. To encourage sanitation planning and decision making which takes into account all the necessary aspects of sanitation delivery, it was considered essential that information on all aspects was presented in a single document in a concise, simple and user-friendly format.

Without being placed into the broader context of sanitation planning, the purpose of the SSPRA with particular reference to technology selection, could also be misunderstood. Since technology selection is an integral part of the sanitation planning process and therefore cannot be seen in isolation, the context of the SSPRA within sanitation planning had to be clearly demonstrated.

To address these problems, it was decided to produce a Handbook for Sanitation Planning to be used in conjunction with the PC-based decision framework. The Handbook would provide a set of guidelines for the sanitation planning process as a whole in addition to providing a user guide for the computer based section of the SSPRA which would include standard checklists for site investigation and the collection of data required in the Decision Framework.

A number of key principles in the planning of sanitation projects was developed during this phase and were to be included in the Handbook.

4.2.4 First Working Version of the SSPRA

On the basis of the comments received on the prototype from both the Steering Committee and other interested parties, a need to revise the approach adopted in the development of the decision support system was recognised. Whereas the primary focus of the prototype was to identify the viability of each of four generic sanitation systems, the need to provide additional guidance in the planning process was recognised. It became necessary to incorporate broader questions relating to the planning process into the DSS itself and not merely to provide for these in the Guidelines Handbook for reference purposes. In particular the need to include further information regarding the participation and preferences of the user community was highlighted. The means of scoring and weighting the various indices was based on similar principles to those described above.

The first version of the Site-Sanitation Planning and Reporting Aid (SSPRA) consisted of the following user screens and indices :

(i) ***Background information***

One of the requirements identified during the development of the prototype was that greater accountability and transparency in decision-making regarding sanitation provision should be encouraged. As a consequence, an initial screen requesting the name and contact details of the SSPRA user was included. The introductory screen also provided for the inclusion of additional information such as the name and location, as well as a basic description of the site.

(ii) Water Availability Index

Notwithstanding some minor revisions in terminology the water availability index was considered by the Steering Committee to be an essential component of the decision support system and was retained in the form outlined in the description of the prototype above.

(iii) Operation and Maintenance Index

The operation and maintenance index was limited to rating the capacity of the local authority to manage the system, access to individual plots for sludge removal, the availability of a sewer network with adequate capacity and the method of anal cleansing.

(iv) Public Health Index

Recognising the need to include public health information the public health index was developed. Calculation of this index was based on the level of public health education in the user community with regard to each of the systems, the frequency of occurrence of gastro-intestinal diseases, the type of sanitation system used at their nearest school or clinic and whether drinking water was obtained from a natural source within 50m of the site.

(v) User Preference Index

A user preference index was included to firstly determine the extent to which the user community had participated in the decision making process, and also to provide an indication of what the user's preferences for the various sanitation systems were. Participation of the community was gauged through two questions querying whether the community had been consulted or whether the community was an integral part of the decision making process. The preference of the community for each of the technology options was rated on a scale of between 1 and 10. The likelihood of successful implementation of a sanitation system was considered greater if a successful water/development committee had been established in the area.

(vi) Financial Planning Index

The financial planning index was enhanced to provide for entry of a subsidy for each of the sanitation systems and an additional question on willingness to pay. The

current means of charging for water was also included to provide an indication of the extent to which the user community has been exposed to payment for services.

(vii) Site Suitability Index

Although the basic structure of the soils component of the site suitability index was not altered several additional options for the acquisition of soils information were introduced. Soils information could be entered on the basis of a field estimation of soil texture, knowing the soil form of the site, or alternatively if the results of a percolation test are known. The other aspects of the site suitability index remained unchanged.

(vii) Ground and Surface Water Pollution Index

The ground and surface water pollution index was enhanced through the addition of options for the inclusion of the results of a WASP Assessment[11], if such an assessment had been undertaken. If the results of a WASP Assessment were not available, then a series of questions including the average slope of the landform, the depth of the water table, the distance to the nearest open water surface and the dependence on ground water within a 10km radius were used to assess the potential for ground and surface water pollution potential.

(viii) Future Planning Index

The future planning index was not changed in this version of the decision support system.

(ix) Confidence Limits

The need to provide an estimate of confidence for each question was considered essential. Confidence estimates were entered for each question, with a value of 1 representing low confidence and a value of 5 representing high confidence. Confidence estimates for each question were combined using the same weightings as the component questions to provide an overall value for each index.

(x) Notepad and Report Generation

Recognising that each index would not capture many of the site specific features which may arise at a given location a notepad feature was added, which enabled the user to make notes concerning issues of importance for each index. At the end of the user screens a summary screen displayed the results and associated confidence limits. The user could then request a report that combined the initial background information, a record of the options selected and the entries in any of the notepads into a single report.

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11 See: *Roger Parsons and Jeff Jolly (June 1994), WASP Manual - Waste-Aquifer Separation Principle, WRC Report No. TT67/94* for a description of the WASP assessment model. WASP is a tool designed for the assessment of the suitability of a waste facility on the basis of geohydrological data.

The first working version of the SSPRA was demonstrated to the Steering Committee during February 1995.

4.2.5 Development of the Final Version of the SSPRA

In an effort to further identify and quantify the non-technical issues critical in determining technology choice, a second workshop (*Workshop 2*) was held in July 1995. Whereas the technical issues could generally be clearly identified and most often quantified, the development of the first working version of the SSPRA had shown that the non-technical issues were less easy to define and quantify. Questions of data availability with regard to these non-technical issues and methods of data collection were also discussed at this workshop. Participants were selected to represent a broad range of expertise in the field of sanitation provision but particularly focused on the non-technical issues. A list of participants at Workshop 2 is given in *Appendix 1C.*

Important learning points from this workshop included:

- that the non-technical issues should be incorporated into the DSS rather than being addressed in a separate set of post screening questions. In this way, there would no differentiation in the perceived importance of the technical and non-technical issues.
- Non-technical issues are more prominent in decision making about sanitation technology and in development planning in general and should therefore enjoy at least the same, or a more prominent status than the technical issues in the SSPRA.

Guidelines Handbook

During the course of this phase of the project the concept of the Guidelines Handbook was rationalised and replaced by a User Manual for the SSPRA, wherein the context of the SSPRA as a technology selection tool would be outlined in addition to a full guide to using the SSPRA. Due to this rationalisation, it was agreed in conjunction with the Steering Committee at their penultimate meeting, that the many sets of available guidelines for sanitation planning, technology selection and technology design would no longer be consolidated, but an inventory of available guidelines would be provided for reference purposes in the User Manual. It was agreed that it was not the purpose of the SSPRA project to provide a sanitation planning handbook. Producing a consolidated set of guidelines would be a duplication of concurrent or already completed efforts by others as well as developments during the research period of consolidation efforts by the Division of Building Technology (BOUTEK) at the CSIR[12].

The list of principles for the planning of sanitation projects produced during the previous phase was retained and incorporated into the User Manual as a guide to planners and service providers using the SSPRA as part of their project planning efforts.

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12 In 1996 the Division of Building Technology of the CSIR offered to act as the custodian of various engineering and other guidelines documents for service delivery *inter alia* the so called "Red Book" which the Division was responsible for drafting. The staff of the Division would provide the service in an effort to make the guidelines more easily available as well as to keep the guidelines updated. It was hoped that through these efforts duplications occurring in various sets of guidelines could be avoided in the future.

Data Availability

At this stage in the project, the issue of the availability of the data to be used in the SSPRA was considered. Preliminary testing of the SSPRA through a number of case studies highlighted the potential problems that could be anticipated with the availability of data required for the SSPRA. Problems were anticipated with the capacity and ability of small local authorities to collect and represent the spatial (GIS) and non-spatial data required in the SSPRA for both technical and non-technical data fields. Although this was not seen to be a problem for Umgeni Water for whom the tool was primarily being developed, one of the objectives of the research was to ensure that the tool would be more widely applicable outside of the organisation. Other service providers might not have access to the same facilities required to run a GIS or some of the fields of data required.

Regional Sanitation Zoning Map

The question of the level at which the SSPRA would be applied in a planning context was raised both by members of the Steering Committee as well as the participants of Workshop 2. Uncertainty was expressed about whether the tool was to be used for site selection only or whether some perspective would be provided on the regional context of particular development projects. It was concluded that some perspective on the regional context would have to be provided.

As a result of the anticipated problems with the production and use of the spatial and non-spatial databases as well as the question of the context of site based planning of services within the development of a region as a whole, the researchers decided to redirect these efforts into the development of a Regional Sanitation Zoning Map (RZM). To simplify the task of consolidating spatial and non-spatial data, a number of key determinants were selected for incorporation into the map, which would be produced by a simple overlay of the different data fields. This approach is consistent with that taken to produce the DSS *viz.* the selection of only those issues critical to the determination of technology options.

The RZM forms an integral part of the SSPRA and is intended to be consulted as one of the first steps in the SSPRA process. The purpose is to establish at a regional scale whether a particular area is suitable or unsuitable for a particular technology group. The zoning map performs a screening function and is intended to focus the procedure of the user through the rest of the SSPRA.

The RZM has been developed to provide a regional context for site based sanitation technology selection. By considering the regional perspective of a sanitation project, it is hoped that many potential problems related to the development might be preempted and mitigated. Alternatively, a perspective on the regional context may assist in determining the feasibility of a particular project at local level. The map is intended to provide a guide to the relative suitability of geographically defined areas in a region for the provision of each of a range of technologies. The characteristics of the septic tank system with a soakaway and the low flush system were considered similar. With this in mind the map was produced from a composite of key determinants of relative suitability of an area for each of the three types of technology viz. a full waterborne system, a septic tank system with a soakaway and a VIP.

- Identification of Key Determinants of Relative Suitability

To test the approach used to develop a RZM it was decided to use the Mgeni Catchment (a major water source in the KwaZulu-Natal region) in the production of a prototype RZM. There are a large number of variables that are traditionally considered in development planning at a regional scale. Many of these could be used in the production of a RZM. However, in line with the principles underlying the structure and contents of the SSPRA as well as the purpose of the SSPRA in assisting with the selection of an appropriate technology, only key determinants were used in the production of the RZM to ensure that the tool would effectively identify areas of differential suitability for different technologies. Arguably, the determinants selected may not be the key determinants in all situations. However, for the purposes of producing a RZM for the Mgeni Catchment, those selected are believed to be the most important variables.

These key determinants were also subject to data being made available in a format that could easily be interpreted by the GIS for the Mgeni Catchment. The rationale behind the choice of each parameter is outlined in *Table 4.1* below:

TABLE 4.2: Key Determinants of relative Suitability of geographical Areas with reference to different Sanitation Types

	KEY DETERMINANT / DATA FIELD	REASONS FOR SELECTION
•	PROXIMITY TO EXISTING RECONSTRUCTION AND DEVELOPMENT PROGRAMME (RDP) AND RURAL AREAS WATER AND SANITATION PROGRAMME (RAWSP) SITES	The aim of projects within the RDP and RAWSP programmes is the provision of adequate water and sanitation to disadvantaged or developing communities. The proximity to existing RDP initiatives is likely to pre-empt the provision of sanitation in other areas.
2	POPULATION DENSITY	The provision of sanitation is only viable if there exists a possibility of good cost recovery. Population density of an area reflects the ability of the community to sustain the cost of a sanitation project. Below this limiting density the cost of delivery may become prohibitive. Conversely, precautions need to be taken with the provision of on-site sanitation systems where population densities are high.
3	MEAN MONTHLY PER CAPITA INCOME	Per capita income within a specified area can limit the choices available to the user community. Although the DSS requires more specific data on the income of users at the site, it is possible to gain a general perspective on socio-economic structure at a regional scale as part of screening.
4	SUSCEPTIBILITY TO GROUNDWATER CONTAMINATION	Many communities rely on boreholes as their sole source of water. The proximity to boreholes used for domestic purposes must strongly influence the siting of a sanitation system. The Directorate of Geohydrology, Departmet of Water Affairs and Forestry has defined a protocol to manage

		the potential for groundwater contamination from on-site sanitation.
5	PROXIMITY TO EXISTING PIPED WATER SUPPLY	Proximity to a piped potable water supply implies that users' water use and therefore need for sanitation facilities may increase. The proximity of such a supply also allows for the comprehensive consideration of wet systems i.e. technologies requiring water for flushing.
6	AREAS EXCLUDED FROM ANY FORM OF RESIDENTIAL SETTLEMENT · dams and rivers · formally protected conservation areas · environmentally sensitive areas	Dams and rivers - self evident Conservation areas - These areas could be excluded from the RZM since they are not likely to be the subject of formal residential development plans. Environmentally sensitive areas - These areas should be excluded from formal residential development and should informal settlement occur, this should be actively discouraged rather than formalised by the supply of services.
7	SLOPE	Gradient has a significant influence on the technology selection for a specific area. Specific design criteria for a sanitation technology are dependent on slope. Although this is less important for waterborne systems, the location of VIP's and LOFLOS systems will be influenced by slope.
8	LOCAL AUTHORITY BOUNDARIES	Local authorities may have bylaws that preclude the use of certain technologies within their jurisdictional areas. This is certainly the case within the Mgeni catchment area.
9	SOIL CHARACTERISTICS	The ability to successfully implement a technology choice in an area is dependent on the soil characteristics. Soil depth and soil texture will in turn affect the installation of LOFLOS, Septic tanks and VIP's.

- Definition of Criteria

The manner in which each key determinant contributes to the analysis of suitability of the region for the different technologies, depends on defined criteria or limiting values for each sanitation technology. Criteria defined for each determinant used in the composition of the RZM for the Mgeni catchment area, are given in *Table 4.2* below:

TABLE 4.2 Suitability Criteria for each of three Sanitation Technology Groups

DETERMINANT	*Waterborne sewerage*	*Septic Tanks*	*VIPs*
1 PROXIMITY TO RDP AND RAWSP SITES	*No direct influence*	*Potential direct influence*	*Definite direct influence - therefore include in RZM*
2 POPULATION DENSITY	*> 2000 people /km2*	*< 2000 people /km²*	*< 30 000 people /km²*
3 MEAN MONTHLY PER CAPITA INCOME	*> R4 000*	*> R4 000*	*<R4 000*
4 SUSCEPTIBILITY TO GROUNDWATER CONTAMINATION	*No direct influence*	*50m buffer around boreholes* *50m buffer around high loading sites, e.g. schools, clinics*	*50m buffer around boreholes* *50m buffer around high loading sites, e.g.schools, clinics*

5 PROXIMITY TO EXISTING PIPED WATER SUPPLY	*Directly influence*	*Potential direct influence*	*No direct influence*
6 AREAS EXCLUDED FROM ANY FORM OF RESIDENTIAL SETTLEMENT - dams and rivers - formally protected conservation areas - environmentally sensitive areas	*Exclude dams rivers conservation areas conservation sites from RZM*	*Exclude dams rivers conservation areas conservation sites from RZM*	*Exclude dams rivers conservation areas conservation sites from RZM*
7 SLOPE	*3-20°*	*0-16°*	*<25°*
8 LOCAL AUTHORITY BOUNDARIES	*Include Transitional Local Authority boundaries in RZM*	*Include Transitional Local Authority boundaries in RZM*	*Exclude Transitional Local Authority boundaries from RZM*
9 SOIL CHARACTERISTICS	*Soil Depth > 0.2m*	*Soil Depth > 0.2m*	*Soil Depth > 0.2m*

The data were assembled on a raster GIS in ARC/INFO and classified according to the effect on sanitation technology selection. A full description of each data layer and its classification is provided in the following paragraphs.

- **Population density**

Population data were assembled from the 1991 Census data which was updated to 1996 by Seneque Maughan Brown - SWK for the Mgeni Catchment Management Plan [13].

Population density is an important criterion as:

- domestic septic tanks require plots of a size which would accommodate the effluent flow from the soakaway
- waterborne systems generally require a density in the order of at least 2000 people per km^2 to make the scheme financially viable
- a very dense network of VIP's could lead to possible water quality problems in certain physical environments.

[13] Department of Water Affairs and Forestry and Umgeni Water (1997) *Mgeni Catchment Management Plan - A Framework for an Integrated Water Management Plan for the Mgeni Catchment.*

Three broad ranges were identified:

POPULATION DENSITY /km²	POTENTIALLY SUITABLE FOR:
1 - 2 000	*Septic tanks and VIP's*
< 30 000	*VIP's and waterborne systems*
> 30 000	*Waterborne systems*

- Per Capita Income

Waterborne systems and septic tanks are expensive systems to install and operate and it was assumed that the cost of these systems may be beyond the financial capability of the lower quartile of the population in terms of per capita income, particularly in cases where external financing was not available. Based on the 1991 Census, the lower quartile was R4 000 per annum.

- Maintenance and Management Requirements

The lack of institutional capacity in areas falling outside of local authority boundaries would place considerable constraints on the maintenance and management of a waterborne system.

- Proximity to Existing Sanitation and Water Supply

The cost of linking to an existing waterborne system is considerably lower than establishing a new network. The same is true of VIP systems made available through RDP initiatives to a community. If VIP's are already being used in a specific user community, this could be used as an indicator of willingness to install this technology and ability to maintain the system. Sanitation education initiatives would also be easier to implement.

- Dams, Rivers, Conservation and Environmentally Sensitive Areas

Rivers, including non-perennial streams, have been buffered to within 50m as areas where any form of sanitation facility is regarded as unsuitable. Dams have also been buffered to within 50m.

Other areas where on-site sanitation would be regarded as unsuitable include formally protected areas and environmentally sensitive areas, such as the habitat of rare or endangered species.

- Susceptibility to Groundwater Contamination

The Directorate of Geohydrology of the Department of Water Affairs and Forestry [14] has defined a protocol to manage the potential for groundwater contamination from

[14] Department of Water Affairs and Forestry, A protocol to manage the potential of groundwater contamination from on site sanitation

on-site sanitation. The following guidelines are provided in the protocol:

- No on-site sanitation system should be installed within 50m of a water supply source (spring or borehole) and vice versa.
- No high loading (school, clinics, etc.) sanitation system should be installed within 75m of a groundwater supply source and vice versa.
- No activity should be allowed within 30m of a borehole other than those associated with collecting water.

Many communities rely on groundwater as their main source of water. The successful implementation of on-site sanitation systems is therefore dependent on location. Should the water supply become contaminated from a mismanaged sanitation system, the community would have to find alternative water sources.

- Soil Characteristics

The characteristics of the soil media influence the siting of a sanitation system. The depth and the texture of the soil are key factors for construction of a system. The soil media also influence the technology selection. This is particularly relevant for VIP's and Septic Tanks systems.

Composition of the RZM

The composite RZM was produced in three parts viz. one map each for waterborne sanitation, septic tank systems and VIPs (*Figures 4.2 a, b, and c*). Each determinant was represented as a geographic map. The maps were combined in a simple overlay process to generate a final map. To simplify the overlay process all data were rasterised using a Geographic Information System (GIS). A GIS can be defined as a suite of tools that can be used to display, query, manipulate and overlay geographic data.

In the process of rasterisation, a fishnet or square grid cells of a specific size is produced over the study area. In a raster or grid-based system, geographical areas are divided into discrete uniformly sized units called cells. Location is not defined as an attribute but is inherent in the storage structure. Each cell is then representative of a defined portion of the earth's surface. In this project, a 50m X 50m square corresponding to input data size was used.

The use of the grid based system was considered to be preferable for a number of reasons, viz.

- Each geographically referenced point is treated in the same manner and is thus converted to the same structure;
- The different data types can be mixed without prior preparation;
- An environment that is capable of data integration allows the user greater flexibility when modeling;
- High processing speeds may be achieved through run-length code processing without expansion. This allows for easy manipulation and display of the data that could not otherwise be achieved.

- It is possible to rapidly and accurately combine all criteria within one system.
- Required storage capacity is greatly reduced.
- It is also possible to easily update the RZM in future, by including criteria for which there are currently no data available but for which data may become available in the future.
- The selection of criteria is subjective. Should the selection not be deemed feasible for use in a particular area, the criteria can be easily changed to suit these new conditions.

The maps indicate regional zoning / broad screening areas suitable for different technology types according to specific selected criteria. The output is directly dependent on the criteria selected and the quality of the data used in composing the criteria maps used to generate the composite. The composite map provides a guide to be used in conjunction with the output of the PC based SSPRA to provide the background for informed decision-making.

The maps for the Mgeni catchment area have been composed for this report and will be recommended for use by the Rural Planning Section of Umgeni Water in all future planning of sanitation projects in this catchment. Once tested, the map will have to be extended to include the remaining area falling within the Umgeni Water supply area to enable comprehensive planning from a regional perspective.

Due to the complexities of sanitation technology choice and indeed sanitation planning, it was recognised that due to particular or unique circumstances at a site, there would be occasions when using the SSPRA would not provide the user with the required information on which to base decision-making. To ensure that users would not be left without additional support in such circumstances, the SSPRA was extended to include two further steps viz. consultation with one or more specialists on a specialist consultation network and technology design modification.

4.2.6 Specialist Consultation Network

The purpose of the specialist consultation network is to provide additional decision support to users of the SSPRA in the form of independent expert advice from specialists in the field of sanitation planning, technology selection and service delivery. The network has been developed in two phases. In the first phase, specialists in the UWSA were identified to address the needs of Umgeni Water and their use of the SSPRA. The network was then expanded to include specialists throughout South Africa. The people on the list have not necessarily had any involvement with the development of the SSPRA. The list of specialists is provided in the User Manual.

4.2.7 Design Modification

Should the user have applied the SSPRA to the particular site and the results are not of such a nature as to provide a sound basis for decision making, and the user has consulted with a specialist listed on the Network, and it still remains impossible to select a particular technology above any other, the SSPRA provides for this eventuality by recommending that the design of the most suitable technology is modified to accommodate the unique site conditions. The structure and contents of the final version of the SSPRA are described in full in Chapter 5.

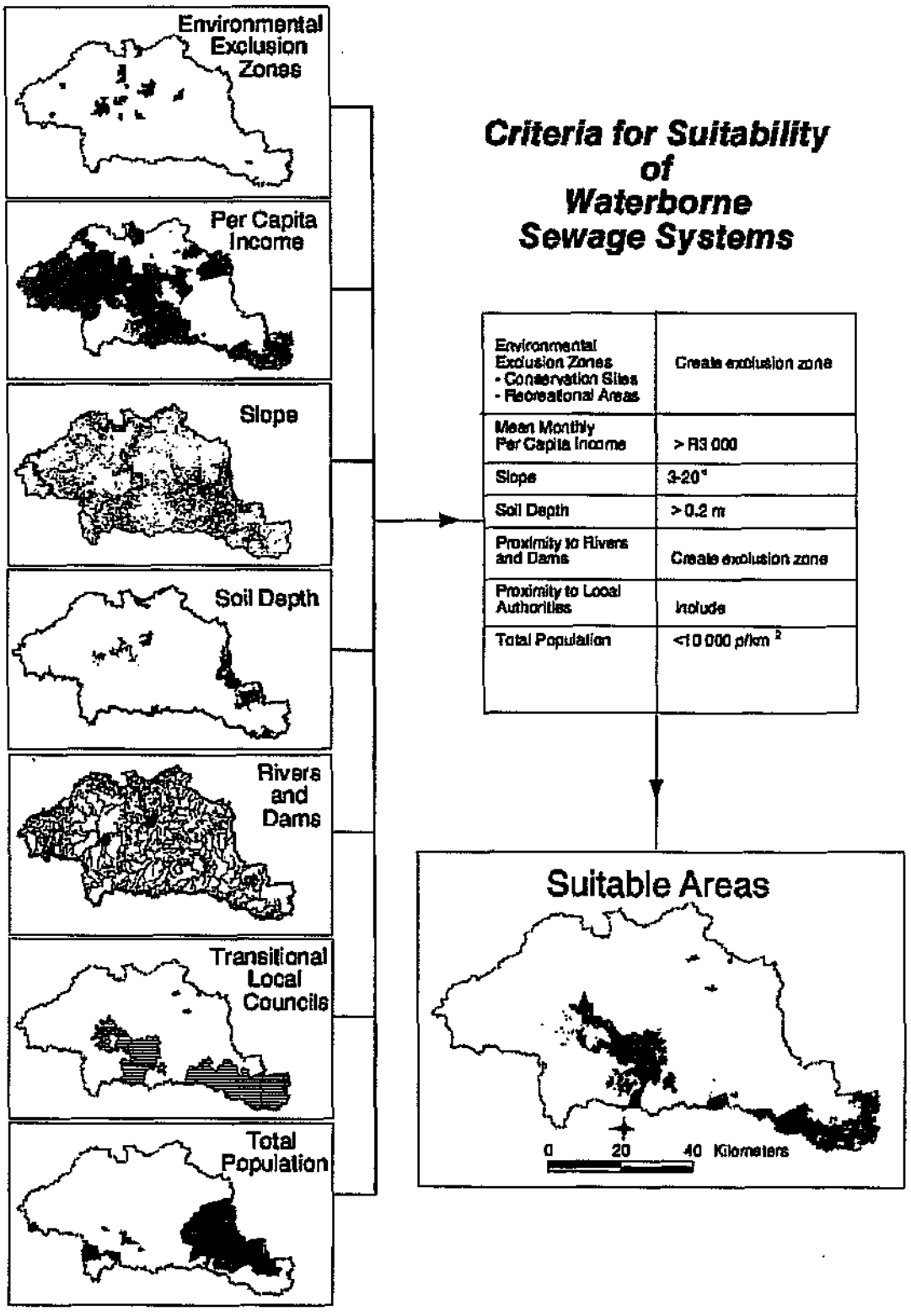


FIGURE 4.2a : **Regional Zoning Map for planning of the provision of Waterborne**

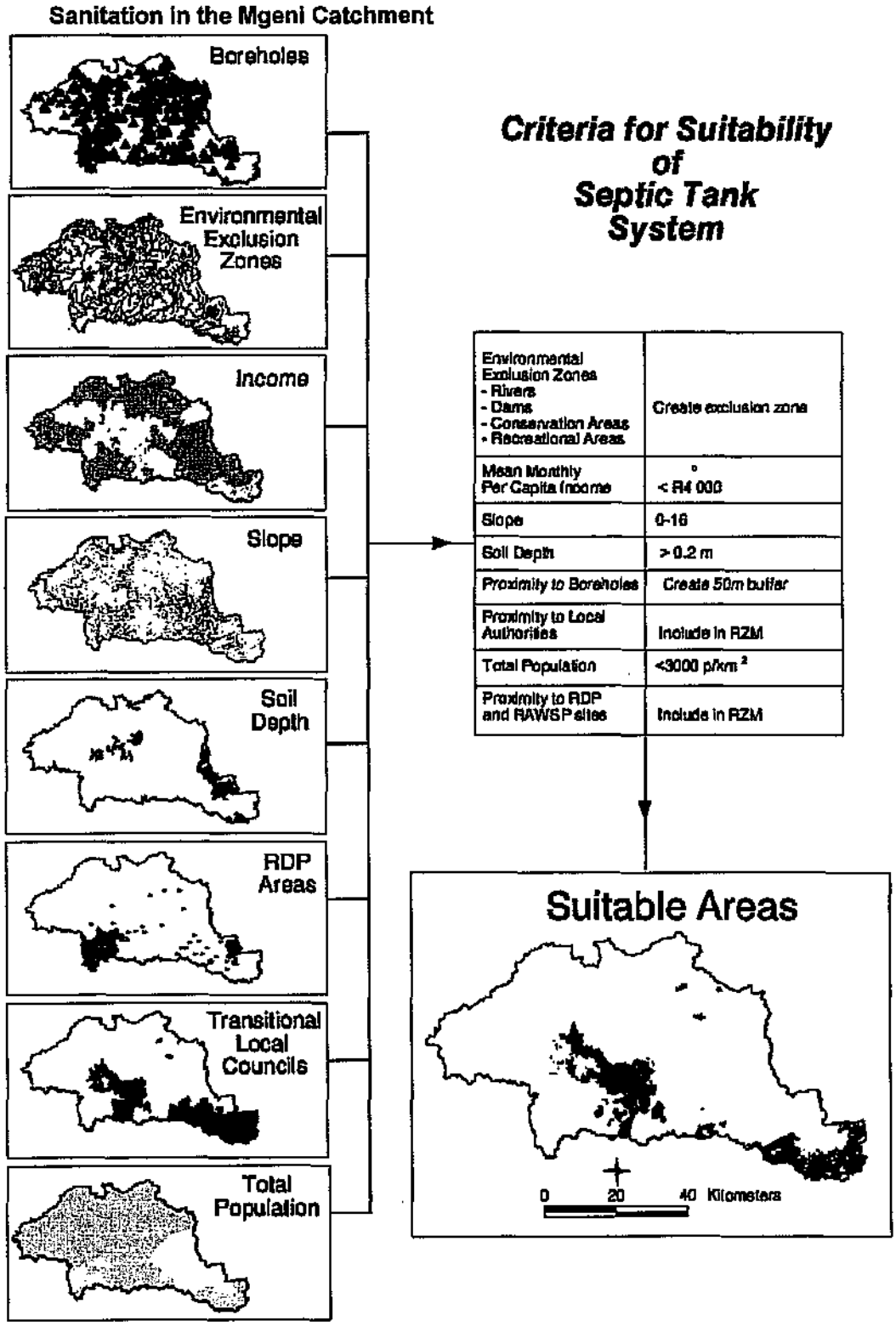


FIGURE 4.2b : **Regional Zoning Map for Planning of the Provision of Septic Tank Sanitation in the Mgeni Catchment**

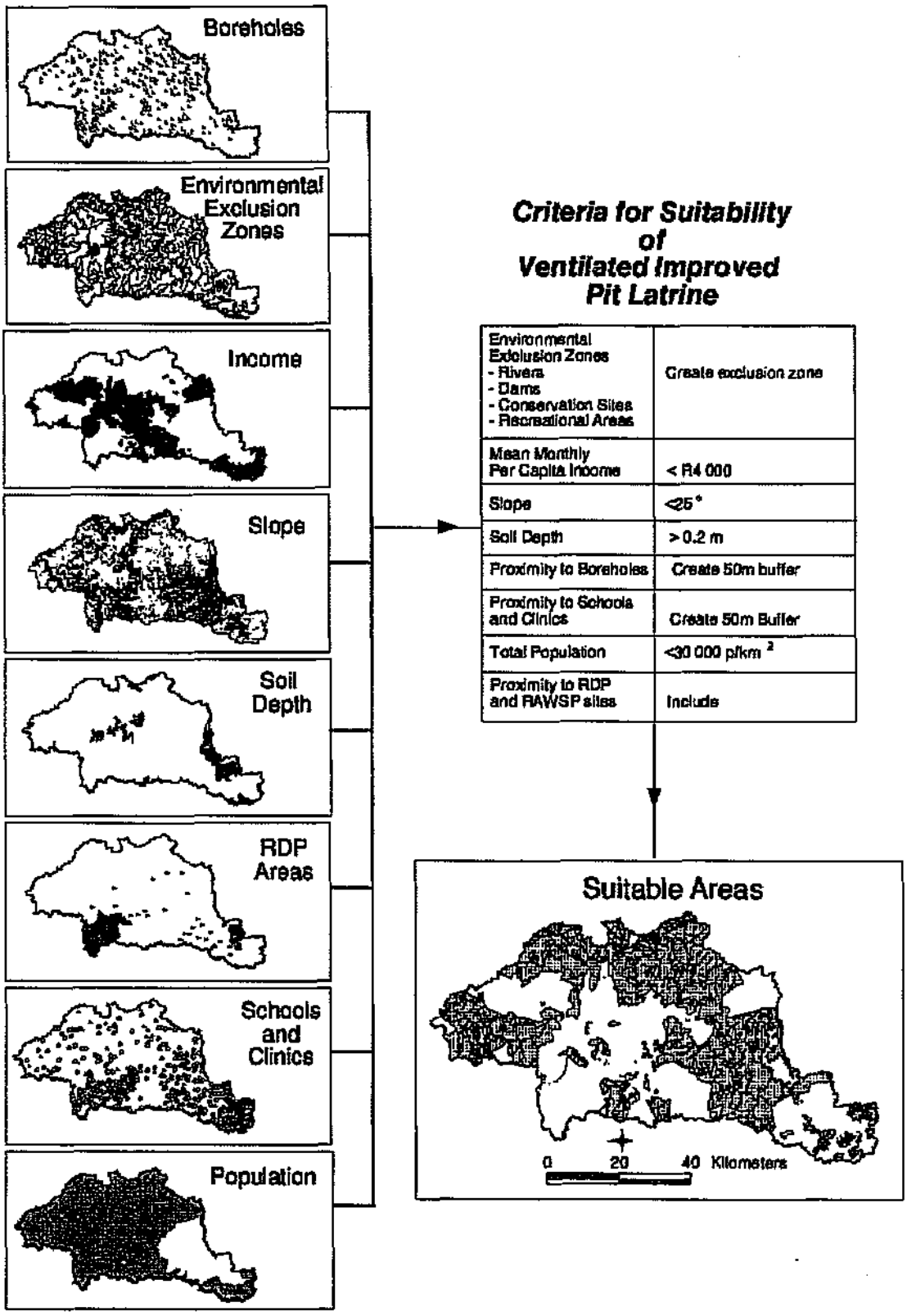


FIGURE 4.2c : Regional Zoning Map for Planning of the Provision of VIP Sanitation in the Mgeni Catchment

4.3 PHASE III : TESTING AND TECHNOLOGY TRANSFER

4.3.1 Sudies and Scenario Testing

An integral part of the process of developing and refining the SSPRA was to test the system by means of a number of case studies. It was hoped that through the application of real data from a range of past and current projects that a more pragmatic and realistic tool could be developed.

Four case studies were selected to test the SSPRA in the initial stages. The case studies were chosen to represent a diversity in the variables relevant to sanitation planning. The areas were selected according to the following criteria:

- a range of different types of settlements (e.g. urban, peri-urban/transitional, rural and with varying settlement densities)
- communities with different socio-economic characteristics (e.g. cross sectional income)
- different physical environmental characteristics and technical feasibility (e.g. topography, soil conditions, water supply)
- variation in development history, institutional input, funding
- location within the Umgeni Water supply area
- easy access from Pietermaritzburg to enable regular visits
- priority planning areas for the Rural Planning Section of Umgeni Water.

A specific methodology was to be applied to the case studies, comprising a data collection phase during which spatial information would be collected for the spatial database and data on the indices incorporated into the decision framework, the application of the data to the SSPRA, the application to the post screening questions and finally an analysis of the results. The profile of each of the case studies, the procedure followed in the decision making process, and the basis on which a technology was selected was entirely inadequate and incompatible with the comprehensive format of the SSPRA and a comprehensive analysis of the original four case studies was not pursued. Attempts to apply the data collected for the case studies in the SSPRA did however raise some important points:

- some questions had to be rephrased due to the likely format of the data input and further questions had to be added;
- data on many of the non-technical issues would be difficult to obtain and guidelines would have to be provided for data collection; and
- technology choice cannot be separated from the planning context and broader planning issues would have to be incorporated into the DSS.

Since there are a myriad issues relevant to technology selection and sanitation planning most attention was focused on identifying *the most critical issues to be incorporated into the SSPRA* before finalising the system. This approach was imperative to ensure that the tool would be meaningful and produce accurate results. Any testing of the system would have to

follow on after this. As a result the system could not be tested meaningfully until the format and content of the SSPRA had been brought to a relatively final form. Some months of testing via appropriate case studies will have to take place following the development of the Final Version of the SSPRA .

In a continued attempt to test the SSPRA, the researchers developed a number of scenarios drawing on the knowledge gained on the sanitation planning process and the issues important in sanitation technology selection during the development of the SSPRA. These scenarios were used in the place of the case studies to test the system.

4.3.2 User Review and Technology Transfer

Potential user's should be requested to review the SSPRA at various intervals and comment on its efficacy. The SSPRA has been designed to be robust and to address the issues that are critical to technology selection. However, only through testing in many different situations by several different agencies will it be possible to refine the tool so that it becomes broadly applicable and meaningful to technology selection in developing communities.

5. DESCRIPTION OF THE SITE SANITATION PLANNING AND REPORTING AID

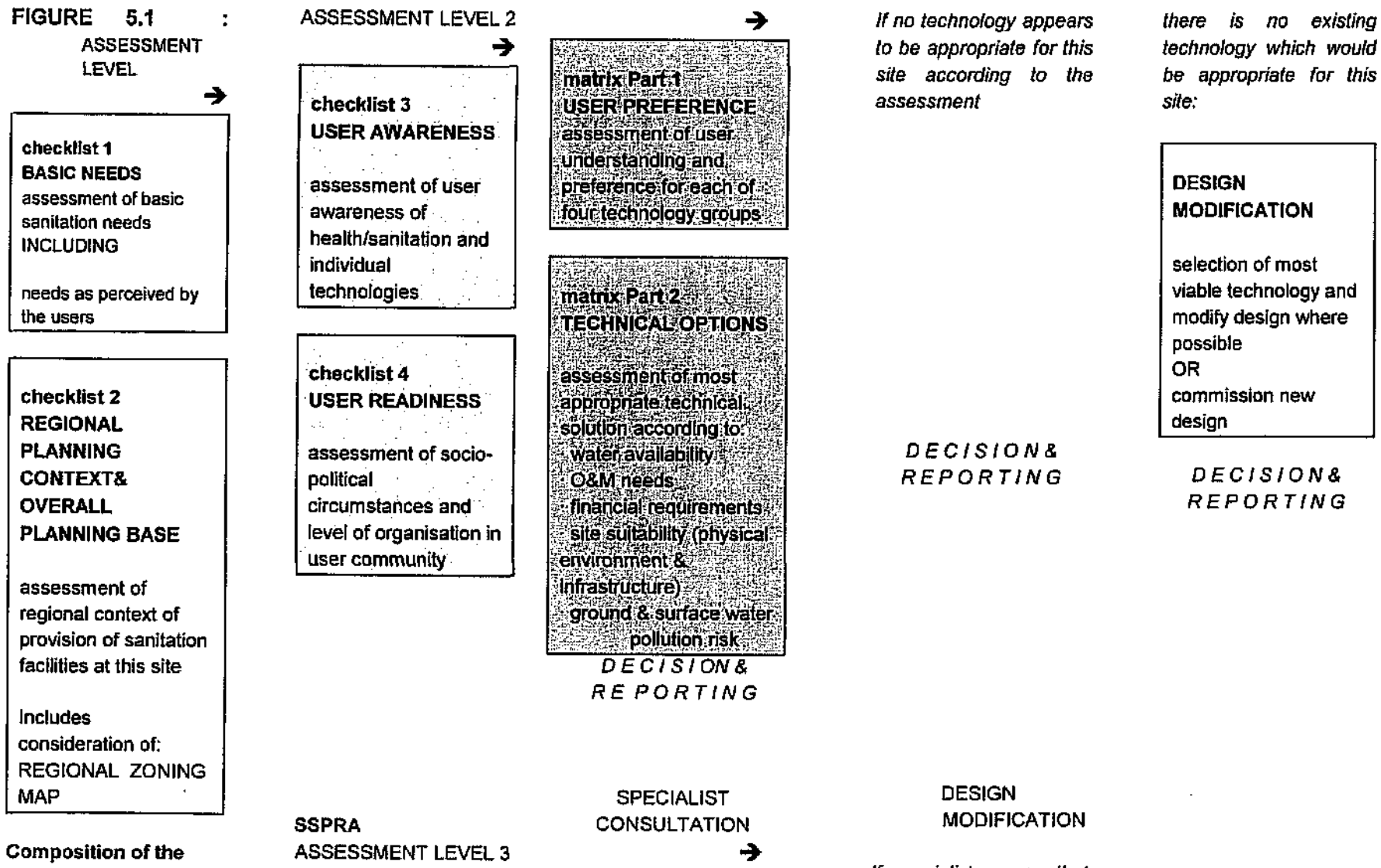
5.1 THE COMPONENTS OF THE SSPRA

The Site Sanitation Planning and Reporting Aid (SSPRA) comprises four components *viz.*

I : a Regional Sanitation Zoning Map
II : a WINDOWS-based planning and reporting aid on PC
III : a list of specialist consultants
IV : an option of technology design modification.

The four components constitute stages in a **process.** They have been designed to be used sequentially i.e. (i) and (ii) concurrently, followed by (iii) and (iv) in that order. The SSPRA process is described in a **User Manual** to facilitate its use by planners, service providers and engineers. The software and the manual should be used in conjunction with each other since the manual contains additional supporting information to that included in the software.
The components and process of the SSPRA are illustrated in *Figure 5.1.*

FIGURE 5.1 : Composition of the SSPRA



5.1.1 Building the RZM

A RZM that defines zones of relative suitability for specific technologies should be composed for the area under the jurisdiction of the planning authority / service provider prior to proceeding with the planning and reporting aid for site-based sanitation planning and technology selection.

The map is a prerequisite to the SSPRA and may be composed from the following data sets:

- slope
- proximity to boreholes
- proximity to high loading sanitation system, i.e. schools and clinics
- proximity to Reconstruction and Development Programme (RDP) and Rural Areas Water and Sanitation Plan (RAWSP) sites
- population density
- soil media characteristics, i.e. soil depth
- per capita or household income
- proximity to existing services, especially bulk water supply and sewer reticulation
- areas which would normally be excluded from any form of residential settlement such as formally protected conservation areas, water bodies and other environmentally sensitive areas, although these may not enjoy formal protection.
- local authority boundaries, to indicate to the planner that areas under the jurisdiction of different authorities may operate under different By Laws.

It is recommended that the method of map composition described in Chapter 3 in the production of the map for the Mgeni Catchment should be used as a guide to producing the RZM for a given area.

5.1.2 PC-based Planning & Reporting Aid

Primarily on the basis of the findings of Workshop 2, the PC-based Planning and Reporting Aid (originally the DSS) was completely restructured. The final version comprises the following components:

A. *User Information*

This is the first screen requesting basic user information and details of the site such as location, magisterial district, and a site description.

B. *Checklists*

In an attempt to include many of the issues arising from Workshop 2 that focused around the non-technical issues, a series of checklists was developed. The checklists incorporate most of the issues originally to be addressed in the post-screening list of questions. The purpose of these checklists is to identify the extent to which various fundamental requirements for sanitation planning have been met. Only when these criteria are met is it possible for technology selection to occur on a sound basis. The checklists must therefore be completed accurately and comprehensively before proceeding to subsequent stages of the planning and reporting aid. These checklists include a User Awareness Checklist, a Basic Needs Checklist, a User Readiness Checklist and a Regional Planning Checklist.

C. *Indices for Technology Selection*

These screens constitute the basis for technology selection and are based on the initial versions of the decision support system. There are seven indices in this section of the SSPRA, *viz.* User Preference, Water Availability, Operation and Maintenance, Financial Planning, Soil Suitability, Site Suitability, and Ground and Surface Water Pollution.

D. *Recommendations and Reporting*

The SSPRA is constructed to provide recommendations emerging from the input of the user. Some of these recommendations appear on the screen directly after the user has provided input, while others are summarised at the end of relevant sections. In all cases, all recommendations, user selected options and notes entered by the user are summarised in report format and can be printed.

The SSPRA consists of the following screens (see *Appendix 2* for printouts of all screens):

(i) Background information

As was the case in the previous versions of the software, the purpose of the background information screen is to identify the programme user, the name and location of the site as well as to provide an opportunity for the user to enter a brief description of the site.

(ii) Basic Needs Checklist

The purpose of the basic needs checklist is to determine the urgency of a sanitation upgrade. Questions asked include whether a reliable source of safe drinking water is available within 200m, if the current form of sanitation technology is on-site, whether residents obtain drinking water from a natural source within 50m, and the frequency of occurrence of gastro-intestinal diseases. The final set of questions establish what proportion of the community use each of a list of different types of technology, and to what extent these types of system work. Urgency of need is graded from 'Urgent need' to 'Low priority'.

(iii) User Awareness Checklist

The purpose of this checklist is to establish whether residents have been exposed to various types of technology, and have a basic awareness of their operation and maintenance. Questions asked include the level of public health education with regard to the operation and maintenance of a variety of systems, and whether residents are aware of the link between public health and adequate hygiene. Residents are requested to indicate to which of several systems they have been exposed, and whether the system was broken or in working order. A final question asks if residents are aware of the reasons for the breakdowns in these systems. A low score on this checklist would suggest that an education programme is essential and should precede any community decision-making about sanitation. Higher scores would indicate that users are well informed and are in a position to make a decision about sanitation options.

(iv) User Readiness Checklist

The purpose of the user readiness checklist is to establish whether the user community is sufficiently organised in order for a representative decision to be made, and to establish the extent to which the user community has been part of the planning process. Low scores in this checklist would suggest that any sanitation provision has a low probability of successful implementation due to insufficient participation of the user community.

(v) Regional Planning Checklist

The regional planning checklist attempts to ensure consistency between regional and local scale planning by requesting information from the RZM (See 5.1.1 above). In addition the permanence of the user community is evaluated as is the likelihood of additional funding or infrastructural development. The purpose of this is to ensure that technology selection does not foreclose on an upgrade path.

(vi) User Preference Index

The user preference index provides an opportunity for the SSPRA user to input the desirability of each of the systems as indicated by the residents. Additional questions relating to the users' awareness of the full implications of each of the technology options are also included to ensure that the preferences are based on an informed understanding.

(vii) Water Availability Index

The water availability index determines the reliability of sufficient supply in relation to the operational requirements of the four generic sanitation systems. Low per capita daily water use and low reliability of supply would indicate that only dry systems are feasible whereas greater assuredness of supply and a household connection would indicate that waterborne and septic tank systems are viable.

(viii) Operation and Maintenance Index

The operation and maintenance index gauges the capacity of the local authority to manage and maintain the system, as well as the availability of local skills for maintenance and repair. Other questions relate to the likelihood of frequent blockages due to the use of unsuitable materials (i.e. other than soft paper). Low scores would favour systems with simpler operating requirements.

(ix) Financial Planning Index

The affordability of each sanitation system is evaluated from the perspective of the subsidy that may be available for each system and the percentage of the capital costs which residents are willing to pay. A cross check is made between the amount residents are prepared to pay, the average monthly household income of the user group and the availability of financing for any of

the systems. The current means of charging for water is used as an indicator of the extent to which residents have been exposed to service tariffs.

(x) Soil Suitability Index

The soil suitability index has remained the same throughout the versions of the software and provides for input of soil factors via one of three options: either percolation rates if available, or a field estimation of soil texture, or by knowing the soil form which implies certain characteristics.

(xi) Site Suitability Index

The site suitability index assesses the broader issues of plot size, access, slope and flooding risk in relation to each of the four generic sanitation types.

(xii) Ground and Surface Water Pollution Index

The potential for ground and surface water pollution is evaluated on the basis of the average slope of the landform, the depth of the water table, the distance to the nearest open water body and the dependence on groundwater resources within a 10km radius. If a WASP Assessment has been undertaken, a greater weighting is placed on the WASP results than on the abovementioned factors.

(xiii) Confidence Limits, Scoring and Reporting

As is the case with previous versions of the software, provision is made for the inclusion of confidence limits. Confidence limits for each question are combined using the same weights as the individual questions, although in this version options are limited to high, low or moderate confidence. Help screens have been consolidated as a single button at the base of each screen. The notepad and reporting features have been retained.

A detailed description of the features of the SSPRA software is provided in the accompanying User Manual.

At this stage in the SSPRA process, it is possible for decision makers to use the information gathered and used in the system to select a sanitation technology. However, this depends entirely on the accuracy and availability of the data required for the components addressed up to that time. Once users of the SSPRA have worked through the first two stages of the system *viz* . checklists 1-4 and the User Preference and Technical Options Matrices it should be clearly evident whether the data are sufficiently accurate and completion of the process has been comprehensive.

(xiv) Data collection

The SSPRA was designed for iterative use where this may be necessary. The higher the quality of the data used, the more accurate the results will be. It is recommended that should the data collected or used for a particular project be incomplete or inaccurate, that improvements be made to the data where necessary and possible and that the SSPRA is then reapplied several times over if the need arises.

In many cases it will be necessary to collect raw data in the field, since it is unlikely that users will have data for all the relevant data fields readily available. The user manual contains instructions and information designed to assist the user of the SSPRA in sourcing and collecting the required data particularly for data fields where problems are anticipated.

5.1.3 Specialist Consultation Network

The purpose of the specialist consultation network is to provide additional decision support to users of the SSPRA in the form of independent expert advice from specialists in the field of sanitation planning, technology selection and service delivery. Specialists on the network will provide assistance in the decision making process should it not have been possible to gain a conclusive result in applying the SSPRA. Specialists on the network do not necessarily endorse the SSPRA or its intended purpose, but are recognised experts in their particular fields in relation to sanitation planning. The list of specialists is given in the User Manual.

5.1.4 Design Modification

Should the user have applied the SSPRA to a particular site and the results are not of such a nature as to provide a sound basis for decision making, and the user has also consulted with specialists listed on the Network, and it still remains impossible to select a particular technology above any other, it is recommended that the user selects the least undesirable option and addresses potential modifications to the design of that system which would accommodate the unique site specific conditions.

5.2 USER MANUAL

The User Manual which accompanies the SSPRA contains a detailed description of the SSPRA and how the user should proceed through the system, as well as additional supporting /background information to assist the user in the broader sanitation planning process.

The User Manual comprises the following parts:

- a list of broad sanitation planning principles intended to orientate the SSPRA user to the complexity of the task of sanitation planning and technology choice;
- a user guide to the SSPRA;
- an outline of data collection methods and data collection instruments (e.g. checklists) required to satisfy the information needs for the SSPRA; and a list of recommended data sources for specific data fields;
- the current specialist consultation network with full contact details;
- appendices containing a descriptive comparison of sanitation technologies;
- an inventory of available guidelines for sanitation planning and technology design; and
- a list of useful reference texts for the user to consult for additional background information.

6 TESTING THE SSPRA - CASE STUDIES/ SCENARIO TESTING

6.1 CASE STUDIES

Although it was originally intended to test the SSPRA by running a number of case studies, during the development of the tool, this process was abandoned. An outline of the methodology for case study testing as well as the rationale behind not pursuing the case studies is provided in Chapter 4.

6.2 SCENARIO TESTING

The SSPRA was tested to determine:

- the robustness of the system and its individual components to inaccurate and/or missing data; and
- its efficacy in assisting with sanitation planning in general and technology choice in particular.

6.1.1 Description of Scenarios

Two scenarios were developed to represent hypothetical sanitation projects. The scenarios intentionally comprised as many divergent characteristics as possible to mimic two actual situations in the KwaZulu-Natal context. The scenarios are outlined below.

Scenario 1:

Type of settlement:	:	Transitional, urban, informal, medium density
Socio-economic characteristics::	:	Low household income (ave range R500-1 200 p.m.) high percentage of unemployed people
Physical environment:	:	Slopes of low to moderate gradient Settlement has occurred in the drainage line of a non-perennial stream but has not yet spread to the floodplain of the river of which this is a tributary. Soils have a high clay fraction, are very shallow and are underlain by fractured shales Groundwater in the area is highly vulnerable to contamination.
Development history /	:	No formal development has occurred in the area.
Institutional environment		(The settlement is entirely informal and recently settled).. The community is not formally organized, there is no representative body / community based organisation and there is no apparent leader in the group

Financing	:	A small grant has been made available by a donor organisation (+/- R500 per household) but they have not specified any particular sanitation technology
Upgrade or Greenfield	:	There are a few crude pit latrines in the settlement (about 1 in every 5 households) but most people use the surrounding bush. This would essentially be a greenfield development.
Other services	:	Water is supplied by municipal tanker service - when the tankers fail to arrive people use water from a number of natural springs in the area. There are a few standpipes on the periphery of the settlement. There is a piped water supply in the adjacent catchment. There is a sewer main within 5km down slope of the settlement.
User preferences	:	A preliminary survey has indicated that members of this community intend to stay in the area and want formal services, in particular piped water and full waterborne sanitation.
Population density	:	3050 people per km^2
Other / miscellaneous	:	The settlement is close to a formally settled area with full waterborne sewerage Because the area has been settled in an informal manner *(viz.* not according to a formal town plan or grid layout, but unstructured) there is now a constraint on the development of linear services such as roads, sewers piped water supply and even with regard to access needed for sludge removal tankers.
RZM zoning	:	Satisfies criteria for VIPs and waterborne sewerage, but not for septic tank systems.

Scenario 2:

Type of settlement	:	Formally settled rural, moderate to low density
Socio-economic characteristics	:	Range of household income from R1 000 to R3 000.
Physical environment	:	Gently undulating topography, tending to very low gradient slopes. Soils very sandy. No open water sources nearby.
Development history / Institutional environment	:	Tribal authority. Local development committee and water committee are well established in this community and have managed the provision of a piped water supply to the area.

		There is a clinic in the community which serves the greater region but the health services are over committed (too few staff for the size of the community).
Financing	:	A financial institution has established a loan scheme whereby members of this community can secure a 60% loan to cover the capital costs of installing their own sanitation facilities.
Upgrade or Greenfield	:	There are currently a number of crude pit latrines, a small number of VIP's and a few Phungalutho's in the area. Many people still use the surrounding bush for sanitation. The implementation of sanitation projects at schools in the area has been very successful. These projects have provided the Phungalutho type of toilet only.
Other services	:	There is a piped potable water supply in the area with standpipes in some sections and household connections in others. The road network is well developed and allows for access to individual plots.
User preference	:	People have not expressed a particular preference. Indications are that there has been a sanitation awareness programme in the community coordinated by the local development committee. The community is well aware of the options open to them as well as the cost implications of each of the systems.
Population density	:	385 people per km^2
Other / miscellaneous	:	Much socio-economic research has been done in the area for the purpose of various development initiatives. The results are readily available. The user community is accustomed to full participation in such initiatives. The settlement has a formal origin and plot sizes are on average 2 500m^2 in size. The floodplain of the river some distance down slope of the settlement is used for food gardening and the gardeners have recently expressed a need for compost to replenish the required soil nutrients.

RZM zoning : Satisfies criteria for VIPs and waterborne sewerage, but not for septic tank systems.

6.1.2 Results of Application to the SSPRA

Scenario 1

A. Basic Needs Checklist

Basic Needs Score : 87
Colour : Red
Confidence : Red
Comment : Urgent priority
Recommendations :

(a) Basic sanitation needs as defined in the Draft White Paper on Sanitation Policy have not been met. This site should be accorded a high priority.

B. User Awareness Checklist

User Awareness Score : 15
Colour : Red
Confidence : Red
Comment : Unsatisfactory user awareness
Recommendations :

(a) Public health education is a high priority at this site.
(b) While residents have some knowledge of VIP's, knowledge of all other systems appears poor. An education campaign to inform residents of the operational requirements and constraints of each system is necessary.
(c) Any further planning of sanitation projects should not continue until the level of awareness in this community has been increased.

C. User Readiness Checklist

User Readiness Score : 0
Colour : Red
Confidence : Red
Comment : User readiness is unacceptable
Recommendations :

(a) As there is no structure in place to facilitate communication with the residents it is strongly recommended that no further planning occur until such a structure has been established. International experience has shown that intervention under these conditions is usually completely unsuccessful.

D. Regional Planning Checklist

Regional Planning Score	:	25
Colour	:	Red
Confidence	:	Red
Comment	:	Short term planning horizon
Recommendations	:	

(a) High insecurity of tenure suggests that a short term planning horizon is necessary.

(b) The possibility of funds being available in the absence of a development plan suggests that a co-ordinated development programme involving the community should be established.

E. User Preference Index

User Preference Score

VIP	:	20	Red
LOFLOS	:	20	Red
STS	:	100	Green
WBS	:	100	Green
Confidence		:	Red
Recommendations		:	

(a) A single interview is usually insufficient for the purposes of adequate sanitation planning. Further consultation with an appropriate and representative community structure is recommended.

(b) Low cost options are not considered desirable, yet the technical, environmental, financial and operational implications of all systems are not understood by the community. An education programme and process of consultation is considered an urgent need.

F. Water Availability Index

Water Availability Score

VIP	:	100	Green
LOFLOS	:	10	Red
STS	:	0	Red
WBS	:	0	Red
Confidence		:	Red
Recommendations		:	

(a) The current water supply is inadequate for any other system other than a dry system such as a VIP.

G. Operation and Maintenance Index

Operation and Maintenance Score

VIP	:	100	Green
LOFLOS	:	12	Red
STS	:	0	Red
WBS	:	27	Red
Confidence		:	Red

Recommendations :

(a) There is insufficient expertise available to maintain off-site sanitation systems.

(b) The likelihood of use of materials other than soft paper suggests the only choice is a VIP. If any other technology option is considered preferable it will have to be preceded by a comprehensive public health education campaign.

H. Financial Planning Index

Financial Planning Score

VIP	:	87	Green
LOFLOS	:	55	Orange
STS	:	11	Red
WBS	:	9	Red
Confidence		:	Red
Recommendations		:	

(a) It appears that only a VIP is affordable to this community, and in addition there is a shortfall in the capital costs.

(b) Further investigation must be undertaken to establish whether the financing which is available is affordable.

(c) An unwillingness to contribute to maintenance costs may result in system failure or shortened design life. The cost implications and maintenance needs of each system should be communicated to residents.

I. Soil Suitability Index

Soil Suitability Score

VIP	:	100	Green
LOFLOS	:	55	Orange
STS	:	43	Orange
WBS	:	100	Green
Confidence	:	Red	
Recommendations	:		

(a) Soil conditions are not ideally suited to on-site, wet systems. If these systems are the only viable options, it is recommended that the design specifications for these systems be closely investigated.

(b) A soil percolation rate test should be undertaken.

J. Site Suitability Index

Site Suitability Score

VIP	:	100	Green
LOFLOS	:	55	Orange
STS	:	43	Orange
WBS	:	100	Green
Confidence	:	Red	
Recommendations	:		

(a) Periodic flooding may be problematic for the proper functioning of a VIP system. Residents should be aware of the dangers of flooding.

K. Ground and Surface Water Pollution Index

Ground and Surface Water Pollution Score

VIP	:	78	Green
LOFLOS	:	64	Yellow
STS	:	55	Orange
WBS	:	100	Green
Confidence	:	Red	
Recommendations	:		

(a) A moderate potential for ground and surface water pollution exists. If the settlement size is large a full WASP Assessment should be undertaken.

Scenario 2

A. Basic Needs Checklist

Basic Needs Score	:	46
Colour	:	Yellow
Confidence	:	Green
Comment	:	Secondary importance
Recommendations	:	None

B. User Awareness Checklist

User Awareness Score	:	47
Colour	:	Orange
Confidence	:	Green
Comment	:	Poor user awareness
Recommendations	:	

(a) Public health education is required at this site.

C. User Readiness Checklist

User Readiness Score	:	100
Colour	:	Green
Confidence	:	Green
Comment	:	User readiness is very high
Recommendations	:	None

D. Regional Planning Checklist

Regional Planning Score	:	83
Colour	:	Green
Confidence	:	Green
Comment	:	Long term planning horizon
Recommendations	:	

(a) High security of tenure suggests that a longer term planning horizon is advised.

(b) The availability of a development plan and the possibility of funds being available suggest that thought should be given to developing an approach which includes the possibility of an upgrade path.

E. User Preference Index

User Preference Score

VIP	:	50	Yellow
LOFLOS	:	50	Yellow
STS	:	50	Yellow
WBS	:	50	Yellow
Confidence	:	Green	
Recommendations	:	None	

F. Water Availability Index

Water Availability Score

VIP	:	100	Green
LOFLOS	:	100	Green
STS	:	55	Yellow
WBS	:	55	Yellow
Confidence	:	Green	
Recommendations	:		

(a) The current water supply is adequate for waterborne or septic tank systems although a household connection will be necessary.

G. Operation and Maintenance Index

Operation and Maintenance Score

VIP	:	100	Green
LOFLOS	:	68	Yellow
STS	:	10	Red
WBS	:	0	Red
Confidence	:	Green	
Recommendations	:		

(a) The likelihood of use of materials other than soft paper suggests the only choice is a VIP. If any other technology option is considered preferable it will have to be preceded by a comprehensive public health education campaign.

H. Financial Planning Index

Financial Planning Score

VIP	:	100	Green
LOFLOS	:	55	Orange
STS	:	18	Red
WBS	:	15	Red
Confidence	:	Green	
Recommendations	:		

(a) It appears that only a VIP or LOFLOS system is affordable to this community, and in addition there may be a shortfall in the capital costs.

I. **Soil Suitability Index**

Soil Suitability Score

VIP	:	100	Green
LOFLOS	:	100	Green
STS	:	78	Green
WBS	:	100	Green
Confidence	:	Red	
Recommendations	:		

J. **Site Suitability Index**

Site Suitability Score

VIP	:	100	Green
LOFLOS	:	100	Green
STS	:	100	Green
WBS	:	100	Green
Confidence	:	Green	
Recommendations	:		

K. **Ground and Surface Water Pollution Index**

Ground and Surface Water Pollution Score

VIP	:	100	Green
LOFLOS	:	89	Green
STS	:	82	Green
WBS	:	100	Green
Confidence	:	Green	
Recommendations	:	None	

7. DISCUSSION AND RECOMMENDATIONS

7.1 THE CONTEXT OF THE SSPRA

The planning and provision of sanitation facilities in developing communities is a complex and multifaceted process. No single tool can hope to address all the issues which need to be taken into account in such a complex process, particularly where decision making is always to some extent based on the subjective judgement of several different parties and on incomplete information. In addition, there are several players in sanitation development projects, whose goals in sanitation provision may be vastly different. The SSPRA has been developed for a very specific purpose which is to assist service organisations, development agencies, local authorities and the like in formalising their contribution to the process of appropriate and acceptable sanitation technology selection, for particular development projects within their jurisdictional areas or to which they may be contributing to in some way. The primary purpose of the SSPRA is therefore to provide the abovementioned agencies with a framework within which information can be recorded in a consistent manner for the purposes of decision-making. Since the tool is focused on assisting with technology selection, it makes a limited but important contribution to the overall sanitation planning process. **It must not be seen as a decision making tool, nor as a replacement of the much broader sanitation planning process.** It must also be borne in mind that the four technology groups used in the SSPRA have been used for illustrative purposes, i.e. they represent permutations of the types of sewage treatment (wet or dry, on-site or off-site) that are possible rather than specific technologies (e.g. VIP's, urine diversion systems, waterborne sewerage). The tool thus provides a foundation upon which further discussion and investigation must take place to come to decisions about specific technologies for specific sites.

The SSPRA may be seen as merely one tool to undertake a specific task within the broader planning process or, more specifically, within particular projects for the provision of sanitation. Sound sanitation planning, requires that there is continuity between planning at a regional level (catchment), through to planning at a project level and within projects, planning at a site specific level. The model in the table below *(Table 7.1)* illustrates the possible context for the two main components of the SSPRA *viz.* a Regional Zoning Map and a computer based Planning and Reporting Aid that provides support for technology selection.

TABLE 7.1: Context of the SSPRA in the broader Sanitation Planning Process

LEVEL OF PLANNING	*METHODOLOGY / TOOL*	*CONTEXT*
1 Regional (catchment)	Regional Zoning Map	INPUT to development planning and implementation process
2 Local (project)	Project Cycle Management Approach incorporating PHAST	MANAGEMENT OF overall process of development planning and implementation
3 Site (household plot / group of plots)	SSPRA technology	INPUT to development planning and implementation process

The essential link between the two components is the approach taken to managing the planning and implementation of sanitation upgrades in user communities. It is proposed that this link be made by using the Project Cycle Management (PCM) approach and positioning the use of the SSPRA computer based tool within this process, as one of a range of tasks and inputs which contribute to the overall implementation of a sanitation project.

The PCM approach is particularly useful for low cost sanitation programmes. The literature review and current debates on sanitation decision making processes reveal that successful water and sanitation programmes have not focused solely on infrastructure provision. Community participation in a) identifying the social costs of poor water and sanitation behaviours and facilities, b) developing locally specific awareness campaigns, c) identifying appropriate technologies, d) contributing to the building of these facilities and e) playing an active and ongoing role in the operation and maintenance of the facilities, defines the difference between success or failure in the improvement of public health. .

PCM places the implementing agent (local authority, development agency, service organisation) in a supporting role to community led sanitation development projects. The SSPRA can be used within this context by the implementing agent to provide organised information to user communities, on technology options and the implications of each, to facilitate their decision-making. There are a number of different project management approaches that could be used for the planning and implementation of sanitation projects and to which the SSPRA could contribute. The PHAST approach is probably the most appropriate in the context of the SSPRA, for the reasons outlined in Chapter 3. If the PHAST approach is to be formally adopted as the project management approach within which the

SSPRA should fit, a mechanism will need to be put in place to ensure that the two processes are compatible and that the PHAST approach informs any future refinements of the SSPRA. An outline of the main elements of the PHAST Programme is given in the Literature Review.

The ultimate goal of the upgrading of sanitation in developing communities is to provide barriers to contamination pathways for the purposes of protecting or improving public and environmental health. Only by examining sanitation technology choice as part of an integrated planning and implementation process which takes place from regional through to local level, will it be possible to realise this goal. For the SSPRA to contribute to improvements in public and environmental health, it must also be contextualised within the broader sanitation planning process. Improved infrastructure alone will not necessarily bring about the desired improvements. The relationship is reciprocal: whereas the broader planning process (the regional planning base and the project management approach) provides a mechanism for the SSPRA to contribute to an improvement in public and environmental health, the SSPRA provides information and therefore promotes understanding, which can contribute to informed decision making within the broader planning process.

7.2 APPLICATION AND EFFICACY OF THE SSPRA FOR TECHNOLOGY SELECTION

The efficacy of the SSPRA as a tool to contribute to consistency in sanitation planning efforts in general and assist with technology choice in particular is evaluated below in terms of its strengths and limitations. The evaluation is based on the findings of the Literature Review, considerable discussion with development professionals and specialists in the field of sanitation provision, as well as the results of the scenario testing exercise. The current planning, policy and institutional environment has also been taken into account in the evaluation.

7.2.1 Strengths

- The SSPRA integrates the consideration of all relevant factors (socio-economic, environmental, technical, financial, political) in the sanitation technology selection process and at the same time assists with broader planning of sanitation projects. The majority of urban local authorities oppose VIPs of any description, on public health and political grounds, and view alternatives to water-borne sanitation as problematic interim measures. Wherever they have the means, local authorities are installing water-borne sanitation, regardless of residents' ability to meet the cost of servicing it. Given the growing polarisation of the sanitation delivery debate into urban: waterborne and rural: VIPs, the SSPRA acts as a necessary reminder of the range of issues essential to sound planning of sanitation.

- Exclusive use of the SSPRA will assist in focusing the data collection efforts of planning authorities. Furthermore this will promote the establishment of a consistent database for use by the relevant authorities and service providers that will in turn facilitate data exchange between these parties.

- The system provides and promotes transparency in planning and decision-making by the encouragement of full user community participation.

- The SSPRA contributes to consistency in planning and decision making across a range of sanitation projects under the jurisdiction of the same authority or service organisation but in different environments, by introducing the range of factors that need to be taken into consideration. The system provides the planning context for the structured introduction of community based participatory methodologies in achieving the purposes of information gathering and local planning.

- A written record of the technology assessment process is provided in a consistent manner from project to project.

- The SSPRA is robust and comprehensive. It has been designed to assist the user though the technology selection process entirely i.e. to ensure that it is possible in the end to select a suitable technology or modify the design for a unique set of circumstances. By taking the user through a logical series of steps each of which depends on the completion of the step before it, the user is guided to a decision at the end of the process. The tool can therefore be considered highly effective in achieving its purpose.

- The SSPRA provides for integrated planning of sanitation provision on a catchment basis through the use of the RZM.

- Although the SSPRA is constrained by its data requirements, the system can be used iteratively as and when better or more accurate data become available for the project area.

7.2.2 Limitations

- The data requirements of the SSPRA are quite substantial and the system is dependent on the quality and comprehensiveness of the data input into the system. The level of support provided for decision-making diminishes in proportion to the availability and accuracy of data. However, a list of data requirements is provided in the User Manual as a guide to users. The need for adequately trained field workers to undertake surveys in communities is stressed in the User Manual and guidelines and recommendations are provided for the collection of the necessary information. The data required for input into the SSPRA comprise information sets that are fundamental to basic planning. Attention should be focused on the gathering of accurate and comprehensive data for the SSPRA and therefore the sound planning of sanitation projects. Failure to address the range of key issues incorporated into the SSPRA will mean that planning is based on incomplete information. The use of community-based approaches to gathering data beyond standard survey/questionnaire methods needs to be explored . Socio-economic surveys and

Technical pre-feasibility studies can be enhanced through the generation and Integration of local knowledge. The range of factors considered and the data field construction of the SSPRA would enable the utilisation of community based data collection methods.

- The SSPRA, in particular the PC based component and the RZM, presupposes the possession by the planner/service provider of the necessary technology to run the system or a GIS. However this problem can be overcome by the better equipped service providers and local authorities offering a bureau service for the use of the SSPRA.

- Should planning authorities or other service providers using the SSPRA have access to GIS facilities as well as high resolution data, there is a risk that they may skip the remaining stages and components of the SSPRA or neglect to incorporate community based decision making processes into their planning, consider the RZM as a complete planning tool rather than a support for technology selection within the broader sanitation planning context.

- Planning according to the RZM on a catchment basis could only be meaningful for areas where communities reside within the boundaries of the catchment, precluding consideration of conditions across catchment boundaries e.g. the proximity of sewer reticulation just outside the catchment boundary but within reach of a community just within the boundary.

- In the context of recent developments in sanitation planning approaches as well as an increased understanding of the issues that are key to technology selection, there are problems with the current knowledge construction of some of the data fields and / or indices in the SSPRA User Interface. These will have to be addressed before the tool can be used to support decision making around sanitation technologies. The reader is referred to *Appendix 2* for printouts of the user screens in the SSPRA. Examples of some of the problems referred to above include:

  (i) The User Awareness checklist confuses exposure to sanitation technologies with health and hygiene awareness. Information on exposure to technologies needs to form part of a data field on selecting sanitation design principles. The technology needs to be seen as one contamination barrier amongst many, the most effective contamination barriers being changes in hygiene behaviour. Assessing the perceptions of the community residents to contamination routes and barriers would provide a more meaningful assessment of user awareness.

  (ii) The User Awareness checklist asks about the "levels of awareness" in the community of the link between "public health" and "adequate hygiene". However, none of these terms are defined. What is an acceptable level of awareness and how is this defined in practice? What is meant by public health and adequate hygiene? Who defines these terms and who is asked? There is

no methodology for determining the answers to these questions and they will therefore be based on the subjective judgement of the SSPRA user and the responses of a few community members. The question should rather be focused on hygiene practices and one method of obtaining this information is through the use of observation surveys. Issues such as the number of users per facility, evidence of hand washing facilities, general cleanliness of the existing facilities, materials used for anal cleansing, children's usage of the facilities and disposal practices for nightsoil will provide some indication of hygiene practices. Levels of awareness can then be extrapolated from existing hygiene practices. However, observation surveys, although more accurate than questionnaires, should not be used in place of community led exploration into household hygiene practices.

(iii) The Institutional Readiness checklist exhibits the same problems regarding the use of subjective terminology. For example, what do "endorse" and "acceptable decisions" mean, and to whom? Again, observations and queries on how many times the community structure holds meetings, reports back to the broader community, number and demographics of participants at these meetings will give a limited idea of institutional readiness. These types of questions usually produce very differing responses depending on the situation of the respondent.

(iv) Institutional Readiness as the only indicator of a community's capacity to manage a project is inadequate. In many cases, problems experienced in a community with leadership structures do not translate into a lack of resources, willingness and capacity to manage a sanitation project. Many of the poorest households (usually single female headed households), do not have the time to attend meetings and are generally alienated by predominantly wealthier and male leadership. Assessment of the readiness of these households and the capacity of the "informal" institutional networks that support these households should be accounted for in the data field.

(v) The willingness of residents to contribute to Operation and Maintenance (in the Operation and Maintenance Index) is only calculated in terms of a financial contribution. There may be other forms of contribution that should be accounted for.

This is not an exhaustive list of potential problem areas in the SSPRA, and is merely provided for illustrative purposes. To improve the usefulness of the tool it will be necessary to review the indices and data fields in the SSPRA in the context of project management to identify problem areas in the current tool and suggest ways in which these can be overcome to better serve an effective sanitation planning and implementation programme.

7.3 Data Requirements and Implications for Data Collection

The output and level of assistance provided to the planner or service provider using the SSPRA are entirely dependent on the comprehensiveness, accuracy and level of detail of the required data input into the system.

Some of the data requirements for the SSPRA and the RZM are not easy to satisfy. However, comprehensive guidelines and data collection instruments have been provided in the User Manual to assist the user in obtaining the necessary data.

The user is also encouraged to obtain assistance in collection of the data for non-technical fields from adequately trained practitioners in this field. The participatory tools developed in WATSAN community based methodologies (PHAST in particular), readily allow for data input as they are based on matrices, ladders and diagrams. Degrees of health awareness, prioritisation of sanitation issues, organisational readiness and available resources may consequently be clearly expressed.

Although there may be considerable demands on the user in terms of data collection requirements for the SSPRA, the issues incorporated into the SSPRA are *key data fields only* and do not represent a comprehensive set of all issues pertaining to sanitation planning. Addressing at least the key data fields is absolutely critical to sound sanitation planning and technology choice and the input of accurate and complete data should not be compromised. However, as the SSPRA stands at present, the data fields for the socio economic, organisational and financial factors are perhaps too thin for meaningful interpretation. These data fields need to be reconstructed on the basis of data collected for the purposes of overall project management and implementation, not only for the limited purpose of technology selection. An appropriate method for collection of the data for input into the SSPRA that is in line with the goals of the overall project, therefore needs to be adopted.

The PHAST approach has developed tools based on Adult Education principles that encourage households to take responsibility for the reduction of the disease burden and improvements in community health, by improving their sanitation situation. The use of these tools could provide the necessary information to reconstruct the data fields so that they become more meaningful.

7.4 SYNOPSIS

There is growing acknowledgment that upgrading sanitation is considerably more than a technical exercise; increasingly, the technical questions - slope, depth of water-table, distance from a water source - are being regarded as a kind of pre-feasibility assessment, with the real decision about technology type resting on a range of people-centered issues.

In some circles, this realisation is prompting an important shift in the approach development planners. It is no longer sufficient to assess the physical feasibility of a particular technology type in at a given site. The level of support and preparedness of individual users must be assessed, and, where inadequate, targeted initiatives will be required to assess how or whether to proceed.

In view of this re-orientation among a growing number of development professionals, it is appropriate to question the validity of a SSPRA that attempts to anticipate the full range of non-technical considerations that may present themselves, albeit through identified key decision factors, and then assign a weighting to them.

These concerns may be laid to rest by stressing that the SSPRA does not aspire to present the user with a decision. The final decision rests with those members of the community who will use the sanitation facilities. What the SSPRA does do is to present the user with a number of issues for consideration in a structured way, and to inter-relate them. Where the user does not have the necessary information to assess a particular situation or factor, the SSPRA highlights this, and offers suggestions as to how the information gap might be bridged. As such it supports decision making, without relieving the user of responsibility for the outcome.

In situations where residents must be sensitised to the implications of their technology choice, the SSPRA may prove valuable in underlining the range of variables that must be considered. This would allow for continual re-evaluation of the data gathering and planning methods facilitated by the planner/service provider, in dealing with the range of issues needed to arrive at acceptable technologies. Moreover, the SSPRA's ability to record all responses to data requests may prove useful in defending contentious decisions, and in proving that the full range of possible alternatives and their implications were considered.

7.5 ACHIEVEMENT OF PROJECT OBJECTIVES

In general, the objectives of the research have been met. The original objectives are reproduced here for the convenience of the reader:

Research Objectives	
1	Synthesis of relevant available information in the local and international literature and from other sources such as unpublished documentation on appropriate sanitation for developing communities in general, and on selection of technological options in particular. In addition, identification of gaps in the existing information and formulation of recommendations for further research.
2	Identification of experts in the fields of provision of appropriate sanitation to developing communities, and in the development of decision support systems, as well as other interested parties and community representatives, and inviting their participation/input in building the DSS.
3	Evaluating the potential physical environmental impact of different sanitation technologies with specific reference to ground and surface water quality.
4	Designing a decision support system which is PC-based and can be linked to a GIS, with a structure and content which is compatible with the requirements of the end user(s) i.e. a practical and workable tool.
5	Ensuring that the technology developed is transferred effectively to the end user(s) and that the DSS can be effectively implemented.

6	Making recommendations for the required support structures for the DSS.
7	Establishing communication with other groups involved in research into or implementation of appropriate sanitation technology in developing communities, to prevent duplication of effort and for mutual benefit to such groups and the sanitation DSS project.

The extensive Literature Review undertaken of the local and international literature has provided a perspective on the importance of the issue of appropriate technology selection and the lack of adequate and comprehensive procedures to undertake this task.

Opinion on the application and utility of an SSPRA for sanitation technology selection was canvassed from a wide range of individuals and organisations. The contributions of these people convinced the researchers that there are a large number of highly experienced people in the field of sanitation planning and provision. Key individuals have been identified for participation in the Specialist Consultation Network. In addition, valuable contact has been made with other groups, institutions and individuals involved in research into the provision of appropriate sanitation to developing communities.

Some work has already been done by others in assessing the environmental impact of different technologies. This work was not taken further, but summarised for inclusion into the SSPRA User Manual for reference purposes.

A functional, robust and effective PC-based tool has been developed to assist planners and decision makers in the selection of appropriate technologies. The system is not formally linked to a GIS but has been provided with a spatial dimension in the form of the RZM. This map also provides a contextual basis for site based sanitation selection. The structure and contents of the tool were workshopped and tested on a number of occasions with many potential users and people active in the field of sanitation planning as a whole. This has hopefully ensured that the tool is both pragmatic and user friendly.

The SSPRA is accompanied by a comprehensive User Manual to provide the user with as much information as is required to use the system effectively. The user is also provided with backup in the form of a network of specialists who can provide additional support. There should be no reason why users should have difficulty in implementing the SSPRA system.

7.6 RECOMMENDATIONS

The objectives of the research have been met in the development of the SSPRA.

1 However, the system remains to be tested in real situations and it is therefore recommended that a testing phase of approximately 6 months be undertaken, followed by the development of the final version of the system.

- *Further testing may be conducted by other service providers across the country to ensure that the tool is ultimately applicable to other provinces and takes account of variations in local conditions.*
- *The system should also be tested by e.g. postgraduate students in engineering, planning and geographical (GIS) disciplines.*

2 For the SSPRA to reach its objective of protecting the quality of both ground and surface water resources from the potential impacts of sanitation, as well as to promote transparency and consistency in sanitation planning and technology selection;

- *It is recommended that concurrent with and following the period of testing and refinement referred to above, that the SSPRA be marketed widely as a practical tool to assist service providers in their sanitation planning and technology selection efforts.*
- *Initial discussions with the Department of Water Affairs and Forestry indicated that there is considerable interest in the utility of such a tool, particularly since the structure and contents thereof are clearly in line with the principles outlined in the Draft White Paper on Sanitation Policy.*
- *Many other organisations worldwide have expressed interest in the SSPRA, notably WEDC in the United Kingdom. This suggests that the SSPRA may be marketable beyond the boundaries of South Africa in other developing countries.*

3 Coherent, consistent and appropriate methodologies should be identified to solicit information on socio-economic, environmental, technical, financial and political factors. Both the methodologies employed, and the type of information generated using a given methodology, would inform what data fields were selected and how data was captured within them.

- *It is recommended that the PHAST approach be adopted for data collection and community based planning, especially for the socio-economic and some of the environmental factors. Responses to the use of specific PHAST tools – for example, three pile sorting or a sanitation ladder - could then be reflected in the data fields of these factors. The adoption of a particular community-based methodology by the planning agent for a given geographical area, would then allow for a consistent approach to the assembly of baseline data, and allow for helpful comparisons between different settlements, communities and projects.*
- *In projects where there is neither a structured nor a participatory approach to decision-making around sanitation, it is recommended that SSPRA be used as the tool to guide decision-making. As the SSPRA provides information on alternative technologies and the range of factors that need to be taken into consideration when planning sanitation implementation, the use of the tool by peri-urban and urban planners would enhance their decision-making process. The emphasis in many of the peri-urban and urban local structures on water-borne sewerage needs review. The SSPRA would reinforce awareness of the need for such review.*

4 The SSPRA's location in the planning and decision-making process needs clarification.

- *It is recommended that the Project Cycle Management (PCM) approach be adopted. PCM is a refinement of the ZOPP, or Objectives-Oriented Planning Method. The appropriate place for technical information and planning tools is as a support to implementing agents, not as an externally determined framework for information and planning. The role of the implementing agent is to support and, if necessary, facilitate community-managed development initiatives. The community managed decision-making process would indicate where technical inputs and support were required. The SSPRA, in this context, would be defined as a support and management tool for the extension/field officers of planning agencies, local authorities, service organisations and the like. The tool would provide extension/field officers with a checklist of technical issues to raise and explore with community members, and facilitate further investigation of locally appropriate technical options within the community managed development process.*

  Again, in situations where decisions on sanitation implementation are solely made by planners outside of a participatory framework, the SSPRA could play an important role in outlining the range of factors that should be considered, so as to expand discussion beyond the assumption that only full water-borne sewerage is relevant.

5 The contents and data requirements of the SSPRA should be determined within the context of the project management approach and method selected. As such:

- *Construction of the SSPRA checklists, index factors and data fields should be reviewed to reflect a specific adopted project management approach and method. The socio-economic factors need to provide meaningful, although limited, analysis.*

6 In order for the SSPRA tool to provide a range of possible appropriate technical options to a user community:

- *Access to relevant information must be provided through the methods described above and the information must be organised in a meaningful way that allows for local understanding. The above selection of a method that encourages this is highly recommended. However, the ability of a computer based tool to do this is limited, but if the limitations are acknowledged and openly understood by the operator, this will not hinder the process, but rather provide a support to an existing information gathering process. The multi-level nature of sanitation programme decision-making makes the selection and construction of all the appropriate information needed for external experts virtually impossible. However, decisions need to be made on what is 'good enough' information, particularly in relation to the socio-economic factors. The UNICEF 'Better Sanitation Programme', PHAST 'Fieldworker's Handbook',*

and the many web sites available all provide guidelines on how to make this particular judgement. The Department of Water Affairs and Forestry Ground water Protocol is recommended for settlement density issues.

In addition it would be useful to have access to a database of alternative technologies that are organised according to design principles. By recommending a technology design principle or type, the SSPRA encourages local variations and the incorporation of site specific design requirements. The SSPRA could cross reference to other support tools for information on specific sanitation technologies.

7 It may be feasible to produce additional supporting material to the User Manual that accompanies the SSPRA system.

- *It is recommended that a pocket guide to the development of sanitation projects according to sound principles and the key issues determining technology choice be developed for wider distribution. This would ensure that the lessons learned in the process or developing the SSPRA are shared as widely as possible, since the user group for the SSPRA will be limited to a relatively small number within a broader audience of people involved in sanitation development planning.*

8 The process of development of the SSPRA and in particular the data requirements of the system, identified a number of areas where further research is required to provide a comprehensive technical data set *inter alia* soil permeability and the environmental impact of individual systems.

- *It is recommended that these aspects be afforded the attention and funding to enable the collection of the relevant data.*

9 The SSPRA, the changing nature of sanitation planning and the continual improvement of available data, will require that the contents of and recommendations generated in the SSPRA PC based system are continually updated.

- *It is recommended that a custodian be identified for the updating and maintenance of the SSPRA.*

APPENDIX 1A : People interviewed during the Course of the Project

Andrew Evans	Medical Research Council, Nelspruit
Jeff Jolly	Ground water Consulting Services cc. (formerly of DWAF), Cape Town
Kerry Murphy)	WATERTEK, CSIR, Stellenbosch
Alan Wright)	
Gideon Tredoux)	
Roger Parsons)	
Wouter Loots	Town Engineer, Lingelethu West Local Authority, Khayelitsha, Cape Town
Hennie du Plessis	Cape Provincial Administration - Community Services Department, Cape Town
Mike Slabbert	Steffen Robertson and Kirsten, Durban
Julian Baskin	Interface Africa, Durban (formerly of Scott Wilson Kirkpatrick),
Rijk Joubert	Africon Engineering, Pietermaritzburg (formerly Van Wyk and Louw)
Richard Savage	BKS Inc., Pietermaritzburg
Stefan Pienaar	Eksteen van der Walt and Nissen, Pietermaritzburg
James Rivett-Carnac	Appropriate Technology Information, Pietermaritzburg
Norman Cleaver	Davies Lynn and Partners, Durban
Adrian Vosloo	Bosch and Associates, Durban
Tony Markowitz	Markowitz English and Associates, Durban
Hugh Hodge	Hodge and Associates, Durban
David Still	Partners in Development / Mvula Trust , Pietermaritzburg
Alan Davies	Water & Waste Department, Durban Corporation, Durban
Jeff Broome	Burrow Binney & Partners (Zimbabwe) / Mvula Trust, Johannesburg
Rob Burgess	Rural Planning Section, Umgeni Water, Pietermaritzburg
Chris Geerdts	Valley Trust, Botha's Hill
Liz Hicks	The Urban Foundation, Durban
Smangali Manzi	Rural Planning Section, Umgeni Water, Pietermaritzburg

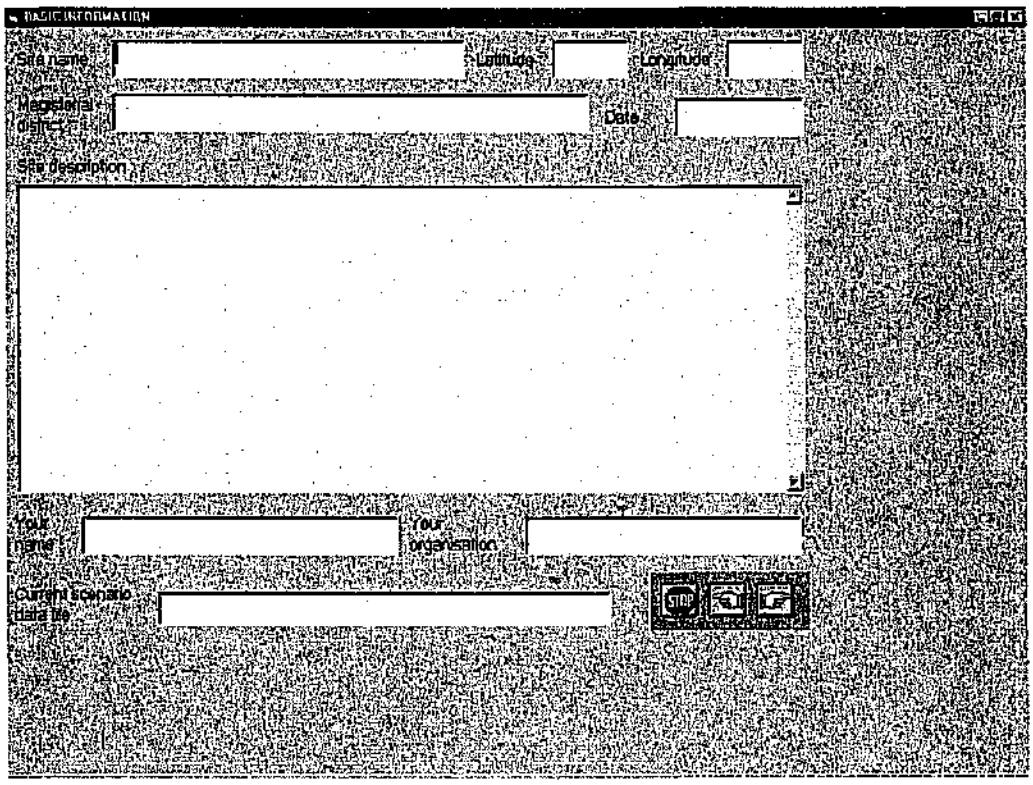
APPENDIX 1B : Participants in Workshop 1 (November 1993)

Adrian Wilson	Corporate Services Division, Umgeni Water, Pietermaritzburg
Ian Palmer	Palmer Development Group, Cape Town
Salim Karim	Medical Research Council, Durban
David Totman	Town Planning Consultant, Pietermaritzburg
Ian Pearson	WATERTEK, CSIR, Pretoria
Isaac Ngwenya	Rural Planning Section, Umgeni Water, Pietermaritzburg
Len Abrams	Steffen Robertson & Kirsten/Chairperson of SCOWSAS, Pretoria
Steve Terry	Water Quality Department, Umgeni Water, Pietermaritzburg
Hilton Furness	Water Quality Department, Umgeni Water, Pietermaritzburg
Nevil Quinn	Institute of Natural Resources, Pietermaritzburg
John Howard	Water Quality Department, Umgeni Water, Pietermaritzburg
Benita Olën	Institute of Natural Resources, Pietermaritzburg

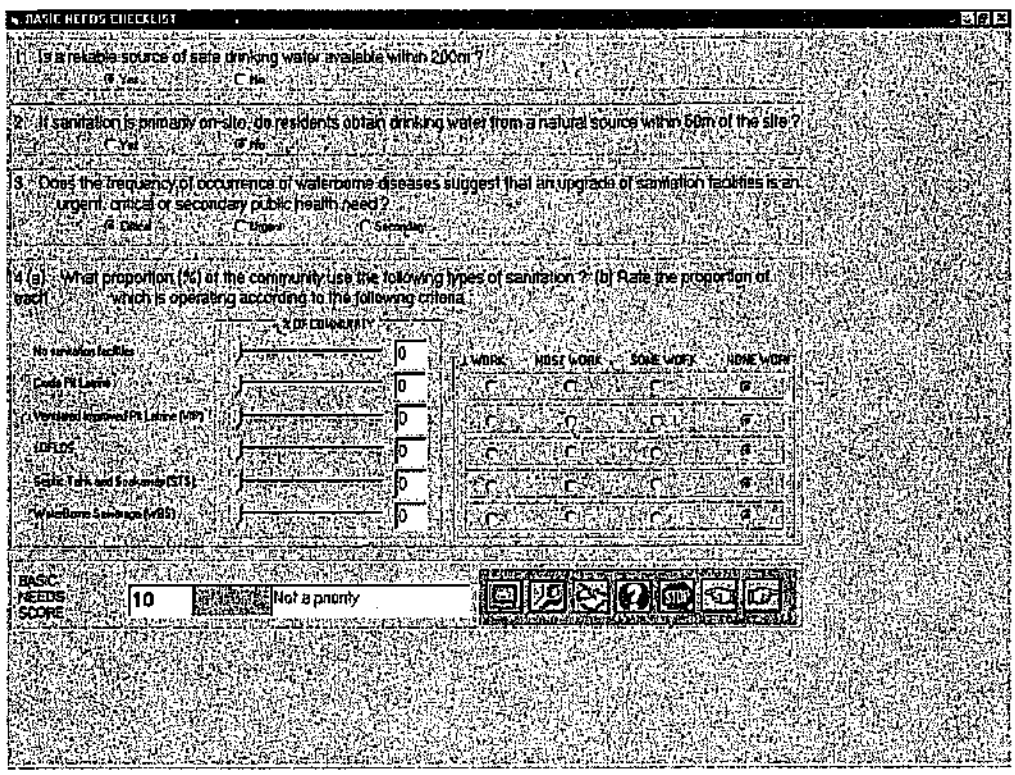
APPENDIX 1C : Participants in Workshop 2 (July 1995)

Carol Murphy	Institute of Natural Resources, University of Natal, Pietermaritzburg
Nana Ndlovu	Built Environment Support Group, University of Natal, Durban
Nicola Budd	Built Environment Support Group, University of Natal, Durban
Dave Still	Partners in Development, Pietermaritzburg
Rob Burgess	Rural Planning Section, Umgeni Water, Pietermaritzburg
Tim Mthembu	Rural Planning Section, Umgeni Water, Pietermaritzburg
Julian Baskin	Interface Africa, Durban
Andrew Torr	Gibb Africa, (formerly Hill Kaplan Scott), Pietermaritzburg
Richard Savage	BKS Inc., Pietermaritzburg
Siya Nkeli	Tugela JSB, Ladysmith
Una Barnard	KZNPA Development Facilitation, Pietermaritzburg
John Howard	Water Quality Department, Umgeni Water, Pietermaritzburg
Benita Olën	Quinn Olën and Associates, Pietermaritzburg
Nevil Quinn	Quinn Olën and Associates, Pietermaritzburg

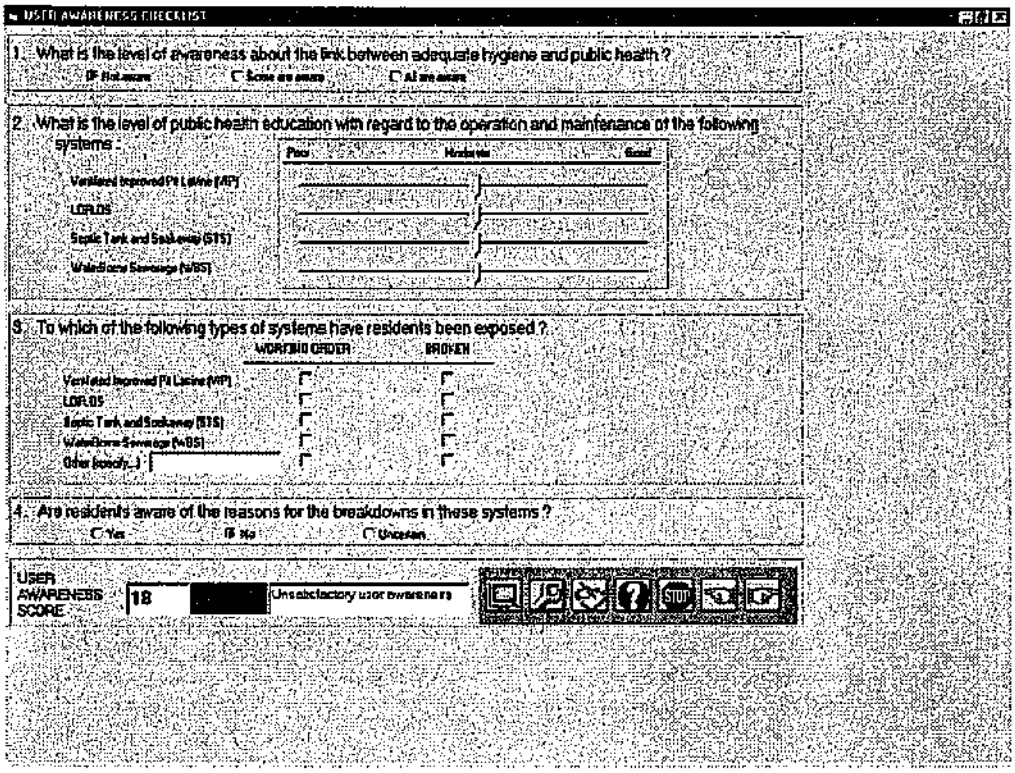
APPENDIX 2 : PRINT OUTS OF THE SSPRA USER SCREENS



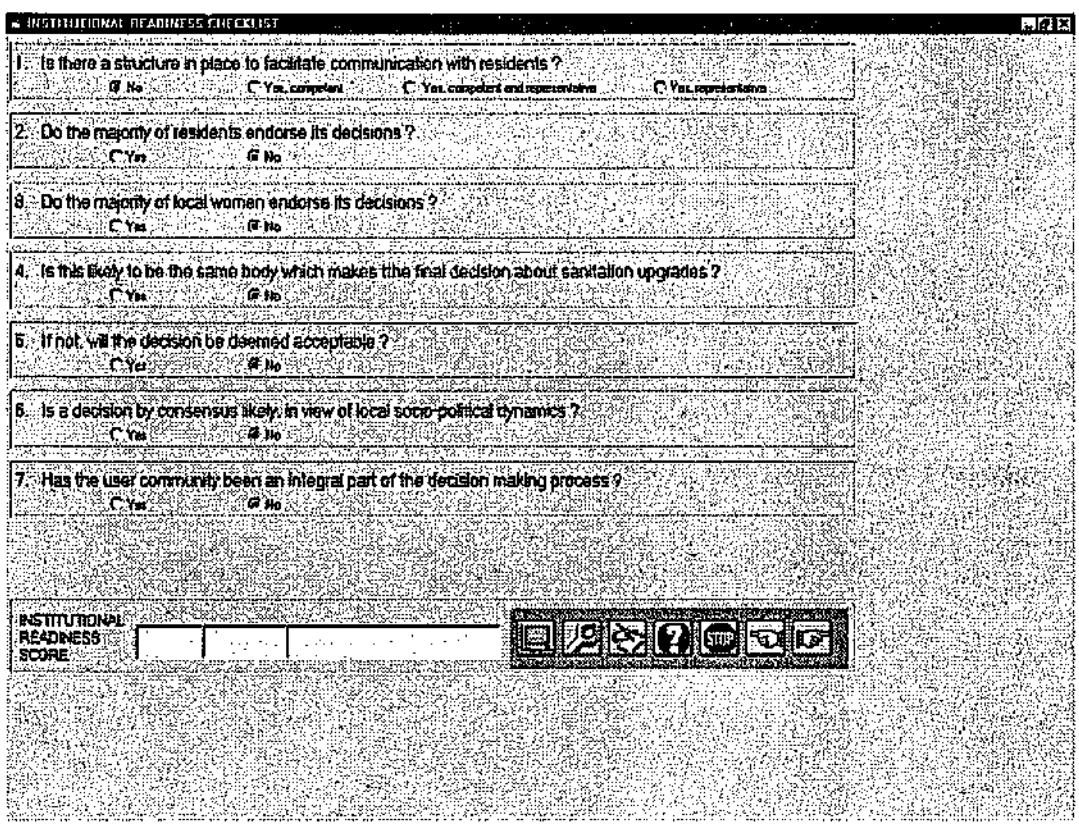
(i) Basic Information Screen



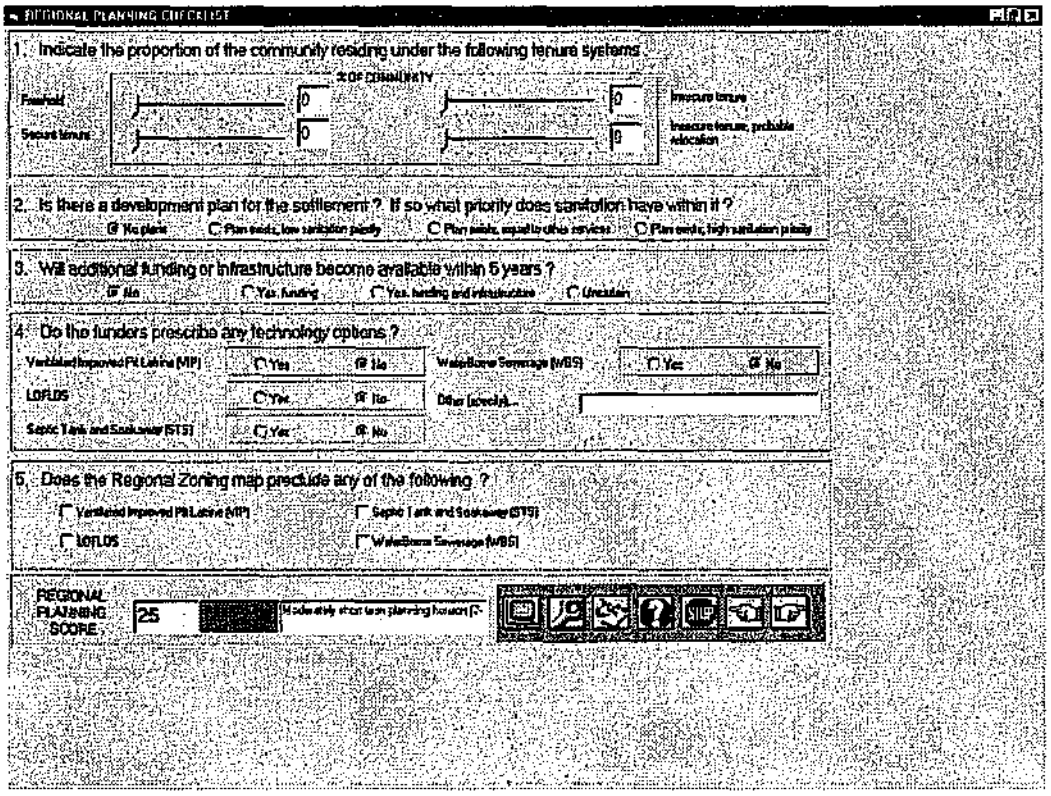
(ii) Basic Needs Checklist



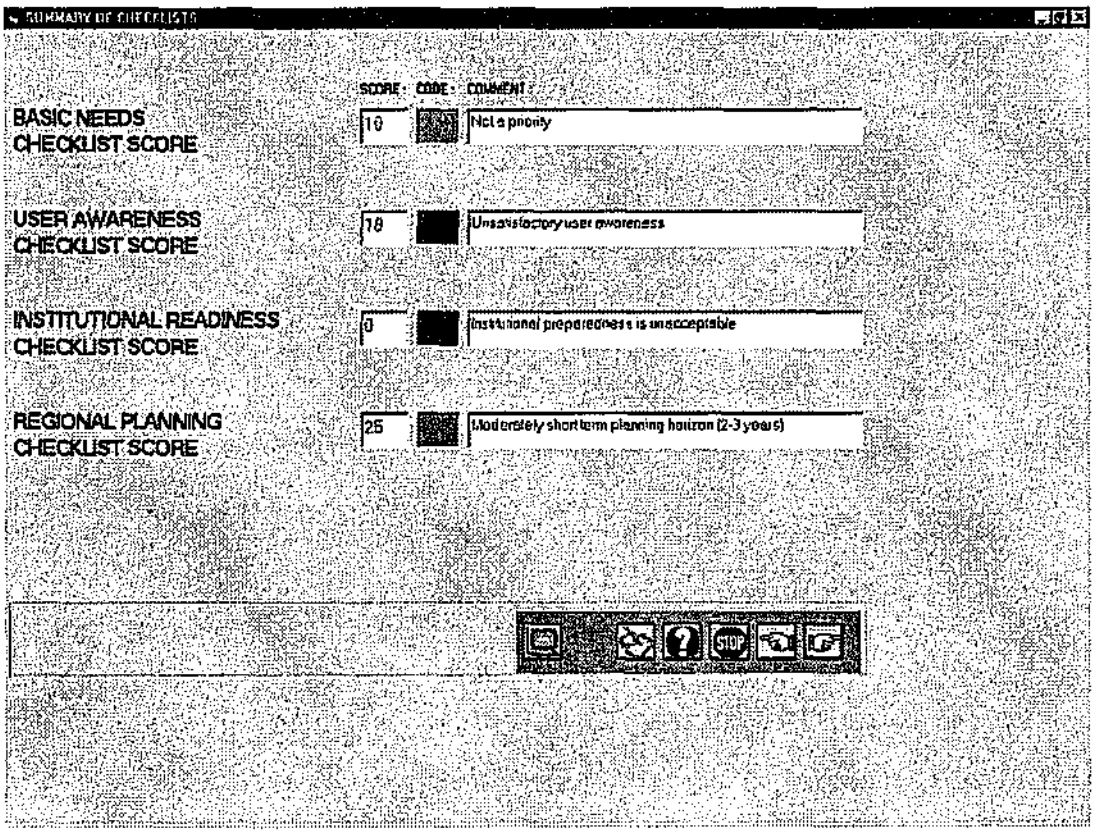
(iii) User Awaresness Checklist



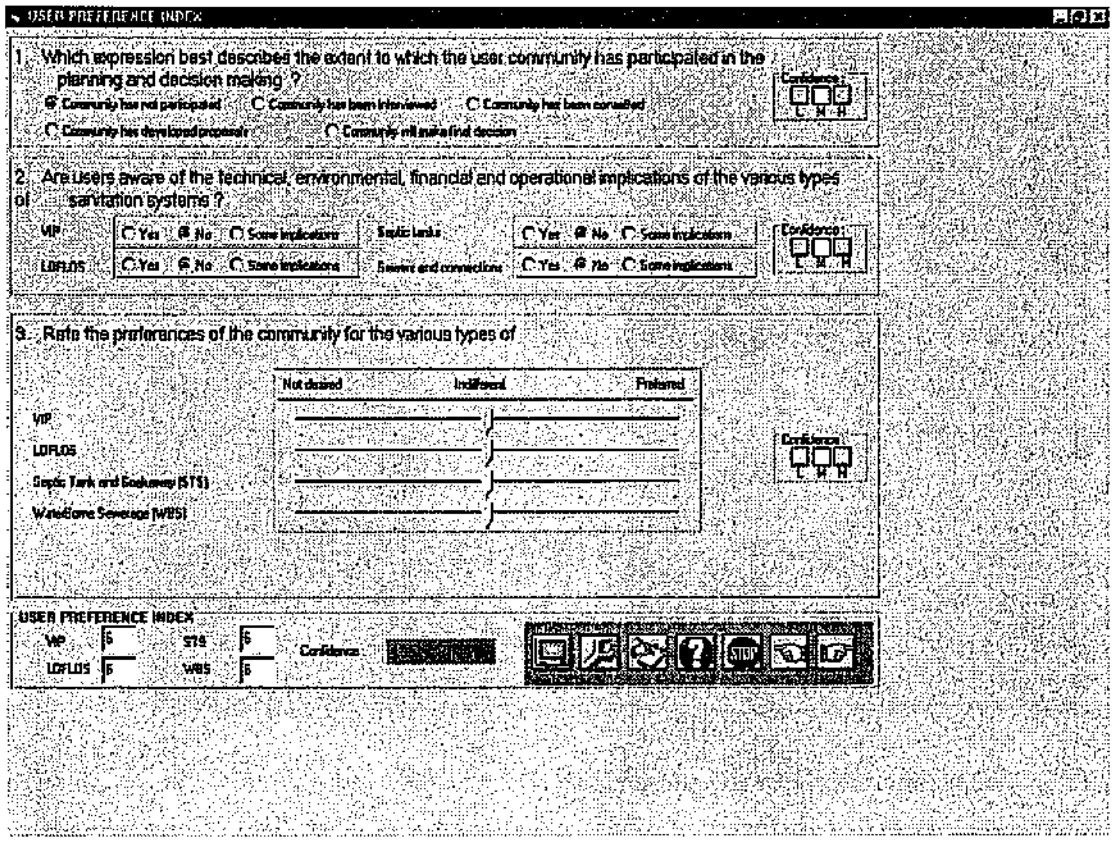
(iv) Institutional Readiness Checklist



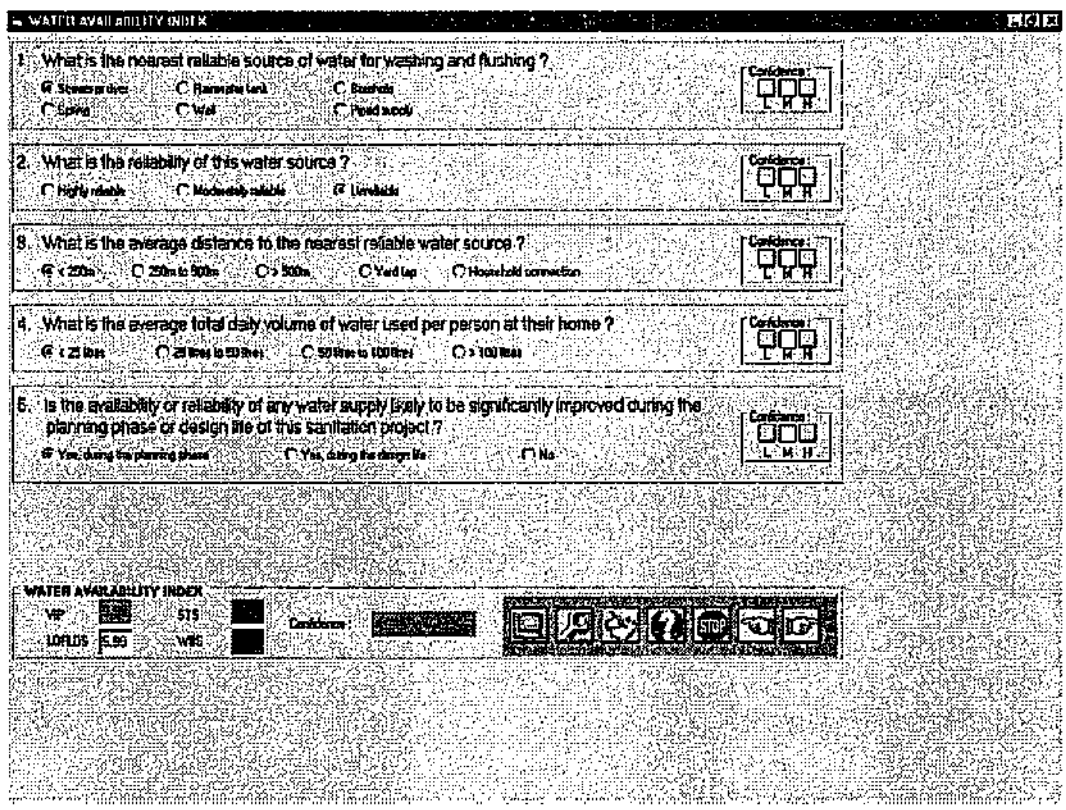
(v) Regional Planning Checklist



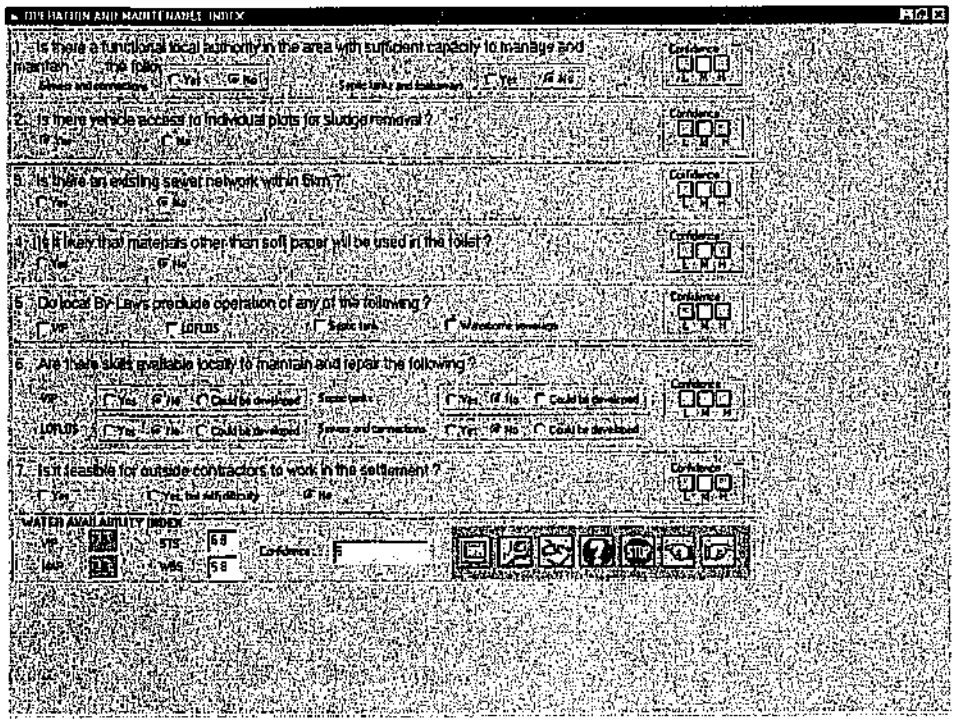
(vi) Summary of Checklists



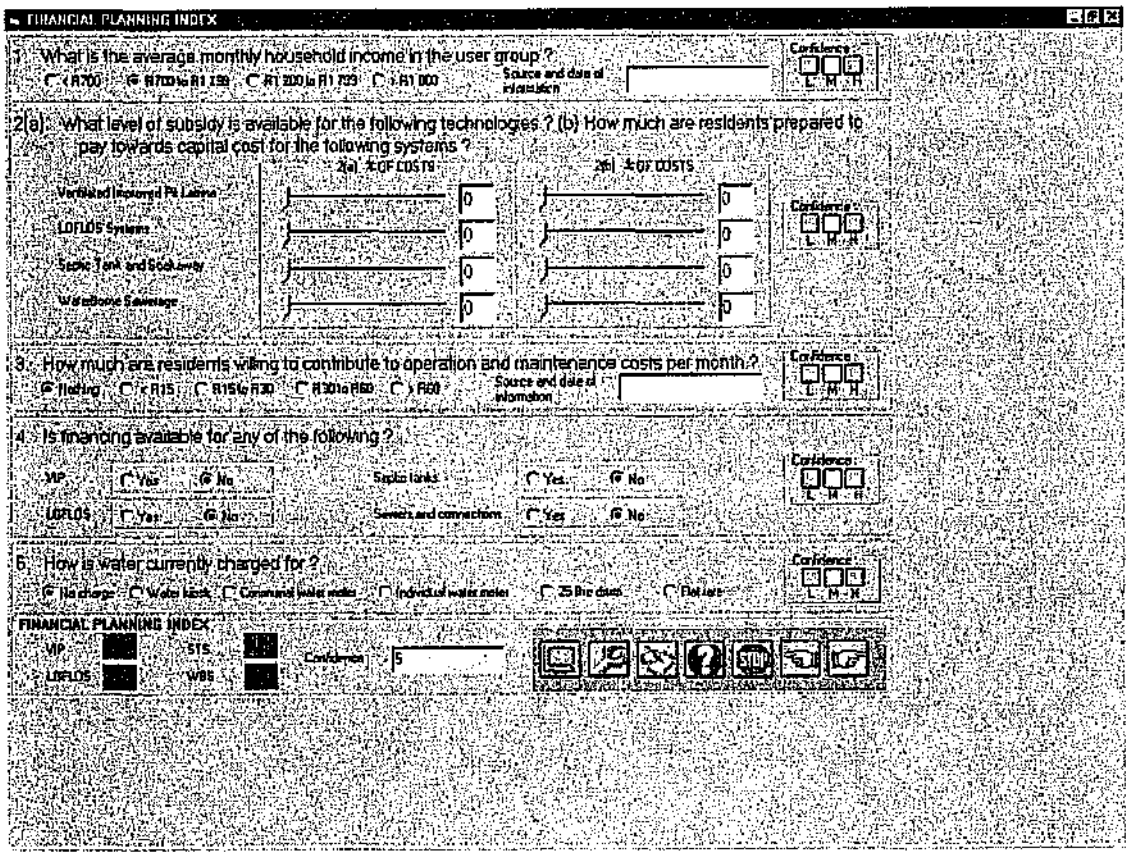
(vi) User Preference Index



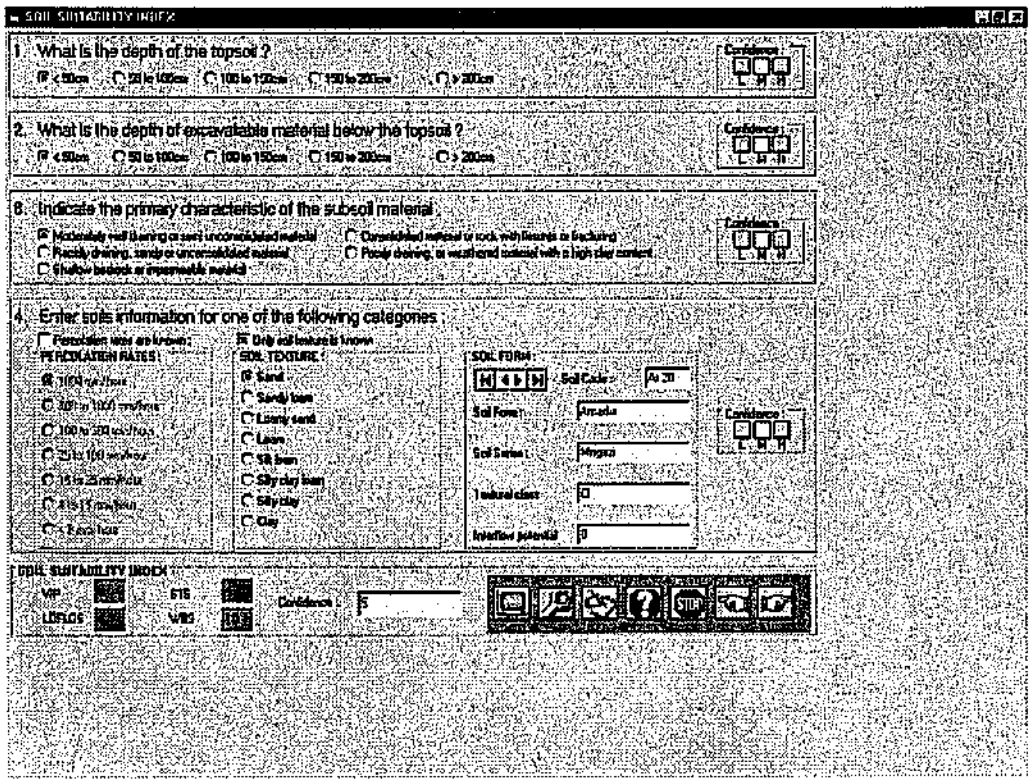
(vii) Water Availability Index



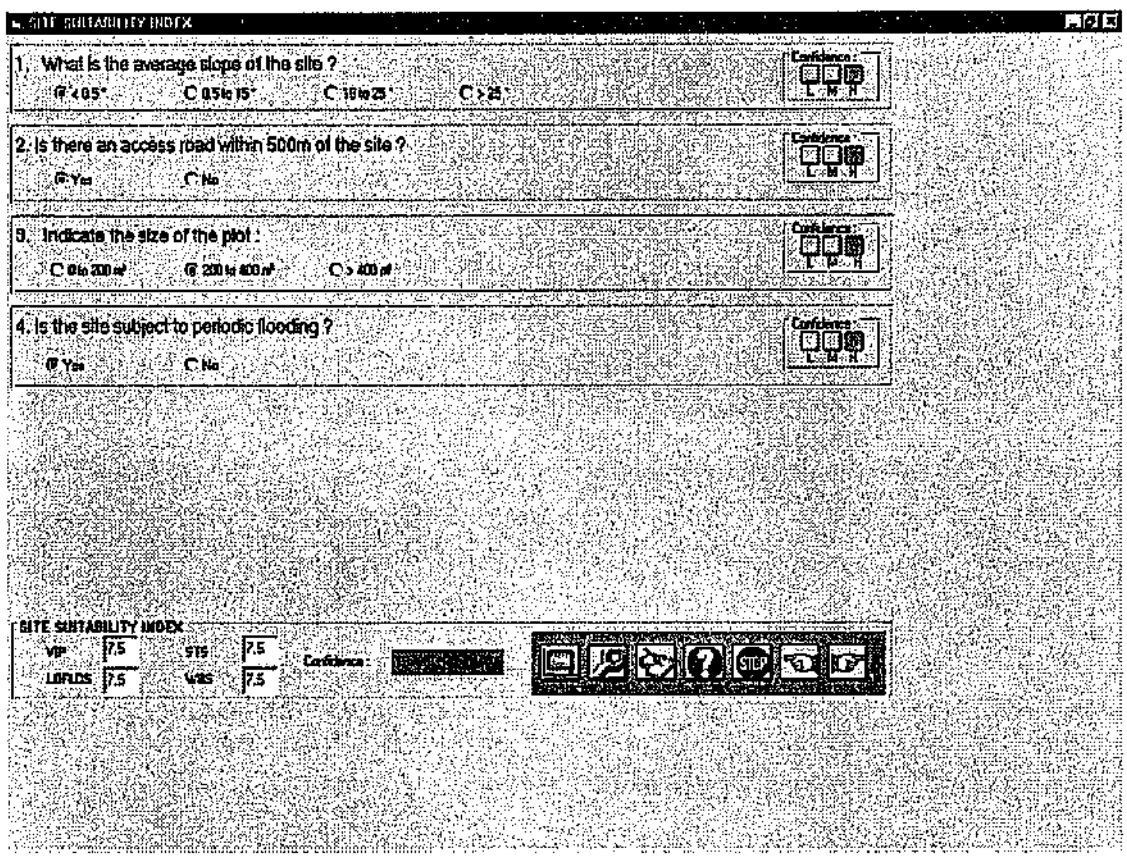
(viii) Operation and Maintenance Index



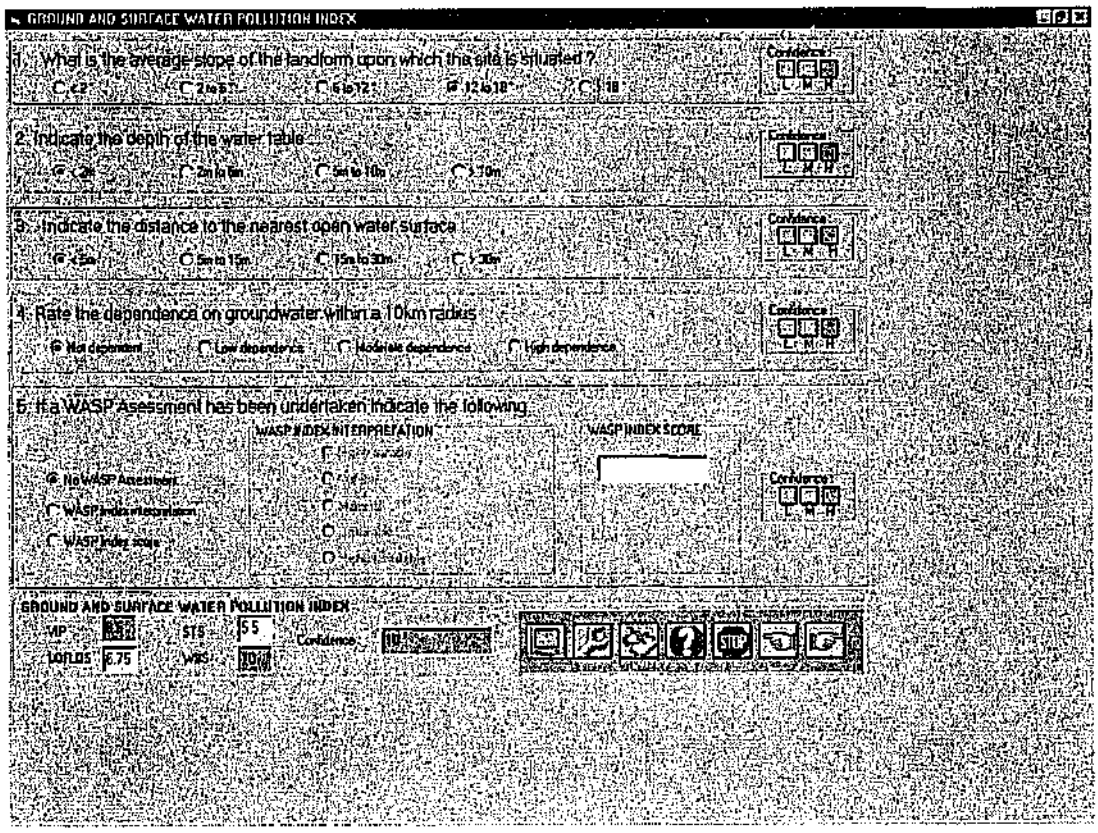
(ix) Financial Planning Index



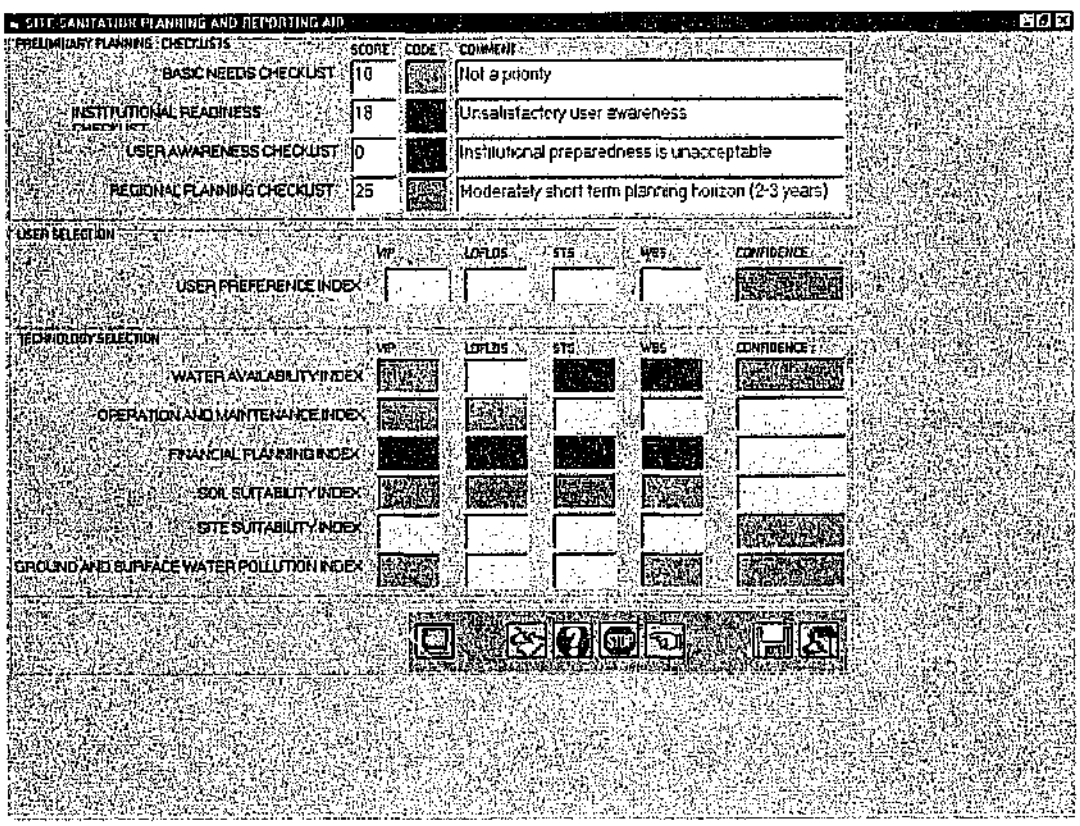
(x) Soil Suitability Index



(xi) Site Suitability Index



(xii) Ground and Surface Water Pollution Index



(xiii) Site Sanitation Planning and Reporting Aid