

IWMI-TATA WATER POLICY RESEARCH PROGRAM

ANNUAL PARTNERS' MEET 2002

Tank Rejuvenation in Karnataka

Why it should be a Community Based
Approach?



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Management Institute**

This is a pre-publication discussion paper prepared for the IWMI-Tata Program Annual Partners' Meet 2002. Most papers included represent work carried out under or supported by the IWMI-Tata Water Policy Research Program funded by Sir Ratan Tata Trust, Mumbai and the International Water Management Institute, Colombo. This is not a peer-reviewed paper; views contained in it are those of the author(s) and not of the International Water Management Institute or Sir Ratan Tata Trust.

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Tank Rejuvenation in Karnataka: Why it should be a Community-based Approach

K.V.Raju

Background

The Decline of Tank Systems: The southern Indian State of Karnataka is dotted by 36,672 tanks with a potential command area of 6,90,000 ha. These tanks have an irrigation command area of less than 2,000 ha with 90% having a command of less than 40 ha. The actual area irrigated by these tanks have shown a consistently declining trend with the current irrigation at 2,40,000 ha. This is only 35% of the total potential. Figure 1.1 depicts this declining trend.

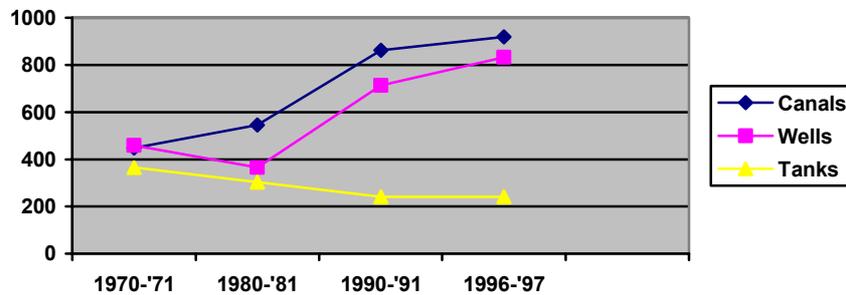


Figure 1.1

The decline in these multipurpose rainwater harvesting structures have its crucial impact not only on the economic scenario of rural Karnataka but have far reaching impacts on socio-cultural and environmental aspects. In spite of the fact that the decline of tank irrigated area is a common phenomenon through out the country, for Karnataka it assumes greater significance. While the national average irrigated area is around 32%, Karnataka has only 20% of its net cropped area under irrigation. The problem is compounded by the fact that 54% of the geographical area of the state is drought-prone compared to only 16% in the country. The improvements of the tank system is critical to enhance the utility of these tanks in the dry areas for supplementary irrigation. This will also help meet drinking water problems as well as recharge underground water. The reasons for the neglect of tank system can be summarised as follows:

- The abolition of ownership rights over private tanks and take over of *Zamindari* tanks by the government.
- The declining capital expenditure and lower allocations for maintenance and repairs on tank system.
- Poor management of integrated tank system, including its structures and distribution system.
- Involvement of multiple agencies and lack of coordination among them.
- Increased access to alternative sources of water (both surface and groundwater) and method of extraction and government's support on massive scale for groundwater extraction.

- Political interference laced with poor technical capabilities in location and construction of new tanks and their size hampered the water regulation and capacity of centuries old upstream/downstream tanks in recent decades.
- Growing conflicts between tank bed cultivators (including unauthorised) and command farmers.
- Increased control by the government agencies with accountability.
- No accountability and control by local communities, and
- Lack of government policy and programme support for traditional water management institutions and their neglect.

Other reasons for the decline in the tank area and poor management of its structure can be broadly classified into social and economic factors as follows:

Table1: Social and economic factors responsible for the decline in the tank area

Social	Economic
<ul style="list-style-type: none"> • Though the tanks exist geographically in the village vicinity, its control and administration has moved to a distant place. For those who control them from a distance, the tank is merely a physical object and a source of revenue. • There is a shift of authority from the visible local community to the invisible government. • Emergence of livelihood patterns that are increasingly independent of tank-based occupations. • Siltation and encroachment of the tanks, and the neglect by local communities and by the authorities located at a distance. • Commodification of water has increased owing to less and difficult access to tank water as common property. Now individuals, who own water extraction mechanisms (like tubewell, diesel engine) control water more. • Breakdown of the values attached to tank and tank water. • Cumulatively, a decline (if not disappearance) of the community interests in maintaining the tanks. 	<ul style="list-style-type: none"> • Changed user expectations from the tanks owing to emphasis on increased food production, high yields supported with major irrigation projects and regular canal water supplies, and better controlled tubewell water use. • State's shift in emphasis (in terms of financial investments and agricultural production) on major and minor irrigation. • Heavy subsidies in power supply for irrigation pumpsets, and discounted loans to install tubewells have nearly killed the community initiatives, and indigenous knowledge, while increasing farmers' dependence on government support. • Inadequate financial allocation for operation and maintenance of tank projects. • Declining attention and investment on tanks owing to little scope for rent seeking.

Present Management of Tanks: Of the 36,672 tanks in the state having a command area of 1 ha-2,000 ha, those tanks irrigating less than 4 ha are owned by the Grama Panchayats, those irrigating 4 ha-40 ha are owned by Zilla Panchayats and those tanks irrigating 40 ha-2,000 ha are owned by the Zilla Panchayats. The remaining tanks having a command area of over 40 ha and less than 2,000 ha are owned and managed by the Department of Minor Irrigation and those above 2,000 ha are with the Department of Major Irrigation. The size-wise distribution of the tanks is given below.

Table 2 :Distribution of Tanks in Karnataka according to Catchment Area

Sl.No	Command Area	Percentage of Tanks
1	Below 4 hectares	41%
2	4 to 20 hectares	42%
3	20 to 40 hectares	9%
4	40 to 200 hectares	7%
5	Above 200 hectares	1%

The Department of Minor Irrigation with its huge army of technical and administrative staff deployed at various levels is not able to properly maintain the tanks attached to it. The reasons attributed for this are many and varied. The Department feels that there is inadequate staff deployment. There is also paucity of funds for undertaking proper maintenance of these structures especially for those managed by the PRIs. There is very little involvement of the actual users in the upkeep and maintenance of the tank systems. The tank management is reckoned as a job of these agencies and involves only the engineering skills.

Small tanks with less than 4 ha command area, were always managed by the taluk board. There was hardly any improvement or maintenance of tank system by the Panchayat institution. As of now in the absence of any budgetary provision, the onus responsibility of tanks irrigating less than four hectares is ambiguous. Whether such small tanks are the responsibility of ZP or TP or GP is not clear. Multiple Government agencies like departments of Fisheries, Forestry, Mines & Geology, Revenue, Agriculture and horticulture still have a role in tank systems, in particularly so in the tanks having a command area above four hectares.

General Agro-Climatic and Geo-Physical Status of the State: Karnataka State is the eighth largest State in India, both in area and population. The State has an area of 19.18 million ha and is divided into 27 districts. According to 1991 Census, the total population of the state is 44.90 millions. The State accounts for 5.84 percent of total geographical area and 5.32 percent of total population of the country. Majority 965 percent) of the state's population is dependent on agriculture with the total number of holdings accounting to 57.76 lakhs with an average holding of 2.13 ha. The overall population density of Karnataka works out 235 persons per sq.km, while the literacy rate of the State stands at 56.05 percent (1991 Census).

Physiographically, the State can be divided into four regions viz., (i) The Coastal region; (ii) The Malnad (hilly); (iii) The Northern Plains; and (iv) The Southern Plains. The two important river systems of Karnataka are Krishna and its tributaries in the North and Cauvery and its tributaries in the South. A number of smaller rivers flow westward into the Arabian Sea. Of these, Sharavathi, Kalinadi, Netravathi are important as they are being tapped for hydroelectric power.

Karnataka State as per Agro-climatic Regional Planning by Planning Commission, Government of India, falls in the Zone X (Southern Plateau and Hills Region with 15 districts). Further, Karnataka has been divided into 10 agro-climatic zones based on climate, topography, soils and vegetation. The State has varying climatic conditions. Generally tropical and sub-tropical weather conditions can be observed. The normal rainfall in the State is 1139 mm, most of which is received during southwest monsoon

during Kharif season (June-September). The annual precipitation varies widely from 569mm in Bijapur district to 4029 mm in Dakshina Kannada district.

Of the total geographical area of 19.04 million ha, 3.06 million ha (16.1 percent) land is under forest while 2.05 million ha (10.7 percent) is not available for cultivation. During 1995-96, the Net Sown Area (NSA) was 54.7 percent of the total geographical area. The average size of the operational holding is 2.13 ha and is larger by about 36 percent than the all-India average of 1.57 ha. The total irrigation potential created up to March 1996 was 3041 million ha. 21 blocks in the state have been categorized as “Dark Area” and 22 Blocks as “Grey Areas”. About 22 percent of the Net sown Area (NSA) in the state was irrigated in 1994-95. However, while in districts like Dakshina Kannada, Shimoga and Mandya 40 percent of NSA are under irrigation, the districts like Kodagu, Chickmagalur, Bidar and Gulbarga have very low level of irrigation. The proportion of Net Irrigated area (NIA) to NSA increased from about 11 percent (1970-71) to 24 percent (1994-95).

Existing Institutional Environment

The approach to natural resource management in India has generally tended to ignore community involvement and participation and the need for a holistic approach to land and water management. Consequently, the outcomes from natural resource management issues have been neither effective nor sustainable. Moreover, the top-down approach has often curtailed the rural poor’s access to natural resources.

These issues are evident in the management of tank systems in Karnataka. Traditional forms of tank management have been undermined as communities have become increasingly dependent on the State for tank rehabilitation. Integrated planning and management of the entire tank system has not been adequately adopted by GOK nor communities. Consequently, as experienced under the World Bank-funded Tank Irrigation project (1981-1989) the outcomes were poor and unsustainable. (see section D1) The importance of identifying tank stakeholders correctly, providing a forum for them to negotiate their rights on the tank, and reviving community based practices of tank management are priority issues to be considered by the project.

A tank, and its associated catchment, is characterised by the area it irrigates by gravity and the catchment area it drains. Responsibility for operating and maintaining tanks including ownership is based on the size of such tanks. The tank irrigation sector consists of a number of tanks located throughout the State, irrigating from 1 to 2,000 ha. Tanks irrigating less than 4 ha (10 acres) are owned by the Grama Panchayats (GP). Tanks irrigating more than 4 ha but less than 40 ha (100 acres) are owned by the ZPs. Tanks irrigating more than 40 ha but less than 2,000 ha (5,000 acres) are owned by DMI. The first two categories of tanks are managed should differ (at times dramatically) depending on the size and ownership of the tank. There is apparently no coordination or common strategy to deal with issues related to tanks. (Note: GoK is attempting to address this issue through the recently formed JSYS). Furthermore, the organisational structure of DMI is dominated by engineers with no representation from environment, social, economic or other related disciplines. A top-down management system persists in tanks managed by DMI without any formal involvement of the community in water management.

Need for the Institutional Reform

a) Decentralisation: Karnataka has received some acclaim as a mature state in terms of decentralization as policies for political decentralization are already in place; however, reality emerging from the field is much less encouraging. Deeply entrenched and inequitable social practices have limited efforts to bring about democratic governance. Moreover, the role of PRIs (especially in relation to community level user groups) in the management of natural resources and in the implementation of other rural development activities is not clearly defined. Providing clarity on the respective roles of user groups, PRIs, and line departments, in a specific situational context, is also a priority issue.

b) Government Strategy: In light of the above issues, GoK's evolving strategy is to initiate a process to transfer management of all tanks in Karnataka to communities. They expect to do so after ensuring that the institutional arrangements are in place and resources are made available for this transfer to be successful and sustainable. As a first step, they intend to transfer all 3,000 tanks (having a command area of over 40 hectares) from the Department of Minor Irrigation to the Jala Samvardhane Yojana Sangha (JSYS) along with the requisite technical and support staff to replicate the community participation process initiated by JSYS in the remaining tanks in a phased way. JSYS is a registered society entrusted with the responsibility of developing and implementing community-based approaches to water management in tank and groundwater systems. PRIs would continue to oversee the 34,000 tank systems entrusted to them but the project would help communities assume management of a subset of these tanks as well. Certain rights to the tanks (the type and extent to be defined during preparation) would then be progressively transferred from JSYS or PRIs to communities. The specific rights associated with this conditional ownership are being defined. GoK views the Bank-financed project as supporting this process by helping develop and strengthen village-level user group institutions and clarify the roles and responsibilities of PRIs. GoK established JSYS to facilitate this process during the transition period.

The proposed constitution of the WRDO has important implications for the project concept.

- The Sector Policy and Reform component would shift its focus to supporting the development of this new WRDO and the SWB with the same aims outlined above;
- The investment components of the project would remain focussed on the tank improvement programme, representing the first investment in a possible long-term strategic programme of reform and development for water resources and irrigation; and
- The concentrated effort on the minor irrigation unit within the new WRDO outlined above would not be diluted. Rather, the scope of the component would be broadened to encompass the essential first steps in strengthening the newly formed WRDO and in providing support to the new SWB. The additional activities would include sub-basin planning, capacity building, knowledge building including management information systems, and modernisation of the functioning of the WRDO.

Project Design

Project Objectives: The project development objective is to improve rural livelihoods and reduce poverty by developing and strengthening community-based approaches to managing selected tank systems. The project aims to demonstrate the viability of a new community-based tank improvement and management approach by developing, testing, and implementing it on a pilot basis. If successful, the project would provide a useful model for scaling up this innovative approach statewide. The poverty focus of the project is based on geographic targeting of taluks across the state with a high incidence of poverty. Within the selected taluks, the selection of individual tank systems will be based on community level commitment and receptivity.

The project impact/outcome indicators are:

- a community and PRI-based, self-supporting tank management institution in place and functioning;
- Meaningful participation of traditionally marginalized stakeholders;
- Agriculture production (productivity and area) in the tank command increased; and
- Household incomes of the local stakeholders increased.

Project Scope: The project is located in eastern and northern Karnataka State and aims to rehabilitate selected tank systems in 34 taluks in nine districts. These districts cover most of the eastern and northern areas of the state on the western extremity of the Deccan Plateau. Districts are well distributed over six of the 10 agro-ecological zones that occur in the state. Terrain slope is mostly moderate (less than 10%) with elevation ranging from 300 to 900 m. above sea level. There are approximately 3,500 tank systems within the project area. It is expected that the number of tanks to be rehabilitated will be in the order of about 2,000.

Project Districts: The proposed project area targeted for tank rehabilitation has been determined by selecting nine districts in the state that exhibit the following attributes: a) high incidence of poverty; b) female illiteracy; c) SC/ST population; d) non-working population; and e) significant number of minor irrigation tanks. Tank systems located in the Cauvery basin will be excluded from the project, to avoid any potential opposition from Tamil Nadu and possible contravention of the Cauvery Tribunal Award and ongoing review process. The following figure shows the districts selected for implementation of the project. The project districts coming under the Karnataka Watershed Development Project and Second Karnataka Rural Water Supply and Sanitation Project are also depicted in the figure.

economic returns to investment. Investments may range from tank rehabilitation to improvements in crop production to multiple uses of the tank. The following will factor into the calculation of economic returns:

- Hydrological considerations: frequent surplusing tank; rapidly depleting groundwater table in the command;
- Tanks located within watersheds covered in the other Bank-assisted project: tanks in watersheds targeted in the other Bank-assisted project where catchment area treatment or other complementary investments to improving the performance of the tanks are considered
- Positive environmental externalities: tanks where rehabilitation in the form of desiltation or catchment area treatment would address environmental problems such as waterlogging, salination, etc.
- Cluster of tanks amenable to treatment under a sub-basin approach resulting in an optimal utilisation of water

The weight to be applied to each of the above criteria or if certain criteria are absolute (ie., they must be fulfilled for a tank to be selected) have yet to be ascertained. It was agreed that these issues would be discussed during the course of project preparation but would be agreed upon before appraisal.

Project Approaches and Strategies

Community Participation and Mobilisation: Though Karnataka has a traditional history of management of irrigation systems by communities (the Vijayanagar channels are often cited), community involvement has deteriorated over time – in large part because of the increasing direct involvement of government. Presently there has been little or no community participation in decision-making or in the management of irrigation water supply. A related issue is the unequal distribution of irrigation benefits biased towards powerful interests within a community. This control of benefits has often led to further marginalisation of vulnerable groups.

The project has been designed for achieving meaningful participation of all stakeholders including vulnerable groups. Tank system is being identified as a common property natural resource and the different user groups are properly identified and an equitable distribution of benefits will be ensured. The project will employ Community-Driven Development approach that provides for representative and transparent decision-making processes within the Tank User Groups and Tank User Committees. The communities participating in the project will be socially mobilised to form Tank User Groups and Tank User Committees, who plan and implement Integrated Tank Development Plans. The communities share a part of the capital cost of investment and assume full operation and maintenance responsibility for the tank system. The project will have capacity building support to empower the communities in strengthening their capacities in planning, implementing and monitoring the project activities.

Holistic and sustainable management of tank systems and their micro-catchment/watershed: GoK recognises the importance of tank rehabilitation, however, no holistic planning or management has been contemplated for the sustainability of the benefits in the past. Improvement of the catchment of the tanks to reduce inflow of the silt has not been considered as an integral entity of the tank

rehabilitation package nor the need for hydrological analysis based on past data and available technology. Moreover, the linkages between irrigation and agriculture, horticulture, safe drinking water, etc. need to be more clearly established to help ensure that improved water management translates to concrete improvements in livelihoods.

The project would support GoK in adopting a community-based watershed/sub-basin approach in planning and implementation to integrate all uses of water and water resources in the watershed/sub-basin. This will include explicit consideration of catchment area treatment, fishery development, groundwater recharge, and improvement in rural water supply availability, etc. The project will pilot such planning in selected sub-basins in its initial phase for their replication in other sub-basins during the remainder of the project.

The project provides for preparation of an Integrated Tank Development Plan for each and every tank to be improved covering the entire tank system including ground water recharge, catchment treatment, on-farm development, and fisheries development with necessary upstream-downstream linkages. The ITDP is generated out of a consultative process by involving all stakeholders and hence minimise conflicts by identifying and mitigating potential externalities that may occur.

Knowledge Management: In order to have a productive, equitable, and sustainable system, it is important to have a comprehensive knowledge base. A useful start can be made on this knowledge base by accessing several databases available within various GoK departments, GoI departments working in Karnataka, and commercial enterprises. The most pressing need is to analyse the already available data in a Geographic Information System. Survey of India and Satellite data should be digitalised to have mini-basin maps. It is necessary to know where these tanks are located within a water shed to have an idea about their inter-relationships. Analysis of information contained in this database would enable the TUG/TUC to manage their resources wisely. The project will assist GoK in developing a database related to water resources in general and tanks in particular through modern techniques such as GIS/remote sensing and development of a MIS system for selective access of the database. With the belief that transparency strengthens accountability, “good governance” would be a key aspect to be addressed under this project, starting with the public availability of information at project sites.

Rural Decentralisation: Karnataka is a matured state in terms of decentralisation as policies for political decentralisation are already in place. The project places significant emphasis in integrating the role of Panchayati Raj Institutions in tank improvement. The different tiers of the PRIs in the state will have a facilitating and monitoring role in the project. A Joint Committee set up under the Karnataka Panchayati Raj Act with representatives from the lower tier PRIs and Tank Users Committees will establish this linkage.

Synergy with Karnataka Watershed Development and Karnataka Rural Water Supply and Environmental Sanitation Projects: The watershed Development Project is operating in five rainfed districts of Chitradurga, Dharwad, Haveri, Kolar and Tumkur. The Watershed Project and the Tank Project will overlap in 4 districts. The Second Karnataka Rural Water Supply and Sanitation Project is expected to operate in

10 northern districts of Karnataka. All 3 projects proposed to create user groups for management of project activities at the local level both during and beyond project period. The projects use common Community Driven Processes aimed at stakeholder consultations, community participation, focussing poor and vulnerable groups, promoting capital cost recovery and full responsibility of operation and maintenance.

The two-tier selection process in the tank project (first level based on poverty focuses criteria through a talukawise analysis) and the second based on demand driven (community ownership) approach will be based on analysis on a cluster of tanks/sub-basin strata. The first criteria would look into aspects such as talukawise socio-economic profile, drought condition, riparian issues etc., whereas the second set of criteria would look into tank specific socio-economic indicators, strong local ownership, tank encroachment issues, positive environment externalities, amenability to sub basin-wise treatment, hydrological issues etc. The investment under the project will, therefore, has a strong linkage on the selection of tanks through such process. Wherever the finally selected tanks/group of tanks lie in a watershed coming under the purview of the “Watershed Project”, there will be suitable dovetailing of the activities under the two projects.

In addition, mechanisms should be evolved for effective institutional and financial coordination in the overlapping areas in different levels (village, micro-watershed, taluk, district and state). A subcommittee consisting of Secretaries and Executive Director/Directors of Watershed Development Department, Rural Water Supply and Sanitation and Water Resources (Minor Irrigation)/JSYS and chaired by the Additional Chief Secretary/Development Commissioner should be constituted to develop and refine these mechanisms.

State’s Strategy on Tank Management

Fully realising the reasons for the neglect and degradation of tank systems in Karnataka, Government of Karnataka has taken measures to enhance the access of farmers and other users of the tank system access to tank system. This will be mainly by abolishing the current top-down approach that increasingly make the rural communities dependent on the state for tank rehabilitation. With the objective of instituting the sustainable tank management system, Government of Karnataka is committed to embark on programmes that will substantially increase participation of all important stakeholders in the management of the tanks and also resorting to an integrated planning and management approach considering the tank in its totality with a holistic approach to land, water and ecosystem management.

As an evolving strategy of initiating a process of reforms in the tank management, Government of Karnataka has taken a bold decision to transfer management of all tanks to communities in a phased manner. GoK created Jala Samvardhane Yojana Sangha (JSYS) as an autonomous and independent society with the following major objectives:

- (i) To develop, conserve and strengthen water sector through participatory system in tanks and ground water to improve livelihoods of the rural people
- (ii) To facilitate community-driven approach in all aspects from project preparation to its implementation

- (iii.) To promote and undertake efforts for integrated interventions and operational convergence in related sectors, viz., Agriculture, Horticulture, Sericulture, Forestry, Animal Husbandry, Fisheries, Ground Water Management, Watershed Development and other related departments
- (iv.) To plan, promote and organise activities of capacity building including awareness campaigns, kalajathas, farmers melas and other programmes
- (v.) To develop guidelines for planning, implementation, monitoring and evaluation

As a first step in transferring the tanks to communities, Government of Karnataka intend to transfer 300 tanks having a command area of over 40 ha from the Water Resources Department to JSYS. Panchayati Raj Institutions will continue to oversee about 34,000 tank systems entrusted to them. GoK will like to help communities to resume management of some of these tanks to the communities. The ultimate objective of the policies of GoK tank systems is to progressively transfer the management, operation and management of all the tanks to the communities. The GoK has set up a committee to frame draft participatory irrigation and management act for tank systems with the following Terms of Reference.

- (i.) To frame the Participatory Irrigation and Water Management for tank systems with a clear vision for future
- (ii.) To undertake all necessary steps directly or indirectly associated in framing such law

Related Bank Projects: Government of Karnataka's commitment to strengthen community participation in water and other natural resources is also evident from the successful completion of the project preparation for the proposed two projects for Bank assistance: a) Karnataka Watershed Development Project; and the Second Karnataka Rural Water Supply and Sanitation Project. These two projects have key common design features like community consultation and participation, focus on the poor and other vulnerable groups of the society, promoting cost recovery, creation of user groups for project activities at the grass roots, linkages with Panchayati Raj Institutions etc.

Implementation Arrangements

Government of Karnataka commissioned Indian Institute of Management, Bangalore to undertake a detailed study to propose the institutional framework most suitable for managing the project. The study team carried out extensive fieldwork and stakeholder consultations before coming up with the recommendations of the institutional aspects. The study analysed the field realities and various legislative and legal framework and suggested the institutional framework. Several important institutional issues have been examined on JSYS, Panchayati Raj Institutions, tank users etc. with respect to governance structure, roles and responsibilities, inter-linkages and domain of activities, accountability arrangements etc. Considering the innovative nature of the proposed community based approach, JSYS is piloting improvements in selected tank systems and the key learning from this have been utilised to frame the institutional arrangements.

Some key features of the proposed implementation arrangements are to:

- Develop and strengthen local water institutions which would be involved in participatory assessment and implementation of tank improvement activities;
- Establish open and effective links between the communities and the PRIs;
- Bring different GoK line departments (eg. minor irrigation, agriculture, rural water etc.) to work together;
- Involve line department staff, PRIs, and NGOs in a collaborative manner;
- Build capacity in DMI and the ZPs to replicate the proposed approach to tank improvements to tanks not supported directly by the project; and
- Design and operate an outcome-driven, participatory monitoring and evaluation system

Project Components: The project would consist of three components:

- Establishing an enabling, environment for the sustainable, decentralized management of tank systems (e.g. TA and studies to strengthen the policy, planning, and legal environment; training and capacity building of NGOs, PRIs, JSYS; project administration);
- Strengthening community-based institutions to assume responsibility for Tank System Management (e.g. formation and strengthening of community level institution for tank management, mechanisms for inclusion of vulnerable groups, planning and preparation of the ITDP); and
- Undertaking tank system improvements: (a) improving the operational performance of selected tank systems through a menu of physical interventions identified and executed by local users (e.g. desiltation and use of silt; rehabilitation of distribution systems; limited catchment area treatment) and (b) facilitating related agriculture, horticulture, fisheries, rural water supply etc. development to help ensure that improved water management is translated into increased household incomes.

As part of the background study, the JSYS has sponsored a study on social and environmental assessment of some selected 50 tanks. The summary presented in the following sections is the outcome of the study, and presents the field observations, findings, issues and strategies for the effective implementation of the proposed project.

Rationale for the SEA Study

- ***Community Participation and Mobilisation:*** The community involvement has almost disappeared over time in large part because of the increasing involvement of government in its role as a welfare state. A related issue is the unequal distribution of irrigation benefits biased towards powerful interests within a community. This control of benefits has often led to further marginalisation of vulnerable groups.
- ***Holistic and Sustainable Management of the Tank Systems and their Micro-Catchment/Watershed:*** The Government of Karnataka recognises the importance of tank rehabilitation. However, no holistic planning or management has been contemplated for the sustainability of the benefits.

Neither the improvement of the catchment of the tanks to reduce inflow of the silt has been considered as an integral entity of the tank rehabilitation package nor the need for hydrological analysis based on past data and available technology. Moreover, the linkages between irrigation and agriculture, horticulture, safe drinking water, etc, need to be more clearly established to help ensure that improved water management translates into concrete improvements in livelihoods.

- ***Lack of Clear and Comprehensive Policy and a Sub-sector (minor irrigation) Strategy:*** The minor irrigation sector requires a coherent strategy for development. The linkage between this sector and the major irrigation sector appears weak. Tank improvement and management have not been dovetailed into overall improvement programmes of the watershed/sub-basin to integrate all uses of water and all available water resources to maximize benefits. Issues such as improvement of the groundwater regime to enable conjunctive use, catchment area treatment to prevent/reduce further siltation, integrating fisheries programmes, strong irrigation-agriculture extension, etc., have not been considered in the planning process. Moreover, involving communities (water users' cooperative societies, PRIs, and their inter-linkages, etc.) in the planning, implementation and management of the tank system has not yet been comprehensively described.

Generally, a tank desiltation project does not include sufficient catchment treatment and management measures to arrest the processes of progressive degradation directly affecting the tank. Where tanks are clustered within a catchment or watershed, an integrated approach encompassing the entire catchment or watershed will provide economies of scales to this sub-component, increasing the sustainability and overall performance of the tank system. Investments are necessary to ensure increased and more reliable water availability, thereby bring about concrete improvements in rural livelihoods. Such investments have to be followed by a meaningful participation by people in the project design, implementation and management.

The major objectives the SEA study are: a) Identifying key stakeholders, evolve strategies for sustained stakeholder participation process; b) Evolving baseline information for key environmental and social parameters as part of project implementation; c) Identification of the detailed positive and negative social and environmental impacts of the proposed project activities and suggest measures to enhance the positive impacts; d) Identification of vulnerable groups and the role of women in the proposed project; e) Developing social and environmental screening framework; f) Identifying institutional issues and suggestions for skill-mix, staffing, and capacity-building needs; g) Evolving institutional framework for project implementation; h) Policy and regulatory environment relating to the ITDP and suggestions for improvement; i) Developing a framework for monitoring and evaluation to enhance project design, decision-making, stakeholder participation and evaluation; j) Evolving plans for gender strategy and action plan, environmental management, pest management, resettlement action plan framework, and indigenous people development plan; and k) Developing tank profiles to illustrate environmental and social issues.

Methodology

The study used a combination of different methods for the purpose of data gathering and consultations. They included Exposure visits, Participatory Transect Walks, PRAs and Focus Group Discussions, Questionnaire canvassing, Consultations with SC and ST members of the community and with the officials of various line-departments, PRAs with community leaders. To validate the findings and our understanding of them, there were a series of internal and consultative external reviews, and feedback workshop involving members of the village communities, representatives of NGOs, experts and state government officials. The tanks and villages for the study were selected based on a list of tanks provided by the JSYS. For the purpose of preparing an R and R Acton Plan and IPDP, the study team revisited six villages for a detailed survey of the PAFs.

A series of methodological discussions were held with the Representatives of the World Bank, JSYS and members of the faculty within ISEC. A list of 50 tanks to be studied by different teams was prepared by the JSYS, which became the basis for the selection of tanks. These sample tanks are spread out in 17 taluks shared by 12 districts and covered by 10 agro-climatic zones of Karnataka state. The selection of the taluks by the JSYS has been made based on the indicators such as: per cent of population below poverty line; per cent of female literacy; per cent of landless and marginal farmers; per cent of scheduled castes and scheduled tribes; density of tanks; per cent of area irrigated by small farmers in the tank area. Two important considerations guided the team in selecting the tanks within these taluks for the study: a) size variation and regional variations; and b) list of tanks given by the JSYS. Further, the selected tanks are sensitive to some of the factors like: a) variation in the nature of community control or use pattern of the tank (single village or multiple village communities as stakeholders at the collective level); b) villages with substantial proportion of families belonging to vulnerable sections of society such as the SCs, STs and similar other groups; c) dependence of the different occupational groups in the village community upon the tanks (those engaged in animal husbandry, brick making, pottery and other traditional occupations associated with caste communities and being influenced by market forces); d) tanks in which indigenous methods and patterns of management are present or those in which they have begun to disappear in the recent past.

Out of the given 50 sample tanks, more than 40 per cent of the tanks are located at a distance of less than 10 kilometers to an administrative headquarter (town, or Gram Panchayat). About 44 per cent are actually located in the village that is either a Gram Panchayat or revenue Hobli Headquarters. Making use of the Census maps preceded the process of identification of the sample villages.

The following summarises the major steps followed as part of the methodology in the SEA Study:

Selection of tanks: A list of 50 tanks with details of names of the tank, the location, area under the tank and basis was provided by JSYS. In all, 50 tanks were visited by the team in 49 villages, as there is more than one tank in one of the villages. In most of the cases, the villages visited were the ones where the tank is located or in which tank water for irrigation was mainly provided.ing, household division of

labour, tank related resource mapping, etc. The focus groups were identified on the basis of social mapping conducted in the each of the villages.

Questionnaire canvassing: Focusing on the themes of environmental, and R and R concerns, a team of trained research assistants canvassed two sets of simple questionnaire, translated into the local language Kannada. The respondents were a sample of farmers identified by the community as having encroached the lands belonging to the tank or its catchment, besides a sample of farmers in the command area. The data gathered through this tool covered information pertaining to social and economic background of the farmers, size of landholding, cropping pattern, alternative sources of irrigation, etc. Data were coded and electronically processed for the purposes of analysis.

- In all the group level consultation, a special focus was given on the perceived problems and prospects of formation of the tank users' association. Key concerns in such issue were the questions of community contribution, linkages with other local organisation, poverty alleviation potentials of the project, and people's role in monitoring and evaluation.
- The specialists concerned with environmental, and R and R issues usually proceeded on a second round of transect walk accompanied by the water overseer or a few well-informed persons. During such visits, it was possible to visit spots where encroachment may have taken place, or unauthorised lifting of water was occurring, etc.
- Separate group discussions were held with members of the community-based institutions, Mahila Mandals to identify the range of stakeholders in the tank, village and governance.

With a view to gaining further and greater in-depth information from the people concerning the tank on R and R issues, another sample of six tanks was chosen for a detailed study. A slightly modified questionnaire was canvassed for this purpose, besides combining other participatory techniques for data gathering.

In addition to the above, the study team got feedback on how to minimize negative externalities and maximize positive externalities and conflict resolution among different users. Data on important parameters, which can be monitored and compared during and after the implementation of the project was also collected. The important parameters considered were related to the catchment, tank bed and command and other areas. Data gathered from the field were supplemented from the work of other studies from GIS-based Information and Knowledge base and Hydrogeology study team. The data collected from field covered important aspects of catchment, tank and the command areas.

Consultations

- **Consultations with SC and ST members of the community:** With a view to preparing an Indigenous Peoples' Plan, special consultations were held with members of the SC and ST population in the village communities. Leading members of the community were also invited to join such consultations so as to be sensitive to the perceptions of other sections of the community

concerning the interests of the marginalised and vulnerable sections of the society.

- **Consultations with other groups:** The specialist on community organization held separate consultations with the landless, artisans, pastoral tenants and sharecroppers regarding their present and perceived role in the project, and to incorporate issues into the project design so as to safeguard their interests. Separate focus group discussions were also held with members of community-based organisations (temple committees, SHG, milk and credit cooperatives) to understand the history of organising practices in the village. Special emphasis was laid on learning from the past experiences of the people in managing community organisations, conflict resolution process, and representation for the different section of the population. The themes pertaining to “non-negotiables” emerged from such discussions.

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Separate group discussions were held with members of the community-based institutions, Mahila Mandals to identify the range of stakeholders in the tank, village and governance.

- **Consultations with the officials of various line-departments:** Officials at various levels (state, district, taluk and revenue subdivision, and gram Panchayat levels) were consulted about the present status of tanks, their operation, irrigation, taxation policies, recovery process and financial allocations, etc. In particular, the discussions with the officials of the Department of Minor Irrigation at the District level proved to be very insightful. Consultations were also held with the Village Accountant and Revenue officers. During the second round of data gathering from a sub-sample of six tanks, these officials, along with a few engineers from Irrigation department accompanied the team especially to assess the situation concerning encroachment of tank property. Wherever water users’ cooperative societies had been formed by the local NGOs, and/or DMI/ JSYS, consultations were held to learn from the experience of formation process and the lessons that could be learnt in the designing of project’s TUA.
- **Other consultations:** In addition to the consultations at the village levels, as part of the SEA studies, discussions were held with representatives of PRI institutions at the village level. Likewise, there had been consultations with the local and regional NGOs working with the people at grassroots levels and

they were consulted from the point of view of the working of community-based institutions and potential participatory issues in regard to the Tank Users' Associations.

- **PRAs with community leaders:** PRAs and FGDs were carried out to assess the role and problems of a range of stakeholders, group formation processes and potentials for collective action. Participation of community leaders accompanied by the local people proved to be very meaningful and informative.
- **Internal and consultative external reviews:** During the course of carrying out the SEA, the team members held open, frank and critical review meetings at the frequency of a week or a fortnight both with a view to learning from each other's experience and insights to inform one's own work, and to sensitise each other of the inter-relatedness of issues centering around the tank, community, environment, agricultural practices, etc. Members of the team also participated in the weekly meetings conducted by JSYS to review the progress made by different studies. Proceedings of such meetings were found to be helpful in identifying a wide range of inter-related issues, as for instance the linkages between institutional studies with those of SEA.
- **Exposure visits:** With a view to identifying the best practices elsewhere a few members undertook visits to the participatory projects of watershed development (PIDOW in Gulburga, UP Water Resources project, Gram Vikas, etc.)
- **Feedback workshop:** With a view to validate the findings, and to identify gaps if any, an one-day workshop was held at the ISEC. Participants included a cross-section of NGO functionaries, leading experts in water and irrigation sector, officials of the World Bank and the state departments of irrigation, JSYS, and more importantly, a few members of the village communities that had been covered in the study. For the benefit of those not familiar with English language, translations were made available. The feedback received was very useful, and in some instances, re-visits to the villages/tanks were made to fill the gaps or to gather additional data.

Stakeholder Assessment and Social Analysis

In almost all the villages visited, members of the community viewed *the tank as something that concerns those owning lands in the, command*. Often, the conception of a tank gets further narrowed down in terms of:

- Those with alternative sources of irrigation and those without;
- Those in the head, mid or the tail-end region;
- Those owning lands in the high lying or low lying areas of the command;
- Those who are originally command area farmers as against those who have converted their lands to have access to the tank irrigation;
- Farmers with varying extent of land in the command (see, Table 2.3); or
- Those who have lands adjoining the command and thereby an expanded holding.

In the context of landownership pattern in the tank command area, we notice that it is usually the members of the dominant caste who own a major portion of the land. Three or four farmers among the dominant castes in most tanks own a lion's share of the lands in the command area. The rest among them tend to have smaller holdings like the non-dominant castes.

In the case of those owning lands in the adjoining areas to the command, at least two processes are to be found in operation. First is the tendency for them to flout norms of distribution and make physical changes in the command such that those holding the land below them are affected. In almost all these villages we find an alternative source of water being created either within the command area or outside. As such, lack of exclusivity in their dependence on the tank or the norms governing the distribution results in:

- (a) Lack of concern for the tank's maintenance,
- (b) Unwillingness to participate; and
- (c) Lack of concern for the effects on those more dependent on the tank.

These problems are further compounded when farmers in such holdings begin to convert their holding in the command area for raising crop other than the purpose for which the rest in the command area use their holdings. When tanks begin to have prolonged dryness, such farmers begin to have permanent interest over the dry tank bed. In quite a few villages, the farmers even claim to have had temporary or even permanent titles (*Pattas*) for such cultivation practice. In a few others, farmers claim that when the tank was constructed or repaired a few years ago, their lands were notified and taken over by the authorities concerned without compensation having been given. Thus, they claim rights over the land as in the past. Several key issues thus confront the project given the situation concerning the stakeholdership in the tank context. They are:

- How accountable will the community be for the tank when the village has exclusive jurisdiction over the tank in such a way that stakeholders of all types will also receive the benefits arising out of the project implementation.
- How to ensure responsible participation by the cross-section of stakeholders *from among* people owning land in the command area though from different villages, at par with the other stakeholders within the village in which the tank is located.
- Establishing institutional norms that would prevent tampering of the physical structures (dams, sluices, distribution canal, surplus-weir, field channels, etc.) during and after the project implementation. The critical times are when the tank receives less water from the catchment in a poor monsoon year.
- How to prevent flouting norms and conventions governing the distribution of water, or introduce them where they do not exist at present?
- How to bring about a uniform pattern of land use in the command area such that there is equitable access to farmers depending on the tanks for raising other crops?
- Should the farmers using water resources from the tank command to the non-command areas be taxed additionally?
- How to regulate the water market created by such farmers indulging in the sale of water, by which there is a reduction in the sense of stakes in the tank by other farmers in the command?

- How to re-create stakeholdership among the farmers not owning any lands in the command area of a tank?

Analysis of Alternatives

The rehabilitation of tanks with community participation is expected to have positive impact on the environment. The rehabilitation of tanks result in the augmented supply of irrigation water, better recharge of groundwater, better quality of drinking water, increased productivity, enhanced employment opportunities and better well-being of the stakeholder communities. Moreover, project interventions or activities would help in better management of natural resources and improve the overall environment and local ecology.

Analysis of alternatives defines the issues and a clear basis for choice among the alternatives for the decision-makers. The major problems faced by the tank system are: siltation of tank resulting in reduction in the storage capacity, encroachment on natural and other water ways and feeder channels in the catchment area, extension of cultivation and encroachment in the foreshore area, damage to the dam, surplus-weirs, main and field channels. There are different alternatives to rehabilitate the tank system with short-term and long-term perspectives. The analysis of probable environmental impacts of major interventions is presented below.

a) Desilting of tank: The intervention aimed at desilting of tanks without integrating the treatment of catchment area may not be useful in the long run. The ecosystem in the catchment has a direct bearing on harvesting rainwater and filling of tanks. A degraded ecosystem in catchment leads to increased run-off and reduces *in situ* moisture conservation. Moreover, soils and channels are eroded and fertile topsoil is transported to low lying areas and finally gets deposited in the tank. Thus, only desilting of tanks cannot be a solution for sustainable use of tanks. The desilting exercise will have to be repeated at short intervals now and then and may not be feasible. Most of the time, accumulated silt removed from the tank bed is disposed off near the tank that is gradually shifted back to tank bed during monsoon. Moreover, improper disposal of silt may create environmental problems in the area. Hence, removal of silt alone cannot be the solution or strategy.

b) Increase in the level of surplus-weirs: The storage capacity of most of the tanks has been reduced due to accumulation of silt. In many a tanks, the accumulated silt have reached to the level of waste /surplus-weirs. The increase in the height of waste-weirs can create additional storage potential but will lead to submergence of crops and waterlogging in the foreshore area. This may lead to conflict between the command area farmers and farmers in the foreshore area. Moreover, the height of the dam/bund structure will have to increase which may add to additional expenditure. The restoration of storage capacity will not improve the groundwater recharge due to low permeability of silt. Fishing activity also may be hampered due to the presence of silt in the tank. Hence, raising of waste-or-surplus weir to augment storage capacity may not be a feasible alternative.

c) All other interventions except desilting: The intervention measures excluding desilting operation in the process of rehabilitating tanks may not pay dividends as the storage capacity of many tanks has been reduced more than half of the original

potential. The catchment treatment, cleaning of feeder channels as well as repair and laying of main and filed channels will help in the efficient use of stored water. However, reduced storage (due to silt accumulation) may not be enough to satisfy the water needs of the command farmers. The accumulated silt may not allow percolation and recharge of groundwater aquifers. Similarly, accumulated silt may pose problems to animals when they enter into the tank for drinking water.

d) Integration of tank project with watershed development: Watershed development and implementation are being carried out in the state since mid 80s. The major emphasis of watershed development has been on soil and water conservation though it aims at sustainable management of natural resources aimed at improving the welfare of all the rural communities. The integration of tank project with watershed development may retard the pace of reforms being introduced in the water sector. Hence, it may yield better results if both the projects are implemented separately but maintain a synergy between the two.

Finally, we provide an analysis here with and without project scenario as shown below. The anticipated benefits emanating from the project are compared with those without the project and the concerns about the present state of affairs. It can be seen that the situation without the project will be awesome. The most important natural resource, i.e., land is left to degrade and if steps are not taken to control degradation the damage caused will be irreversible. Water resources are also not managed properly. The rehabilitation of tank will not only increase agricultural production through increased irrigation but also increase the income levels of labour households due to increased opportunities for gainful employment. Improved recharge of groundwater aquifers will augment the supply of drinking water for the community. Not only that but it also saves the community from the curse of using fluoride contaminated water drawn from a higher depth. Stored water in the tank will meet the drinking water needs of animals. The rehabilitation of tank thus will have many positive socio-economic as well as environmental impact whereas non-implementation will impinge on the environment and will have negative socio-economic impacts.

Table 3: Analysis of alternatives

Concern	Without project	With project
Catchment area	<p>Depletion of land resources will continue Soil erosion, loss of fertile top soil and nutrients Feeder channels and natural waterways blocked and diverted by encroachers Unsustainable land use Fragile and poor lands used for cultivation of crops Sparse vegetation, scarcity of organic manure Unsustainable use of chemical fertilizers, depletion of soil fertility Degraded pastures and grazing lands</p> <p>Denudation of forest cover and shortage of fodder and fuel Siltation of tank bed due to soil erosion in catchment and foreshore areas</p> <p>Ecological imbalance</p>	<p>Treatment of arable and non-arable land will arrest soil erosion and loss of nutrients along with fertile soil Treatment of natural drainage channels, cleaning of feeder channels Scientific land use planing Crops as per the land capability Tree crops/ dry land horticulture Increased tree cover, higher bio-mass production</p> <p>Increased supply of organic manure, better soil health Rejuvenation of pastures and grazing lands through silvi-pastoral system Higher production of fuel and fodder, less dependence on forest</p> <p>Land treatment using eco-engineering techniques arresting soil erosion and reduction in the rate of silt accumulation in the tank bed Better environment</p>
Tank bed/off-shore area	<p>Soil erosion due to lack of soil conservation measures and faulty cultivation practices Lot of encroachment and impediments for free flow of rain water into the tank</p> <p>Most of the tanks have accumulated silt and reduced storage capacity by more than half of the potential storage Tanks are infested with different kinds of weeds and thorny bushes (prosaphis juliflora, Ipomia carnica jacq, Zondu grass, etc.) No vegetative barriers/silt traps of filters in foreshore area</p> <p>The sluice and surplus-weir are under disrepair At many places tank bunds/dams have developed cracks/ stone pitching has given way and are weak and carry an element of security/safety risks.</p>	<p>Application of appropriate soil conservation measures and adoption of suitable cultivation practices Removal of encroachments and allowing free flow of water with the provision of silt traps, filter points, etc. Desilting of tanks will augment the storage capacity of tanks</p> <p>Tanks will be cleaned and made free of weeds during desilting operation</p> <p>Planting of bamboo and other trees in the foreshore will serve as filters and also be used by the poor as raw material for handicrafts. Sluice, waste-weir and operating system will be repaired Tank dam/bunds will be strengthened by using excavated silt / other material. Pitching of interior wall with stone will be carried out wherever necessary</p>
Command and adjoining area	<p>A sizable area under the tank command is left fallow due to shortage of irrigation water from the tank. Main and field channels are either damaged, encroached or disappeared due to lack of interest or non-</p>	<p>Productive lands can be brought back under cultivation after the rehabilitation of tanks</p> <p>Main as well as field channels will be realigned for proper irrigation</p>

	<p>availability of irrigation water from the tank for a long time Most of the farmers located at the tail-end of the command do not get enough and timely water supply. Suffer losses due to shortage of water during crucial crop growth stage. Only single crop is grown in most of the command areas Currently, flood system of irrigation is used wherein water from main /sub-channels is released in the field at the higher elevations and is allowed to flow into the lower parts of the command area by gravitation. This leads to wastage of precious water, loss of nutrients and helps the transmission of diseases and pests from one plot to another. Lot of water is lost through seepage from main channels Depleting groundwater and lowering of water table Lack of water and vegetation increases the temperature and desiccation effect in the surrounding area. This also results in higher frequency of irrigation</p>	<p>Tank users' association will be responsible for equitable distribution of water among the Command farmers. Decide about the schedule for release of water There is good possibility of increasing cropping intensity once the accumulated silt is removed from the tanks The main and branch channels (field channels) will be used to conserve and minimize wastage of irrigation water. Main channels may be lined wherever possible and necessary to arrest seepage Improved recharge of groundwater aquifers will arrest lowering of water table level. Adequate water in the tank and vegetation around keeps the local atmosphere cool and humid, reduced requirement of irrigation</p>
Others	<p>Shortage of drinking water for animals due to inadequate storage Drying up of tanks and silt accumulation discourages fishing activity Non-availability of water discourages aquatic flora and fauna and also does not attract birds and bees Non-availability of water forces women to wash clothes near the borewell, which supplies drinking water. The washing of clothes near the borewell creates cesspool and breeding place for mosquitoes. Moreover, seepage of water pollutes the underground aquifers with detergents and other chemicals Dried tanks in the state of disrepair do not provide any aesthetic value but an ugly picture of sick and dead.</p>	<p>Rehabilitation will augment storage capacity of the tank structure and provide drinking water to animals Availability of water in the tank for a fairly long time provides opportunities for fish culture. Healthy water bodies attract water loving birds and insects. Many of these are predators of crop pests while others like honeybees help pollination. Availability of water in the tanks for washing clothes and to meet other domestic needs will keep the environment clean and neat. The flora and fauna present in the tank has a great capacity to degrade the hazardous chemicals and thus keep the system healthy. Tanks with clean water, surrounded by good vegetation, with birds around definitely provide a pleasing look and have great aesthetic value.</p>

In order to achieve systematic decision-making and to choose and prioritise the best intervention among alternatives, it is desirable to use analysis, which involves the comparison of a set of alternatives. The approach, which is generally followed to carry out the comparative analysis, is based on assigning the scale value depending on the magnitude of impact such as major potential impact, significant impact and marginal impact. The various identified key environmental components have been assigned weights in-terms of project importance units (PIU) in the hierarchy of interventions. The magnitude of impact and numerical values assigned are presented in the following table.

Table 4: Magnitude of impact and value

Sl. no.	Magnitude of change	Positive / Negative
1	No change/status quo	0
2	Marginal potential impact	1
3	Significant potential impact	2
4	Major potential impact	3

The values assigned to key environmental components are based on the value judgement or subjective. After assigning the value for significance and the weight for the project activity, we arrive at the numerical value of impact of the project activity on key environmental component. Two different scenario of the alternative are presented in the following tables (without and with the project scenario).

Table 5: Potential environmental impact matrix - without project scenario

Environmental Components	Catchment			Tank structure		Command		Total Score
	Land treatment	Land use planning	Restoring feeder channels	Desilting	Repair of sluice /dam/ waste weir	Repair of main and field channels	Support services	
Importance	10	10	20	25	15	10	10	100
Land Environment								
Arable lands	-2	-3			-2	-3	-3	-140
Non-arable lands	-2	-3					-2	-70
Forest lands	-2	-1					-2	-50
Land productivity	-3	-2			-2	-2	-3	-130
Soil Environment								
Soil erosion	-2	-2				-2	-3	-110
Soil fertility	-3	-2	-1			-1	-3	-90
Soil biota & degradation	-1	-3					-3	-85
Soil moisture	-2	-3		-1	-1	-1	-2	-105
Biological Environment								
Flora & fauna	0	-2		-2			-1	-100
Fragile Areas	-3	-2				-2	-2	-80
Water Environment								
Surface Hydrology	-2	-2	-1	-3	-1		-2	-170
Groundwater	-2	-2	-1	-2	-2		-2	-170
Sedimentation	-2	-2	-3				-3	-130
Water quality	-2	-1	-3	-2			-3	-170
Silt deposition	-2	-2	-2			-1	-2	-110
Total								-1720

Table 6: Potential environmental impact matrix - with project scenario

Environmental Components	Catchment			Tank structure		Command		Total Score
	Land treatment	Land use planning	Restoring feeder channels	Desilting	Repair of sluice/dam/waste weir	Repair of main and field channels	Support services	
Importance	10	10	20	25	15	10	10	100
Land Environment								
Arable lands	3	2	2	2	2	2	3	230
Non-arable lands	2	2	1	1	1		1	115
Forest lands	2	1	1	0	0		0	40
Land productivity	2	2	1	2	2	2	2	190
Soil Environment								
Soil erosion	3	2	1	0	0	2	3	120
Soil fertility	2	2	0	2	0	1	3	130
Soil biota & degradation	3	1	2	0	1		3	125
Soil moisture	2	3	0	2	2	1	2	160
Biological Environment								
Flora & fauna	2	2	1	2	0	1	3	140
Fragile Areas	2	3	2	0	0	1	1	110
Water Environment								
Surface Hydrology	2	2	2	3	3	2	2	240
Groundwater	2	2	2	3	2	1	2	215
Sedimentation	3	2	3	1	2	2	1	145
Water quality	2	1	1	2	0	1	2	140
Silt deposition	3	2	2	0	1	1	1	110
Total								2210

As shown in the normative analysis, the impact matrix shows that without project interventions, the impact of different components will be negative and impinge on the environment. The unscientific use of land and neglect of the catchment leads to soil erosion and degradation of land resources. Encroachment on feeder channels and foreshore area, and cultivation of these lands adds to sedimentation and siltation of tank structure. On the other hand the various interventions proposed in the project will help in sustainable management of resources and improving the environmental conditions in the project area.

Social and Environmental Impacts

Social Impact: At present it appears that there is very little scope for project activities to directly benefit the poor and the vulnerable sections of the communities. This is especially because the rich and the more powerful landowners belonging to higher castes and class have alternative sources of irrigation, besides owning larger extent of land in the command area. The other legitimate uses of the tank for the members of the village community have to come by way of groundwater recharge, safe drinking water, etc. In order to be able to accomplish such advantages, the WUCs/TUAs have to, from the very beginning, incorporate a "Tank-Plus" approach in preparing the village/tank level plans. To facilitate such a tank-plus approach, the bylaws as circulated among the promoters should permit enough flexibility to suit the local conditions, besides placing a greater dependence upon the voluntary institutions in their role of social engineering. Handing over the rights to the local organisations to fish in the tank and fodder also becomes a requirement for this purpose. Some of the positive and negative impacts and mitigating alternative strategies are indicated below.

Table 7: Social and environmental impacts- strategies

Social, Economic and Environmental Impact	Benefit Enhancing or Mitigating Alternative Strategies
Social and Economic Positive Benefits	
Improved source of irrigation is to result in a decline of an unfavourable dependence of the poor on the rich.	Ensure membership of landless and sharecroppers in the TUA
Possible increase in income through second crop in the command	Ensure activities to promote sustainability of tank structures
Minimising of difference in access to water between the head-reach and tail-end farmers	Ensure that the distribution channels are kept in good repair at the end of each crop. Keeping space for small water paths to the fields down the command area to be made mandatory. Practice of flooding the plot of land, allowing water to overflow only after a certain number of days of application of manure to be stopped. Divisions in the family property should not entail the inheritors to alter the course of distribution channels (Raja Kaluve) or their tributaries. Command area farmers with their own sources of irrigation barred from using field channels for harnessing water.
Increased employment opportunities for women from the poorer and lower caste households.	Greater involvement of women from all sections in decision making process
Social and Economic Negative Impact and Alternative Strategies	
Loss of income due to crop loss affected by water logging in the catchment/ tank basin.	Under the Integrated Tank Management Plan, plan and erect Checkdams, bunds and similar other structures.
Increased dependence on market, under unfavourable terms, especially for credit supported agricultural inputs (fertilisers, pesticides, etc.)	The TUAs may undertake to supply these inputs to the member farmers to minimise market-determined vulnerability.
The rich get richer, the bigger landowner gets more benefit of the project implementation.	While keeping the linkage between the extent of land owned and the costs to be borne / user tax to be paid, a weightage has to be added to bigger landowners to determine their contributions. For instance: Calculate the average size of land owned per household in the command. Those owning double this average may be made to pay one unit cost extra; likewise, those owning thrice the average to pay an additional unit cost. Likewise, add an additional cess on those with additional source of irrigation from which the plot (s) in the command area receives supplementary water. The additional cess shall be at a higher rate if the source of water is located in the command area and supplied to fields outside it. Farmers selling water or sharecropping for water should pay a proportion of their share received to the tank user association, annually or per crop. Income thus additionally generated should be spent for creating tank-related assets to the tailenders, small and marginal farmers owning land in the command, or for the benefit of the vulnerable groups without lands either in the command or elsewhere. Examples of such activities: undertake watershed development activities in the dry lands, erect cement structures for water flow in the tail ends, undertake desilting activities in the distribution channels, subsidise agricultural inputs supplied by the TUAs, etc.

The Major Environmental and Social Issues involved in the Tank System have shown in the figure below.

- The step involved in rehabilitation includes treatment of catchment which includes soil and water conservation measures, gully plugging, embankment of water ways to reduce soil erosion and nutrient loss from fragile and poor soils in the catchment.
- Construction of check dams and silt traps to arrest sedimentation and siltation of tank bed
- It also involves land use planning to have sustainable use of land. Development of pastures and grazing lands is also one of the components. The non-existence of land use planning and soil conservation measures leads to land degradation, increased soil erosion, sedimentation and silting of water bodies. Cultivation of land in the ‘foreshore area’ without adopting soil

conservation methods adds to erosion of soil and siltation of tank. The encroachment of water-spread area reduces the storage capacity in tanks.

- Neglect of tanks by the community turned the tanks into disrepair, accumulated silt and growth of aquatic and other weeds in the tank bed and on bunds damaging the ecology of the tanks.
- De-weeding of feeder channels, tank bed as well as desilting of the tank bed and proper disposal of silt
- The sluice and waste-weirs are damaged at most of the places. Dam structures are weak. This leads to leakage and wastage of water and the weak dam structure poses safety risk.
- The mains as well as the field channels are damaged and irrigation from field to field leads not only to wastage of water but also to the spread of pests and diseases.
- The mono cropping, loss of bio-diversity and lack of diversification also leads to loss of soil fertility, and erratic use of agro-chemicals has environmental implications. Hence, it is necessary to consider environmental implications in the project formulation of implementation.
- Over exploitation of groundwater than the dynamic recharge has resulted in lowering of water table and many shallow open wells have gone dry.
- The environmental assessment has considered all safeguards indicated by the World Bank policies applicable or those triggers in the implementation of the project. The tanks for rehabilitation can be screened using a few simple parameters like the tanks which gets regular inflow of water, degraded catchment, having potential for recharge of groundwater, scope for diversification, etc..
- The environment management plan includes the interventions to be taken, its impact and mitigating measures to minimize negative externalities and to ensure positive impacts of the proposed interventions. The project also suggests the integrated pest management plan (IPM) for the control of diseases and pests. A note on capacity building at various tanks to implement and monitor the plan is provided in the report . The study also provides guidelines on monitoring and evaluation process of the project.

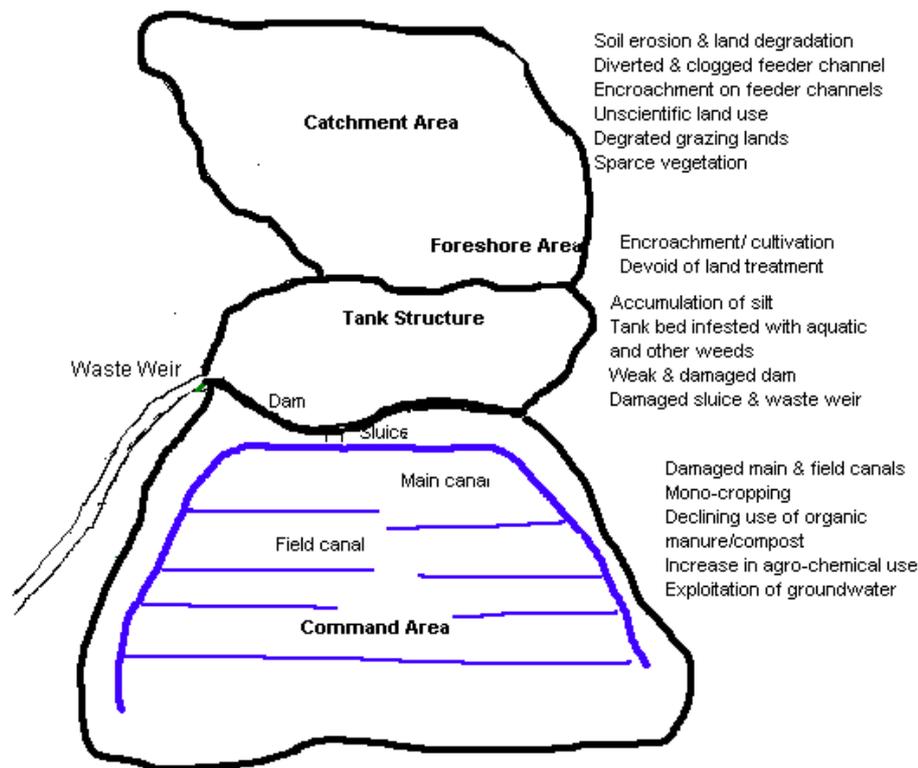


Figure 3

Mitigation/Enhancement Action Plans

a) Resettlement Action Plan

Project and the Adverse Impacts: In the process of rehabilitating about 5000 tanks, there are likely to be some adverse effects or impacts on the families and people in the form of losing the livelihood source. Apart from this, there may be likely effect to community structures and assets. To minimise the adverse effects there is a need to prepare a Resettlement Action Plan (RAP).

Types of Impacts: The proposed project does not involve any major adverse effects such as dislocating the main source of income through land, or dispossession of house or other assets. Neither is there an instance of any loss of property with cultural heritage value attached to it. Categories of affected persons are : a) People losing land that is encroached, and b) People losing trees.

Magnitude of impact: The total water spread area of six tanks is 195.45 ha. and the affected area is 8.76 ha. The total number of families and the population that is likely to be affected is 76 and 401 respectively. There is no physical displacement of population as a result of the proposed project interventions. The affected families include 6 STs, 13 SCs and the rest belong to other castes.

Minimising adverse impacts: The proposed interventions under the project are not expected to have any major adverse impacts on the local population. Particularly, in the physical displacement. The technical aspects of the interventions are being

limited to the restoring the tank system to its design position. Therefore, it will not entail any additional land acquisition or submergence of physical assets.

R&R Policy: For this project, an R&R policy has been formulated by the Government of Karnataka. Specific entitlements to the identified affected families as provided under the policy are given below.

In preparation of the RAP, extensive consultations were held with the potentially affected persons both individually or collectively. These consultations were held after explaining the project objective and the likely effect on the project area, people and its benefits. The issues raised and discussed in these consultations were: Land acquisition; Resettlement and rehabilitation; Encroachment; Loss of livelihood; Compensation payment to encroachers; Compensation payment to BPL and landless encroachers; and How to deal with encroachers of Tank properties (Tank bed). These wide ranging consultations have formed the basis for preparation of this action plan.

Action Plan and Implementation: The following matrix indicates the details of identified issues, proposed approach for adoption, designed plans, procedures, and the agencies responsible for its implementation. Authentication of the affected is carried out jointly by TUG, PRIs (Gram Panchayat, Taluk Panchayat, and Zilla Parishad, as relevant), and Departments of Revenue and Minor Irrigation. This will form the basis for implementing the RAP.

Institutional Arrangements for Implementation of RAP: The institutional arrangements for the implementation of RAP involves the following: a) R&R and Tribal Development (TD) Unit in JSYS, will ensure the availability of required funds and coordinate with the departments concerned in GoK to facilitate the smooth and timely implementation of the RAP, b) R&R and TD Specialist in District Project Unit will work closely with the CEO of the ZP and the Deputy Commissioner of the District to coordinate and facilitate the implementation of the RAP with the departments concerned at the district level, c) Responsibility to facilitate the assessment of social impacts of the project interventions at the tank level lies with the Cluster Facilitating Team (CFT) which has R&R and TD Specialist as one of the functionaries.

Grievance Redressal mechanism: All grievances related to the land acquisition are resolved through the provisions available in the LAQ,1894. However, for issues related to the R&R, a District Grievance Redressal Committee (GRC) will be constituted under the chairmanship of Deputy Commissioner of the district with the District Manager of DPU as member secretary. The CFT will record the grievances of affected people and present in the GRC for resolution.

Monitoring and evaluation: Monitoring and Evaluation (M & E) of the RAP is necessary to watch the progress and to ensure adequate and timely implementation of the proposed R & R activities. This provides feedback to the plan for mid-course corrective measures. The monitoring will be both internal and external. At the district level, this responsibility lies with the R&R and TD Specialist. The external monitoring agency, which will be selected and engaged for the entire project, will also cover R&R aspects of the tanks.

Table 8

Issues	Approach	Plan	Procedures	Agency Responsible
Minimising adverse impact	Limiting the project interventions to the technical specifications	Consultations at the community level by the technical wing of the Project to identify project interventions accordingly	Carry out PRAs, examining alternatives, examine alternatives in Gramasabha(s)	Technical department of JSYS / DMI (Project Design and technical interventions); CFTs, TUG- and Gramasabha (consultations).
Voluntary surrender of lands encroached	Persuasion to give up lands	Consultations and community counseling. Get consent letters certified by TUG and village revenue officials.	Land survey, group meetings, explaining advantages, meetings with individual encroachers. CFT will document the voluntary surrender of land, which will be checked by the R&R and TD specialist. The external monitoring agency for the project will also verify the validity of this process on a sample basis.	Land survey department, Revenue officials (identification of land and determining legal status) TUG, Gramasabha, CFTs, village elders (Persuasion). External M&L agency.
Removal of encroachments	Identification of encroachers, consultative evolving of support programmes for livelihood rehabilitation	Finalise the list of encroachers, extent of land encroached; determine eligibility for livelihood support; identify training needs and organise training programmes with special focus on women members of the PAFs; Provide alternative income by dovetailing with GoK's programmes; assist in accessing institutional credit.	Notices will be served for repossession of the encroached lands and refrain from further sowing; consultations on alternative livelihood opportunities and selection of livelihood activities to be taken up with the seed capital provided as per the R and R policy provisions under the project. Seed capital will be channelised through the District Industries/ commercial banks. At the time of implementation, further consultations to be held to identify Igs for PAFs. Organise training programme for skill development. Establish links with appropriate departments for receiving benefits from the GoK programmes, and provide technical guidance, and follow up. Ensure proper forward and backward linkages for the livelihood activities promoted.	Revenue official at village/Taluk level (Identification of land encroachers, extent of encroachment) Line departments, CFT (Training needs, technical guidance and follow-up), Commercial Banks (loans), District Industries Centre (GoK schemes and technical guidance), Training institutions, TUG and CFT (consultations, dovetailing GoK programmes, promoting IGAs, and ensuring proper use of Rehabilitation grants).
Information Dissemination	Copies of R&R policy for displaced or affected will be provided to people in the project area	CFTs, local organisations can be involved for this purpose	The R&R policy will be translated in the local language and a brief will be prepared and distributed among the local population.	Documentation and Communication Cell of JSYS, CFT, DPU, TUG, Anchor CFTs.

b) Tribal Development Plan

The Tribal development plan is based on detailed studies carried out in six tanks in five villages (two tanks in KK Halli, and one each in Obatti, C.N. Halli, Halkurke, and Byalya villages). In these five villages, 51 per cent households belong to the other castes, more than 35 per cent households belong to ST, with another 12 per cent belonging to SC. In Byalya and KK Halli tank villages, SC and ST together constitute 70 and 57 per cent respectively. However, in terms of landholding, SC and ST do not have proportionate share in the command area. It is evident that the extent of dependence of SCs and STs upon tank for irrigation purposes is significantly lesser than the other castes. Rehabilitation of these tanks, however, will benefit the SCs and STs by way of labour employment opportunities, since they are the main source of wage labour in these villages.

Consultation with stakeholders. Wide-ranging consultations were held with the stakeholders. Methods of consultations included individual interviews, focused group (landless, women, SCs, STs, land holders, command area farmers, encroachers) discussions, and village level meetings. The data was collected through both structured and unstructured formats. Secondary data was collected from population census documents, village revenue records, and Panchayat office.

Institutional Arrangements: The institutional arrangements for the implementation of TDP involves the following: a) R&R and Tribal Development (TD) Unit in JSYS, will ensure the availability of required funds and coordinate with the departments concerned in GoK to facilitate the smooth and timely implementation of the TDP, b) R&R and TD Specialist in District Project Unit will work closely with the CEO of the ZP and the Deputy Commissioner of the District to coordinate and facilitate the implementation of the TDP with the departments concerned at the district level, c) Responsibility to facilitate the assessment of the needs of SCs and STs in the project implementation at the tank level lies with the Cluster Facilitating Team (CFT), which has R&R and TD Specialist as one of the functionaries. The CFT will guide TUG in the planning and implementation of the TDP, d) TUG, in liaison with the CFT will hold consultations with the SC/ST communities to facilitate their greater participation and help accessing project benefits on par with the rest of the communities. CFT will help TUG in dovetailing various development programmes of the government for the purpose of implementing TDP as outlined above.

Table 9

Issues	Strategies	Action Plan	Agency Responsible
A high incidence of landlessness	Strengthen off-farm and non-farm occupations	Identify educated unemployed youth for job-oriented skill training programmes, tying up with DICs and NGOs, and KSCSTDC and/or KSFC. TUGs <u>tank-plus activities</u> * to be oriented for inclusion of SC/ST. Promote animal husbandry: sheep, goats, cows and Buffaloes, tie up with the Director of Animal husbandry and the District's lead lending bank. The KMF to be requested to include the tank-villages in the Milk route to encourage dairying among the SC/ST. Implement Tree Patta Scheme for trees grown in the tank property with landless among SC/ST as main beneficiaries. Formation of self-help groups, sponsored by the local NGOs and TUGs. Membership fee should be provided by the Project for BPL members.	TUG, CFT, R&R and TD specialist at DPU
No land owned in the command area	Promote irrigation Improve dryland farming Integrate with animal husbandry and watershed development programmes	Tie up with the department concerned for either individual or community irrigation scheme, with emphasis on drip irrigation. Promote TUGs to undertake, with the participation of community, in renovating the open wells belonging to the SC/ST. Promote mixed farming in rain fed conditions in consultation with agriculture and animal husbandry departments.	TUG, CFT, R&R and TD specialist, and agriculture specialist at DPU
Low return from agriculture	Need based agricultural extension and support services	Facilitate exposure to improved agriculture practices, with support from the line departments and research institutes: supply of seeds, fertilisers, pesticides and technical know how Periodic soil testing and demonstration of techniques to make the best use of soil conditions. Organise special training programmes and demonstration plots with the help of KVKS and other line departments Organise exposure trips to agricultural farms, research stations progressive farmers. Facilitate access to institutional credit Establish linkages with the Taluk agriculture-marketing network, provide logistic support.	TUG, CFT, R&R and TD specialist, and agriculture specialist at DPU
Tail-end command farmers and irregular/inadequate availability of water	Mandatory membership for representatives of SC/ST in the TUG executive committee. Evolve appropriate water distribution system	Emphasize on equity for distribution of water Participatively determine the water-flow dimensions in the command. Insist on field distribution channels in place of flooding water from field to field.	TUG, CFT, R&R and TD, agriculture and irrigation engineer at DPU
Poor leadership qualities	Advocacy and communication of TUG norms and principles. Training in organizational development	Work with specific groups of SC/ST to communicate the goals, strategies and plans of TUG and the project. Ensure adequate representation for members of SC/ST in the executive committee of the TUG. Design and organise specific capacity building programmes among SC/ST	TUG, CFT, R&R and TD specialist, and training specialist at DPU
Low literacy	Promote functional literacy Extension programmes to focus on the needs of the illiterates	Integrate with mass education and total literacy programmes Extension programmes to include audio-visual aids and participatory learning methods. Customise training programmes to meet the needs of illiterate and neo-literate SC/ST family members	TUG, CFT, R&R and TD, agriculture, gender, and training at DPU
Inadequate awareness on health and sanitation	Promote health awareness Increase access to health and sanitation facilities	Organise health campaigns, health camps (general and referral) in association with line departments and local medical institutions Promote nutritional gardens with the support of line departments. Distribute seed material kit and saplings.	TUG, CFT, R&R and TD, agriculture, gender, media and training at DPU

Note: * Tank Plus Activities refer to all those social and community oriented activities under the project, covering those beyond the mere physical development of the tanks. Thus, tank plus activities cover advocacy, training, capacity building, income generating activities, etc.

c) Environmental Management Plan

The environmental management plan (EMP) is intended to outline the institutional and process measures that need to be undertaken in order to ensure mitigation against any adverse impact of the project interventions and to enhance the positive environmental impacts of the project. The EMP presented here provides guidance on all the activities to adequately address the environmental issues in the project. It includes screening of new tanks, activities/ interventions to be included, baseline data collection, integration of social and environmental issues, capacity-building and training needs and emphasis on the systematic development of an environmental knowledge-base, analysis capacity as well as regular monitoring and evaluation. The key environmental issues (shown earlier) has formed the backdrop for EMP. These issues have been largely influenced by consultations, analysis of baseline information.

Screening of Tanks and Interventions:The process of screening of new tanks for inclusion in the project for interventions or otherwise is shown below.

Figure 4: Screening of tanks and interventions

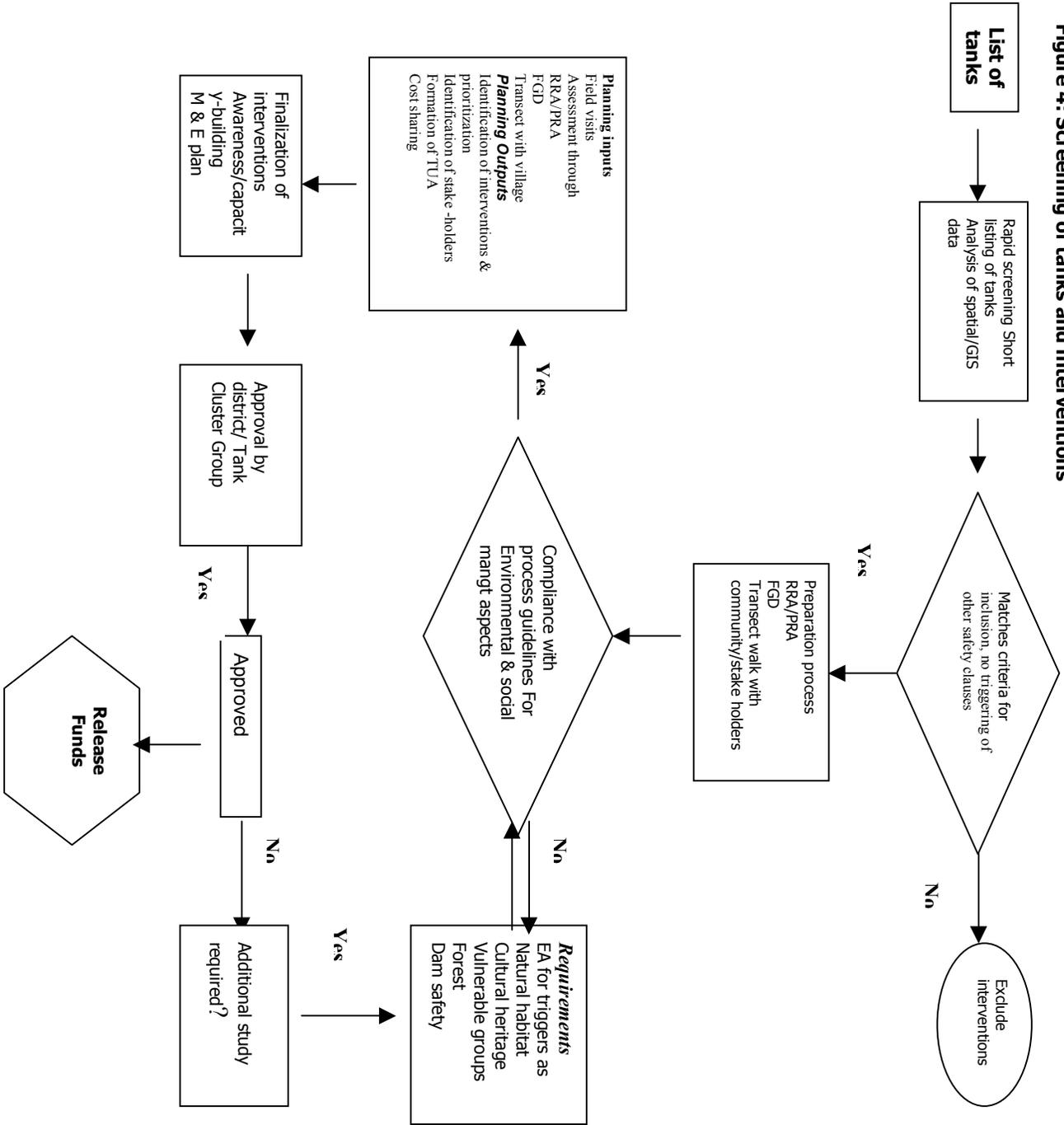


Table 10: Environmental management plan and mitigation measures (awareness, training and capacity-building)

PROJECT COMPONENT	ACTIVITIES	POTENTIAL IMPACTS		MITIGATION MEASURES
1	2	3		4
Enabling environment	Training/workshops	<p>(3a) Positive Improved knowledge-base on Tank systems in a spatial Context Improved Environmental Management Capacity and Knowledge Improved Inter-departmental Coordination Improved public access to Information on tank systems, JSYS and rehabilitation efforts</p>	<p>(3b) Negative Large-scale Mainstreaming of paradigms may be a problem if the paradigm is poorly-designed</p>	<p>Improve public access to information Ensure good monitoring and evaluation to enable continuous learning and innovation</p>
Community development & planning	Training/Seminars/study tours	<p>Environmental Awareness Improved Environmental Management Capacity in Communities Improved coordination of Activities at village-level Improved community Monitoring and evaluation skills</p>	<p>Neglect of environmental issues may impinge on natural resources Large-scale mainstreaming of paradigms may be a problem if the paradigm is poorly-designed</p>	<p>Adequate training and capacity-building with substantial environmental awareness components Capacity to monitor and evaluate environmental and social impacts of project interventions</p>
Integrated Tank Plan Development Implementation	Initial activities	<p>Selection of tanks of project Intervention using GIS and other secondary data Use of time-series and spatial Data would help in objective Contd... Assessment of tanks</p>		<p>Subjective assessment and selection of tanks may fail to achieve the goal of the project Training in using secondary and spatial data will avoid wrong selection</p>

<p>Pre-planning Consultation, FOD, RRA, PRA, PRA,</p>	<p>Screening process helps in Identification of tanks, which can be considered for project Interventions.</p>	<p>Improper screening may Impinge on the gains Expected from the project</p>	<p>The screening criteria have been discussed in detail in chapter 7 Screening may include size of the tank, community participation, scarcity of water, alternative sources of water, potential for diversification of agriculture, etc</p>
<p>Planning Formation of TUG screening interventions, analysis of alternatives, capacity-building & training</p>	<p>Helps identification of stakeholders It also facilitates understanding the issues and priorities of the stakeholders.</p>	<p>The interventions and prioritization may not suit the local conditions.</p>	<p>Analysis of spatial/gis data Consultation with stakeholders</p>
<p>Implementation Proper scheduling of activities, transparency, collective decision- making, monitoring and evaluation</p>	<p>Proper planning and preparation of action plans avoid mistakes in the future Tug in place before initiating interventions will help in the smooth implementation of the project activities Analysis of alternatives would provide qualitative assessment of the interventions</p>	<p>Subjective assessment and selection of interventions may not bring the desired results Implementation of the project activities by the govt. Agency or line department may not be successful as experienced in other developmental projects. Stakeholders don't feel their involvement and vested interests may take the advantage</p>	<p>Follow analysis of alternatives as provided in chapter 6. Similarly, training and capacity-building about environmental aspects for analysis, M & E activities is essential. Promote awareness about environmental issues among the stakeholders.</p>
<p>Post-implementation M & e Corrective action use of sustainable resources.</p>	<p>The training and capacity-building help in M & E of the project This would help in completing the project in time Less pilferage M & E help in mid-term corrections Sustainable use of assets and natural resources Warning for appropriate and corrective action</p>	<p>Improper scheduling and ad-hoc decisions would result in difference of opinion among the stakeholders and may affect the project adversely. Mistakes will go unnoticed if M & E are not internalized.</p>	<p>Prioritize the selected interventions in consultation with the tug and stakeholders Maintain transparency in decision making Decisions taken should be based on consensus Follow the guidelines for m & e provided in chapter 7 section 7.5</p>
<p>Active TUG Improve involvement of all stakeholders Compliance with the tug rules</p>	<p>Assets created may loose their utility Tank system again turns into despair</p>	<p>Assets created may loose their utility Tank system again turns into despair</p>	<p>Active TUG Improve involvement of all stakeholders Compliance with the tug rules</p>

d) Integrated Pest Management

The proposed project does not propose to finance the use of pesticides. Moreover, the use of plant protection chemicals (PPC) is relatively low in the command area of study tanks when compared to the state and national averages. However, IPM activities would be promoted in the project area. The services of the line departments such as agriculture and horticulture would be used for diversified agriculture, extension and promotion of IPM. IPM is one of the important components of watershed development programme, which is also being implemented throughout the state. The promotion of IPM will include basically the following:

- ◆ Improving farmer's awareness of the health hazards of misuse and mishandling of PPC and the advantages of IPM
- ◆ Improving awareness and training for proper handling, usage, storage, and proper disposal of containers of PPC.
- ◆ Increasing awareness about efficacy and advantages of eco-friendly alternatives of chemical pesticides.
- ◆ Promoting use of bio-pesticides.
- ◆ Training and demonstrations related to the use of IPM techniques and practices.
- ◆ Dissemination of information about traditional practices used for the control of insect/pests.
- ◆ Integration of IPM into a package of practices for the area
- ◆ Improving the information and knowledge base on pests, chemical pesticide use, health impacts, IPM use and trends across the regions. This would be included in the monitoring and evaluation schedule suggested for the project.
- ◆ Development of promotional material, dissemination of IPM through field demonstrations, canvassing through extension personnel and NGOs.
- ◆ Exposure of JSYS staff and others (field level functionaries, farmers and NGOs) engaged in the implementation of the project to IPM through integration of IPM in the training programme.
- ◆ Initiating a rewarding and recognition system for an individual farmer or group of farmers for adopting IPM. Provide incentives to the farmers as well as traders for promoting use of bio-pesticides.
- ◆ Strengthening institutional capacity on IPM

Policy, Regulatory Framework and Institutional Capacity: The Government of India as well as the State Government is striving hard to discourage the use of hazardous PPC and to promote the use of environmental friendly techniques as IPM encourages the use of botanicals, pheromones, bio-control agents and microbial pesticides. The Prevention of Food Adulteration (PFA) Act is the policy tool that regulates the quality of food products manufactured, sold and consumed in India. Under this act, pesticides are noted contaminants and are defined as harmful to human health.

The Insecticide Act of 1968 has been suitably amended by the Parliament during the Budget session (February- May, 2000) to ensure supply of quality pesticides to farmers and to better deal with offenders. There are five insecticide control laboratories located at

Commissionerate of Agriculture, Bangalore, Dharwar, Bellary, Shimoga and Kotnur (Gulbarga) in Karnataka.

Institutional Framework: Biological control measures are now in place as substitutes for harmful PPCs. Biological control measures have been well received by the farmers owing to its cost effectiveness and absence of residual problems. Biological control includes use of predators and parasites. Various types of predators and parasites have been identified and introduced. Laboratories for multiplication of parasites have been established and production and supply of bio-control agents have been streamlined in the state. There are a few private companies (Pest Control India Ltd, etc.) engaged in the production and supply of parasites to the farmers.

Department of agriculture runs four bio-control laboratories in the state. The main objective of these laboratories is to control pests of important crops using natural predators instead of using chemicals. Bio-control methods are useful in reducing the plant protection cost and also the environmental pollution. The department of horticulture has established 17 major and 46 small-scale parasite producing laboratories. Parasites produced in bio-control laboratories are supplied to farmers at subsidized rates.

The Government of Karnataka provides direct subsidy for adopting IPM by the farmers. The Government of Karnataka has earmarked Rs. 11.95 million for IPM for the year 2001-02, under the schemes suggested for horticulture sector. The financial outlay under IPM includes expenditure on demonstration, training and publicity programmes related to IPM. There are many Institutes that are involved with teaching, research and extension aspects of IPM programme in the state. They can impart orientation and training about IPM to the extension personnel, NGOs, officials from JSYS as well as to farmers from the project area. The State government has well trained personnel with the department of agriculture and horticulture posted at different levels. However, the extension personnel working at the grass-root level will have to be trained in adopting IPM for different agricultural horticultural crops.

Integrated pest management will be a major component in the World Bank financed Watershed Development Project in Karnataka. However, Tank rehabilitation project would also integrate IPM in the intervention strategy. The activities will include:

- ◆ Training, exposure/ study tours and visits, awareness building, outreach and advisory services.
- ◆ Strengthening the institutional capacity for IPM and improving inter-agency coordination and partnerships.
- ◆ Facilitating access to eco-friendly bio-pesticides and dissemination of information about cultural practices, mechanical and biological techniques as part of IPM.
- ◆ Initiating adaptive trials and demonstrations for technology refinement centering around IPM related measures.
- ◆ Compiling indigenous technical knowledge database, pre-testing on fields before demonstrating on the farmers' fields.

- ◆ Strengthening the disease/pest surveillance and forewarning system, and dissemination of information.
- ◆ Monitoring, evaluation and documentation of case studies.

Jala Samvardhane Yojana Sangha (JSYS) would coordinate the demonstrations about IPM approach with the support of departments like agriculture and horticulture. The demonstrations should be for major crops grown in the command area of the tanks in different agro-climatic zones. The State Agricultural Universities and Agro Centres can also be involved in the distribution of parasites, predators, plant protection chemicals and equipment in the project area.

e) Gender Action Plan

The project proposal recognises that “women are marginalised from local decision-making for 'socio-cultural reasons’”. But as evidenced in the field and documented in the stakeholder analysis (social and gender), women are the primary stakeholders in the benefits of the project. They are part of the socio-economic mainstream of the village in its dependence on the tank. Women's knowledge about its management and their experiences and strategic use of its resources during crises situations are high. Their potentials have to be made use of by the project to achieve its stated goals of community management and maintenance of tanks in a sustainable way. The recommendations to mainstream gender into the project are as follows:

Administrative: i) Representation to qualified women at all levels of administration like State Water Board, State Water Policy Implementation Committees, Water Resources Department (that consolidates the major, medium and minor irrigation and groundwater departments), and wherever applicable, these bodies shall be represented by women from the project related CBOs, ii) Women administrators at all levels of the DMI, ZP, and other line departments to address issues relating to gender and water resources: a) All efforts should be made to attract and post qualified women officials for technical posts as well, instead of confining them to merely ‘soft' posts; b) Appropriate steps to inculcate gender sensitivity at all levels; c) Federations of TUAs should also have 50 per cent or even more of women members. ITDP should consult the women members also in matters of decision making; d) Since conflict resolution on matters relating to encroachments, generation of revenue for rehabilitation, O & M have to be settled through the ITDP, the role of women in it is important, and their involvement to be made mandatory; e) Women should be given responsibilities for repair and maintenance work. They have important roles to play since they manage their homes during crisis situations and abject poverty conditions. What is required is power and opportunities invested in them with sufficient knowledge and support initially. Such women must be chosen based on their social standing, commitment to common resources, age, marital status, bargaining power, etc; f) The idea of an integrated tank management system requires that the tank and its surroundings must be treated equally. Each of its components is useful to different socio-economic groups. But when they come under the ITDP through TUA, they have to monitor the use of the tank by different stakeholders. Women members must be compulsorily placed in each of these responsibilities.

Tank and Community Level: a) Women's participation and mobilization through a NGO to prepare the women to participate in tank improvement project; b) Arrangements for Operation and Maintenance of assets created for exclusive use by women or for off-farm activities; c) Women's involvement in the preparation of ITDP. Tank plus activities, focusing as women should form part of the ITDP in as much significant way as catchment or command area development; d) As part of TUA activities, there shall be a Micro-Plan for women's development which shall consist of: identification of various activities including IGA/SHGs; and not merely women from command area landowning HHs, but also from other sections; e) Women's groups shall be viewed as partners in implementing the project than as beneficiaries. Where possible, such women's groups shall undertake main responsibilities of TUA activities such as, bund plantations, forestry/nursery raising, seedling nursery, maintenance of washing spots, etc; f) Priorities should be given to women to use water from the tank (through a dead storage) for feeding livestock. This is especially useful to communities depending on livestock rearing for livelihood. Women from these communities themselves may decide the framework for this. This should strategically get into the MoU between the departments of forest, minor irrigation, the ZP, NGO and the TUA. This should be non-negotiable; g) The poverty focus on 'Gender' has to be ensured by selecting women headed HHs, other vulnerable sections among women like women from habitual migrant households, widows, women from SC, ST and indigenous groups, particularly among marginal farmers and tail-enders.

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