



**Gram Panchayat Spatial Development Plan
Dec 2020
for
Ministry of Panchayati Raj
Government of India**



**MANIPAL SCHOOL
OF ARCHITECTURE AND PLANNING**
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EXECUTIVE SUMMARY

The project was to develop model plan for Spatial Development Plan as conceived by Ministry of Panchayati Raj, Government of India, to be futuristic and create a way forward for the next 20-30 years. The basic goal of the project was taken as Sustainable Development. Sustainable defined as: - Balance which can last, which can be maintained over long period of time, beyond economy, GDP, Per capita income criteria, and Development – which is better, gives more opportunities, gives better facilities, beyond growth and different from bigger the better concept. The four pillars of sustainability were developed through study of the context with the following layers as the foundation. First basic foundation which cannot be changed and has to be the basis of all decisions is the 'Kestra'. This layer is developed by studying the natural setting, the geography, climate, flora, fauna, geology, hydrology etc. The second layer which needs to be respected and is essential to develop identity of the place is the 'Loka'. This layer studies the paradigm of the context which has evolved over time through historic events, beliefs, traditions and evolution of settlement pattern. The third layer which understands the dynamics of the settlement and its needs is 'Desa'. It is understood through the social and economic status of the place, the governance system, the political structure, the demographic distribution, occupational characteristics, income etc. The final layer assesses the present resources and facilities available is 'Kala'. This layer is developed through documentation of the physical infrastructure for basic services and social facilities of the settlements. Added to this the systems of operation in place for transportation, housing, education, healthcare, waste management, providing various services etc., is studied noting the efficiency and deficiencies of the same. The next stage in the project involved bench marking the goals of the future plans for the settlement looking at the aspirations of the people at the village level, the goals set at district level and state level and finally the vision of future at national level. Here the idea was to remove the gap of development between rural and urban with an idea that rural is as good a place to settle as an urban setting. The goals to look at rural as a driver of future economic and social welfare of the country, whenever we set the future development plan it is important that we see that the plan proposed is change for the good. We should plan for the resource management, the waste management and an enabling setting for the people of the place.

The context of Udupi District is that of a land where west side is the Arabian sea and the eastern side is the Western ghats. It has a unique geography where the altitude changes from 1000m to 0m above mean sea level across 10km making it a steep terrain. Its climate is that of hot and humid, and receives very high rainfall of around 4000mm per year. The 196km of coastline is punctuated by five rivers originating from the western ghats and having a web of tributaries and drains across the land. The settlement consists of a web of small and medium sized villages scattered all over the district in three vertical belts. The population is highest along the coast with the national highway and most of the medium sized towns here, the midland is agricultural development with medium density and large villages and the ghats strip in the east is the low density village settlements in a predominantly forest area. The terrain and settlement go hand in hand, with the form of settlement as scattered development, and the rural and urban form merging along the roads in a gradual manner. The proposal is to create a web of such development centers which includes urban centers and gram panchayats which provide the necessary facilities to nurture and support the future of the people.

The project took one month of July collecting data from secondary sources, planning the formats of data collection and creating checklists, questionnaires and building of team for the project. The next month of August went in creating base maps, getting app from NRSC, meeting the gram panchayat members and administrators of the district and briefing the team of volunteers. The following month of September was spent in collecting the data from the villages and reviewing it with the assessment of satellite maps, documenting facilities, infrastructure with household surveys, focused group discussions etc. We also got maps from NRSC with higher accuracy for base maps. The month of Oct was spent in developing the vision plan, detailing the concept and creating the masterplan in consultation with the administrators of state, district, gram panchayats and stakeholders of the village. End of Oct and Nov there were review meetings and presentations to all stakeholders, administrators and state coordinators whose comments, observations and suggestions were incorporated in the final proposal.

- The terrain of ghats made accessibility very difficult especially in the 4-5 months of rainy season. The predominant occupation and economic base was agriculture and horticulture. Though very fertile the land was very vulnerable being foothills of western ghats. It is a biodiversity hotspot of national importance. The variety of flora and fauna supported in this area makes it important to retain the natural forest both for nurturing the ecology as well as for welfare of the people in the area. The heavy rainfall and steep contours makes it necessary to have strict zoning of development areas and guidelines for the type of development of built forms and landscapes. Stability and resource management was priority in demarcating the zoning regulations and future development plan. There was an urgent need to create water management plan and protect the waterbodies, rivers and forest to have food and water security for the future.
- Historically it was important to note "Shankaranarayana" is considered as one of the sapta ketra (seven holy places) created by Maharshi Parashurama. The sapta-kshetra region is 409 kms which includes: Gokarna, Kolluru, Shankaranarayana, Koteshwara, Kumbhakshi, Udupi, Subramanaya. In Shankarnarayana there is one of the rare temples

where we can see the sangam (confluence) of Shankara (Lord Shiva) and Narayana (Lord Vishnu). It was built 400 years ago. Shankaranarayana village, named after the temple, is in the valley of mountain ranges close to the Sahyadris. There were two temples of regional importance which attracted pilgrims of around 100 to 500 people per day. The natural forest and rivers were also preferred for eco-tourism which was yet to be explored. Each section of society and cluster of houses were associated with their local gods and temples. All the water bodies and lakes were associated with temples. This was a potential to be used for the future development plans.

- The main issues and concerns were the lack of good healthcare facilities and education facilities for vocational and professional courses. Since the economy depended on agriculture and horticulture it was important to increase income of people by upscaling the products through small scale agro industries and give avenues to increase income per sq. m of land using mixed farming. Due to lack of labor there was a need to mechanize agricultural activities. The waste management was dismal and there was urgent need to enforce the best practices as soon as possible to prevent further damage to the environment and health of the people. The women and children were vulnerable due to lack of access to facilities for education, healthcare and additional income source. There was a need to create center to support women and child welfare and support centers. There was child labor and drinking addiction in low income groups which made it necessary that the schemes were made to reach children directly rather than in form of money or through parents. There was a need to collate all data and statistics from various departments and groups to collate the existing situation accurately and see that the financial resources are given to the projects, schemes and people where it is needed in reality. There is mismanagement of funds and facilities due to duplication and false claims. On the other hand, there is neglect of people, schemes and projects due to lack of data capture. This can be avoided if there is integration of all data regarding people, projects and schemes at gram panchayat and is cross verified and referenced on ground at regular intervals.
- There main state highway and district road were wide and well maintained but there lack of drainage and local roads were in a very poor condition. There was very bad mobile network and lack of internet facilities which made them isolated and vulnerable in times of emergency or access to facilities. Though new roads were not required there was a need to maintain existing roads in a better way and give access to internet and mobile facilities at regular intervals. Since the area has lot of thunder and lightning the long distant travelers and locals get stranded during rainy season hence there is a need to create shelters along the main roads. Though the houses were in a good condition it is important to provide guidelines of development for future conversion of land, guidelines were needed on plantation and stabilization of slopes, size and typology of built forms for sloping terrain to avoid landslides in future. Earthquake and flooding are constant threat in such areas.

The key points of vulnerability were identified for the ghat section of villages like Shankarnarayana is as follows.

| Sl no | Parameters | Remarks |
|-------|---|--|
| 1. | Forest-Land Use change (Loss of canopy cover to <10%) or Reduction in forest change | Demand for forest land for agriculture and other purposes including construction and housing. |
| 2. | Regional Elevation | It is used to identify sites that are safe and not prone to landslides. |
| 3. | Use of forest by community | Forest dependence by several communities, Occurrence of fire, Preponderance of invasive species. |
| 4. | Forest Management | Marginalization of native biodiversity |
| 5. | Current climate and variability change | Currently is not affecting the region but analyzing the situation, this might be a concern too. |
| 6. | Soil Erosion | Continuous rains and uprooting of trees leading to this issue. |
| 7. | Forest Cover | The relative or sure land area that is covered by forests. |
| 8. | Slope Management | The improper modification methods adopted on original slope condition in hilly regions for the purpose of construction and widening of the road affects the stability of the cut slope (Singh et al.2013). |
| 9. | Catchment Area | The area from which rainfall flows into a river, lake, or reservoir. |



Based on the study and issue identified the vision for Shankar Narayana was, 'A sustainable village that embraces its natural assets, encourages community development, empowers the people and provides opportunities to improve their livelihood.'

| | |
|---|--|
| Goal 1: Conservation of eco sensitive elements | To conserve eco sensitive elements and develop them as assets |
| Goal 2: Employment generation | Create employment and economic opportunity so that people are encouraged to stay within the Gram Panchayat |
| Goal 3: Infrastructure development | Development of infrastructure to support upskill of people and improve the current scenario |
| Goal 4: Agricultural reform | Agriculture reform to increase yield & creating a multiple options of income throughout the year. |

The key points of resilience were identified as follows

| Sl no | Parameters | Remarks |
|--------------|--|---|
| 1. | Social | Access to and participation in various groups or organizations. Peace and security in the area. |
| 2. | Economic | The money that allows people to adopt various livelihood strategies. This could be in form of a regular source of income or savings. |
| 3. | Community Capital | The human, natural, built, and social capital from which a community obtains benefits and upon which the community depends for continued existence. |
| 4. | Institutional | All the policies, acts etc. made by the official bodies which helps in vulnerability reduction of the any community. |
| 5. | Housing/Infrastructure | The basic infrastructure which people utilize to function more productively. |
| 6. | Environmental | The natural resources (water, forests, land) and associated services (e.g. storm protection, erosion protection) on which resource-based activities (e.g. fishing, farming, etc.) depend. |
| 7. | Regulatory | Regulations set by the government bodies (e.g. CRZ regulations) that help in biodiversity conservation and thus enhancing peoples' livelihood. |
| 8. | Business Plans | The business plans of private companies that have an impact on rural peoples' livelihood. |
| 9. | Connection and Caring | Helping each other and working together for solutions. |
| 10. | Information and Communication | Information and communication technology (for e.g. prior alert and warning) could enhance rural communities' disaster resilience. |
| 11. | Transformative potential and disaster recovery | The ability of people to quickly return to normalcy once any disaster occurs. |

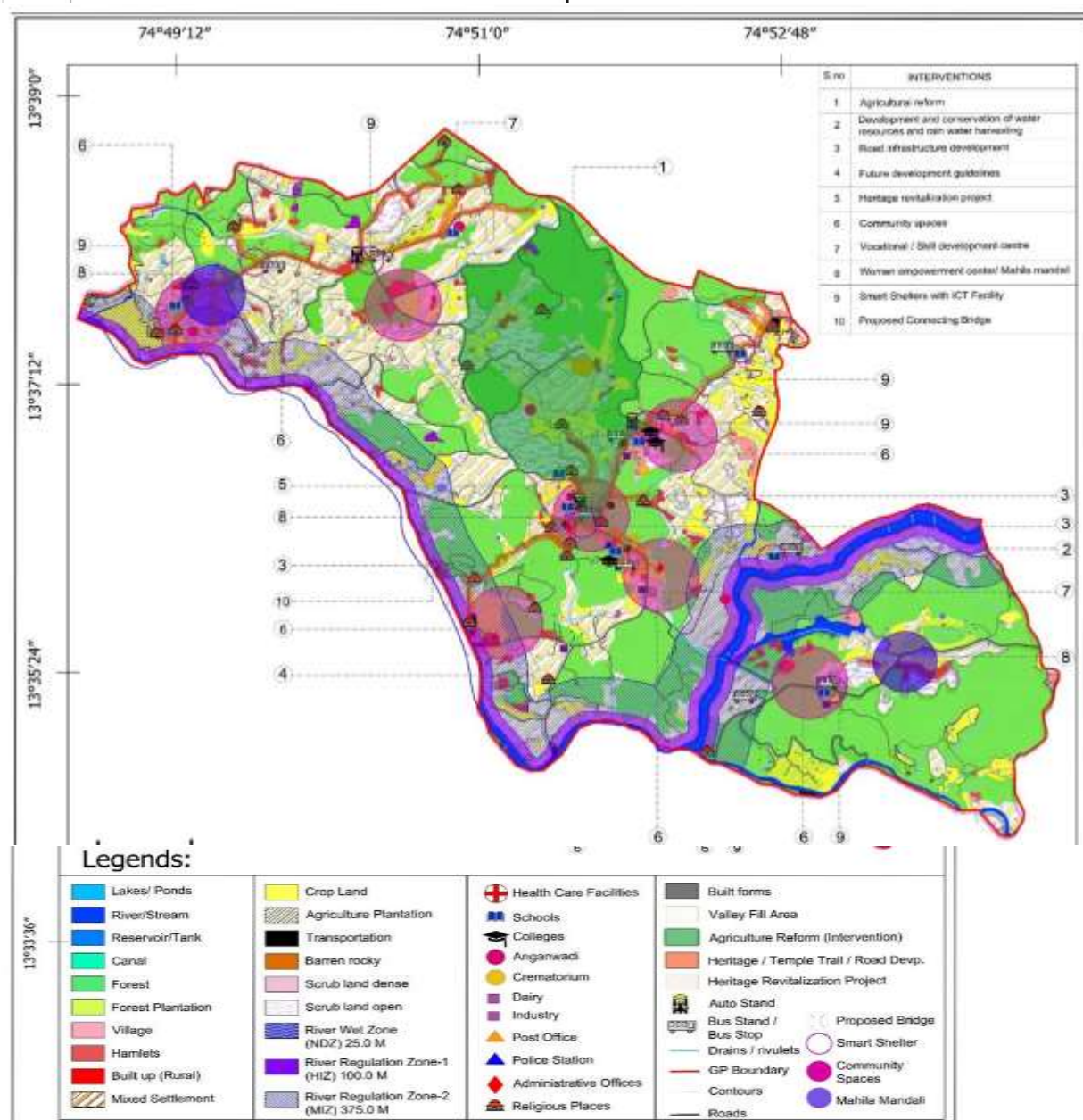
The guidelines were made for water management, slope stabilization, conservation of forest. No development zones were marked for safeguard of environment and ensure safety of landform and resources. Development guidelines were made for different zones like river side, road side, steep slopes, medium slopes and gently sloping sites. There was a policy suggested for women

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and children support center combined with community support centers. The faculties could be an add on to existing healthcare and educational centers with ICT facilities. New community support center for economic and social growth at existing government facilities. There was a need to enforce existing national building codes and ECBC codes for built forms.

The proposed masterplan and interventions were as follows.

| S.no | INTERVENTIONS |
|------|---|
| 1 | Agricultural reform |
| 2 | Development and conservation of water resources and rain water harvesting |
| 3 | Road infrastructure development |
| 4 | Future development guidelines |
| 5 | Heritage revitalization project |
| 6 | Community spaces |
| 7 | Vocational / Skill development centre |
| 8 | Women empowerment center/ Mahila mandali |
| 9 | Smart Shelters with ICT Facility |
| 10 | Proposed Connecting Bridge |





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LIST OF ABBREVIATIONS

| | |
|--------|--|
| DEM | Digital Elevation Model |
| DOP | Date of Pass |
| FCC | False Colour Composite |
| GIS | Geographic Information System |
| GP | Gram Panchayat |
| GPS | Global Positioning System |
| GPSDP | Gram Panchayat Spatial Development Plan |
| HRS | High Resolution Satellite |
| ICT | Information and Communication Technology |
| IRS | Indian Remote Sensing |
| IMD | India Meteorological Department |
| IMSD | Integrated Mission for Sustainable Development |
| ISRO | Indian Space Research Organisation |
| KRSRAC | Karnataka State Remote Sensing Application Centre |
| LISS | Linear Imaging Self Scanner |
| LRDP | Land Resources Development Plan |
| LULC | Land Use Land Cover |
| MoPR | Ministry of Panchayati Raj |
| NCC | Natural Colour Composite |
| NIC | National Informatics Centre |
| NRIS | Natural Resources Information System |
| NRSC | National Remote Sensing Centre |
| RC | Regional Centre |
| RS | Remote Sensing |
| SIS-DP | Spatial based Information Support for Decentralized Planning |
| VHRS | Very High Resolution Satellite |
| WRDP | Water Resources Development Plan |



1. Introduction

Before diving into the topic of spatial planning and settlement, one needs to be able to distinguish between urban and rural and understand what the future of our city is going to be? Is the Urban Development going to remain the way it is now or is the rural development going to remain the way it is now? Many of them have contemplated this and have come up with different types of solutions. In fact, if it is seen very critically the Urban Development is moving towards a semi-rural type of development, and rural development is moving towards urban infrastructure with rural ideology. Further if looked at the practical on-ground development it is seen that there are Industries, certain Institutions popping up, without any defined planning guidelines put in place for this kind of development in the rural areas and these are creating an imbalance in the ecosystem of the rural area. So, this Rural Spatial Development project becomes important because it has come at such a phase of the developments where one must decide how rural areas are going to be in the coming 20-30 years. There is a need to establish the role of these areas and how this divide between Urban and Rural can be eradicated by developing an ideal settlement pattern. These settlement patterns may be different from what is seen in cities, but the main aspect of these patterns is how it is designed and whether it addresses and reduces the problems faced in terms of migration, poverty, lack of housing, environmental problems, pollution and now at present the issue of the pandemic. This spatial planning can be used as an opportunity to redefine the development in a rural area in a way that is more sustainable and in a way that addresses the above issues while moving forward for better settlement design.

1.1. Understanding Sustainable Design in Spatial Development

What is Sustainable Design? When the word sustainable is being used, in simple language it means which can last which can be maintained over a long period of time. It goes beyond the economic parameters of GDP, density and turnover. But many a times when sustainable settlement is considered, it is still measured in terms of density of population, the turnover of the economic parameters, the overall GDP, and the per capita income, but is it really defining sustainable? Is sustainable about the consumption parameters that one wants to define an Urban Development as or should it be a broader picture of what can last? So that is one question that needs to be answered or redefined.

The next question is how can anything be defined as development? It is usually assumed that development is better, it gives more opportunities and gives better facilities but normally it is associated with the growth of something different and bigger, bigger is considered better and different is considered great. But development is not just about being bigger and better or being different, it is also about knowing that it will make things better for the people so at times even things like restricting a development beyond a certain level, restricting number of people beyond a certain level, preventing any kind of development in a no-development zone or in critical natural hubs in order to maintain balance in the environment is also considered as part of the development. Development is not about just building and construction by man, but it is also keeping things in control in a way such that it makes a more balanced habitat.

So sometimes not doing anything, not growing bigger, putting limits on growth and development of buildings can also become a type of development. At times, these types of development are what make things more sustainable.

1.2. Scales of Design

Whenever any design is considered, it needs to be inferred through different scales of design. From the product to energy, from lifestyle design to building design, from sector level design and planning to city level design and planning and all this coordinated with regional level design and planning.

When the different scales of designs are considered especially in sustainable design, the impact of each of these scales increases with increasing scales or it can also be explained as the savings of energy or aspects of sustainability is higher as the scale increases. However, the ease of implementation of the design or the challenges faced by putting it on the ground increases with an increase in scale, that is, the ease of implementation becomes more and more difficult as the scale increases and it's much easier at the product level. So, in short, it can be said that the impact is inversely proportional to the ease in which these sustainable designs can be implemented.

However, that does not mean that any scale can be given less or more importantly, it is a cumulative effect of all these scales that will only enable one to have truly sustainable design and development.

1.2.1. District level

While designing, vision plays a very important role. It is always preferred to have a vision and a schematics or strategic plan at an overall level. Even though there are different commissions and government bodies like the Planning Commission and the statements by the Central Government on their vision for the country and different goals assigned for the development of the country. However, there is a need for more detailed design and strategy at a Regional level where partially spatial planning, economic planning, and policy planning, are developed. At later stages, it penetrates the city where a more detailed development plan along with the land use plan, policies, by-laws are prepared in a more structured manner and finally, sector-level planning is done where spaces are designated, land use is designated, types of building typology is defined. This stage is very critical because it ensures a sustainable design infrastructure at an overall scale, this has a bigger impact than any green building or a green product. So, this is a very critical aspect of design or vision which is considered primarily.

1.2.2. Gram panchayat level

Another, very critical and important is the stage of creating a form or morphology of design which includes the building typology, the by-laws, understanding the different typologies of building in terms of their heights, FAR and the lifestyles of people going to be residing there and how it is going to be moderated in terms of consumption of water, consumption of energy, the types of gadgets used, the types of produce and the waste management, the supply of power in terms of generation of alternative energy, and the types lighting fixtures for various equipment, all of these needs to be standardized or a benchmark needs to be set. After which the overall infrastructure, the types of the benchmark are set for the people in terms of education, in terms of health benefits, in terms of access to the Internet, mobile network. The different methodologies to set standards for infrastructure are followed such that it is available to each and every citizen of that settlement. This is the second stage of design, and this needs to be detailed out before committing to any kind of long-term development strategy along with a complete cost-benefit analysis that needs to be done along with detailing, and the amount of investment needs to be detailed out, while also establishing the impact and the appropriate scale and intensity that can be allowed. These decisions need to be made before the development takes place and not after. In the second stage, the further details are worked out thus making it equally important and critical as the first stage.

1.2.3. Project Level / Building Level

This stage of design is again very important for implementation and the practical layout of this is to give the facilities to enable people, to enable the planning such that it is in accordance to the vision developed in the first and the second stage. This means that the products, the type of material for the green building, the kind of products that people would be using, the kind of facilities given for waste management and rainwater harvesting, are all in place and the detailing of these aspects is done very critically. So, when the implementation is considered, it starts with the third stage, moving towards the second stage and then finally the first stage of design. Whereas in terms of thinking and/or designing it is the first stage that comes first and then it moves on to the second stage, lastly followed by the third stage. When summed up it can be said that thinking is more from first to second to the third stage, while implementation moves from the third stage to the second and then to the first stage of design in terms of scales and implementation. So, until and unless the products and the facilities are not available in the market, it becomes difficult to achieve the goal of the vision and plan of design for the buildings, for the infrastructure for the region and the city.

1.3. Concepts of Sustainability

The concept of sustainability can be based on the consumption pattern because Urban Development or measure of a lifestyle has always been based on the consumptions, the kind of house, the size of the house, the types of materials used, the kind of lifestyle, the amount of food being produced. But slowly because of the idea of the concept of sustainability, people have realized that the total consumption amount must be reduced as much as possible and use only what is required and not waste. Similarly, reducing is further followed by the idea of reuse, So, certain aspects of a



product that can be reused or even recycled are encouraged rather than the products that are one-time use and need to be disposed of. Both the plastic cutlery and vessels have been considered to understand which amongst the two is a better option in terms of consumption. Hence it can be said that the concept of sustainability initially started with measuring consumption and slowly it moved towards impact assessment. If certain types of construction or change in the landscape are done, it becomes very important to understand the impact and outcome of these changes and the replacement they result in. So, with the environmental impact assessment, one tries to establish the type of replacement and the energy it consumes, the impact of these new materials used, the effect of it in terms of nature, in terms of the value of it, in terms of the carbon footprint, carbon use of oil, fuel everything converted to the carbon footprint. Thus, impact assessment became another measure that helped to make better decisions towards sustainable design. Today, there is a new idea of a circular economy where products are evaluated based on the whole life cycle in terms of seed to soil as it is called. It is the type of analysis that starts from understanding the raw material and how it is procured and the kind of consumption of water and the impact it has on the environment. It also involves understanding how the raw material is processed and again at every stage of the product right from manufacturing, to use, to disposal, the impact of the product on the environment and how much energy does it consume, how much water does it consume is understood and looked into, followed the rating of the product which is done to establish if the product is eco-friendly, environmental friendly, is it energy efficient. These ratings are done using the star rating systems, or through eco-labels, or the green building rating systems, all of which are based on the LCA or life cycle assessment.

When the complexity of a city or a region is considered, it would be rather difficult to give complete justice to the concept of sustainability in terms of consumption, impact, or circular economy. The thinking or thought process must go beyond that because there are lots of complex networks of social aspects, economic aspects, spatial aspects, climatic aspects, and geological aspects. The best source of learning can be obtained directly from nature and it can be mimicked to develop a better sustainable design. Nature has always maintained a very good balance within its ecosystem and if observed very critically one would see that there is no concept of waste in an ecosystem, the waste of one species or an event becomes the raw material for the next species or the next event and it goes back cyclically without any generation of waste that way the whole ecosystem including what the humans do becomes a balanced act. Now the same ideology needs to be applied and developed for the cities, where there is no concept of waste, every aspect takes place in a more balanced way and each and every activity like the total consumption, in which it is ensured that the consumed products are in given back in one form or the other, such that it can be used for the next level of consumption. The consumption, rather than calling it that, it can be considered as use and everything is and becomes useful, thus not allowing anything to become wasteful. Thus, it can be said that a lot of different innovative ideas to generate sustainable concepts for human settlement or human endeavors can directly be adopted from nature.

When the ecosystem is defined and classified some very critical features need to be taken into consideration, safeguarded, and understood before it can be taken further in terms of design.

So, what are those considerations, is it the type of area, in terms of area of coverage, is it the type of Geographical features that area has such as mountains, river, water bodies and understanding the topography of the area. is it a flatland or is it a sloping site? all of these aspects matter for housing that ecosystem. Then certain other aspects need to be considered such as the longitude-latitude, the location of the site, the climatic conditions, and the interaction between these Geographical features. For example, consider the climatic condition of the Western Ghats, it is the hilly region when this type of climate interacts with the tropical climate it results in heavy rainfall and flora fauna experienced in this region. Also, the next important aspect to be taken into account is the geology that is the soil structure, the earth structure, the type of soil present and understanding the type of quarrying that can be done for that type of soil, would it be safe to make the land flat, can the land be cut for development of the building, the different types of water management systems, that is the underground water, the different kind of layers of soil and strata present, if the flow of water is enabled, does the soil have percolation capacity or is it impervious. These are some of the particulars that need to be taken into consideration before proposing any kind of change. The working of the whole system needs to be understood as all these systems support a certain kind of flora and fauna. Each and every species has a role to play in the ecosystem starting from some small bacteria in the soil to a worm to a plant to seed to any kind of species of animals such as a moth or a fly, or a butterfly to the larger species of animals, only when these roles are played efficiently will it result in a more balanced ecosystem. Human beings are also a part of this balanced ecosystem. Thus, when any design changes are made for better human comfort or need, it should be ensured that the resulting ecosystem is also equally balanced or as much balanced as it can be made. It is preferable to use the help of nature itself, as nature has a sense of rejuvenation, adaption,

and accommodation of changes, it is not a static aspect. Thus, one needs to be able to appreciate what nature can do and adapt to it along with using the potential of nature to one's benefit while also maintaining the balance of the ecosystem. Hence this understanding of interdependence is very crucial to make a design sustainable.

1.4. Understanding the difference between need and greed

At the start of the design, targets are set as to how much water would be needed to provide for each of the people, how much accessibility of resources would be needed, how much facilities would be given for the people, what would be the density of the population residing in a certain given amount of land, all of these are some of the prerequisite standards and goals that are set before the start of the project. It is of utmost importance and it should be ensured that these goals are based on need and not greed. There is always luxury available to use a variety of different solutions but it should be based within the scope of need, so when different benchmarks of the lifestyle anticipated to give to the citizens of the settlement are set, it should be such that it is of a certain pattern which is sustainable, which we can avail the resources which are available in the local area, make it compatible with the type of climate and topography and the lay of the land being constructed upon. When certain income groups are considered, now this is a very interesting thing when one says income, is it about just the money that a person earns and spends or is it about the kind of lifestyle that the person is allowed to have, the main difference being the health part. Now suppose a person has a certain amount of income but spends most of it (30 to 40%) in maintaining good health that means the quality of life is so low that most of the earnings are going in maintaining health. Considering the cost of education if one wants to learn something that is the effort or the cost that he puts in ensuring that he can learn certain things and what is the availability of resources for welfare like suppose a person wants to have a backup or say insurance or something for his children as a resource and to have a backup, what are the different welfare facilities that he is going to be able to avail, or if the person was supposed to get unemployed soon what kind of fall back would he have in terms of job opportunities for the source of income. So, it can be said that welfare facilities also ensure stability in habitat such that one feels more secure living in a certain place, living in a certain community, or living in a certain society. So when the term income is talked about it's not just about the money it's also about the quality of life, having high income but no quality of life becomes of no value if it does not give anything in terms of lifestyle or social welfare. Thus for a habitat when a benchmark is set, it should be a cumulative effect of all these things, that is access to education, having good health so when the pollution is reduced automatically the types of health problems faced will reduce, the expenditure for maintaining health will reduce, have access to good food healthy food which is produced in the local area will automatically reduce the expenditure for good food and nutrition to maintain good health. If education facilities are provided in the nearby area, then access to good education good facilities of development will automatically be achieved. Hence it can be said that whatever may be the income, it is not about the money but it is about the quality of life that it can afford so it's not earning the money but it is about what kind of life one can lead with it.

So, the benchmarks need to be set accordingly, when planning and designing for this facility as a whole for habitat that one wants to give and there should be a clear distinction between need and greed.

1.5. Perception of lifestyle

When designing aspects like the kind of facility to be given, building typology, the type of sector it would be, different ideologies for water management, need to be considered along with understanding the general perception of people in this regard. For example, consider a garbage collection point most of the people don't prefer to have it in front of their property due to the perception that it will stink, it will look ugly, and it is not something anybody would want to see every day when they come out of the house or building or flat and hence it is not something that is considered conducive for the enjoyment of a good life. The perception will change, only when there is a change in the way the garbage is collected and kept. If it is smelling good, if it looks good and if it is used as a recreational facility and it gets merged with surrounding such that people do not even notice that there is a garbage collecting point, then there would not be any problem in having it at a certain place or location. No one would object to it. It becomes of utmost importance to understand the perception of people, their aspirations, their needs, the way they want to be known in the society, the kind of respect they demand from the society, and the way the society looks at benchmarks in terms of the profession. For example, consider a cleaner on the street, is he given respect by society, is that profession good enough to call himself a successful person? All of



these also matter, so when certain services are expected it should also be seen to it that the profession is respected in the society and give dignity to the labors, and it is made in such a way that, the person feels good that he's doing that job or feels that he will be respected for doing that job. So many at times the solutions are not just about giving a service or an infrastructure but putting it in such a way that the society will accept it and respect it and the people giving that service will feel pride in doing that service. The dignity of the labor, respect from the society, acceptance from the society and going along with the hierarchies placed by the society or changing it in a natural manner is very crucial when such services of systems are made in our design and this will come from the understanding of the culture of history, of social power play, the interactions, the political setups that the society works with. There has to be a thorough understanding of these things before any kind of service or infrastructure is proposed, because otherwise it will be wasted and it will not be accepted, it will not be maintained and all the vision and effort will go waste. And finally, when people accept the design and there is a sense of ownership to the design from the people, from the stakeholders, it creates a sense of belonging and the vision comes into life or becomes a reality. So, the basic idea is whenever anything is designed it should be something that can happen in real and that can be accepted by people or rather people would own and use it as if it were their own.

1.6. Urban Development

When development is considered be it urban development or any kind of settlement development. The questions that need to be asked are where are the buildings going to be located in terms of the existing landscape, existing nature, what is it going to replace, what kind of form will it be as compared to what exists already. If suppose it is replaced what will the overall impact be, what are the things that are going to be there like trees, or will there be horticulture or will there be agriculture or there may be an existing settlement what is it doing now and what would be the impact on that settlement if it gets replaced. Would the replacement make things better or would it be the same or would it become worse? These are some of the questions that need to be thought about and answered before making the final decision. In addition to these, some other aspects that need to be thought about are, after the construction how will it be managed, what kind of waste would be generated, how the is going to be managed, how much consumption of energy would be there in terms of building it, the products, the methods that have been used the source of material that has been taken. Secondly, aspects like the energy required to maintain the facilities created, the life of the facility and if it were to be replaced with new what would happen to the old and how this new facility would be procured, the whole carbon footprint that the development will have right from seed to soil should be considered. Similarly, the services that are required to maintain the comfort, to maintain the lifestyle, to maintain facilities and services of the settlement should be thought about in terms of the cost of the services, the impact, the overall carbon footprint, the energy consumption, the kind of waste generated, before making the decisions about the facility to be given. Lastly, the question that is asked is where it is coming from? Now, whenever there is a design or shape there are multiple types of materials to choose from, a good decision would be to base the decision on understanding where the raw material came from, if say the raw material were food, then where was the food coming from? if it were water from where would the water be sourced if it were energy from where would the energy be arranged?

In this case, it becomes very important to understand the source of whatever that is consumed and different ways to maintain that resource, now if it were a natural resource how different ways need to established to recharge and maintain it for a long time, if it were a man-made resource then different ways have to be determined to produce it with minimum impact on the environment. So, everything that has been considered to be used for the development or to be provided in the development there has to be questions like 'where is it coming from?' 'how could it be provided?' 'what is its impact on the Environment?' which needs to be answered in these kinds of settlement design.

1.7. Progress towards Sustainable Design

| | Developed countries | Developing countries | World |
|--|---------------------|----------------------|-------|
| Urban population 2000 (millions) | 903 | 1986 | 2890 |
| Percent urban, 2000 | 76 | 41 | 47 |
| Urban growth rate, 2000–2025 | 0.5 | 2.9 | 2.2 |
| Passenger cars, 1996 (per 1000 persons) | 326 | 15 | 84 |
| Gasoline consumption, 1997 (litres per person) | 626 | 55 | 182 |
| CO ₂ emission, 1999 (tonnes per person) | 10.8 | 1.8 | 3.9 |

Table 1-1 Global statistics on urbanization, energy and resource use compiled from tables published by the World Resource Institute and available at www.wri.org

Source: Gerald Mills, University College Dublin_ <https://www.researchgate.net/publication/227266114>

The urban settlement and urban climatology, they have categorized urban population in blocks of 2000 million and it can be seen how the number of such blocks in a developing nation is more and it accounts for more than half, almost 60% of the urban population is in developing countries and if the percentage of the population living in urban areas is considered it can be seen that it's the other way round, that is the 76% of the total population of the developing countries is in urban areas. Now, what does this mean? It means that the resources from the developing countries are being utilized for feeding the urban population in the developed countries that is why these countries are able to have so much population in the urban setup. If the same pattern is followed, that is 76% of the urban population (considering the way urban is defined today) is converted into the urban population in the developing countries there are not enough resources to maintain. As shown in the above table, it is seen that the growth rate in developing countries is being pushed towards urbanization or rather a similar pattern as the developed world is being created. But looking at the consumption of passenger cars in the developed countries, for every 1000 population 326 people are using cars while in the developing countries, for every 1000 population 15 people are using cars, this indicates that the more the population is in urban setup the more is the vehicular traffic which further leads to types of infrastructure, carbon footprint, consumption of petrol, so on and so forth. Also, considering the gasoline consumption it is 626 liters per person in the developed countries compared to a mere 55 liters in the developing world. Now suppose if the developing countries were to convert their 76% of the population into urban setup, not only would they be reducing the agricultural, forest land, and the wetlands, which are producing food and resources for and is supporting that population. It would also be increasing the carbon footprint and overall consumption. So, on one hand, the production is being reduced while on the other hand, the consumption is increased. That is not a sustainable way to approach the issue. While the developing countries say that they are progressing towards a more sustainable settlement, this whole table shows that moving towards converting more and more population into an urbanized setup is not being sustainable. In fact, looking at carbon emission in 1999, it can be said that at present it surely has doubled and the carbon emission is 10 times more in developed world so if when the developing countries are moving towards the developed country, then it can be said that they are looking at consuming 10 times more than what they are doing now and are also looking at producing much less, almost 10 times less than what they are producing now. Can it be considered as a sustainable plan is the primary question here in this scenario and is that what should be put forward for developing a strategy for human settlements. When looking at the numbers above it does not make sense, so what must be done is bridge the gap between urban and rural in a much more sustainable manner and in a much better way which can be considered balanced. First of all, the developing countries should reduce giving away their resources for the urban population, the urban setup itself has to start producing resources and start managing its waste better and create a lesser carbon footprint. For a sustainable design approach, on one hand, the urban sector needs to move away from this kind of consumption while, on the other hand, the rural has to update its infrastructure so that the rural is not completely converted into an urban model, and it would help in reducing the tendency of people for migration and conversion of the population into urban pockets, rather the rural itself becomes a good place to live in while also being sustainable and the maintaining a low carbon footprint. Thus, the understanding obtained from the above chart is very simple, the more rural the countries are, the carbon emission and environmental stability better. But for the sake of aspirations of people and the type of infrastructure that is needed for the citizens, for the people there is a need to create a balance in such a way that urban infrastructure is created but not at the cost of this kind of development.

1.8. Defining Settlement Design



Finally, it is about fundamentally defining a good settlement, it can only be considered as a good settlement if it is taking care of the basic requirements of the people, like food, water, providing a sense of society or sense of community or a sense of culture. There are different aspects such as to respond to climate, soil, landform, the type of soil fertility existing at present, then the different planning and policies such as agricultural planning and development, horticulture planning and development, support from fishery, flora fauna, the forest produce and the land produce needs to be considered to achieve good food lifestyle. The first stage is about understanding how up to a maximum level the context can be utilized to satisfy the requirement of food in a balanced manner. The second stage is all about water. Now food and water come almost parallels because without water there is no food, without the support facility of water management it is difficult to assume that one will have food that is required. Thus, the criteria remain the same like soil, climate, landform, water bodies, agriculture, horticulture, but in this stage another aspect is added that is the lifestyle, how much of waste is being collected, how much of pollution is being created due to lack of waste management, resource management also becomes important along with kind of products that gets into the water, all of these also become equally necessary for good water management. The last aspect being the society along with the climate, landform, agriculture the type of food, flora, and fauna all of which influence in terms of the culture, in terms of food habits, in terms of maintaining the comfort condition and in terms of a lifestyle. Apart from the above aspects the history of how things have evolved and how events have influenced the daily practices, the belief system, and way of relating to natural elements, all these paradigms will also affect the way a good settlement is defined. So overall, this kind of understanding of a place can fundamentally define what is a sustainable settlement for that particular context for that particular place for that set of people for that specific culture.

2. Literature Study

Over the last many years, the world has become more aware of the environmental issues and the overall sustainability in settlement development, in the lifestyle of people, in using the different construction methods. Sustainable development should also focus on providing better living and working conditions for the poor, along with providing them affordable access to housing, health care, water, sanitation, and electricity. (Towards Sustainable Cities, World Economic and Social Survey, 2013).

Sustainability can be defined in many ways, one of the broad ways of saying would be that which meets the need of the present generation while also ensuring that the future generation is left with sufficient resources. Sustainable development constitutes 3 major dimensions – economic, environmental, and social along with other aspects like health care and technology. Presently the idea of sustainability has become so popular around the world that it is considered as a potential solution for many issues faced at international, regional, and local levels by society such as overpopulation, diseases, political conflicts, pollution, infrastructure deterioration, and unlimited urban expansion under limited resources. (Jovovic, R., Draskovic, M., Delibasic, M., Jovovic, M., 2017).

2.1. A framework for sustainable cities:

It has been proposed that the building of a green city is equivalent to building a sustainable city. (Beatley, ed., 2012). Many countries are developing green cities also called eco-cities as a starting point for developing sustainable planning. But it is very important to understand that the sustainability of the city does not only dependent on green buildings but also depends on social development, economic development, environmental management, and urban governance, it refers to the investment and management decisions taken by the local municipal authority. (Towards Sustainable Cities, World Economic and Social Survey, 2013).

It can be said that to achieve sustainability in the cities, the integration of the four pillars – social development, economic development, environmental management, and urban governance play a very important role.



Figure 2-1 Pillars for achieving sustainability of cities

Source: UN/DESA, Development Policy, and Analysis Division

The notion of sustainable development is considered development when both economic and environmental goals are used along with the use of sustainable construction techniques for better agricultural production, energy use management, natural resource management, and industrial production. There are different approaches to understanding the aspects on which sustainable planning is dependent. One of which as suggested by the author, (Munasinghe, in Pearce, 1999) is that the concept of sustainability depends on only the three major aspects i.e. economic concepts, environment, and social these are based on aspects of integrated community development in the regional areas which also include healthcare systems, technology, recreational, and culture. When considering settlement development only these three concepts can be considered unlike the four pillars mentioned above for regional level city planning. Implementing the above three concepts of economic, environment, and social on a regional level requires the numerous amount of planning and policies and it would become rather difficult to integrate these on a regional level as the



implementation and coordinated action in different areas should be such that any achievement in economic growth also helps in achieving the social objectives without endangering the resources of the planet.

The above three classes of issues can be arranged in a triangular format explaining their interdependency through Munasinghe's Triangle. (Munasinghe, in Pearce, 1999). Sustainability involves finding solutions for the above three aspects in such a way that all the impact is balanced. (Jovovic, R., Draskovic, M., Delibasic, M., Jovovic, M., 2017).

Under the Economic aspects of the issue, major points to be considered are the efficiency, growth, and stability while in the environmental aspect, biodiversity, natural resources, and pollution are considered and social aspects poverty, empowerment, culture, and heritage are to be considered.

Another way of perusing the inter-connection or interrelation between the above three aspects: environment, economic and social can be expressed through Daly's Triangle which replaces the social aspect from Munasinghe's approach with equity and considers the three main aspects to be equity, economy, and

environment. These aspects can be arranged in a triangular format with the environment being the most primary and occupies the bottom of the triangle followed by the economy which occupies the center of the triangle and the top of the triangle which is occupied by equity.

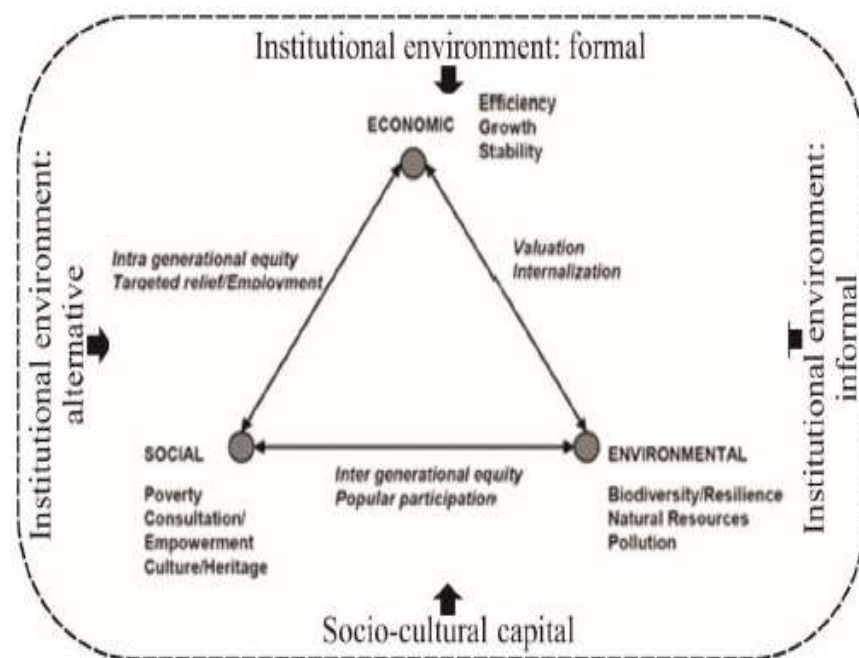


Figure 2.2 Munasinghe's Approach to Sustainable Development
Source: Adapted to Pearce, 1999.

The natural environment is considered as 'ultimate means', economy, technology, ethics, political is considered as 'intermediate mean' while equity, human wellbeing, is considered as the ultimate ends' in this triangle, designed according to Daly's triangle. In this the intermediate mean that is the economy is placed at the center of the triangle so that when economy succeeds it achieves the ultimate end that is it achieves the equity and human well-being and when the economy is conserved and protected this results in ultimate meaning that is the conservation of the natural environment.

The three aspects of sustainability from Munasinghe's approach, the economy, society, and environment can be considered as three eccentric circles where the economy is placed within society and society and economy both are placed within the environment. One can achieve sustainable development or a sustainable settlement only when measures and policies are taken such that all three interconnected aspects are equally respected.

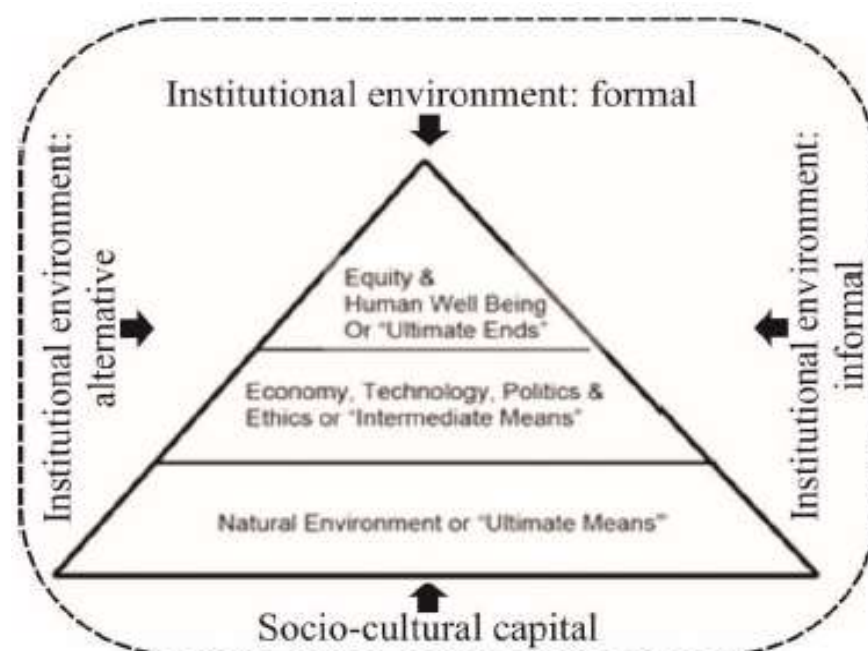


Figure 2.3 Daly's Triangle of Equity, Economy, and Environment
Source: Adapted:
Source: www.sustainablesonoma.org/keyconcepts/dalystriangle.html

2.2. Institutional Components and Sustainable Regional Development:

Understanding the institutional components of regional development also plays a major role in achieving Sustainable Regional Development. The following are the six sub-systems showing the interconnections between each other. Each of these sub-systems to be viewed as representing a certain type of potential that is vital to the overall development of the total system. (Bosel, 1999; Shuaibu & Oladayo 2016).

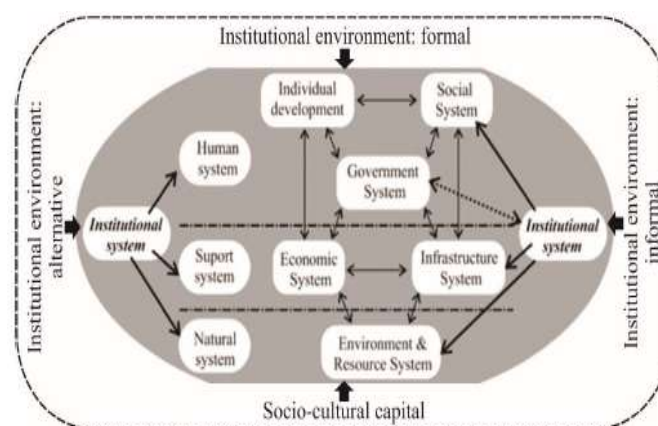


Figure 2.4 The six major systems of the anthroposphere and their major relationships

Source: Adapted: Bosel, 1999

The above figure, first depicted by H. Bosel explains the sustainable settlement through an institutional system, considering it to be an important aspect of sustainable development on the global and local levels. (Langeweg, Hilderink & Maas, 2000)

Sustainable Development can also be approached through a central objective which would be to decouple the conventional use of resources with the economic development of the city using various technological innovations, improved efficiency, and changes in individual practices.

As the global urbanization is increasing and the human activity is getting more concentrated in the urban areas, efficient settlement planning becomes the key feature of sustainability planning, the inclusion of environmental aspects in the planning along with understanding the urban climate can help develop efficient planning strategies.

Even though there have been lots of research conducted concerning the relation of climatology with urban settlements, but there has not been generated such an applied climatology that establishes a link between design decisions and climatic outcomes. (G. Mills, 2005).

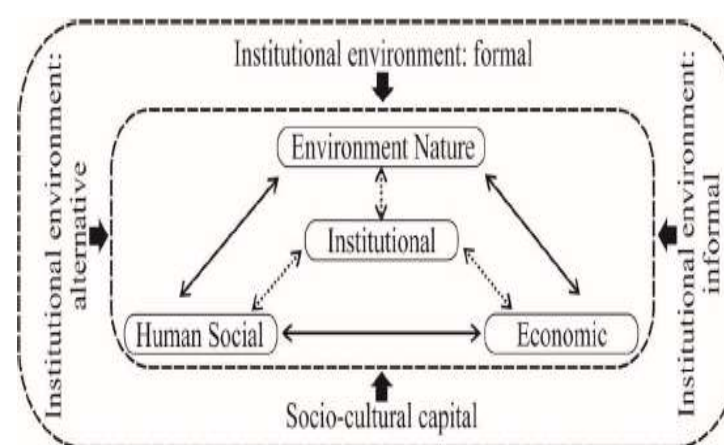


Figure 2.5 Characterization of sustainable development: the interaction between economic, environmental, human and institutional domains

Source: Adapted: Langeweg, Hilderink & Maas, 2000

2.3. Understanding various approaches considered by different countries towards designing sustainable settlements:

To better understand the different ways in which sustainable development settlement can be planned, extracts can be taken from different existing case studies, from both foreign and Indian contexts.

The author (Bulcent Acma, 2005) explains the different concepts of promoting human settlements and eco-city planning approach in the GAP project in Turkey. Anatolia receives less precipitation compared to the other regions of the country, the idea was to utilize this rich water potential for energy generation and irrigation and regular the flow of the rivers (Unver, 1999). This integrated project does not just cover the multipurpose dam and irrigation schemes but also looks into the development in related areas of agriculture, energy, transportation, telecommunication, health, education, and urban planning. The basic development idea of the GAP masterplan was to transform the region so that it acted as a base for agro-industrial products. (Bulcent Acma, 2005, GAP Master Plan, 2002).

This plan also observed the principles of sustainability. While supporting the socio-economic adaptation and resettlement. The eco-city planning criteria were applied in all aspects such as biodiversity, analyzing climatic features, wildlife projects, environmental health awareness projects, social components, the economic component, spatial component, and related activities along with proposing various government strategies and policies.



The types of construction materials and traditional design techniques used also play a very important role in developing a sustainable settlement design.

Considering two different climate cities of Iran, authors (I. Khajehzadeh, B. Vale, F. Yavari, 2016) discuss in their paper the different traditional materials and techniques used in the ancient times to survive the hot and dry and hot and humid climate of Yazd and Bushehr cities respectively.

Both the houses were typical central court houses, with mud-plastered walls, the brick obtained from the same land where the houses are being constructed. No windows towards the exterior walls to avoid direct hot breeze from the outside environment. Wind catchers designed on the southern side of the house to allow a cool breeze into the house during hot summers. Single or Double storied houses. While the Bushehr house is normal double-storied, sometimes also supporting three floors, with high walls to allow more shadow as the temperature can go high during the summer. The central courtyard is a square and mostly regarded towards the north.

These are some of the design techniques that could be used in the Indian context with similar climatic conditions. These traditional and passive techniques also help approach the settlement design pattern more sustainably and efficiently.

When discussing building materials, thought could also be given to the green development in the Slovak Republic, where they are trying to achieve sustainability only using the ecological materials available in their locality. (M. Moresová, M. Sedliaciková, J. Schmidtová and I. Hajdúchová, 2020).

This method though not popularized yet between the locals, a few younger generations have started building their houses using ecological materials like wood, bamboo, reed, straw, and clay, while avoiding the use of brick masonry for construction.

The use of ecological materials has started becoming more popular in the town area where the carbon footprint is already high due to different large industries, and people do not want to add to that carbon footprint by further constructing even their houses using masonry.

But in rural areas, these materials are yet to be as much popular. People are reluctant to construct using wood and bamboo as it does not have higher fire resistance and it requires trained labors along with a sufficient economy.

If these building materials are promoted and people are educated about the availability of the material, it could be widely used in both rural and urban areas.

When proposing a newer efficient Sustainable settlement planning, certain different aspects can be taken from the traditional Indian and Arab sustainable planning techniques, as mentioned by authors (M. Dhingra, S. Chattopadhyay, 2016).

The physical form of the cities is measured in terms of distribution and density. Urban forms are all about – Building aspects, skylines, city boundaries, social groups, and special markings.

While cities in Arab gave in to the urban globalization and started constructing a tower-like tall structure, some of the cities in Rajasthan have still maintained their traditional aspect of planning through this globalization.

In Arab, the traditional residential planning in a settlement was a courtyard type plan with opening placed onto the inner side of the courtyard, the orientation of the houses was away from the direction of the sun, prominent wind towers, use narrow streets as private street corridors. While in Alwar, Rajasthan the traditional residential planning was of the 'Moholla' type planning, which included a cluster of residences throughout the settlement separated by narrow roads and open spaces, religious spaces along with Chaukas designed near the intersection as public gathering spaces. This kind of organic growth pattern created a sense of visual linkage to the Aravali hills.

The planning strategies in Alwar involved, multifunctional with courtyard centrally placed, fenestrations, and open spaces in the form of jallis and balconies, oriented and tilted sideways to avoid direct sunlight. The overall accessibility was provided using narrow walkways and alleys, and street corridors for kids to play. These traditional settlements show a holistic approach to building technologies that were sustainable and environmentally friendly.

All these aspects can be used in the present settlement planning for efficient design development.

In the modern-day urbanization process, the streets are losing their diverse traditional touch and moving towards homogeneity in terms of commercial shops, material, building construction, and is slowly being transformed into a more modern style, especially through modern material of façade design (glass and concrete). One such example as explained by the authors (A.B Sholihaha, T. Heath, 2016) is Pasar Baru Street in Indonesia, a complete traditional street that transformed into the modern street due to urbanization.

Therefore, when developing a settlement design strategy, it should be seen to it that the existing streets do not lose the traditional touch in terms of function, sense, and visual quality maintaining the diverse and ethnic style within the streets thus improving the quality of streets and the urban space around it.

2.4. Sustainable Settlement Planning in Indian Context:

The above discussed were the different ideologies and strategies about sustainable settlement planning taken from the foreign case studies and perspective, these can be modified and developed further to suit the Indian context.

Now, what does Sustainable settlement planning mean in an Indian context and principles? According to the author (Dhiru Thadani, 2011), who tried to understand the famous statement by Mahatma Gandhi “The future of India lies in its village”. Gandhi believed that it was impractical for Indian cities to accommodate the ever-increasing population efficiently. The villages in India were self-sufficient, simple, free, non-violent, and truthful. Thus, he suggested that the Rural part of India could be provided with enough services in all aspects so that the people did not migrate to Urban areas and overpopulate the same. In this manner, India would have a well-balanced both Rural and Urban area. He suggested that robust community life is essential in the rural village as it is in any other urban neighborhood, the building block of a successful city.

Vice President Shri. Naidu said that approach to development must have a dual focus, it must be comprehensive and must keep both the urban and rural ideologies in view. He also agreed with the principles of Mahatma Gandhi and proposes that more development of services and infrastructure should be considered in rural areas as well, to avoid migration to urban areas as those are already congested and have a very large carbon footprint. The traditional aspects, arts and crafts, skills of the village should be utilized as a part of the development. He also pointed towards the main aspects that need focus are – a clean source of energy, reduction in consumption, and efficient waste management. (Development of villages is an essential precondition to development of the nation: Speech by VP at the AICTE Awards Ceremony, 2019).

2.5. Understanding the Concept of Smart Villages in India:

The increasing population of the world makes it necessary to alleviate the cities and the villages to serve smartly. (Dr.C. Grace Indira, V. Anupama, 2015).

In this present era, development is needed for rural and urban areas to maintain balance. The concept of smart villages can be obtained through first establishing the vision and need, different approaches, government policies, and technology. It is also dependent on the local condition, infrastructure, and available resources in the rural area. Urbanization up to a certain extent cannot be stopped but it is always important to maintain a balance between rural and urban development.

The various approach towards smart villages considered are as follows:

Community mobilizing

Converging government schemes and private initiations

Partnership development

Life cycle approach

Protecting the local culture and tradition

Technology development

With this kind of development in the village area, the migration from the rural to urban can be avoided thus reducing the clustering in the urban region.

2.6. Understanding the relationship between Streets and Sustainable Settlement:

In a settlement planning, the design of streets also plays a major role, it becomes important to understand how these streets have been designed in terms of commercial aspects, built and unbuilt spaces.



Foam based coding (FBC) is a way of regulating land use development to achieve a particular type of landform. According to the authors (L.S Shajia, M.K Kini, 2016), the following are the aspects that can be obtained from FBC considered through a case study of a commercial street in Kerala:

Each stop in the street will have its own commercial area
Corner plots to imbibe a pocket area to attract people
Neighboring shops can share a common veranda space if they share a common wall
Segregation of shops from the main road to the collector to avoid congestion at a one single area
Maintain a sense of history, use of material such that it depicts the cultural through material and form
Build height to street width ratio to be maintained
Built to unbuilt space ratio, such that the scale and character is maintained
The same aspects can also be applied to streets in settlement design to obtain a more sustainable and efficient development plan.

2.7. Vastu Shastra in Sustainable Town Planning:

In India, a lot of importance is given to Vastu and people believe and follow these traditional planning principles in most of the building design strategies. Respecting the beliefs of people, the principles of Vastu can also be used for a sustainable town-planning design. (Reena Patra, 2014). For sustainable town planning concepts of Purusharatha i.e. Dharma, Artha, Kama, and Moksha along with Vastu Purusha Mandala are implemented.

As mentioned in the Vedas, man can improve the condition of a site by understanding its location, direction, deposition.

The fundamental principles of Vastu Shastra are:

The doctrine of orientation: the cardinal points

Site planning: soil, size, shape, colour of site

Proportionate measurement of Building

Six cannons of Vedic Architecture

Aesthetics

The following points are to be considered when implementing Vastu in town planning;

The site should be lowered on the east side to allow direct sunlight, natural scenery should be such that it adds to the beauty and grandeur of the place, any site should be avoided on the western side of the mountain, avoid southerly exposure or tilts, it is preferred to have water bodies on sites such as lake, river, pond or tanks. The roads running from East to West – allow circulation of sunlight through the day, and roads North to South – circulates cool breeze throughout the day.

Vastu Shastra also describes the location of different buildings such as the admin complex, schools/universities, industries, residences, commercial shops, and cremation ground within the town. (Reena Patra, 2014 and Ancient Settlements in Literature-Article).

2.8. Sustainability and Livability in Settlement Design:

The other aspect to be considered in a settlement development is the relationship between sustainability, livability, and settlement planning.

Settlement plays an important role in creating human civilization by providing space to meet the present and future needs. Overtime the occupation and activities of human change and thus the environment provided should be able to adjust to the change and in turn, the inhabitants have better living conditions to achieve sustainability. (Thorsby, 2006; Leby J, L Hashin, A, H, 2010). Livability here is mentioned as the rating of happiness or something that provides the external opportunity or improves the quality of life. It can also be explained as an ideal condition where a settlement or city can adapt to create an enjoyable life to maintain and even improve the quality of life. This improvement in the quality of life will further lead the inhabitants to develop a sustainable city. Therefore, it can be said that livability on a settlement is a process that would integrate the various aspects of the life of its inhabitants. (P. Setijanti, I. Defiana, W. Setyawan, J. Silas, S. Firmaningtyas, and R. Ernawati. 2014). Livability is the implementation of sustainability in the context of the local community.

2.9. Understanding the importance of Resilience in cities:

When discussing the development of the cities, different types of shocks and stress impact the city in different ways. Their levels at present are increasing at an alarming rate due to rapid urbanization, climate change, and political instability. One such aspect that can help in reducing these effects is by designing resilience cities. Resilience refers to the ability of the urban system to maintain continuity through the different shocks and stress. The approach towards designing a resilient city is to have different access plans, policies, and acts while preparing itself to face different challenges. (Resilience Cities_UN-Habitat)

Natural disasters to date have caused huge losses in terms of humanity, resources loss, thus damaging the economy of the country. The concept of resilience cities increases the capacity and decrease the fragility of the city.

The different resilience strategies as per UN-Habitat that can be incorporated in cities are:

- provide knowledge about the best practices by gathering information from the local body
- advocating the different strategies and activity through campaign and promotions
- collaborating and partnering with a private corporation

These strategies not only help in developing a resilient city but also help in developing a sustainable settlement and city.

The overall literature study has given an idea about the different approaches in terms of planning of buildings, streets, use of different local building material, use of different government policies and strategies to develop a sustainable settlement plan, which also retains the local traditions and culture along with an aim to improvise the quality of life of the people living in the settlement.



3. Structure of study

Four pillars of sustainability defined through literature and Indian ethos is that the design should respond to context and context is defined in four pillars.

1. Natural Setting- Kestra- natural setting including geography, climate, flora, fauna etc. Understanding ground water, hydrology, geology, geo morphology, water catchment, drainage pattern, slope analysis, bio diversity et chance knowing the natural resources and ecological cycles of the region.
2. History and Heritage- Loka- paradigm of the place, a construct of settlement developed through time and historic events. This gives the key events and importance of various structures and practices in history. Understanding the perception and beliefs of the society. Respecting the local know how and culture of the place.
3. Socio-economic-political structure- Desa- the socio-economic and political context for governance, mortality, human development index, demographics, occupation etc. Trends, aspirations, lifestyle of people. Immigration and migration of people and the reasons.
4. Physical Infrastructure- Sthana- Mana- the current status of the place w.r.t. to physical infrastructure, social and cultural facilities, water sources, social infrastructure for health, education, transportation etc.
5. Planning concept and structure- Bindu and Cakra- developing overall benchmarking for people, addressing critical factors of the region, development criteria and best practices, circular economy, sustainable practices, management of resources, waste management, good governance etc.
6. Physical development plans and policies- final landuse and development plan with policies and guidelines for physical infrastructure, conservation of resources, circular economy for waste, sustainable industries and building guidelines, recommended guidelines for waste, and future developments etc. and demonstrated in projects.

3.1 Survey Procedure and Approach Strategies:



- The saved Entry can be completed by accessing the Continue Previous Tab.
- The form can be sent after completion.
- Geo tagging has to be done under the open sky.
- The information required for the app is quite limited as compared to the survey form
- The app is functioning smoothly, and no other issues are identified so far.

3.2 Survey Approach Strategies:

Take sample from each ward and each community, profession, age group, as much as possible. Geo tag water sources, social infrastructure and landmarks etc. Identify local volunteers and handhold them and train them for the app. Do ground survey ward wise ourselves with the volunteers. Collect Phone numbers of People at random. Circulate Hard copy survey forms in Kannada for the others and ask volunteers to continue the survey. This way we can complete most of data collection off site. Challenge would be to keep track of Geo tagging for the App
Do on site observations and take soil and water samples.

3.3 Process and Timeline followed for Gram Panchayat Spatial Development Plan

WEEK- 1:

A brief overview of GPSDP proposal by MoPR, SISDP presentation by GOI-MoPR.

First virtual meeting on Gram Panchayat Spatial Development Plan for rural areas was held through video conferencing on 1st July 2020 where the Secretary, Ministry of Panchayati Raj made introductory remarks regarding the vision of the gram panchayat special planning project (Figure-3.1). The NIC National Informatics center made a presentation on the Gram Manchitra application for GIS explaining the features and the functionalities available in there. The NRSC (National Remote Sensing Centre) demonstrated the Bhuvan platform for GIS. It was briefed that the aim of the spatial planning proposal should stimulate the decentralized model of development taking into account the local sensitivity of the people, their visions and their expectation striving towards Atma Nirbhar Bharat.



Figure 3.1 Virtual Meeting with MoPR
Source: GP Survey Group, MSAP

WEEK- 2:

Distribution of work in teams & listing of data to procure from GPs for GPSDP proposal.

The principal investigator Dr. Deepika Shetty, Director, Manipal School of Architecture and Planning (MSAP), briefed the team about the Concept Note and the criteria for selection of Gram Panchayats Uppunda and Shankar Narayana in lines with the criteria given by MoPR and Vision Document of Udupi 2025 (Figure 3.2).

Three teams were formed comprising of MSAP Faculties with three principal aspects:

TEAM-1: Socio, Economic and Morphology,

TEAM-2: Environment and Natural Resources and

TEAM-3: Physical Infrastructure.

The related information and the data that was needed to be collected from Gram Panchayat offices were listed out. In brief, land utilization index, resource mapping, land value, socio-economic structure, vulnerability index, Development Plan guidelines, policies, decision-making tools, assessment and monitoring guidelines for supporting documents were listed out to initiate the data procurement process.



Figure 3.2 Work division and discussion on project related data procurement.

Source: GP Survey Group, MSAP

WEEK- 3:

Preparation of checklist for GP data collection for both GPs by respective teams.

A preliminary set of questionnaires were framed by each team with respect to their study aspects for both the gram panchayats. The list of questionnaire included the occupation (service, job, industrial labor), land holding, housing (built up details), services, monthly expenses, health facilities, food supply, seasonal variation, various Government Health Schemes, Vocational Training, presence of Self-Group Organizations any schemes availed under SHG, issues related to water supply, sanitation, electricity and telecommunications services.

In addition to this, questionnaires should include suggestions asking for improvement of the village in terms of infrastructure for social facilities, educational facilities, healthcare facilities, business facilities, employment facilities etc.



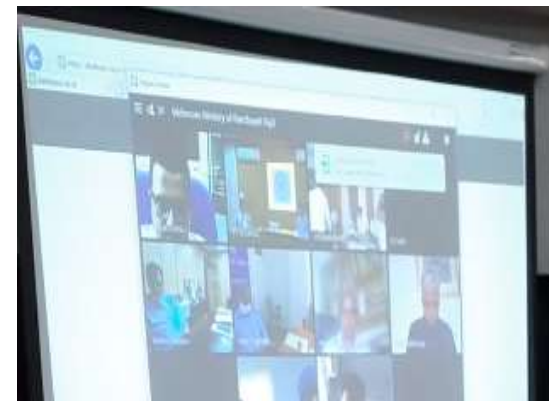
WEEK- 4:

Development of existing land use map by GIS team for GPs

(Source: Bhuvan Panchayat 3.0).

Geographical data of shortlisted Gram Panchayat as directed by Sri Uday Kumar DDG, were provided in layers for an area around 5 kilometer of the specified Panchayat boundary which included road, railway line, Canal line, Canal polygon, river line and polygon, settlement (built up), water body, Panchayat boundary.

The progress of review of the initiative taken by team MSAP was presented by the principal investigator Dr. Deepika Shetty during the Progress Review meeting by respective institutions (Figure 3.3). The Inception Report for both GPs was mailed to MoPR.



**Figure 3.3 Progress Review for institutions
(Presentation by Team MSAP)**
Source: GP Survey Group, MSAP

WEEK- 5:

Consideration of TCPA & PR acts to implement in the study checklist.

(As suggested MoPR).

Each team reframed the set of questionnaires for the Field Survey with reference to the Rural Spatial Planning Policy issues under Town and Country Planning Act and Panchayati Raj Act. Various Government Schemes were considered for understanding the policies and schemes from the Ministry of Rural Development like Water Conservation stories, Sabki Yojana Sabka Vikas, Gram Swaraj Abhiyan, Disha, Mission Antyodaya MGNREGA, PMAY- G, Swachh Gram etc. The list of attributes to be collected in field documentation was enlisted and shared with NRSC for developing the smartphone based mobile application for the field survey and data collection (Figure 3.4).



**Figure 3.4 Documentation of attributes for field
survey and data collection.**
Source: GP Survey Group, MSAP

WEEK- 6 and 7:

Documentation of 6 layers generated by NRSC in the study list related to Infrastructure.

The 6 layers generated by NRSC (LULC, Slope, drainage, Settlement, rail and road) through discussions held on 04 August 2020, was added in the study list and analyzed by respective teams. High quality and sustainable human settlements focus area such as Resource optimization, facility development, sustainable tourism, context specific neighborhood, etc. have been broadly identified by team as the key issues for the development proposal.

Action Plan on methodology, benchmarking and best practices were framed by respective for the broad issues identified by them. GIS team had created QGIS files and generated CAD files (layer wise).

WEEK- 8 and 9:

Demonstration on the application of Mobile App by NRSC and Timeline of activities for the Survey was planned Team MSAP.

NRSC under the guidance of Joint Secretary (Fiscal Devolution) Sh. Kushwant Singh Sethi, had demonstrated the mobile app for geo- spatial household survey considering the aspects which are shared by various institutions to be updated in the mobile app (Figure 3.5). The User Manual was shared by NRSC to all departments and a demo survey was conducted on 25 August 2020, after the credentials were shared.

The observation checklists under each broad topic were enlisted by respective teams and was shared with the survey team for the conduct of Household Survey. The survey form questionnaires were translated in Kannada language along with English transcript for the village people and the GP local volunteers for the smooth conduct of the survey.

The data needed by various Government authorities were enlisted and official letters were sent to the concerned authorities. The survey team (MSAP faculties with student volunteers) was briefed about the survey intent and process. For each GP, the team was divided as such that they shall be able to collect the relevant data and information pertaining to the issues identified for both GPs. In addition, the respective GPs were requested to allocate Local Volunteers to assist the Survey team. The application of Mobile App was re-tested again before the commencement of the survey. The following layers were received from NRSC namely, contour, geo-morphology, lithology, soils, satellite data.

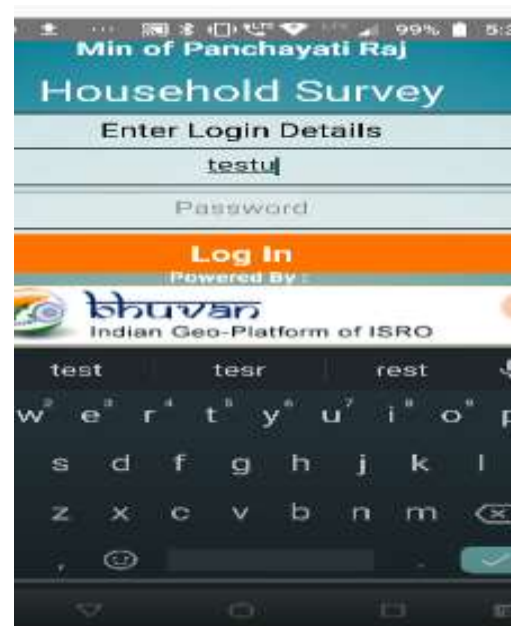


Figure 3.5 Mobile App demonstration by NRSC for Household survey.

Source: GP Survey Group, MSAP

WEEK- 9:

Onsite field Visit for Project briefing to the Gram panchayat officials.

The onsite visit was scheduled on 29 and 30 August 2020, firstly with the Gram panchayat officials briefing them about the development proposal. The reason for selection of their GPs was briefed by principal investigator Prof. Deepika Shetty with a formal interaction with the officials. The local volunteers were briefed about the Mobile App application by Team MSAP.

The team visited Shankar Narayana GP in forenoon and scheduled the visit to Uppunda GP in afternoon.

The Shankar Narayana volunteers were assigned with the survey team with respect to the wards they belong to so that the context study with related infrastructures could be geo- tagged properly.



Figure 3.6 Shankarnarayana GP Officials with local volunteers and Team MSAP.

Source: GP Survey Group, MSAP

WEEK- 9 and 10:

Onsite field Visit to Gram Panchayats for household surveys and identifying issues and challenges faced by the GPs.

For generating action plan, as instructed by NRSC, the water bodies and water- resources, soil condition and soil samples, rain water harvesting methods (if any), agricultural farmland descriptions (crop types) etc. were required to be compulsorily documented with geo-tagging. The Team: Environment and Natural Resources, collected the samples of Water sources, soil types from different wards for testing and analysis (Figure 3.7). The physical Infrastructure team were working on the household survey and discussing the challenges and issues faced by the village people in terms of basic amenities or facilities for their livelihood, health and education (Figure 3.8). All the contextual information (existing roads, wards boundaries, existing social infrastructures, land holding areas, water bodies, major canals etc.) were marked on the land use maps (Figure 3.9).



The major issues to be identified in both the GPs as shared by NRSC team were documented by the Survey team which were as follows:

Water resources: Existing drinking water scheme, Sources of water and whether it is perennial, Village bore well, dug wells (geo tagged locations of few), quality of water in them, status during summer, what depth usually the water is available in them. Existing water harvesting structures, Irrigation types and approximate area under them. Agricultural resources (Dominant crops, plantation types, how many crops taken, Fodder crops etc.). Assets: Mandi, market, schools, anganwadis, Primary health centers, agro based industries, storage facilities, warehouses, etc. Soil types: broad type color and texture. Issues and aspirations of the people for a better livelihood and quality of living.



Figure 3.7 Collecting Soil and Water samples for Testing

Source: GP Survey Group, MSAP



Figure 3.8 Household survey (Ward-wise)

Source: GP Survey Group, MSAP



Figure 3.9 Documenting existing Infrastructure

Source: GP Survey Group, MSAP

SHANKARNARAYANA GRAM PANCHAYAT – TOTAL NO. OF HOUSEHOLD SURVEY

| WARD NUMBER | TOTAL NO. OF HOUSEHOLD SURVEY |
|-------------------|-------------------------------|
| WARD 1 - KULLANJE | 59 HOUSES |
| WARD 2 - KULLANJE | 61 HOUSES |
| WARD 1 | 18 HOUSES |
| WARD 2 | 60 HOUSES |
| WARD 3 | 87 HOUSES |
| WARD 4 | 84 HOUSES |
| WARD 5 | 52 HOUSES |
| WARD 6 | 24 HOUSES |
| TOTAL | 445 HOUSES |

WEEK- 11:

Progressive brief Presentation to Ministry of Panchayat Raj:

The progress brief meeting about the Development Proposal with Ministry of Panchayat Raj was scheduled by Team MSAP on 09 September 2020, to update about the work process. Panchayat Raj Secretary Uma Mahadevan, Commissioner Priyanka Mary Francis and ISRO coordinator Sudha Ravindran were briefed about the plan of action and the key challenges and issues identified during the survey (Figure 3.10).

Their recommendations and suggestions were documented and included for further refinement in the strategies for the Proposal.

Meeting with NRSC for work progress of Spatial Planning Proposal by all Institutions.

The VC meeting with NRSC officials held on 12 September 2020, to discuss the progress of Spatial Planning Study by respective institutions was conducted through virtual conferencing (Figure 3.10). The principal investigator Prof. Deepika Shetty briefed about the needs and concerns of both GPs, vulnerable areas of Uppunda GP, violation of CRZ rules, flooding impacts in Shankar Narayana GP where she explained that each GPs have their distinct characteristics and both of them need interventions with skills and waste management being significant in both GPs. The major recommendations by Secretary were marked for inclusion in Development Proposal which were as follows:

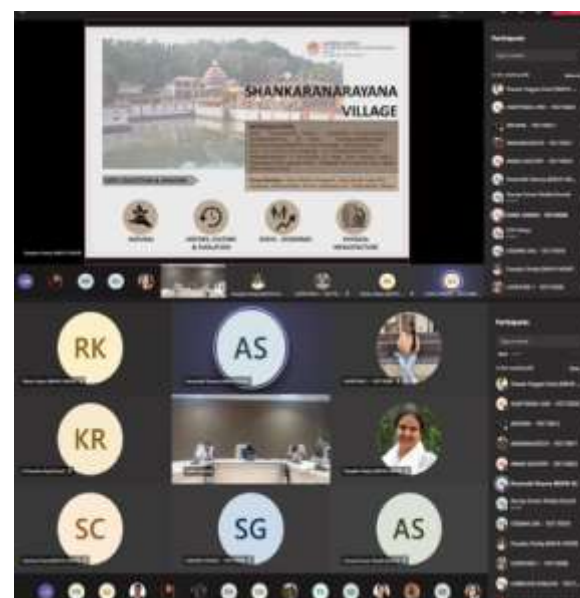


Figure 3.10 VC meeting with NRSC
Source: GP Survey Group, MSAP

Focus on policy implications in Report which lay down the work of GPs, State Govt and GOI for GP Development Plan with focus on strong methodology to give a quality report. Consider the best use of benefits of existing infrastructures, locational advantages can be built in their geographical context.

- Issue of jobs is a nationwide issue to be addressed (whether rural or urban)- address the youth unemployment of graduates. GPs where electricity is inadequate, households need to be virtually self-reliant by using renewable sources like solar and also if possible, return the excess energy to grid to get benefits. Propose possible solutions to the areas where encroachment is an issue to meet the standard road width. Solid and liquid waste management solutions under Swach Bharat Gramin, Phase -2. Also address water logging issues which is seen in certain GPs.
- Focus on involving villagers as equal partners of development proposals. GPs should be the drivers of economic growth, they should be a part of ecosystem where water supply, sanitation services should be par with quality benchmark of services as good as in cities. Proposal should fulfil the aspirations of people which they should determine for themselves.

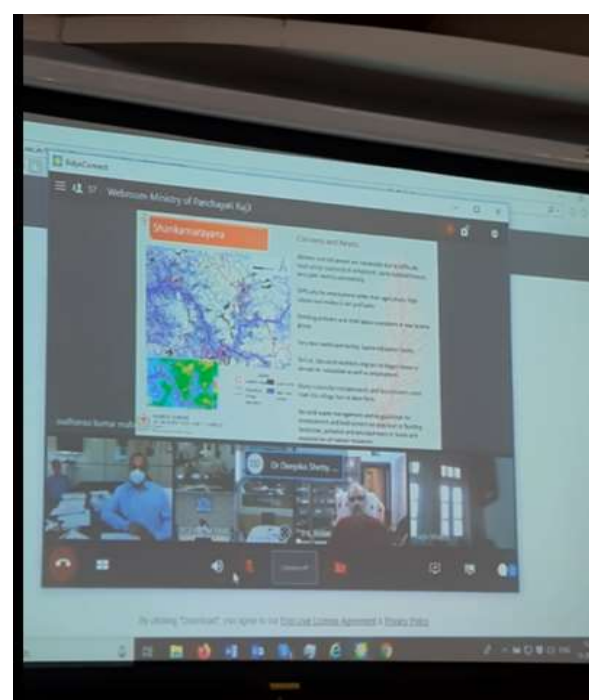


Figure 3.11 Stakeholder meeting with the GP
Source: GP Survey Group, MSAP

WEEK- 12:

Revisit to GPs to collect survey forms and discuss on analysis done by Team MSAP with GP officials.

The Team MSAP re-visited the GP on 14 September 2020, with their analysis and discussed with stakeholders and GP officials about them (Figure 3.12). The key challenges with respect to job opportunities, livelihood income during non-working seasons, lack of infrastructure and potentials for skill development opportunities, waste management challenges etc. were the key concerns which have been raised by both the GPs which needed an immediate attention in the development proposal.



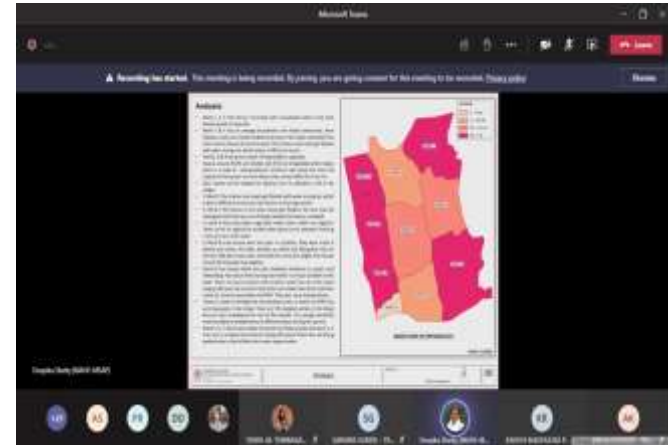
Figure 3.12 Meeting with Stakeholders and GP officials.
Source: GP Survey Group, MSAP

WEEK- 13 - 19:



Data Analysis: Existing Policy as per Govt. schemes, Understanding of local Practices in both GPs and Proposed development for GPs.

The major concerns were analyzed by Team MSAP pertaining to both GPs and the development proposal was focused on these major key aspects (Figure 3.13). All the policies related to each aspect with its best practices were included in the development plan with recommendations. It was analyzed that Land use management (different criteria's) should be different for both the gram panchayats. Recommendations for built form, guidelines for built form, ghat section (coastal areas) should be generated analyzing the base situation.



Key Issues to be addressed for Shankar Narayana GP:

1. Natural forest resource management
2. Solid waste management (strengthen the existing system)
3. Skill development
4. Health and education sector
5. Road infrastructure management (road access and road system)
6. Water management

This was presented on 1st Oct 2020 to Karnataka coordinator Ms. Priyanka Mary Francis, Director MoPR, Karnataka and her team, Ms. Preeti Gehlot, CEO, Zilla Panchayat, Udupi District and her team, Ms. Sudha Ravindran, ISRO, Bangalore and her team.

WEEK- 20 and 21:

Meeting with Stakeholders with Proposed Development Proposals for both GPs.

The stakeholders meeting was conducted in MSAP on 28 October 2020, where the development proposals were projected for their feedback and recommendations.

The stakeholders' inputs were more focused towards alternate job opportunities, solid and liquid management solutions, education and healthcare services.



Figure 3.14 Stakeholders Meeting with the GP.

Source: GP Survey Group, MSAP

WEEK- 23:

Finalization of Spatial Development Proposal and Submission of Report for both GPs.

The inputs from both GP stakeholders were incorporated in the Master Plan of the Proposal for both GPs based on the vision document of Udupi 2025. The paradigm of place because of the historical evolution of the GPs were considered in the final proposal. The development of socio- economic and physical infrastructures in line with Vision 2025 were incorporated in the Master Plan proposal.

WEEK- 24-27:

Presentation of final plan and report to state coordinators and Ministry of Panchayati Raj, Govt of India.



Figure 3.13 Data Analysis through virtual Meeting- Team MSAP.

Source: GP Survey Group, MSAP

The inputs from both GP stakeholders were incorporated in the Master Plan of the Proposal for both GPs based on the vision document of Udupi 2025. The paradigm of place because of the historical evolution of the GPs were considered in the final proposal. Chapter of updated maps and analysis was received from NRSC on Nov 17th 2020. The development of socio- economic and physical infrastructures in line with Vision 2025 were incorporated in the Master Plan proposal. The final plan was presented to state coordinators on 19th Nov 2020 and to Ministry of Panchayati Raj and national level teams on 2nd Dec 2020.



4. Natural Setting-Kestra

4.1 Introduction

The coastal area is fragile in nature which needs special attention while visualizing any planning activities. In three tier (District, Block and Village) Panchayat raj system, village plays a vital role as most of the planning activities can be successfully implemented when done at the grass root level. Now-a-days, the remote sensing technology along with geographical information system (GIS) can act as useful tool in any decision making process. The terrain information and its attributional data can be well analyzed through high resolution satellite images and geospatial technologies. In planning activities, the role of geospatial technology is increasing day to day. Information on different theme of the study area can be analyzed and different spatial planning in village level can be initialized.

District profile

Udupi district (13° 20' 27" N, 74° 44' 31" E) of Karnataka is situated in the western coast of peninsular India. This is separated from the rest of peninsula by Western Ghats. It has vast areas under coastal belt and undulating plateau. The geographical area of the district is 3,575 km². There are three Taluks, 146 numbers of panchayat and 267 villages in Udupi District. The district has a population of 1,177,361 and 146 numbers of panchayat (Census, 2011). These coastal landforms are low and sandy and have broken and rugged rocks. These undulating plateau support scrubby, deciduous and semi-evergreen vegetation that invariably extends up to the foot of Western Ghats. These evergreen forests occur on upper slopes of ghat regions, annually receive the rainfall of above 4000 mm. The forest resources significantly contribute to the State's Gross Domestic Product (GSDP) by being a major source of timber, medicinal plants, non-timber forest products (NTFPs), grazing, recreational activities, carbon sequestration, watershed provisions etc. The important crops are like coconut, paddy, arecanut, pepper, cashew, and rubber etc. (Forest Department of Karnataka report, 2019). The district has 90km long coastal belt which provides good scope for fisheries in Udupi and Kundapura taluks. The coastal belt has a large number of wetlands, backwaters, estuaries and creeks, mangroves, salt marshes and lagoons. Malpe, Kaupu, Thrasi and Maravanthe beaches are well known and have good tourism potential. The wild life of Udupi district is both abundant and varied with a variety of fauna which are both small and big, including vertebrates. The fauna and more particularly the percentage of larger mammals essentially reflect the abundance of flora in the area. This area has no. of species like dwelling animals: monkeys, giant mammals: bison, elephants and deer (Prajapati, 2010). The Someshwara Wildlife Sanctuary in Udupi is situated towards the southwest of the larger section. The sanctuary is mostly made up of evergreen forests, semi evergreen and moist deciduous forests. It is situated very close to the much bigger Kudremukh National Park. There are a number of animals live in the environs of the sanctuary like Barking Deer, Bonnet Macaque, Common Langur, Gaur, Jackal, Leopard, Lion Tailed Macaque, Sambar, Spotted Deer, Tiger, Wild Dog and Wild Pig. There are also a few exquisite birds found like Ceylon Frogmouth, Malabar Pied hornbill, Malabar Trogon, and Malabar Whistling Thrush. The reptiles and butterflies are also found in this sanctuary. Reptiles like Pythons, Monitor Lizards and King Cobras abound in the forest. The flora and fauna of Coastal Karnataka, comprising of Dakshina Kannada, Udupi and Uttara Kannada are depicted in Table 4.1 (D'Cunha and Nair, 2013; Gowda, 2013; Rao and Suvarna, 2016; Narasimhaiah et al., 2016).

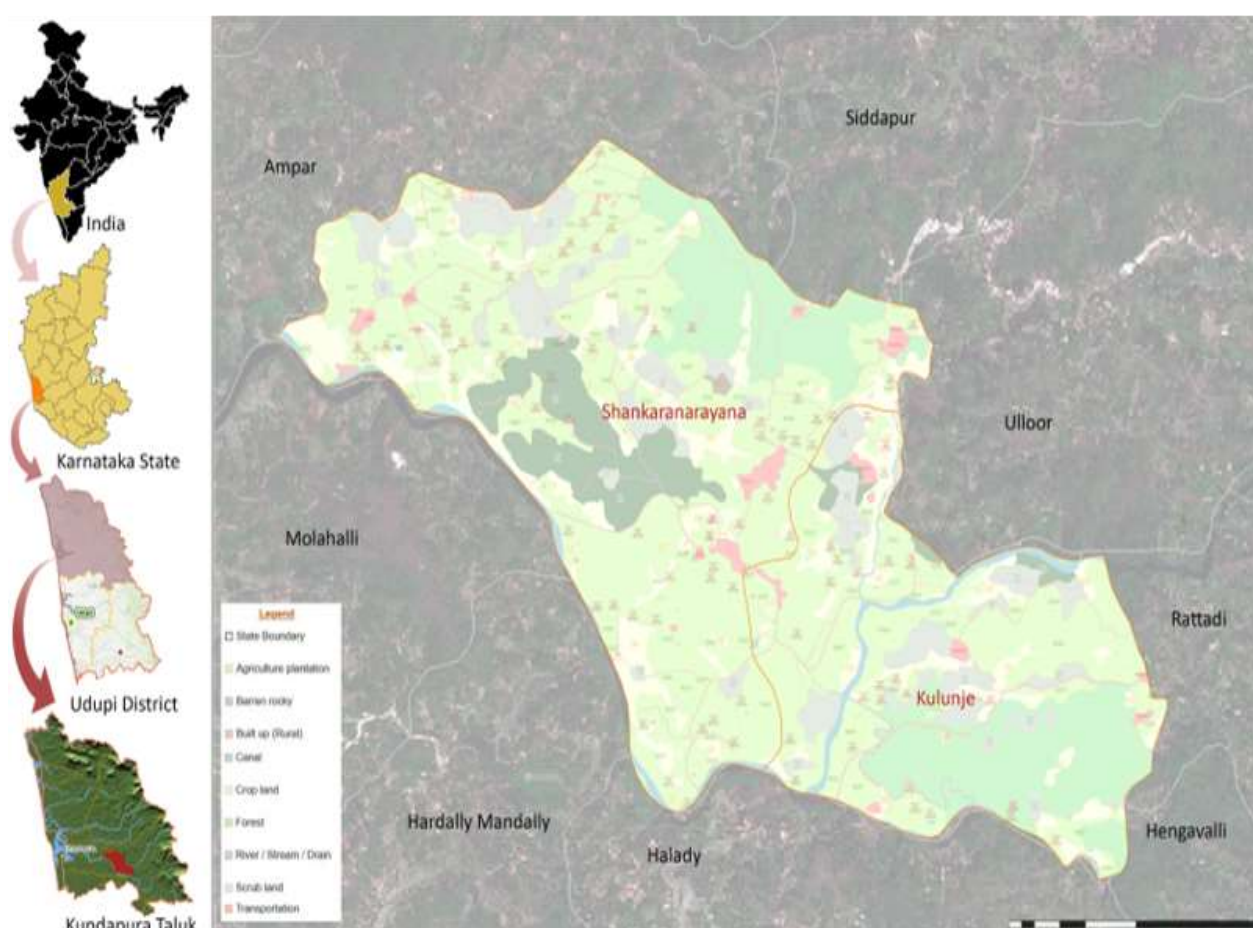


Figure 4.1 Study area location map. (Source: GIS data by NRSC, Layers added by Author)

4.1.1 Udupi district and Shankaranarayana gram panchayat

This district is located at 13° 20' 27" N, 74° 44' 31" E of Karnataka is situated in the western coast of peninsular India. This is separated from the rest of peninsula by Western Ghats. The district has vast areas under coastal belt and undulating plateau. The geographical area of the district is 3,575 km². There are three Taluks, 146 numbers of panchayat and 267 villages in Udupi District. Shankaranarayana (13°37' 29" N, 74° 51'25" E) is a village in Kundapura Tehsil of Udupi district in the state of Karnataka is in the western coast of peninsular India. It is situated in midst of coconut and arecanut plantations along with forests adjoining Western Ghats. The State Highway (SH) 27 – Kundapura Agumbe highway passes through this gram panchayat (GP). The GP is situated 13 km away from sub-district headquarter Kundapura and 45 km away from district headquarter Udupi. The study area can be accessed through Udupi headquarter and it is well connected with a transportation network. Shankaranarayana gram panchayat has two villages such as Shankaranarayana and Kulanje with total geographical area of 2312.48 and 1440 hectares respectively. Bhatkal is nearest town to Shankaranarayana which is approximately 13 km away. The Udupi district has a population of 1,177,361 and 146 panchayats and the Shankaranarayana GP has population of 5144 (Census, 2011). Shankaranarayana gram panchayat of two villages such as Shankaranarayana and Kulanje respectively. Shankaranarayana village is under Shankaranarayana gram panchayat which is governed under Kundapura taluk administration. The village covers an area of 2312.5 hectares and has a population of 5144 and 6066 people according to census 2011 and gram panchayat records of 2020 respectively, living in 1026 and 1401 households as per census 2011-gram panchayat records, 2020 respectively. The language spoken include Tulu, Kannada, Konkani, Beary, Hindi and English. The base elevation of the village is of 13m above the mean sea level. The primary activity of the village is agriculture with 417 hectares of land under paddy cultivation, 221 hectares of land covered by forests and 1818 hectares of cattle population. Kulanje village is under Shankaranarayana gram panchayat which is governed under Kundapura taluk administration. The village covers an area of 1440.7 hectares (14.4 sq. m) having a population of 1987 and 2128 people according to census 2011 and gram panchayat records, 2020 respectively, living in 411 and 441 households as per census 2011 and gram panchayat records, 2020 respectively. The language spoken include Tulu, Kannada, Konkani, Beary, Hindi and English. The base elevation of the village is of 13 meters above the mean sea level. The primary activity of the village is agriculture with 204 hectares of land under paddy cultivation, 1 hectares of land covered by forests and 1346 hectares of cattle population. The study area and some pictorial views of Shankaranarayana and Kulanje village are depicted in Figure 4.1 and 4.2.



Figure 4.2 Sree Shankaranarayana Sewa Samithi (a) and Kulage village road (b)

Source: MSAP survey team

4.2 Study area

The annual fair attracts large numbers of people from surrounding villages. There are five Shankaranarayana temples within a radius of about 15 km. Government Hospital, Petrol Bunk, National Bank and Co-operative banks, clinics and dispensaries, Police Station, Sub Registrar Office, Veterinary Hospital and Oil Mills are located (District census handbook, 2011). The place is well connected to Kundapura, Udupi (District center), Shimoga (Neighboring District) and Kollur (important pilgrimage center). Coconut, paddy, arecanut, pepper, cashew, and recently grown rubber are main crops (District census handbook, 2011). Mookambika Wildlife sanctuary is situated at Kundapura Taluk of Udupi district, in the state of Karnataka and the Eco-Sensitive Zone is spread over an area of 391.36 km². A total of 41 villages fall within the Eco-sensitive zone, the villages neighboring Shankaranarayana GP that fall under eco-sensitive zone are- Hosagandi, Siddapura, Ulluru, Ajri (Mookambika Wildlife Sanctuary- Gazette of India, 2018). Moderating the tropical climate of the region, the site presents one of the best examples of the monsoon system on the planet. It also has an exceptionally high level of biological diversity and endemism and is recognized as one of the world's eight 'hottest hotspots' of biological diversity. At least 325 globally threatened species occur in the Western Ghats (IUCN India Red Data List, 2019).

4.2.1 Agriculture

Agriculture is the backbone of the Udupi district's rural economy, where the majority of the population lives. In these coastal areas, fishing is the main occupation whereas, agriculture (sugarcane) and allied activities contributes 17 % to district's gross domestic product (GDP). During 2014-15 crop years, the net cultivated area was 96974 ha and gross cropped area was 110929 ha and the cropping intensity works out to be 1.14. The district witnessed steady deceleration in gross cropped area since 2001. The gross cropped area declined from 133261 ha in 2000-01 to 110929 ha in 2014-15. The cropping intensity which was 1.31 has reduced to 1.14 during this period. The irrigated area is mainly through wells, tanks and check dams in Udupi district. At present, the district has not any operational major or medium irrigation projects.

The district has one of lowest percentage of area under cultivation in the state. The net cultivated area in the district is 27 percent of geographical area as compared to the state's 55 %. It has been reported that the proportion of net cultivated area is the highest in Udupi taluk (34 %), followed by Kundapura (27 %) and Karkala has the lowest (22 %). The gross cropped area in the district is 1.11 lakh ha. The cropping pattern in Udupi is mainly concentrated on paddy. During the crop year 2014-15, total area under paddy was 49555 ha. Paddy crop was mainly raised during Khariff - the rainy season. In Rabi season, pulses and oilseeds like black gram, horse gram, green gram and cowpeas have grown and the statistics shown that the area under pulses was 3948 ha in 2015. Moreover, the Groundnut has been the main oilseed grown in the district and it grows in 1800 ha, Sesamum grows in 36 ha and other oilseeds in 29 ha. Paddy accounts for nearly 47 percent of the total gross cropped area, followed by pulses (4.6 %) and oilseeds (1.8 %). Sugarcane, which was grown once in about 2000 ha, is now abandoned with the break-down of Brahmavar sugar factory.

The district has substantial acreage under horticultural crops. Coconut accounts for 17798 ha, areca nut 7837 ha, cashew-nut 19373 ha, rubber 4693 ha, banana 992 ha, black pepper 353 ha, and vegetables 1533 ha. In kharif season, under rain-fed condition, cereal crops are sown in an area of 43012 ha and in rabi and summer, it is sown in an area of 6537 ha. During rabi and summer seasons, pulses and oil seeds are sown in an area of 3648 ha and 1799 ha respectively.

The district is also known for growing Mallige in 214 ha. The cropping patterns in district of Udupi, Karnataka is given in Table 4.1 (www.pmkys.gov.in).

| S. No. | Crops grown | Area under crop (ha) | Percentage share |
|--------|---------------------------------|----------------------|------------------|
| 1 | Food crops: paddy | 49555 | 44.68 |
| 2 | Maize | 30 | 0.01 |
| 3 | Pulses | 3948 | 3.56 |
| 4 | Oilseeds | 1865 | 1.68 |
| 5 | Plantation crops | 25767 | 23.23 |
| 6 | Fruit crops | 22433 | 20.22 |
| 7 | Vegetables | 1533 | 1.38 |
| 8 | Sugarcane | 53 | 0.01 |
| 9 | Flowers, spices and other crops | 5798 | 5.23 |
| 10 | Total | 110929 | 100.00 |

Table 4-1 Cropping pattern in Udupi district, Karnataka

The ground water quality: The Granitic gneisses with occasional laterite capping and unconsolidated river and marine sediments occupy in area of Udupi district. The gneiss is wide spread in the distinct outcrops at varying magnitude especially along river courses. Basic intrusive like dolerites and gabbros and acidic intrusive like pegmatite and quartz veins and pink porphyritic granites are found all over area of the district. The ground water in the Udupi district region mainly occur in various geologic formations like beach alluvium, coastal sediments, laterites and in weathered and fractured granitic gneisses under phreatic and semi-confined to confined conditions, but mainly under water table conditions. Coastal alluvium along with the laterites, occur as an aquifer of phreatic nature. The hydrology of Udupi district can be subdivided in to two broad hydrogeological units like a) hard and fissured formations in the pediplain and porous unconsolidated formations in coast (www.cgwb.gov.in). On the basis of occurrence and behavior of ground water, ground water system of the district is described under four zones in general such as shallow zones up to 25m, moderately deep zone (25-60 m), deep zone (60-100m) and very deep zone (beyond 100m) respectively. The quality of ground water has been reported by Central Ground Water Board in 2008 that, at certain depths in the sandy aquifer are found good and potable and in the adjoining areas covered by lateritic/weathered gneissic rocks. The dug wells in the alluvial area generally yield saline water during summer months and get fresh water during monsoon periods.

4.2.2 Climatic and meteorological data

The climatic and meteorological data like sun hours and sun days, rainfall, maximum wind speed and maximum and minimum temperature are depicted in Figure 4.3, 4.4, 4.5 and 4.6 respectively. It receives a constant 280 hours per year of sun exposure which is suitable for supporting solar heating strategies. The area receives an average rainfall of 3500mm and wind speed up to 24Kmph. The area is humid (78%) in nature and the recorded maximum and minimum temperature are 40°C and 18°C respectively. It receives maximum rainfall in the month of May, June, July, August, September and October. The warmest month is May with maximum temperature of 32°C (89°F). The coldest month is January with maximum temperature of 28°C (82°F).



Figure 4.3 Sun hours and sun days. (Source: www.weatheronline.com)

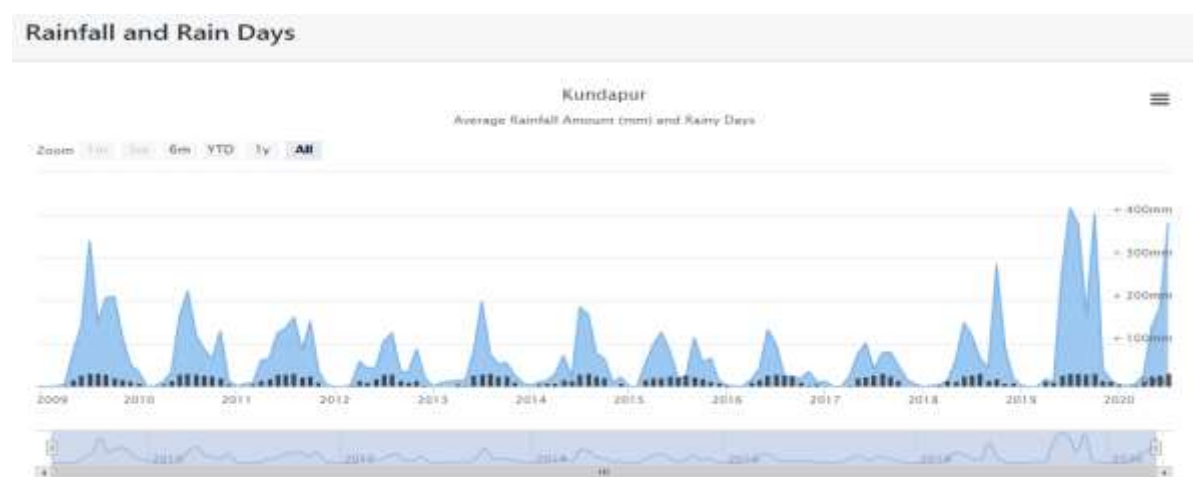


Figure 4.4 Rainfall and rain days. (Source: www.weatheronline.com)

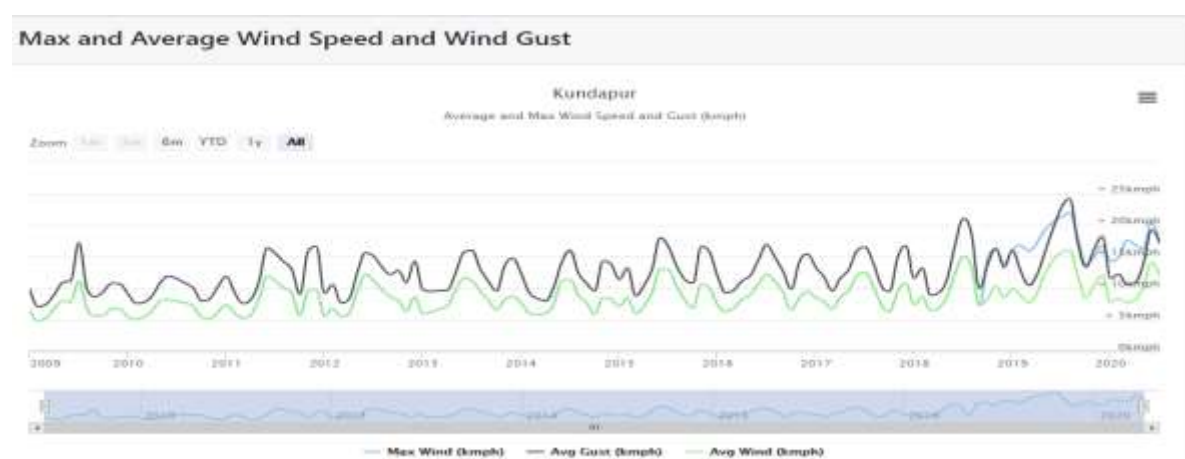


Figure 4.5 Max and average wind speed and wind gust. (Source: www.weatheronline.com)

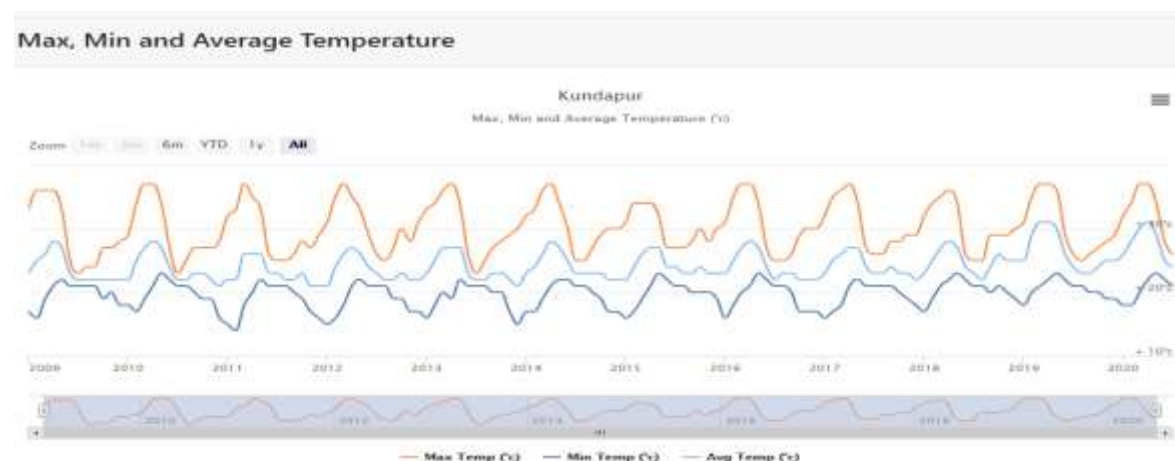


Figure 4.6 Max, min and average temperature. (Source: www.weatheronline.com)

4.2.3 Soil

Coastal regions of Udupi district have predominantly lateritic (high water holding capacity and high value iron oxide) soil type with some degree of alluvial soil type near rivers. Northern part of the district has black soil as the predominant soil type. Southern parts are mostly having alluvial (best soil type for agriculture) and red soil (low nutrient value and low

humus) type due to presence of multiple river systems. The soil maps of Udupi district and Shankaranarayana are given in Figure 4.7 and 4.8. The soil profile of Udupi district mainly includes the costal alluvium of 9268 hectares (ha), low land of 9257 ha, mid land of 12818 ha, upland of 29173 and hillock of 31983 ha. These sandy soils are being confined to narrow strip of the coastal belt having width ranging from less than 100 meter to 1 km, approximately. These fine to medium texture sandy soils are being characterized by their extremely high rate of infiltration. Yellow loamy soils, which are mostly found along the river banks and lower valleys, are fertile, well suited for irrigation and has been proved to be responsive to various irrigation practices. These red lateritic soils are the most dominant soil type in midland area where the texture of the soils vary from fine to coarse. The soil in general is acidic due to heavy run-off, but rich in nitrogen and deficient in potassium and phosphorous (shodhganga.inflibnet.ac.in). Two types of soil are present in gram panchayat (1) Fine: Kaolinitic (Kaolinite, group of common clay minerals that are hydrous aluminum silicates; they comprise the principal ingredients of kaolin also known as china clay) in nature which are good for agriculture and plantation (2) Loamy Skeletal: They are defined as inceptisols (type of soil order in USDA soil taxonomy. They form quickly through alteration of parent material) and have moderate fertility (Encyclopedia Britannica, 2012) and (3) Clayey Skeletal: They are defined as rhodustults (type of autisol defined as strongly leached, acid forest soils with relatively low native fertility. They are found primarily in humid temperate and tropical areas of the world, typically on older, stable landscapes) and have less fertility (Encyclopedia Britannica, 2012).

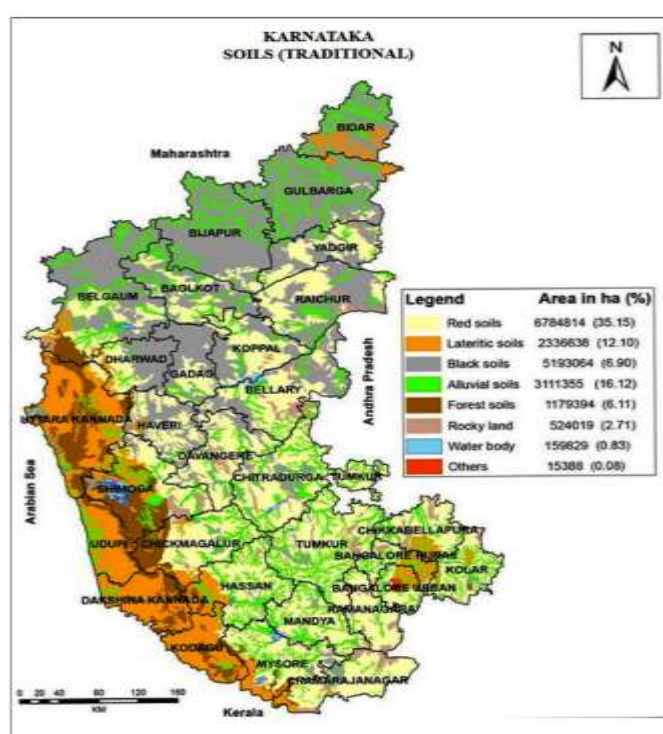


Figure 4.7 Soil map of Udupi district,
Source: District NRDMS Center

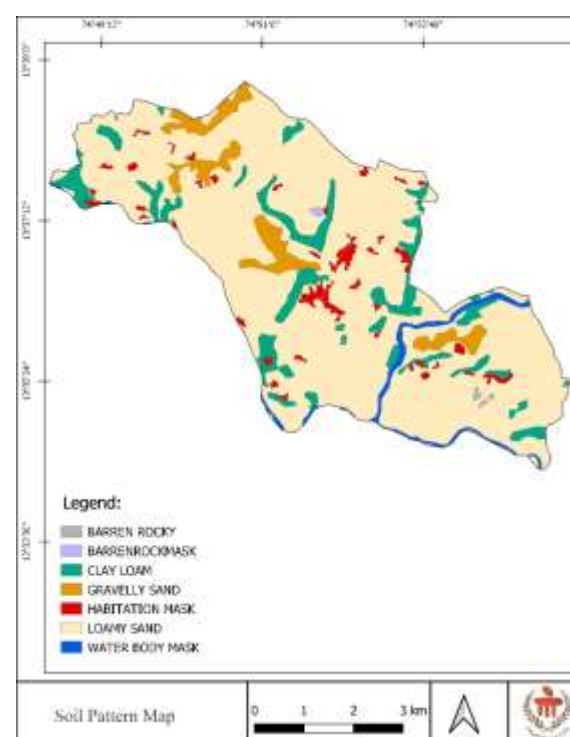


Figure 4.8 Soil pattern map, Source: GIS data provided by NRSC

4.2.4 Geology

The area falls over a region of Amphibolite, which is a metamorphosed type of igneous rock. The District geology map is given in Figure 4.9. The Amphibolite is a coarse-grained metamorphic rock, composed mainly of green, brown, or black amphibole minerals and plagioclase feldspar found in this area. Amphibolite has a variety of uses in the construction industry. It is harder than limestone and heavier than granite. These properties make it desirable for certain uses. Amphibolite is quarried and crushed for use as an aggregate in highway construction and as a ballast stone in railroad construction. It is also quarried and cut for use as a dimension stone. Higher quality stone is quarried, cut, and polished for architectural use. It is used as facing stone on the exterior of buildings and used as floor tile and panels indoors. Some of the most attractive pieces are cut for use as countertops. The lithology of Shankaranarayana gram panchayat consists of majorly two types of rocks genesis such as hornblende gneiss, which is a coarse-grained metamorphic rock belonging to the gneiss family, its overall dark colouration is due to high levels of the mafic mineral hornblende, while quartz and feldspar are also present (Rigby and Milsom, 2010) and lateritic type which is mostly residual capping. The lithology map for gram panchayat is given in Figure 4.10.



Figure 4.9 District geology map, Source: Dist. NRDMS Center, Udupi

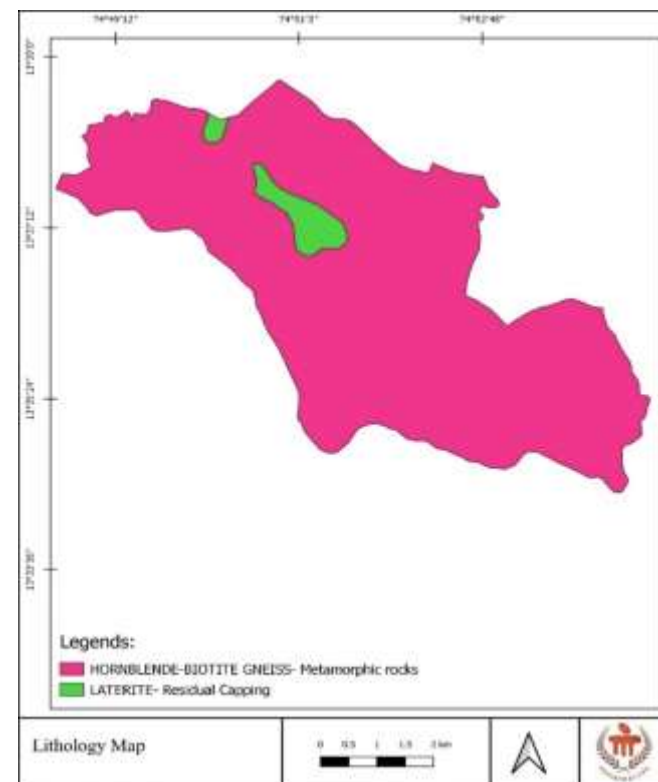


Figure 4.10 Lithology map of GP, Source: GIS data provided by NRSC

4.2.5 Geomorphology

The district and gram panchayat geomorphology maps are given in Figure 4.11 and 4.12. It is observed that the iron and aluminum phosphate causes high acidity, toxicity aluminum and manganese, deficiency of potassium, calcium, magnesium, zinc and boron. The low-level laterites are suitable for growing paddy, banana, coconut, arecanut, cocoa, cashew, coffee, tea, rubber etc. Different types of agricultural crops, like rice, sugarcane, maize, groundnut, potato and sunflower are cultivated in the study area. It is classified in two major categories such as residual hills and dissected pediment which is characterized by gentle slope. They are cut by river/drains and have sufficient layer for vegetation. It could be a possible land for development and agricultural activities. Another one is residual hills which is characterized by steep slope and soil by its type. No construction along with plantation should be allowed in such zones as they pose serious threat of landslides due to soil character and composition. Preservation of natural features at such sites should be of prime importance. Although edges can be reserved for agricultural activities.

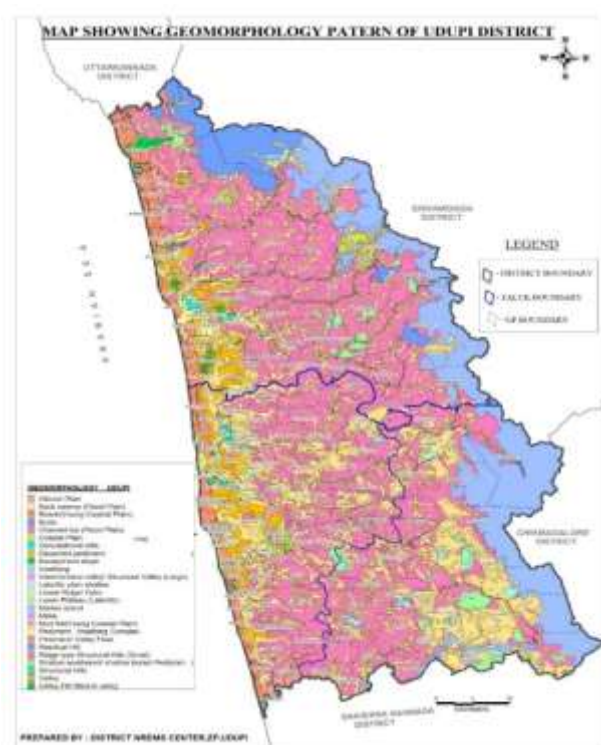


Figure 4.11 District geomorphology map, Source: District NRDMS Center, Udupi

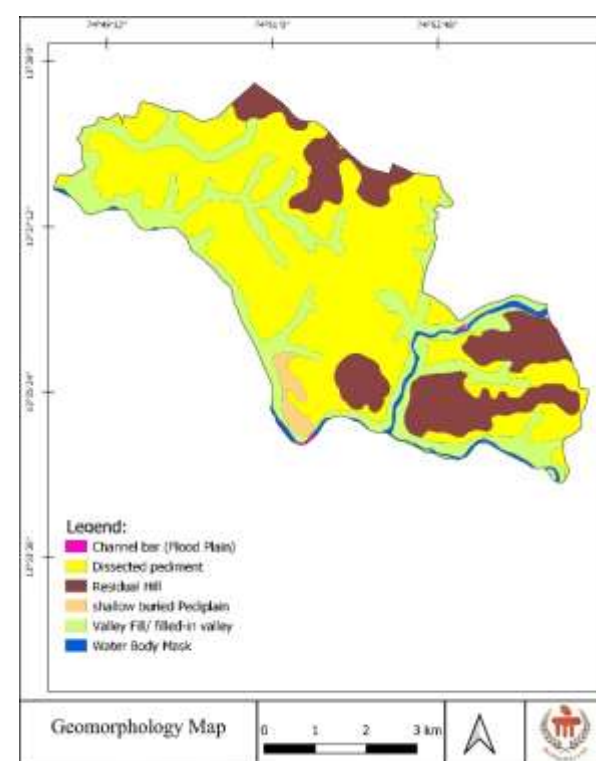


Figure 4.12 Geomorphology map of GP, Source: GIS data provided by NRSC

4.2.6 Flora and fauna

The available important crops in the study area are coconut, paddy, arecanut, pepper, cashew, and rubber. Forest resources significantly contribute to the State's Gross Domestic Product (GSDP) by being a major source of timber, medicinal plants, non-timber forest products (NTFPs), grazing, recreational activities, carbon sequestration, watershed provisions etc. (Forest department of Karnataka report, 2019). Floriculture is an untapped area in the district so far except Udupi 'Mallige' a species of jasmine which is a seasonal flower cultivated in small pockets of agricultural land. Orchid farms can be promoted which is having high export potential (Naina, 2019). Horticulture department is providing technical assistance and incentives to private growers of medical and aromatic plants which can be a raw material for ayurvedic medicines having both domestic and export potential. Patchouli is an important aromatic plant available here and its essential oil is one of the best fixatives for heavy perfumes and is highly valued in perfume and soaps. Cultivating certain plant varieties suitable for bio diesel, species like honge, jatropha, mahua, neem and simarauba in the dry land can be a major resource for non-farm activity of bio diesel processing. Market for bio diesel seeds and oil is readily available in the state of Karnataka and other parts of the country. There is scope for establishment of seed nurseries & tissue culture units (Janakiram et al., 2016). Butterflies are biological indicators of the habitats. They are very sensitive to their environment; their very presence or absence indicates the health of the environment. There are over 300 species of butterflies, some of them are endangered such as Crimson rose, Danaid Egg fly and 176 species of orchids from 49 genera; most of them are endangered and are brought under wildlife protection act. As per survey report the total horticultural production in Karnataka is 97.30 lakh tons per year. The production stands at 40.79 lakh tons (41.92%) with respect to Fruit Crops; 44.03 lakh tons (45.25%) Vegetable crops; 5.96 lakh tons (6.13%) Spice Crops; 4.96 lakh tons (5.09%); Garden/Plantation Crops and 1.57 lakh tons (1.61%) crops coming under commercial flowers including the medicinal and aromatic plants (Biodiversity of Karnataka at a glance, 2010).

4.2.7 Land use and land cover (LULC)

The LULC is classified into agriculture, non - agriculture, residential flat, residential apartment, commercial flat and commercial apartment (SRO report, 2015). Agriculture is dominant in this area which comprises agricultural land, now sprouts dairy farming in lieu of its crop-cultivation failure (Naik, 2019). The distributed area of the study area is given the Figure 4.13, 4.14, 4.15, 4.16, 4.17 respectively. The spatial distribution of LULC is as follows: Agriculture is the prominent practice with pockets of forests and wastelands. Other themes like reserved forest cover followed by wastelands (wasteland, refers to the plot of land that is kept vacant so as to replenish the soil's fertility). The panchayat has the potential to get higher agricultural production output from its agriculturally utilized land but is currently facing an issue of underachieved yield due to water scarcity which is discussed further in this report. Similarly, wasteland along the state highway has potential for non-polluting industries which utilizes clean energy sources such as solar energy. 5.1 km² of reserve forest area is in the gram panchayat. As reserved forest having ecological importance and are eco-sensitive areas, provision of buffer zone for forest areas for preserving and conserving forest and wildlife resource is very necessary. Preservation and conservation of forest areas are vital as it is a major contributor to ecological strengths. The land use map highlights barren rocky area that coincide with the residual hills as depicted in figure 4.15. These are prominent geographical features of the Western Ghats. Residual hills as seen in Figure 4.13 should be dealt with sensitively as the areas is prone to landslides.

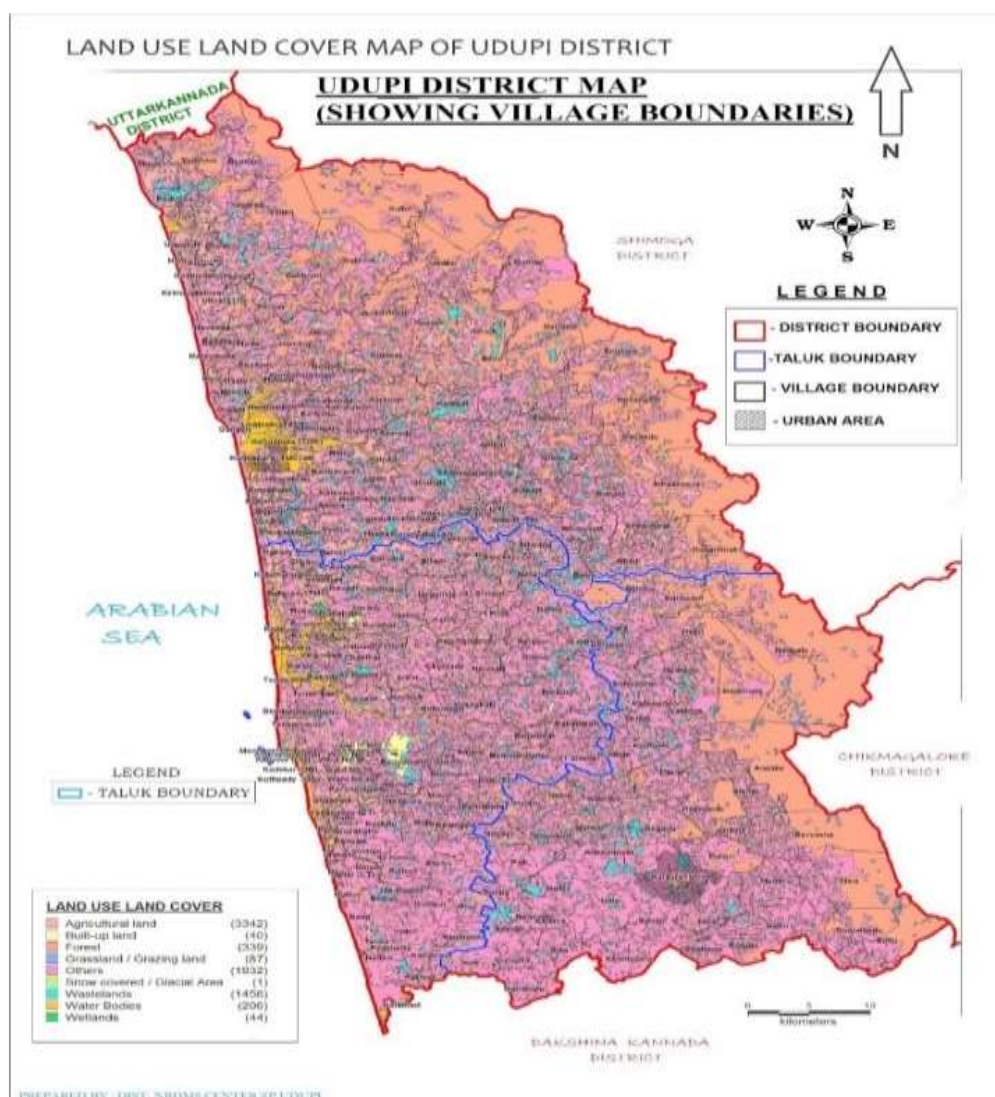


Figure 4.13 District land use and land cover. Source: District NRDMS Centre, Udupi

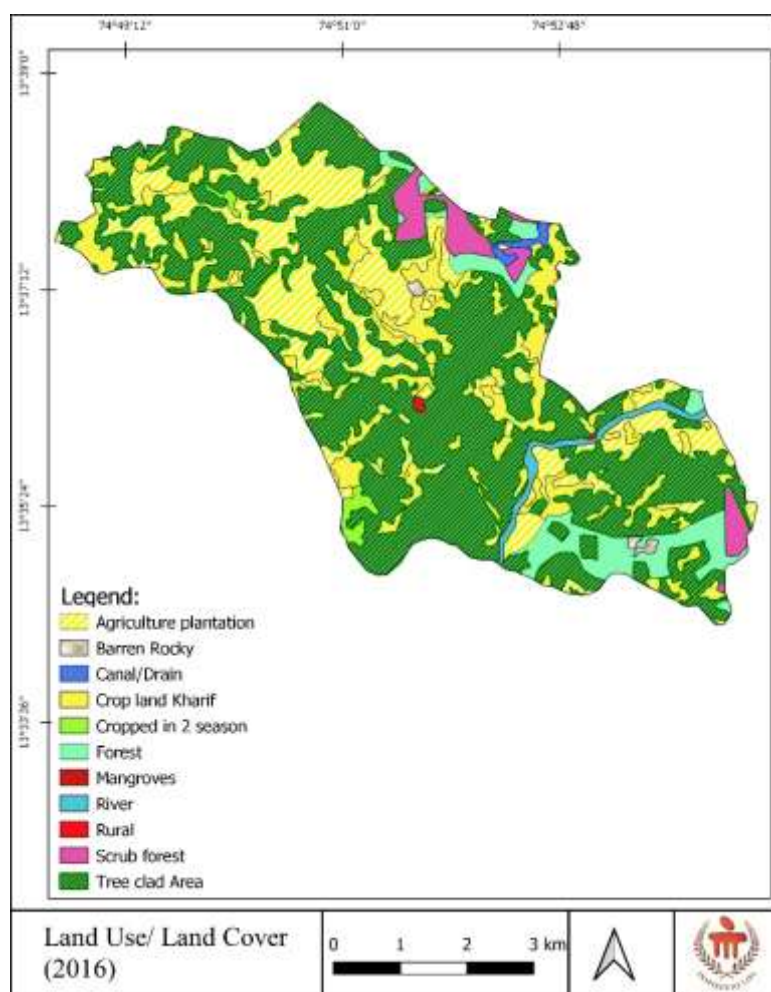


Figure 4.14 Land utilization map 2016, Source: GIS data provided by NRSC

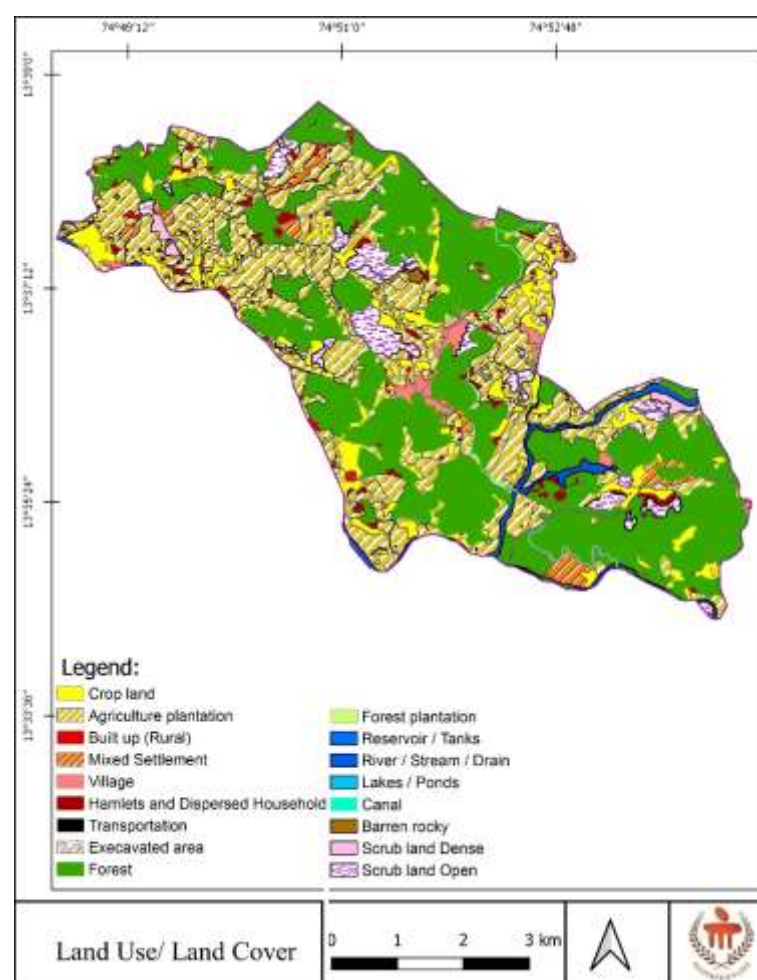


Figure 4.15 Land utilization map 2019, Source: GIS data provided by NRSC

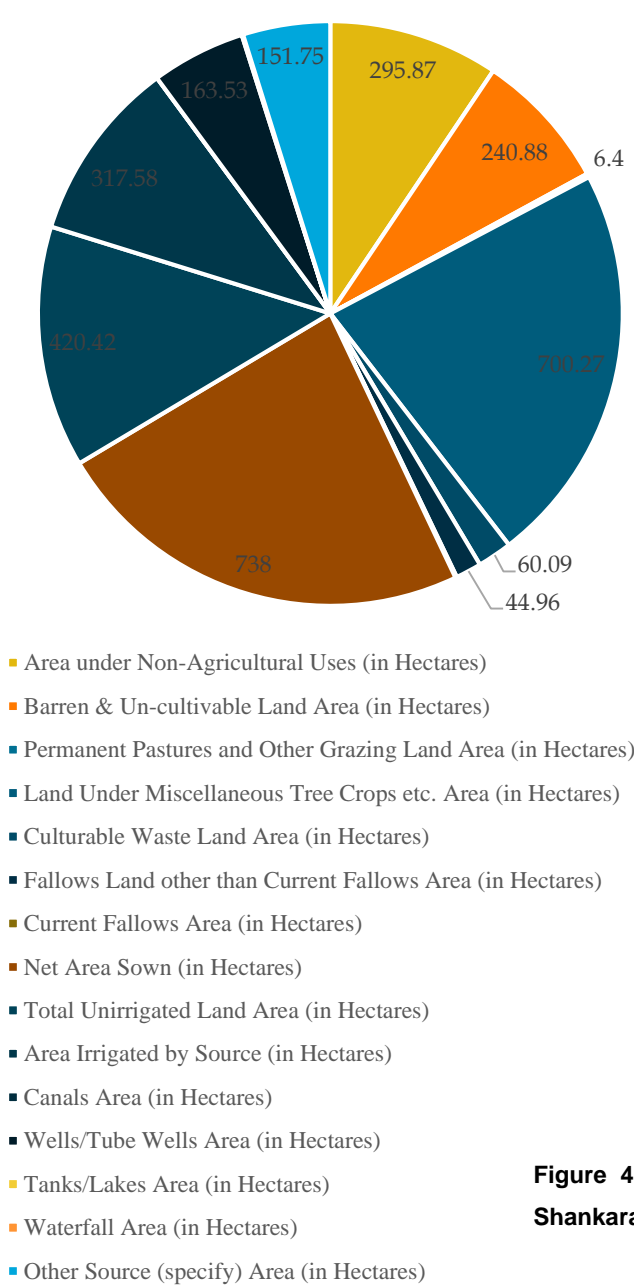


Figure 4.16 Land use area distribution for Shankaranarayana village, Source: District

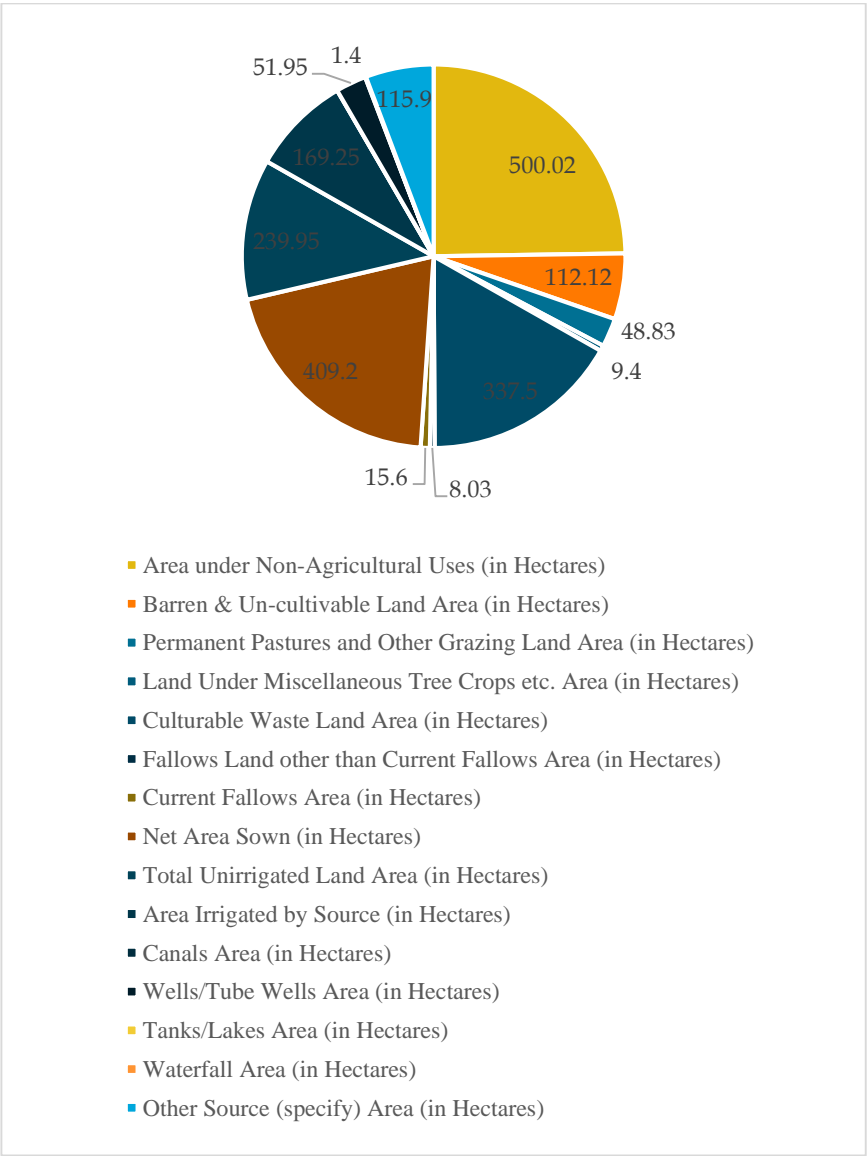


Figure 4.17 Land use area distribution for Kulanje village, Source: District census data



4.2.8 Ratio of cultivated land

District has a huge potential for agriculture as it has large amount of uncultivated land. Although a great amount of cultivated land is irrigated near the coast. The ratio of irrigated to cultivated land in the district is given in Figure 4.18.

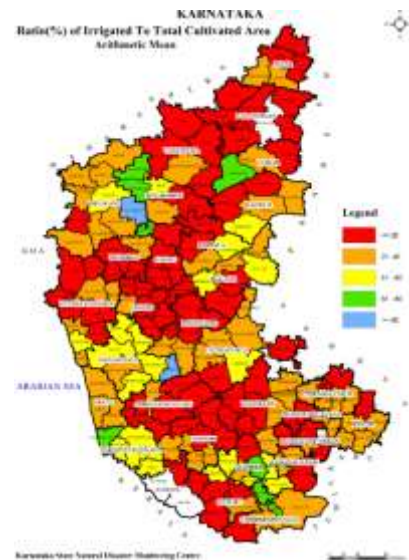


Figure 4.18 Ratio of irrigated to cultivated land, Source: Karnataka State Natural Disaster Monitoring Centre

4.2.9 Drainage network

It has a dense branched water draining network that covers the area with the Varahi River taking the Eastern load via the south. The Varahi hydro power plant is situated on the Varahi River (also known as Haladi River downstream) is a major source of power nearby cities. Drainage pattern of the district flows towards the west but Shankaranarayana GP poses a different circumstance due to its geography. The GP is divided into two villages i.e. Shankaranarayana village and Kulanje by the Haladi (known as Varahi upstream) river with Kulanje village being towards the south of it. The drainage system consists of river, drain and network of canal system. The main river system in Shankaranarayana village is the Varahi River. The drainage map of the studied area is given in Figure 4.19 and 4.20. The river borders of the GP boundary in the western side and divides the GP into the two villages, Shankaranarayana in the north and Kulanje in the south. The river Haladi runs for a total length of 18 km and stretches in an area of approximately 2 km². Additionally, Shankaranarayana gram panchayat has two branch canals, the length of each is 2.212 and 1.203 km for Shankaranarayana and Kulanje respectively.



Figure 4.19 District watershed map, Source: District NRDMS Centre, Udupi

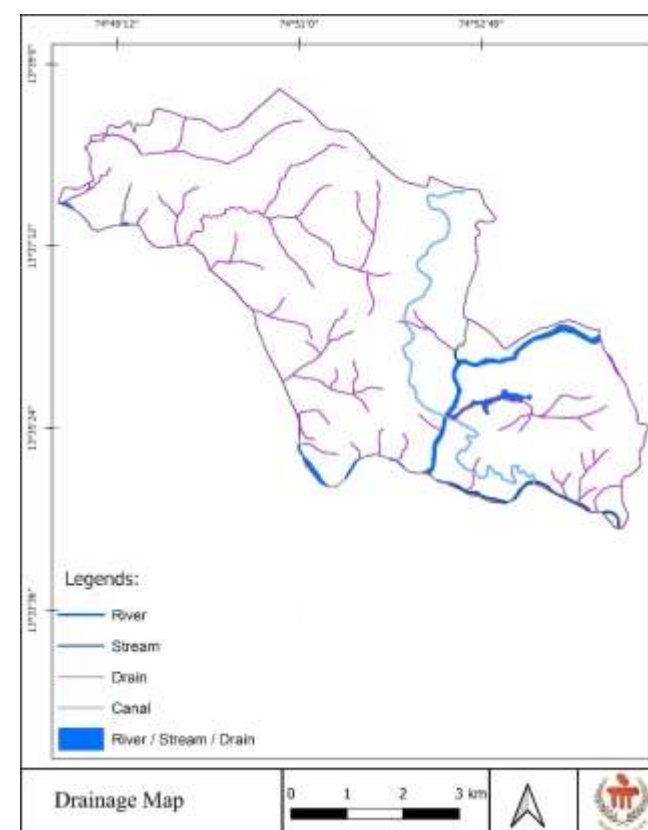


Figure 4.20 Natural drainage map of the GP, Source: GIS data provided by NRSC

4.2.10 River network

It is located about 100kms from the foot of the Western Ghats and thus is naturally shielded from the steep surface water runoff from the slopes. The panchayat is however lies at the trunk portion of the water networks (Varahi river and 15kms from Mani reservoir at the east and Savehaklu reservoir 20kms on the north east). The settlement has natural water draining from its western periphery. Varahi River support the settlement in fulfilment of water resources that covers the south-western border of the panchayat. Shankaranarayana with its hilly terrain has a dense branched water draining network that covers the area with the Varahi River taking the Eastern load via the south. Additionally, Varahi River is the main support for the settlement and covers the south-western border of the panchayat. District water network and tanks



Figure 4.21 District water network map, Source: District NRDMs Centre, Udupi

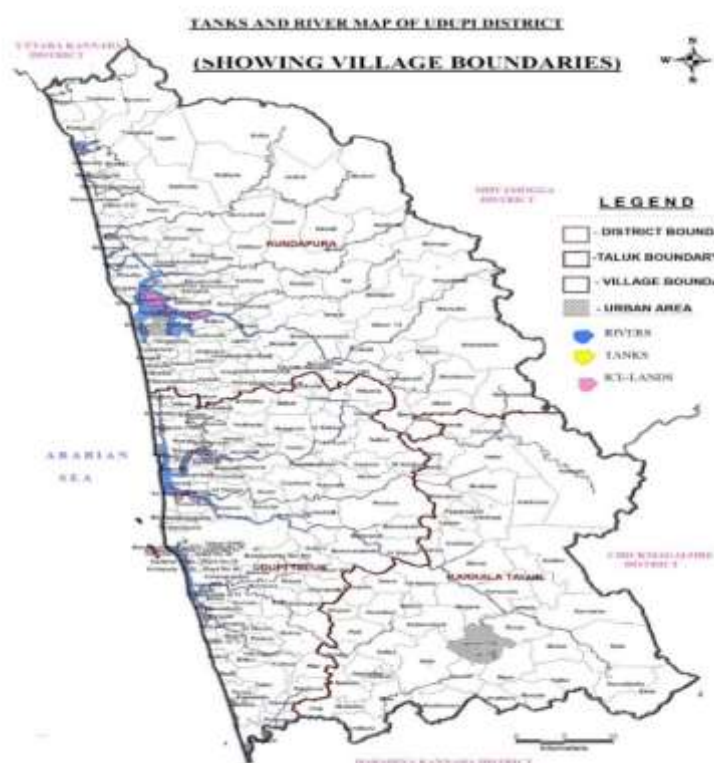


Figure 4.22 District tanks and river map, Source: District NRDMs Centre, Udupi

4.2.11 Slope

In the slope region forest cover is found, thus, conservation of these forests and afforestation techniques are vital in tackling soil erosion. The district slope pattern is given in Figure 4.23. Residual hills are also found predominant in forest areas which increases the importance of conservation of such areas. Buffer zone for forests should be also provided to conserve wildlife in these forests and reduce circumstantial interaction of wild animals in and with agricultural and built up areas. Shankaranarayana is in an undulating terrain with ground elevation ranging from >120m to 8m. Small packets of land which can be used for development purposed, to avoid major disturbance to existing land pattern. It is a rugged terrain where the groundwater occurrence could be through fractures and as an unconfined condition along valley fills. The slope pattern of the Shankaranarayana gram panchayat is given in Figure 4.24.

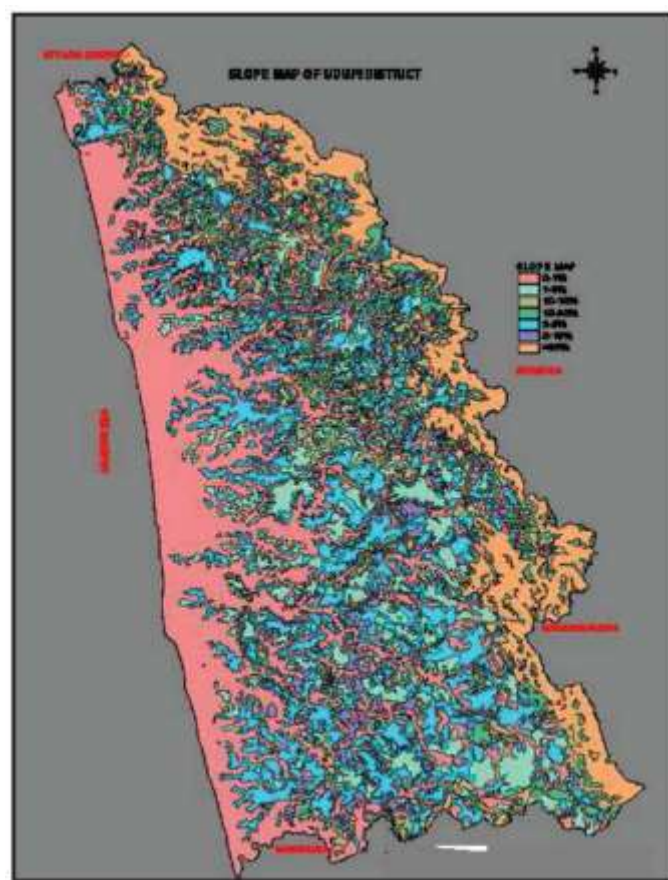


Figure 4.23 Slope map of Udupi district, Source: (Naveenchandra et al., 2010)

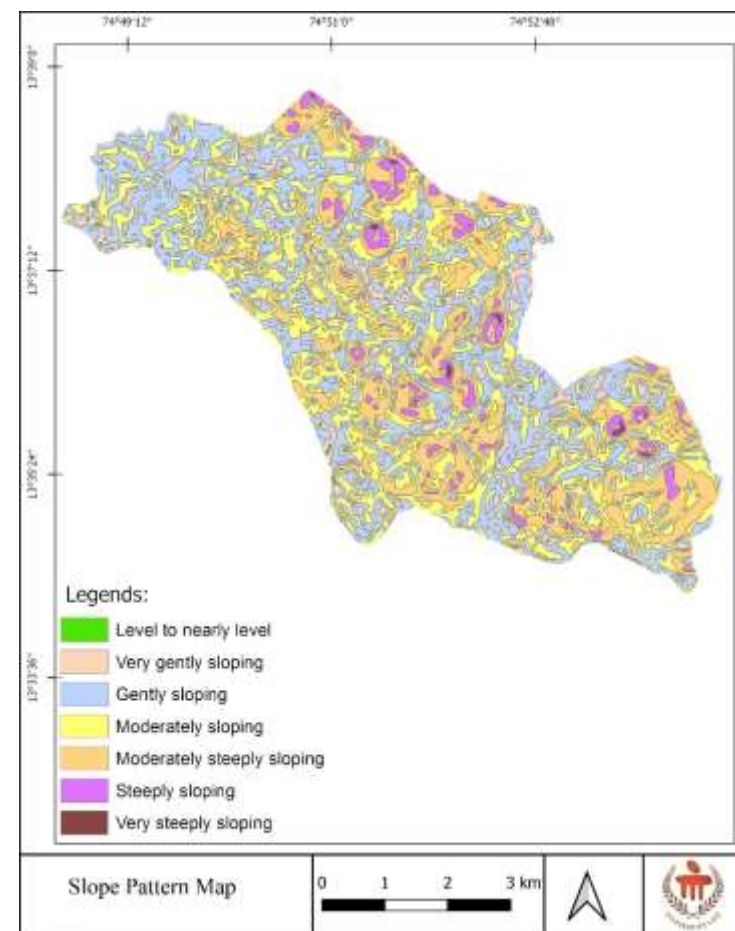


Figure 4.24 Slope map of GP, Source: GIS data provided by NRSC

4.3 Analysis and inferences

4.3.1 Geospatial multi-criteria analysis

The geospatial based multi-criteria analysis which is used in the present study is discussed below: According to topography the regions marked in the green (variant) are more feasible for settlements as it provides lesser level differences /discrepancies. Areas marked in green present more feasibility for the direction of future development of the village and can be considered as future spots for developing infrastructure, housing, services etc. (except for forest areas and residual hills) as shown in Figure 4.25. Also, settlements near water systems which may obstruct the natural water flow may create drainage issue in the future. Maintaining an unobstructed natural water flow of the water systems becomes an important task for the local ecological management, disaster mitigation. It is also an important part of resource and watershed management and its equity. It is also observed that the high number of watersheds signifying undulated geography and multiple natural drain channels are shown in Figure 4.26. From the geo-morphology map (Figure 4.27), it is observed that most of the panchayat have a low dissected pediment profile.

Built up forms in the conflict areas should be redeveloped/resettled if they are not related to the essential infrastructure for agriculture of the area. Housing settlements in these conflict areas are advised to be resettled in the feasible development areas i.e., the green variant in level gradient map as shown in Figure 4.25 and 4.29 respectively. This is also observed that the area where most of the agriculture is done and at the interim peak elevations we see built up. The South-eastern, South, South-western and North-western parts are edged by the Varahi River and constitute the active flood plains as seen in Figure 4.28. The current city center is also in line with the understanding of the physical attributes of the village, therefore the development should be focused more towards the north and north eastern and in some parts of the south eastern parts across the river system are shown in Figure 4.30.

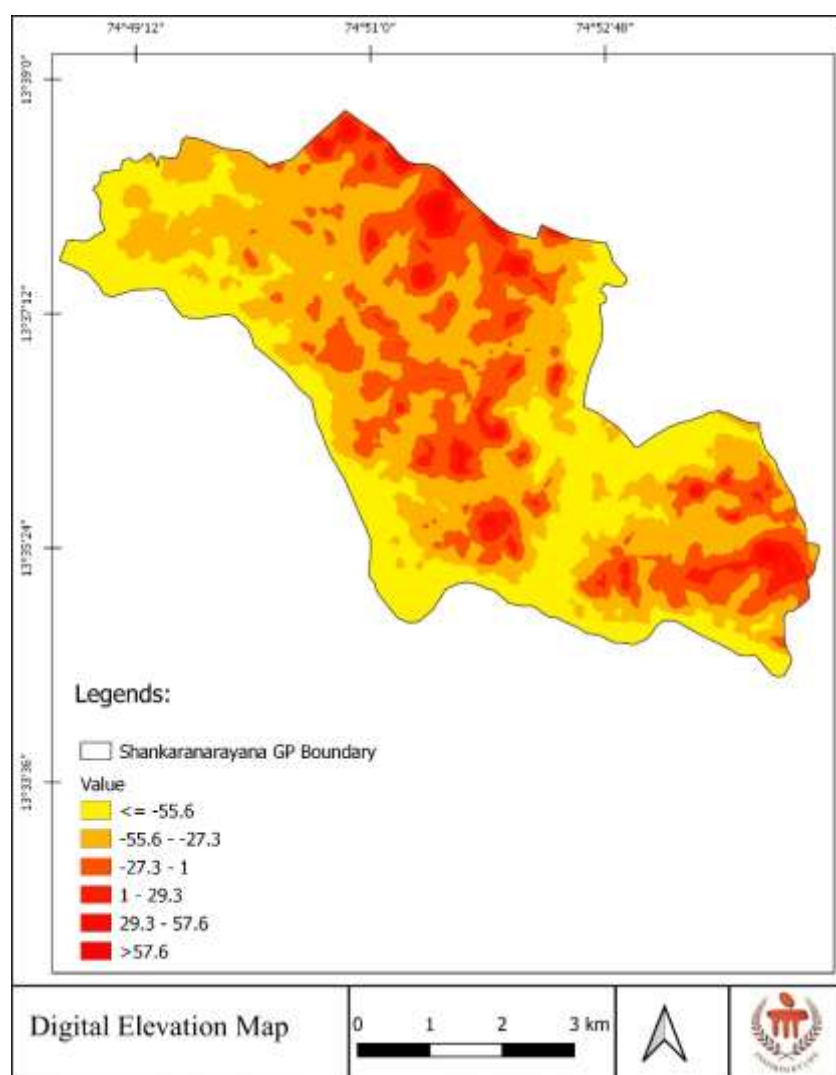


Figure 4.25 Elevation gradient map, Source: Data provided by NRSC

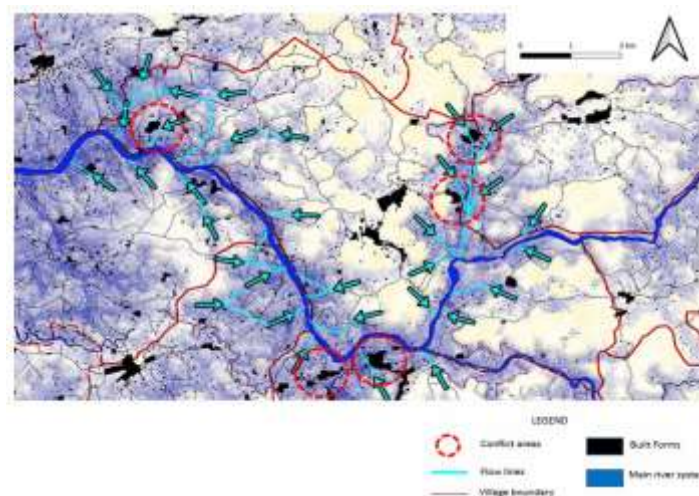


Figure 4.26 Conflict area in the natural water flow, Source: GIS data provided by NRSC with layers added by Author



Figure 4.27 GP Geomorphology map. Source: Bhuvan e-portal, ISRO



Figure 4.28 The GP watershed map, Source: Bhuvan e-portal, ISRO

The built up is heterogenous and sparse. It is observed that the linear village growth supported by the Kundapur-Agumbey highway along the north-south through the center of the panchayat. Fifteen unique watershed covers 40 km² of the gram panchayat as seen in Figure 4.28. These watersheds and the major drain channels divide the GP into three regions are depicted in Figure 4.29. These regions are also where we observe the most settlement developing with religious structures being the central node of development. With the higher elevation and steeper slopes of these regions compared to the remaining of the panchayat area, these three regions have developed around the agricultural and built land use area. Regions A and B are the domain of Kundapur-Agumbey highway and thus the region's markets develop here. This region is however bare facing the western ghats and would receive the high volume storm water run-off flow. Region C is naturally drained by the Varahi and Haladi river system, that shelter most of the north and north-eastern parts from run-off water from the higher watershed run-off.

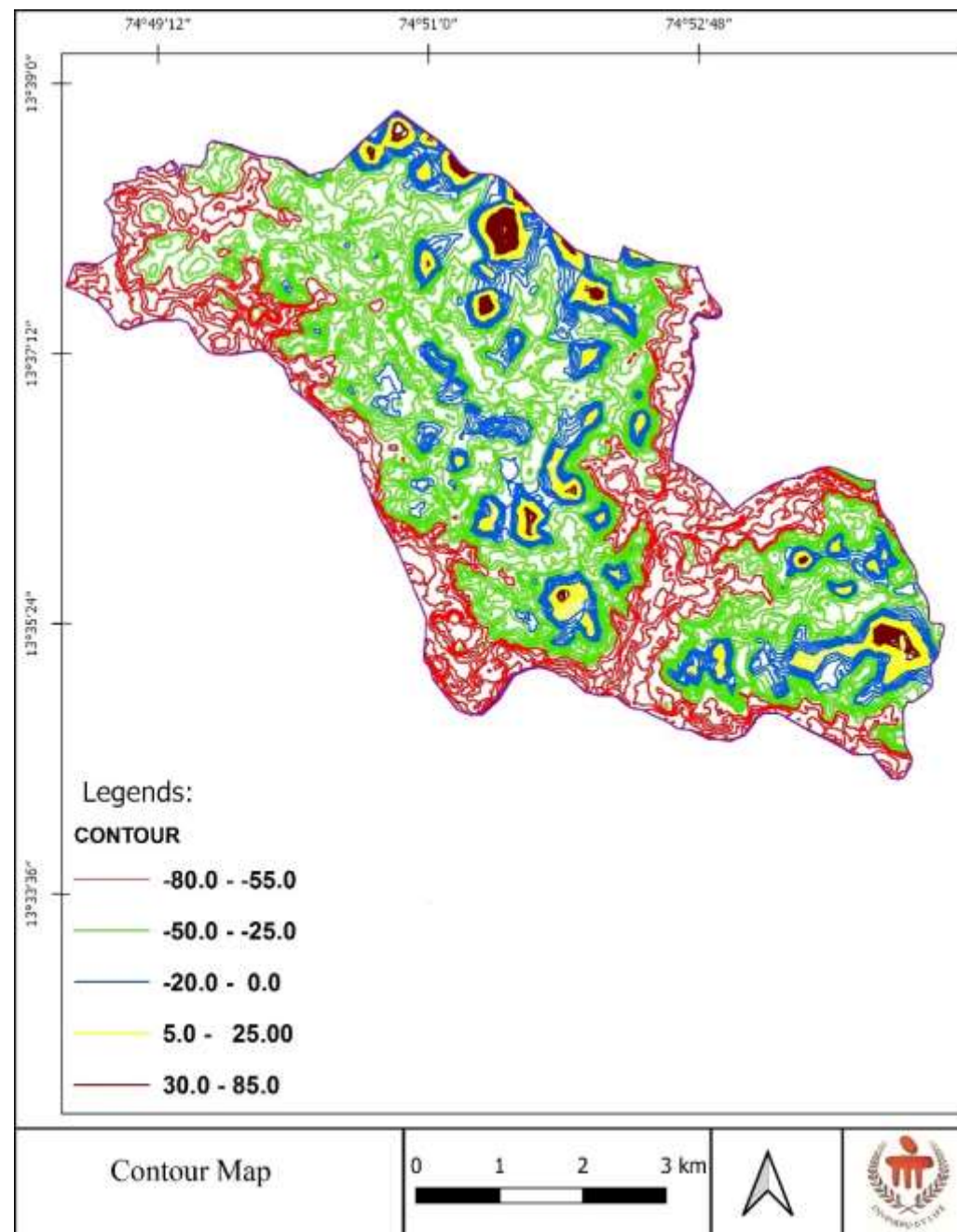


Figure 4.29 Contour level maps, Source: GIS data provided by NRSC

The Shankaranarayana gram panchayat can be divided into three major zones of slope (Figure 4.30, 4.31, 4.32 and Table 4.3) such as steep (17-25%), the moderate (15-17%) and Gentle (5-15%) slopes form the majority of the land typology and co-relate with the existing built up. Areas marked in the yellow ellipses are areas of steep slope where residential construction have been done. These areas are at risk of land slide and storm water flooding in an event of strong precipitation or cloudburst. A – Proximity to Shree Mahalingeshwara Devasthan, B – Proximity to Sri Mahaganpathi temple and Nandhi Chikkamma Dhaivasthan and SH 27 and C – Does not seem to follow a similar logic of settlement.

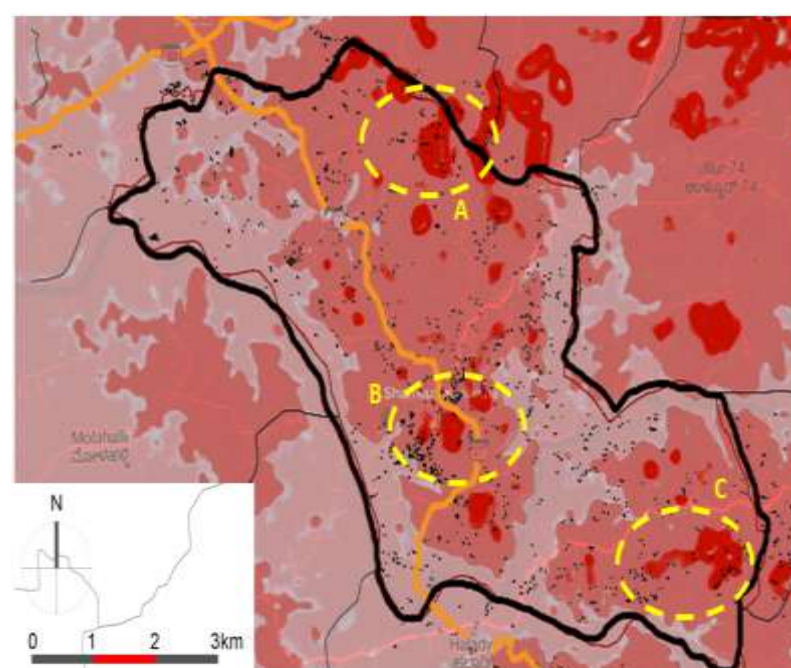
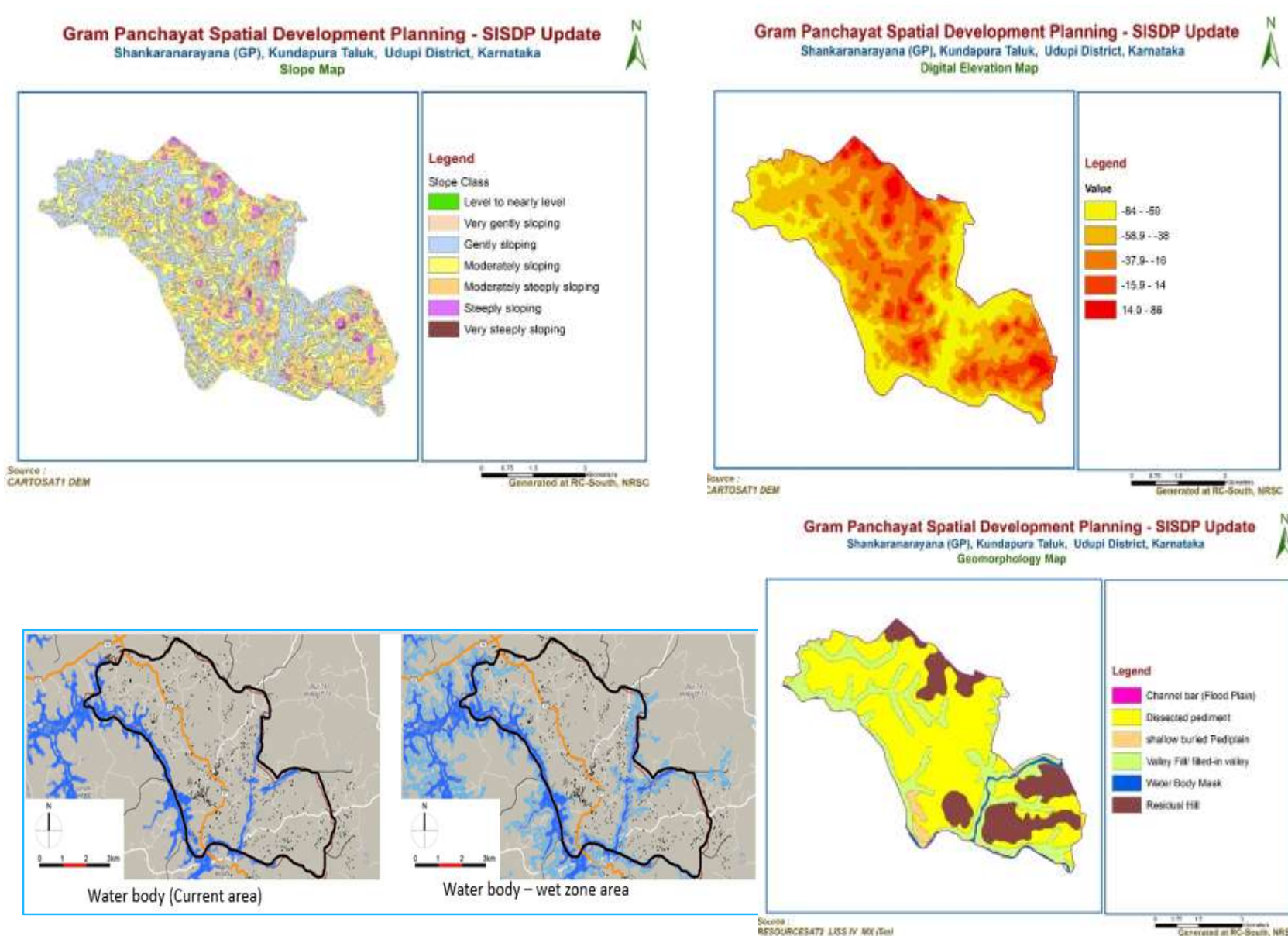


Figure 4.30 Future development areas and conserved forest areas. Source: GIS data provided by NRSC with added layers by author

| | Slope | Area | Recommendation | Agricultural Practice |
|--|-----------|--|---|--|
| | 17% – 25% | Steep terrain | Restriction on construction, Buffer vegetation area (trees with large root spread – mango, jackfruit) to control soil erosion | Forested reserve area – NOT to be harvested. (Provides food source for wild animals) |
| | 15% - 17% | Agricultural and Residential (Dissected pediment substratum) | Gentle slope, Low rise construction | Agriculture can be practiced along with increasing built up |
| | 5% - 15% | River and River bank + Residential (Alluvial plain substratum) | River wet zone to be demarked and restricted of permanent construction. | Agriculture can be practiced in proximate land, Mainly paddy. |

Table 4-2 The major zones of slope in Shankaranarayana



| | Slope | Area | Recommendation | Agricultural Practice |
|--|-----------|--|---|--|
| | 17% – 25% | Steep terrain | Restriction on construction, Buffer vegetation area (trees with large root spread – mango, jackfruit) to control soil erosion | Forested reserve area – NOT to be harvested. (Provides food source for wild animals) |
| | 15% - 17% | Agricultural and Residential (Dissected pediment substratum) | Gentle slope, Low rise construction | Agriculture can be practiced along with increasing built up |
| | 5% - 15% | River and River bank + Residential (Alluvial plain substratum) | River wet zone to be demarked and restricted of permanent construction. | Agriculture can be practiced in proximate land, Mainly paddy. |

Figure 4.31 Slope analysis. GIS data provided by NRSC

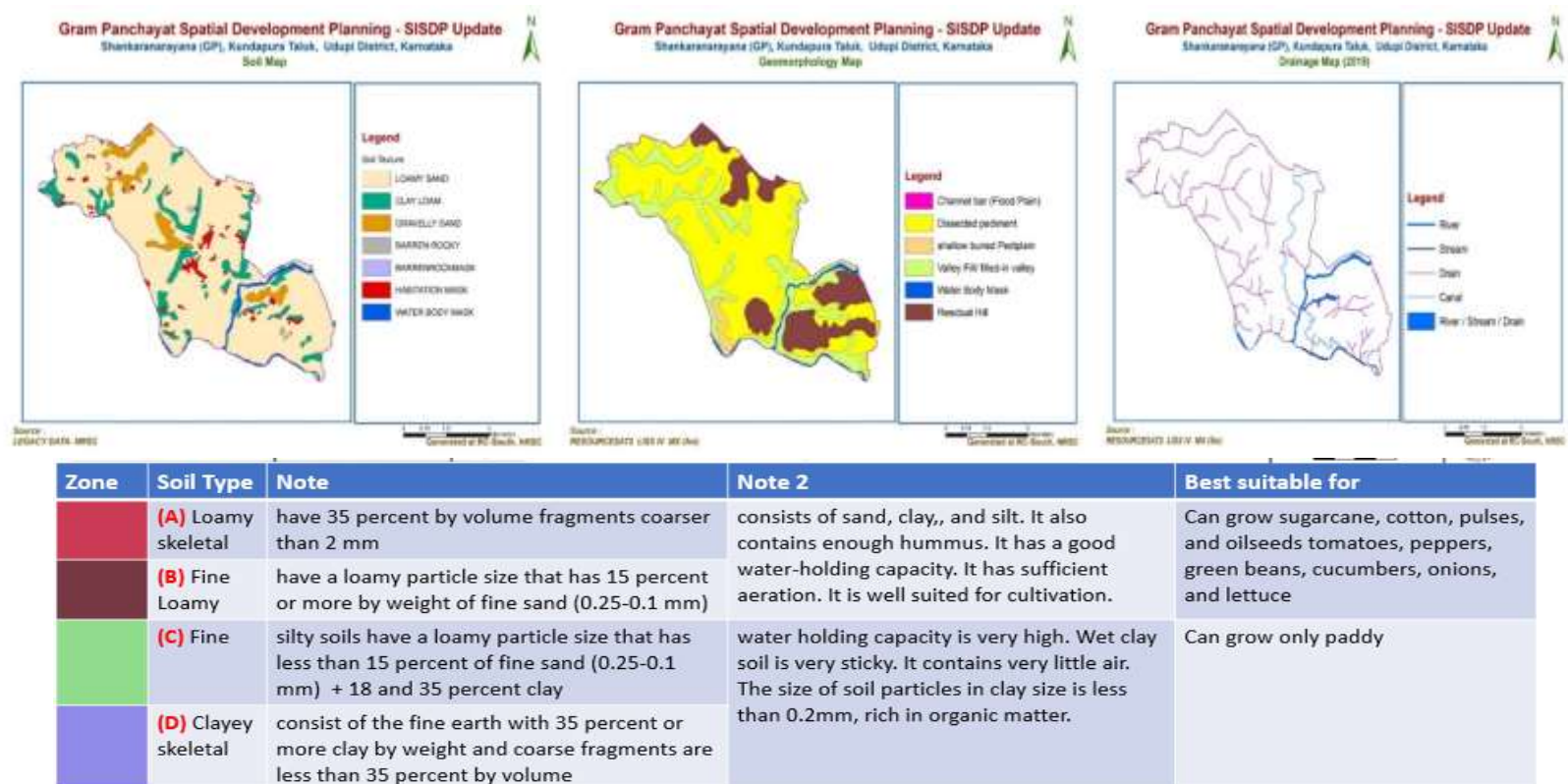


Figure 4.32 Slope analysis. GIS data provided by NRSC

Contour and built up map show pre-existing water bodies and new proposed reservoirs (Figure 4.33). Location of proposed water bodies have been chosen according to the slope and nearer to settlements. New proposed reservoirs are for future development that may arise due to the proposed development plan. Reservoirs are observed in these areas with gentle slope and below in order to catch the runoff water according to the drainage pattern (Figure 4.33 and 4.34). Out of two observed branch canal in study area, a new canal can be proposed through lower or gentle slopes for each village i.e. one in northern part of Shankaranarayana and one in the Kulanje village (Figure 4.23). Possible new proposed branch canal can be introduced flowing from east to west in the southern part of Shankaranarayana village. New branch canal extension is proposed to provide water for the agricultural practices in the summer months for the areas with water scarcity. The marked forest areas are to be conserved for ecological and environmental balance. In accordance with the vision of Ministry of Panchayati Raj, marked areas for future development of settlements near to the highway will be feasible as seen in Figure 4.35.

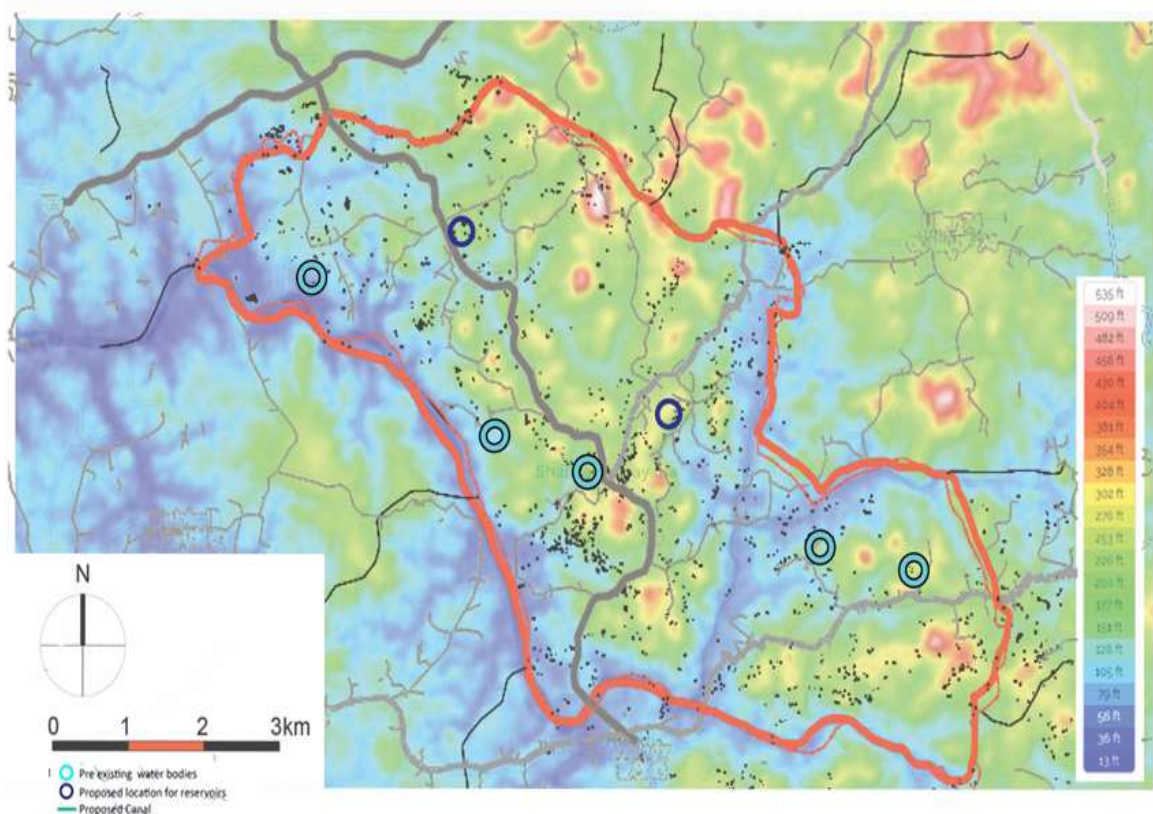


Figure 4.33 Map of existing water bodies. Source: topographicmaps.com with added layers by author

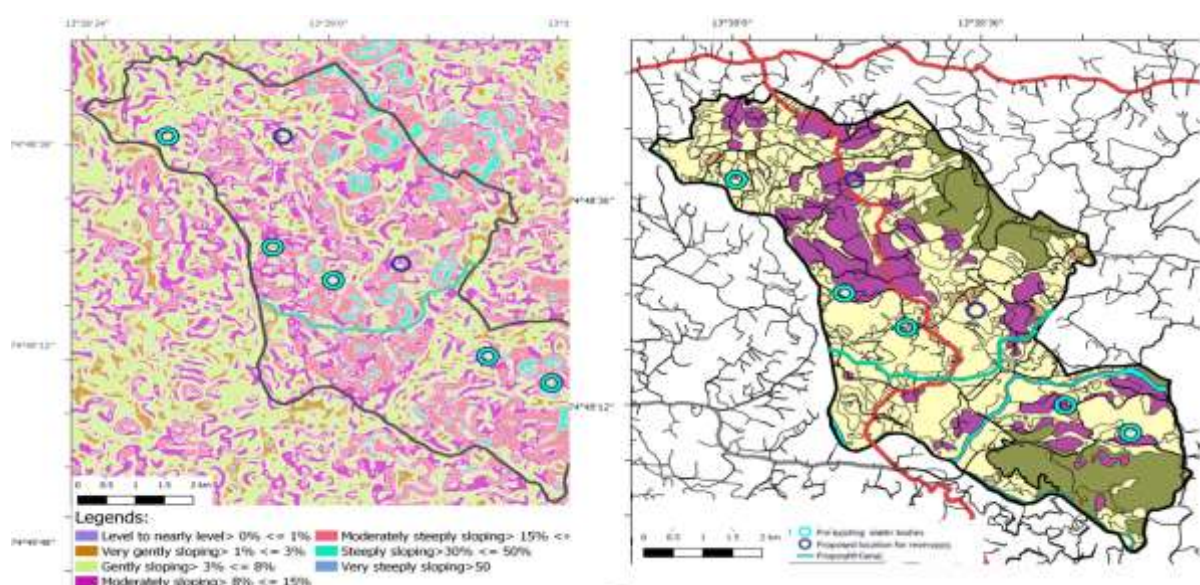


Figure 4.34 Water network analysis, Source: GIS data provided by NRSC with added layers by author

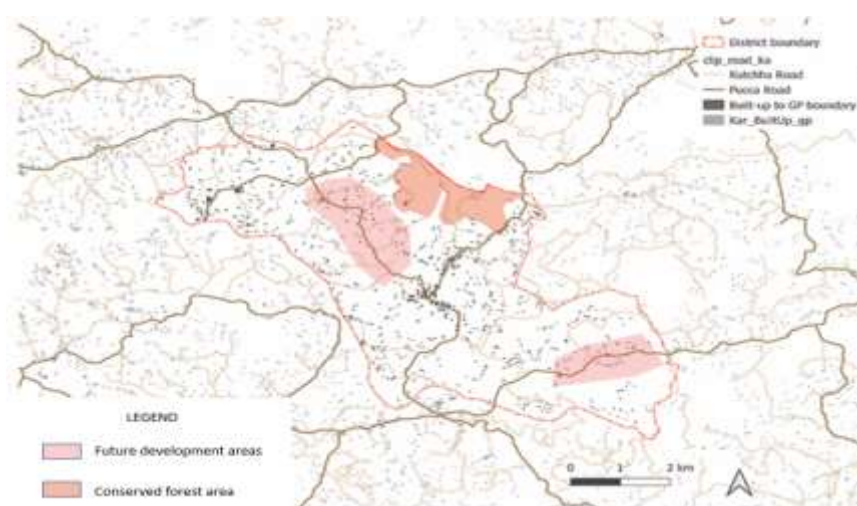


Figure 4.35 Future development areas and conserved forest areas, Source: GIS data provided by NRSC with added layers by author

4.3.2 Soil types and quality

Soil plays an important role in hydrology as they allow the precipitated water to infiltrate downward to groundwater regime. An essential knowledge of the soil on its texture, structure, porosity and permeability is very much required where the texture and permeability of soil are two important aspects taken into consideration while irrigating the land. Morphological and physio-chemical properties of the soils have bearing on growth of vegetation and crops and also influence the chemistry of groundwater. Micronutrients are the essential substances for plants but are required in small quantities. The eight elements which have been established as micronutrients are iron, zinc, manganese, copper, nickel, boron, molybdenum, chlorine. Based on the form of absorption by plants, these are further grouped as cationic (iron, zinc, manganese, copper and nickel) and anionic (boron) micronutrients. These are essential for plant growth and take part in many complex processes in plant development. Each micronutrient performs certain biochemical functions which affect the metabolism, growth and productivity of crops (Goulding, 2016). The soil types and quality of Shanakarnarayana gram panchayat are depicted in Table 4.4 and Figure 4.36 respectively. The soil quality of Shanakarnarayana gram panchayat has been found to be acidic in nature. The soil types have been observed such as clayey soil which is rich in Fe_2O_3 and Al_2O_3 and must be a derivative of metasediments/metavolcanics (1), typical lateritic soil with pebbles of Fe_2O_3 and clayey components (2), typical alluvial or valley fills with clayey soil and quartz crystals indicating a pegmatite intrusion nearby and must be K_2O potash rich (3) and lateritic soil rich in K_2O ,



Figure 4.36 Types of soil, Source: GP Survey Team, MSAP



clayey soil with Al_2O_3 and Fe_2O_3 and thus it is good for Areca, banana, coconut, cashew, cocoa and vegetable cultivation (4).

| Soil Parameters | Value | Status |
|-----------------|--------|------------|
| pH | 5.87 | Acidic |
| EC (dS/meter) | 0.15 | Normal |
| OC (%) | 1.60 | Very high |
| N (kg/hectre) | 118.91 | Very low |
| P (kg/hectre) | 94.03 | Very high |
| K (kg/hectre) | 324.75 | High |
| S (ppm) | 8.93 | Deficient |
| Zn (ppm) | 1.71 | Sufficient |
| B (ppm) | 0.21 | Deficient |
| Fe (ppm) | 29.80 | Sufficient |
| Mn (ppm) | 12.07 | Sufficient |
| Cu (ppm) | 1.55 | Sufficient |

Table 4-3 Shankaranarayana soil characteristics. Source: Adi Udupi agriculture office

4.3.3 Ground Water Table in Udupi District

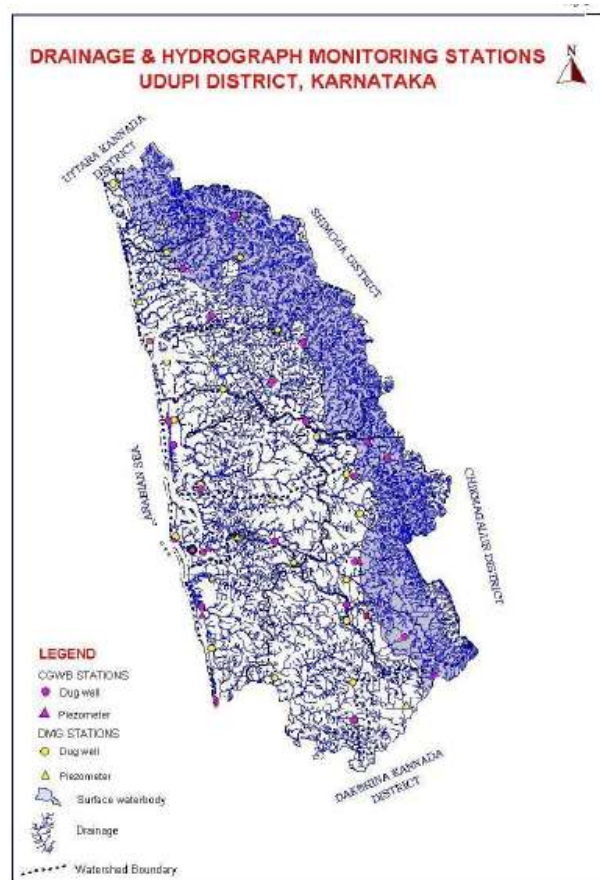


Figure 4.37 Drainage and Hydrograph monitoring Stations, Udupi District, Source: Central Ground Water Board-2008

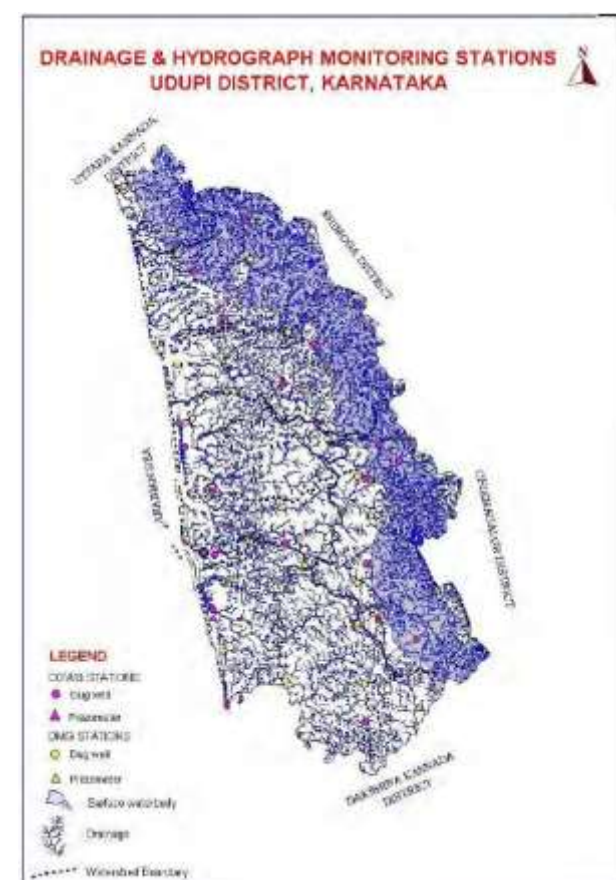


Figure 4.38 Drainage and Hydrograph monitoring Stations, Udupi District, Source: Central Ground Water Board-2012

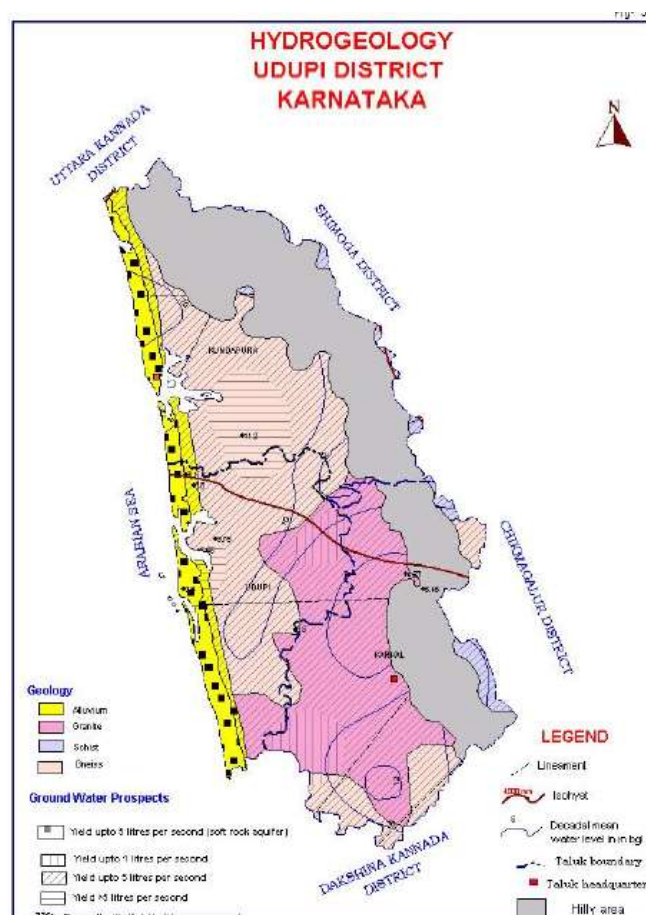


Figure 4.39 Hydrogeology, Udupi District, Source: Central Ground Water Board-2008

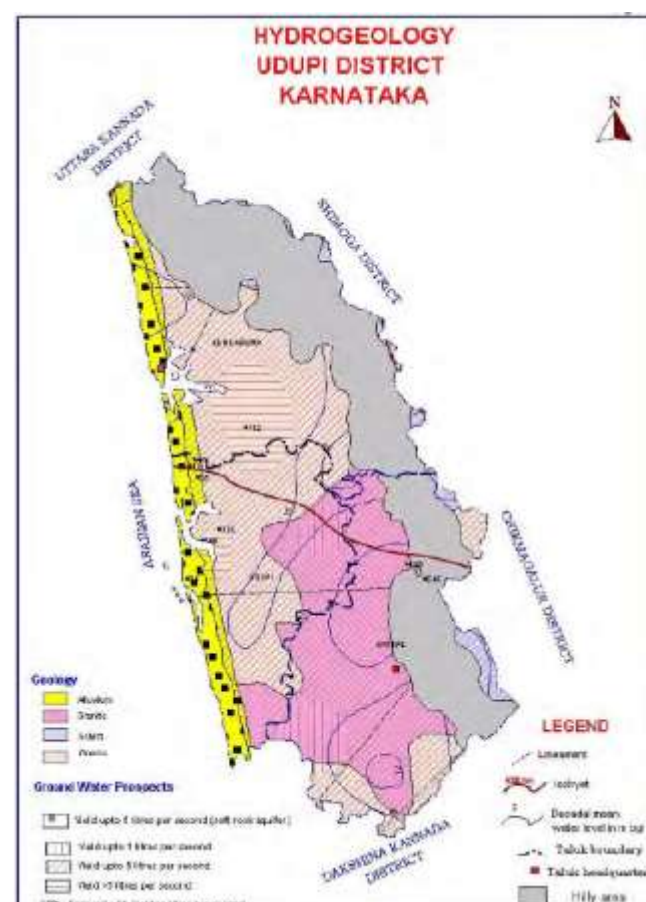


Figure 4.40 Hydrogeology, Udupi District, Source: Central Ground Water Board-2012

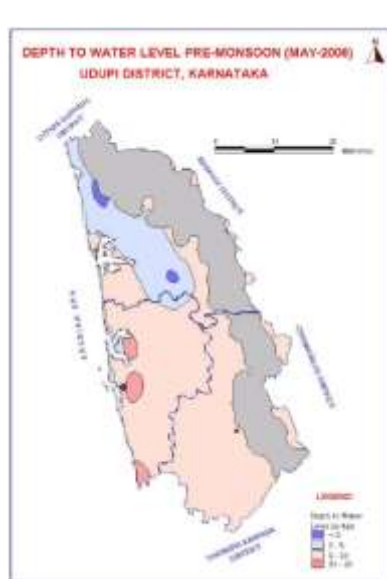


Figure 4.41 Depth to Water level Pre monsoon and Post monsoon, Udupi District, Source: Central Ground Water Board-2008

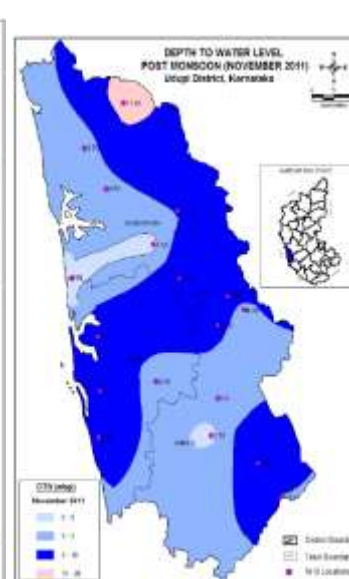
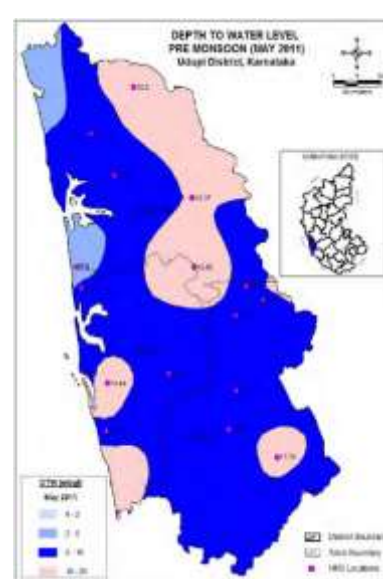


Figure 4.42 Depth to Water level Pre monsoon and Post monsoon, Udupi District, Source: Central Ground Water Board-2012

A total of 11 water samples were collected from well, municipality supply and river to evaluate drinkability. The physio-chemical analysis of well, river and municipality water samples of Shankaranarayana Gram panchayat were estimated using various methods. The physio-chemical parameters measured include pH, electrical conductivity (EC), total dissolved solids (TDS), oxidation redox potential (Eh), total alkalinity (TA), dissolved oxygen and temperature. The physio-chemical quality parameters result of groundwater samples in well, municipality supply and river in Shankaranarayana gram panchayat, Udupi, Karnataka are depicted in Table 4.5 and Figure 4.43-4.47. The results of the analysis showed that the quality of groundwater does not vary to a great extent. Most of the water samples from municipality supply and Varahi River are within permissible limit (6.48), (pH-6.5 – 8.5, TDS - 500), however the well water is slightly acidic in Shankaranarayan Gram panchayat due to the acidic soil in the region, and also the sample is taken in the rainy season (4.99 – 5.43), (pH-6.5 – 8.5, TDS - 500). Similar findings for ground water quality have also been reported by previous researchers for Varahi River water quality in Shankaranarayana Gram panchayat (Ravikumar and Somashekar, 2011).



Shankaranarayana Gram panchayat, Udupi, Karnataka.

| Shankaranarayana | | | | | | | |
|------------------|------|--|--|------------|-----------------------------|-----------------------------------|------------------------------------|
| Water samples | pH | Electrical Conductivity (EC) ($\mu\text{S cm}^{-1}$) | Oxidation-Redox potential (ORP) (Eh), mV | TDS (mg/L) | Temp ($^{\circ}\text{C}$) | Acceptable limits (IS:10500:2012) | Permissible limits (IS:10500-2012) |
| well | 5.79 | 35 | 288.6 | 17 | 26.56 | pH-6.5-8.5 | pH-No relaxation |
| well | 5.7 | 49 | 291 | 25 | 25.23 | TDS-500 | TDS-2000 |
| Municipality | 5.43 | 58 | 368.6 | 29 | 28.53 | EC-NA | EC-NA |
| Varahi river | 6.48 | 27 | 336.3 | 14 | 26.96 | ORP-NA | ORP-NA |
| well | 5.54 | 47 | 281.3 | 24 | 27.97 | Temp-NA | Temp-NA |
| Municipality | 6.58 | 37 | 263.8 | 18 | 28.31 | | |
| well | 4.99 | 42 | 331.6 | 21 | 28.09 | | |
| well | 5.08 | 27 | 361 | 13 | 27.15 | | |
| well | 5.43 | 42 | 361 | 21 | 27.93 | | |
| well | 5.5 | 39 | 299.6 | 20 | 27.2 | | |
| well | 5.67 | 78 | 292.7 | 39 | 24.92 | | |

Table 4.5 Physico-chemical quality parameters results of groundwater samples in well, municipality supply and river in

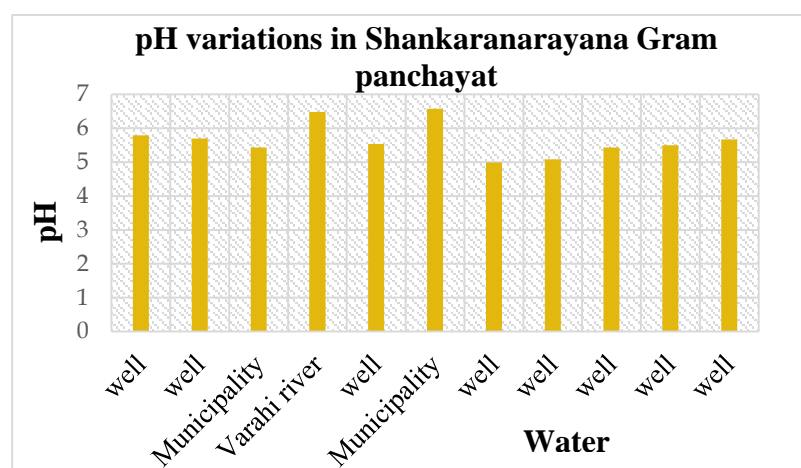


Figure 4.43 pH variations in Shankaranarayana GP, Source: MSAP survey team

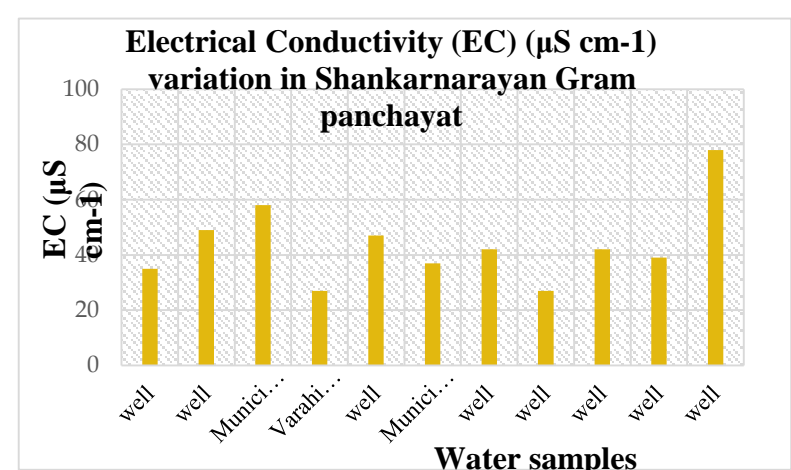


Figure 4.44 Electrical Conductivity (EC) ($\mu\text{S cm}^{-1}$) variation in Shankarnarayan Gram panchayat, Source: MSAP survey team

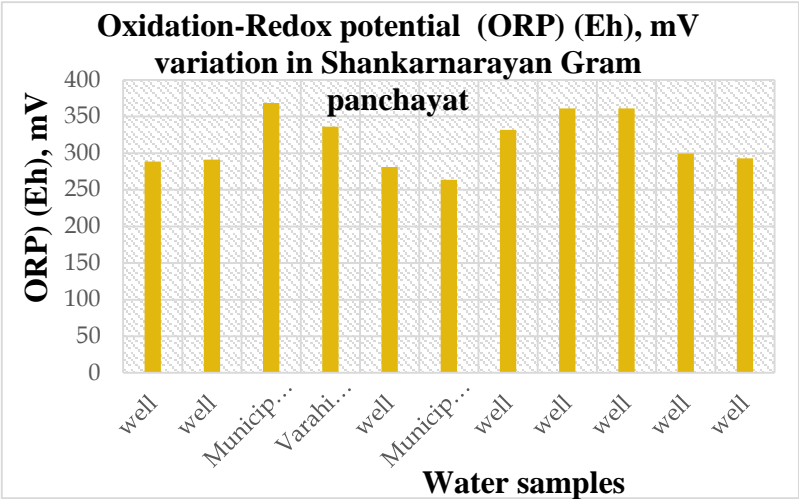


Figure 4.45 Oxidation-Redox potential (Eh), mV variation in Shankarnarayan Gram panchayat, Source: MSAP survey team

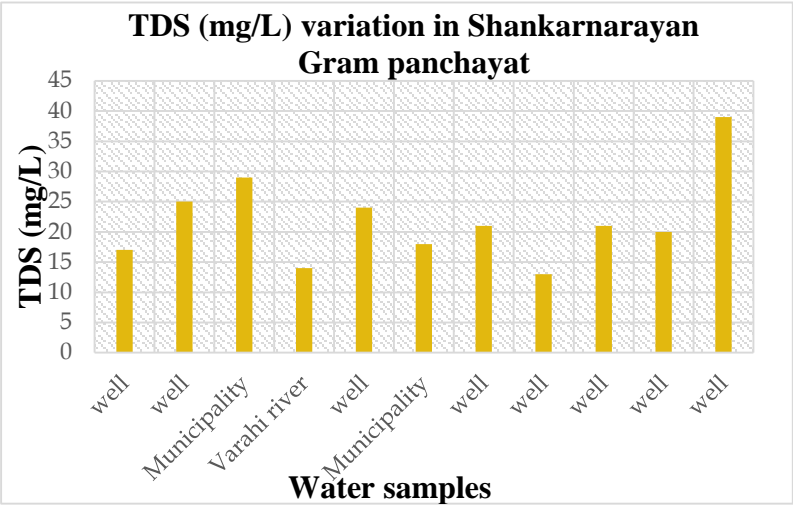


Figure 4.46 TDS (mg/L) variation in Shankarnarayan Gram panchayat, Source: MSAP survey team

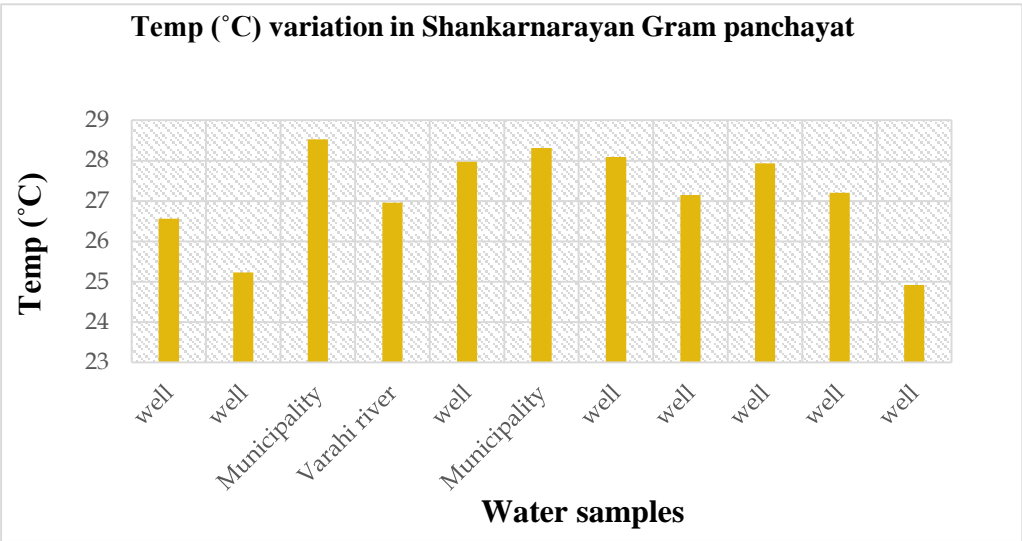


Figure 4.47 Temp (°C) variation in Shankarnarayan Gram panchayat, Source: MSAP survey team

4.3.5 Earthquake Risk Assessment

Forming the western mountainous part of the DC, the Sahyadri encompasses the NNW–SSE ending *en echelon* ranges that abruptly end as steep slope-breaks at their northwestern ends and as very high scarps that face west. It has been described as an example of a retreating rift-flank. The Western Ghats escarpment is not straight or curved, but characterized by *en echelon* pattern of slope-breaks and scarps. The mountainous terrain is cut by a multiplicity of predominant NNW-SSE trending *en echelon* sinistral faults and less common ESE/E– WNW/W oriented shear zones West of the-more-than-700 m high escarpment lies the Coastal Belt of an undulating terrain, characterized by low ridges and shallow depressions that have approximately NNW–SSE trend and by a thick mantle of laterite. The elevation of this erosion surface (coastal belt) varies from 40 to 120 m above sea level. Lithologically and structurally the Coastal Belt is not different from the mountainous Sahyadri. However, the altitudinal contrast is very great and the change of elevation is quite abrupt. Interestingly, the geological, geomorphological and tide-gauge data near Mangalore on the coast (13°N) confirm earlier studies that this coastal tract has been rising at the rate of 1.95- 0.14 mm/yr. and 3.22- 1.1 mm/yr. relative to the areas, respectively to the north and the south. Significantly, these three areas (of observation) lie on three different NNW–SSE trending fault-delimited low ridges. It may therefore be inferred that these three linear blocks have different rates of uplift. This can happen only if the faults that delimit them are active to different degrees. The current rates of uplift indicated by tide-gauge data (= 3 mm/yr.) and spirit-level data (= 6 mm/yr.) are higher than the Quaternary rates and are consistent with the recent strain (< 10 Nano strain/yr.) measured geodetically in southern India.

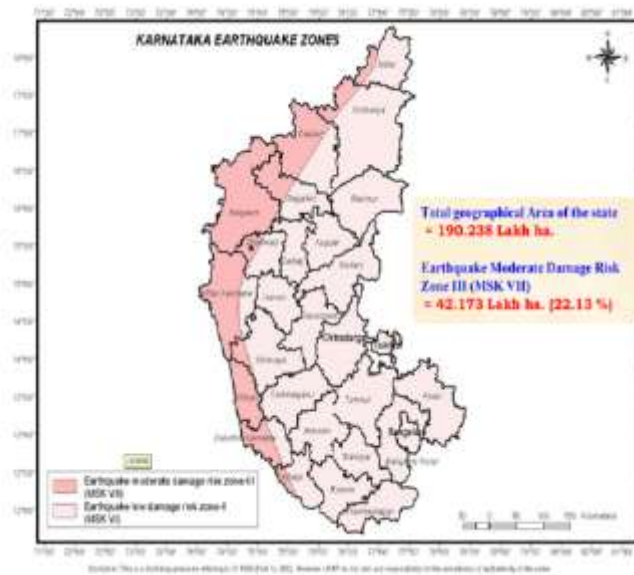


Figure 4.48 zoning of risk assessment (from gazetteer 2011) and prominent fault lines

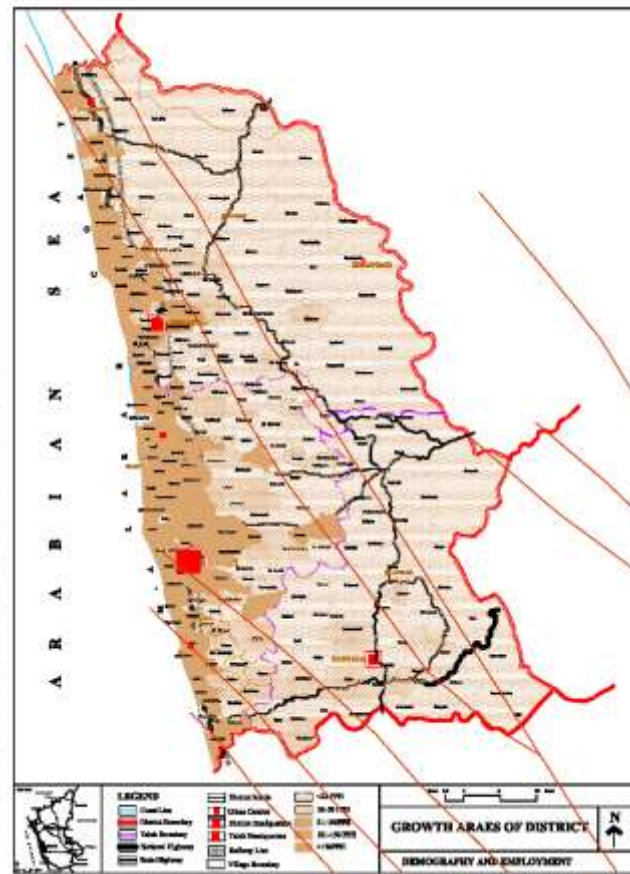


Figure 4.49 Map of Udupi district with population density and prominent fault



Figure 4.50 Recorded earthquakes and their magnitude lines

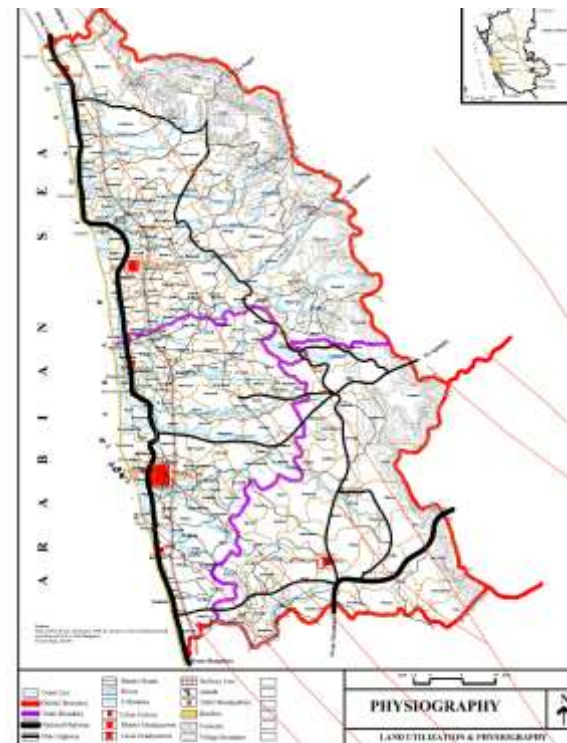


Figure 4.51 Physiography and transport network superimposed on fault lines

4.3 Masterplan

The Varahi river (known as Haladi River downstream) cover nearly 2 km² stretch of with a river wet zone of approx. 1.8 km² (Figure 4.42 and 4.44) which flows through the gram panchayat as it major river system. It is also the major source of water resource for agriculture. The study area also contains some eco-sensitive areas such as the residual hills. These residual hills are prone to landslides and no construction or plantations are advised. These residual hills cover 6.3 km² area and are present in the north-eastern part of the GP and in southern part of Shankaranarayana village and Kulanje village (Figure 4.52). Coastal plain (which makes up to around 0.5 km² and is good for agricultural practices), the majority of the GP has dissected pediment which totals to approx. 17 km² and valley fill zone which is around 11.1 km² and also good for growing.

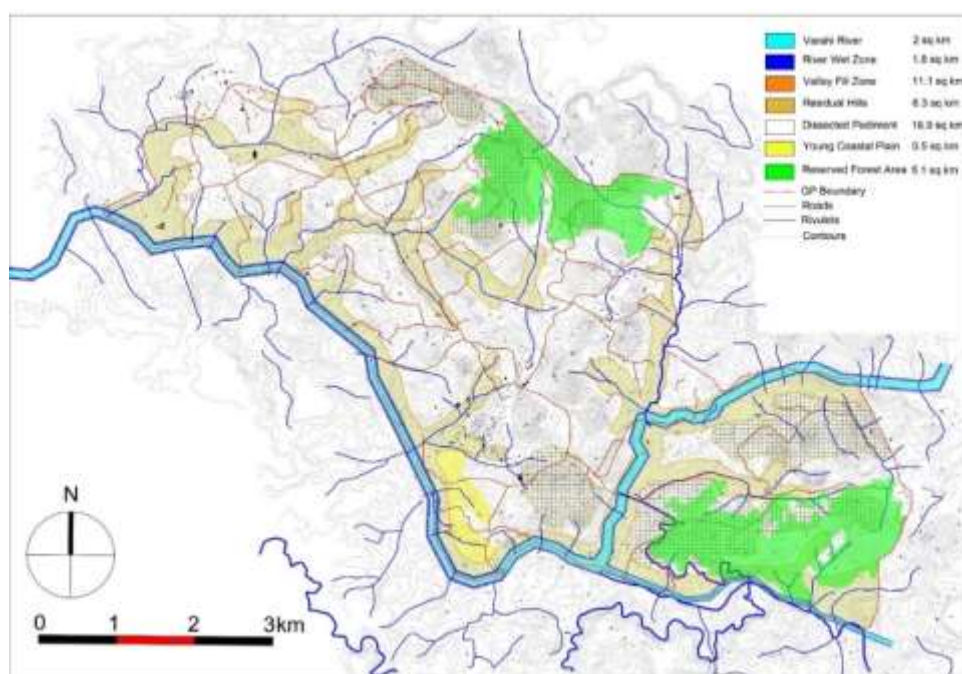


Figure 4.52 Geomorphology zone map, Source: GIS data provided by NRSC with added layers by author

Reserve forests present in the north-western part of the GP and in south and south-western parts of Kulanje village cover around 5.1 km² area. They need conservation and various species of flora and fauna are found in the region and are crucial in maintaining the ecological balance. The strategies should be implemented to reduce built up and increase areas using afforestation techniques. Buffer zone for forested areas are to be planted with wild jack, wild mango, etc. Harvestable trees are permitted here whereas cutting trees is not permitted. The forest types are categorized as follows (Figure 4.53).

1. Reserved Forest – Forest area that are legally protected (5.1 km²)
2. Forest at steep slope – Have to be protected to strengthen the soil (3.5 km²)
3. Residual hills – Have to be afforested and protected (6.3 km²) and
4. Forest pockets – Have to be maintained (2.6 km²)

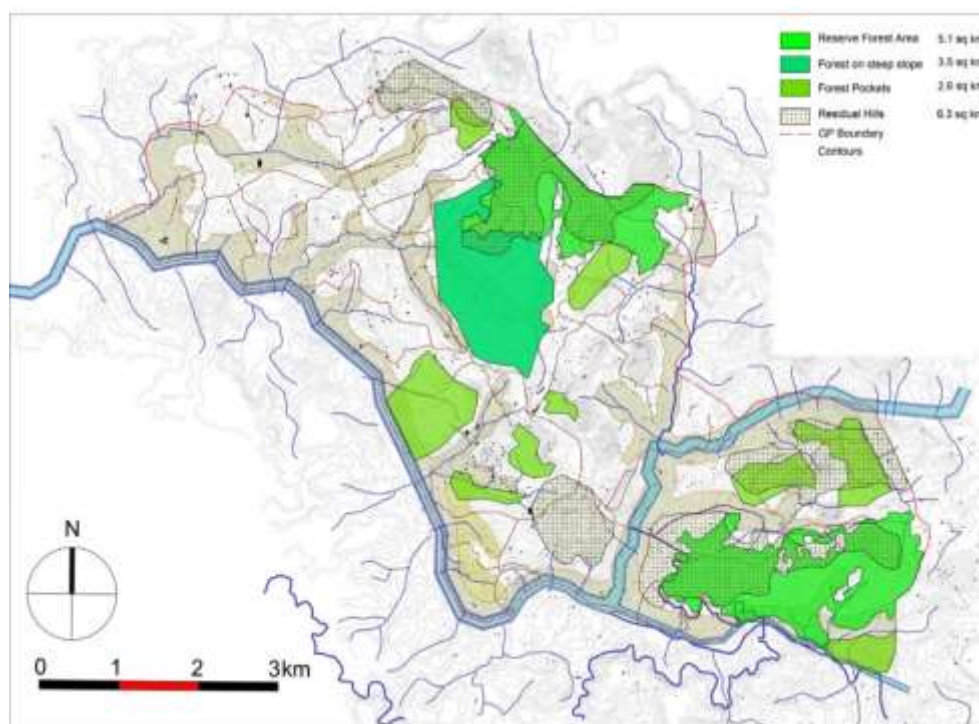


Figure 4.53 Forest Zones Map, Source: GIS data provided by NRSC with added layers by author

The natural river systems and water bodies present in the GP should be maintained with strict guidelines. The objectives of the guidelines should be formulated to maintain the health of the water body and focused must be paid on shoreline/bank protection.

Water quality and pH level should also have maintained. River regulation zones (RRZ) are proposed based on the RRZ draft report 2012 and these zones are shown in Figure 4.54. Different layers for Shankaranarayana gram panchayat such as eco-sensitive zones, geomorphological form, reserve forest and waterbodies are depicted in Figure 4.55. River regulation zones are:

1. Wet zone buffer: 7.5 m (1.8 km²), riparian buffer area which should be protected and afforested.



2. River Regulation Zone 1: 100 m (2.1 km²), only traditional capture fishing and organic farming allowed. Solid waste dumping and land should be protected from reclamations and is strict no construction zone and
3. River Regulation Zone 2: 375 m (7.4 km²) only allotted for grazing by domestic animals and temporary construction.

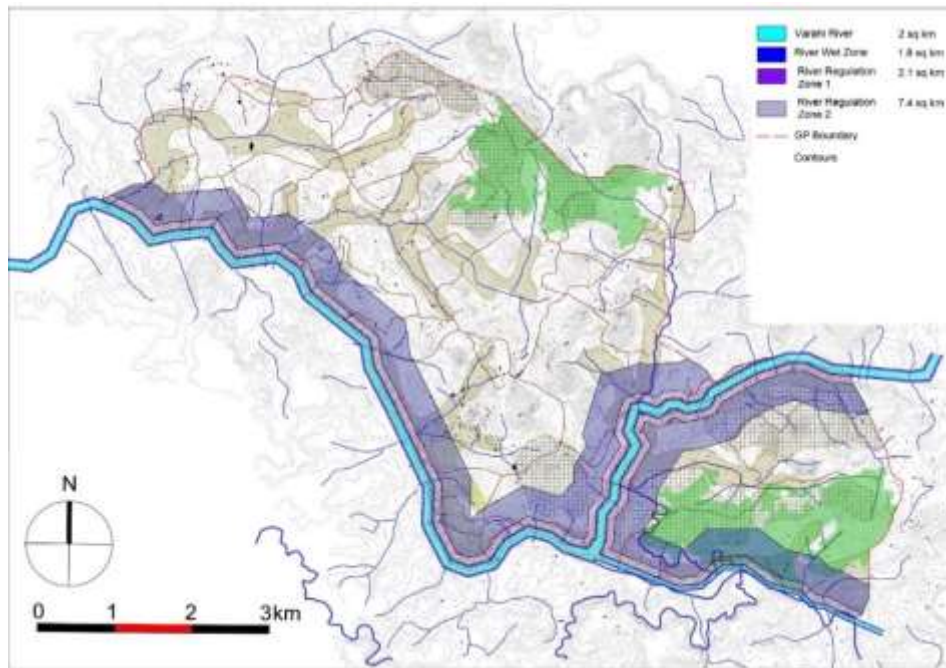


Figure 4.54 River buffer zones map. Source: GIS data provided by NRSC with added layers by author

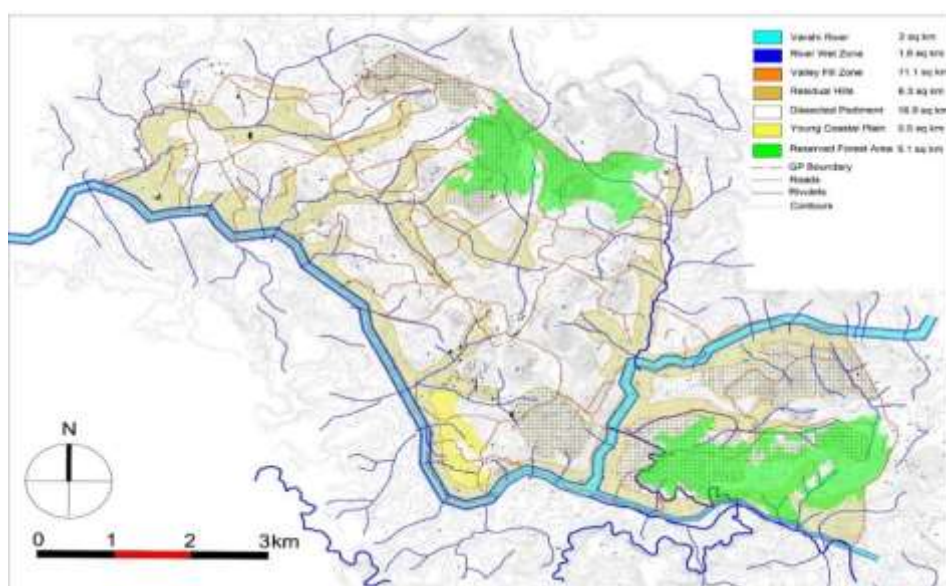


Figure 4.55 Composite map. Source: GIS data provided by NRSC with added layers by author

4.4 Issues and recommendations

4.4.1 Issues

Household surveys and stakeholders' meeting highlights certain issues and challenges of Shankaranarayana gram panchayat. The major issues present in the study area are discussed below:

1. The GP is located at the foothills of the Western Ghats and enjoy the boon of flora and fauna diversity that inhabits. The forest cover provides resources such as firewood, construction wood, fruits, resins and grazing patches for the cattle.
2. Encroachments into these forest areas and over exploitation of these resources has impacted on ecosystem. The tree density along with soil quality has been deteriorated in course of time. The human intrusion causes conflicts between local and wildlife and resulted in loss of their habitat.
3. The primary source of income of the Gram panchayat is based on the agricultural production. The major crops are paddy, coconut, arecanut, black pepper, cashew and rubber (District census handbook, 2011). Farmers whose lands are at the foot of the residual hills, steep slope or jiggered terrain face issues during the monsoons which precipitate a large volume within a short time period (typical of north Kanara precipitation pattern) and causes damage to crops since the plants are unable to hold against the strong storm water run-off.
4. The jagged topography with its fragmented watersheds in combination with the lateritic soils and dissected pediment substrate contribute to poor water retention of the ground which results in incomplete replacement of

the ground water sources. The scarcity of water is then reflected in the agricultural practices, paddy is not cultivated for the second half of the year and the mismatch between changing monsoon patterns and the crop cycles result in low quality produce.

5. The wet zone of the Varahi River also has encroachments and residences built in these regions that cause pollution in the river. The leaching and deposition of waste in to the river resulted in increasing of pollution level.
6. Shankaranarayana gram panchayat being on a lateritic soil substratum has its ground water resources on the acidic side of the pH scale. As observed in Table 5 and Figure 37 - 41, the ground water sources are within permissible limits, for making use of the water for potable, agricultural or cattle feeding etc. that needs purification.



5. Inventory and Analysis of Natural Resources using Geospatial Technologies

Chapter from NRSC/ ISRO

5.1. Introduction

For any nation, effective utilization of natural resources and their management are extremely essential. Hence, there is a need to catalyze the planning process at grassroots level. Land is a limited resource and has pressure from social, economic and environmental needs, including urbanization, industrialization, mining, transportation, rural development, protection of environmentally sensitive zones and resource areas. Unplanned development in rural, peri-urban areas and that in the vicinity of national and state highways also has adverse social, environmental and health hazards. Spatial planning in rural areas is of paramount importance in order to have well-designed rural communities, as well as scientific and orderly disposition of land resource. This would in turn, foster economic development and contribute to the ease of living along with improvement in the quality of life.

Developmental planning is a complex process of decision making based on the information about the status of resources, socio-economic conditions and institutional constraints. Reliability of the databases, both the spatial and non-spatial, is therefore crucial to the success of the developmental planning. Hence, it is necessary to understand various elements of Gram Panchayat and their interrelationship for ecological planning.

The conventional techniques employed to provide spatial information on natural resources are highly tedious, time consuming and more often subjective; whereas satellite remote sensing with synoptic and regular coverage has the requisite potential to provide up to date information in a timely and more objective manner. Remote sensing (RS), Geographic Information System (GIS) and Global Positioning System (GPS) constituting the emerging field of geospatial technology offer great promise for generating spatial information on natural resources at national and subsequent disaggregated levels. With advancements in space technology, availability of high resolution data and advanced processing techniques, the remote sensing technique has become a powerful tool for mapping and monitoring of natural resources. These techniques have immense potential for providing spatial information on natural resources resource mapping and monitoring at regular intervals.

GIS is a powerful tool for integrating natural resources for development of spatial decision support systems. Thus, geospatial technology along with Information and Communication technology (ICT) has become a very useful technique and powerful tool for providing spatial information including development of land use information systems, towards decision making. Further, the system is also highly useful for updating and monitoring the dynamics of land use changes through the monitoring capabilities of the multi-temporal remote sensing data. Remote Sensing in conjunction with Geographical Information System (GIS) and other IT tools is also emerging as flexible, efficient, speedy, cost-effective and reliable technology for obtaining information on natural resources analysis and modeling. It is an integral part of data management in large number of applications. Spatial information - images and maps, forms the foundation and basis for the most planning and implementation of developmental activities; infrastructure development; disaster management support; environmental monitoring; natural resources management and many other national activities. Over the last two decades remote sensing and GIS have been widely used for the preparation of different types of thematic layers and integrating them for different applications that include land and water resources planning, agricultural applications, water resource management, disaster management, forestry applications, watershed management and urban applications etc.

The present study focuses on the inventory and analysis of natural resources for Shankaranarayana Gram Panchayat in Kundapura taluk, Udupi district, Karnataka (Figure 5.1). Shankaranarayana Gram Panchayat is one among the 32 pilot GPs identified under the GPSPD project initiated by MoPR, Govt. of India.

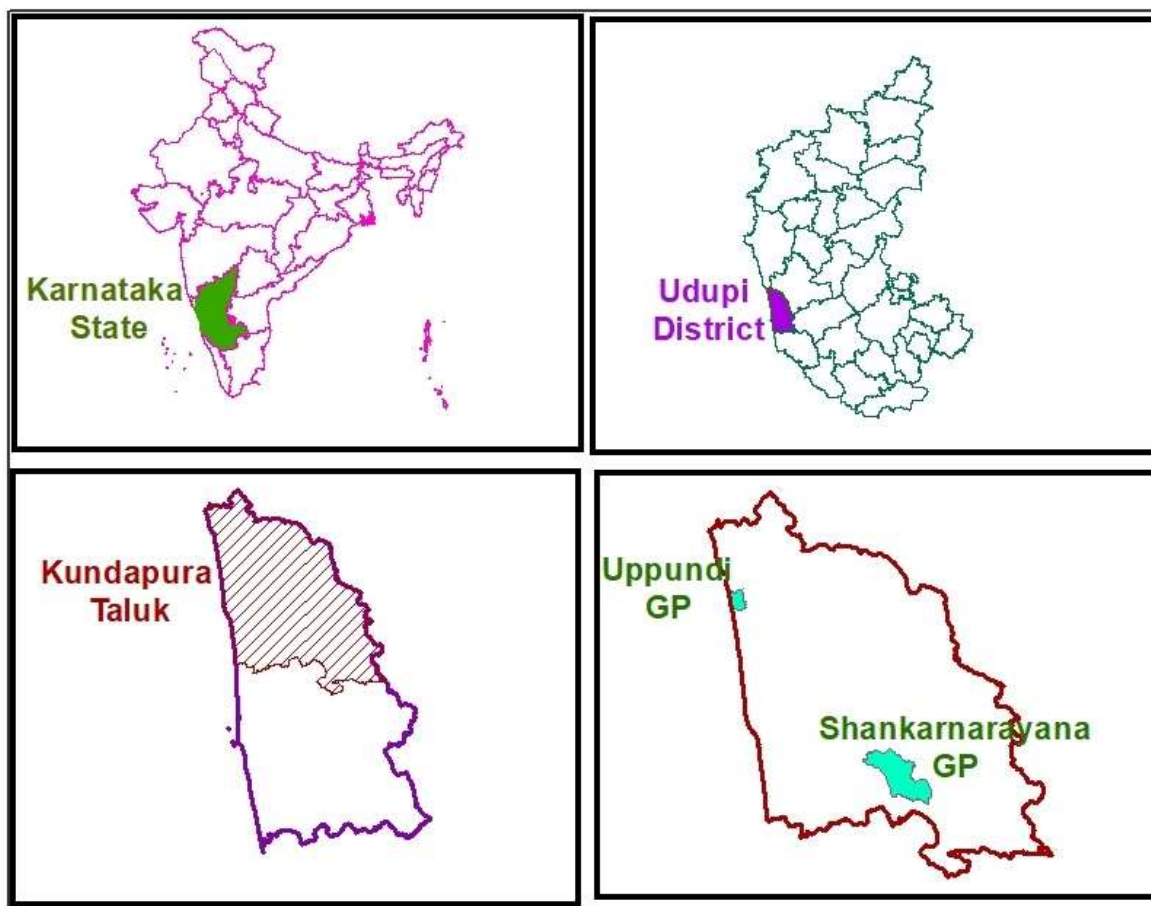


Figure 5-1 Study area location map for pilot GPs of Karnataka under GPSDP

5.2. Objectives

As the information on natural resources of a region is crucial to any planning process, the present study was taken up with the following objectives:

1. Providing very high resolution, high resolution and medium resolution satellite datasets along with natural resources information in the form of thematic layers viz., infrastructure layers, LU/LC, slope, drainage network & water bodies, contours, soil etc.
2. Analysis of rain-fall and run-off estimation
3. Generation of Land and Water resource development plans

5.3. Inventory of Natural Resources using High Resolution Satellite Data

Potential tools such as remote sensing and GIS techniques are utilized for generation of various thematic resource maps in conjunction with collateral data. Data integration and generation of development plans are carried out in Geographic Information System environment.

5.3.1. Satellite datasets / Thematic database for developmental planning

Satellite data from CARTOSAT-1, IRS P6 LISS-IV, IRS-1D LISS III datasets and other collateral data form major source for preparation of various thematic maps as spatial database. The data acquired from the multi-spectral sensors LISS IV (5.8 m resolution) and CARTOSAT-1 (2.5 m resolution) of the Indian Remote Sensing Satellite (IRS) series are extensively used for generating spatial databases. The data needed for this study is studied in detail and the collected primary maps have been grouped into hydro-geomorphological, topographical, land use/land cover, hydrology and socio-economic parameters (Table 5-1). Subsequently, these primary maps are used to produce utilitarian types of maps to serve planning decisions. They are derived, in some cases, by direct translation of single thematic map and in others by combination of two or more thematic maps or chosen parameters of the different themes (Table 5-2). Natural resources data representing environmental status of the study area that were generated under various national level projects at 1:50,000 scale was considered for the present study and are presented below. The database was standardized for integrated analysis under GIS environment.

**Table 5-1:** Information sources for development planning

| Data/map | Source | Spatial/Non-spatial | Scale |
|---|--|---------------------|------------|
| Digital Elevation Model | CARTOSAT Stereo data | Spatial | 10 m |
| Contour | CARTODEM | Spatial | 5m |
| Geological map | Rajiv Gandhi National Drinking Water Mission, NRSC | Spatial | 1:50K |
| Geomorphological map | | Spatial | 1:50K |
| Structures/Lineaments | | Spatial | 1:50K |
| Soil Texture | NRIS, NRSC | Spatial | 1:50K |
| Ground water potential map | NRSC | Spatial | 1:50K |
| Ground water quality bore well location map | NRSC | Spatial | 1:50K |
| Land use/ Land cover | High-resolution data | Spatial | 1:10K |
| Drainage map and Surface water bodies | High resolution satellite data | Spatial | 1:10K |
| Meteorological data | IMD | Spatial | 25 km grid |
| Settlement | High-resolution data | Spatial | 1:10K |
| Infrastructure | High resolution satellite data | Spatial | 1:10K |
| Gram Panchayat boundary | NIC | Spatial | 1:50K |
| Village boundaries | NRSC | Spatial | 1:50K |

Table 5-2 Derived spatial databases required for planning

| Derived map | Theme map | Remarks |
|---------------------------------|--|---|
| Contour/Slope | Topographical map/IRS PAN stereo data | Derived from DEM |
| Groundwater potential | Geology, Geomorphology, bore well, Lithology and yield data | Integration of thematic maps and point database |
| Water Resource Development Plan | Slope, soil map, land use, drainage order, lineament, Runoff Potential | Multi Criteria analysis |
| Land Resource Development Plan | Slope, soil map, land use, Ground Water Potential, Geomorphology | Multi Criteria analysis |

5.4. Satellite Data Used

High resolution satellite datasets (5.8m and 2.5m) and Digital Elevation Model (DEM) were used for preparation of spatial thematic layers for Shankaranarayana GP.

5.4.1. High Resolution Satellite Data (HRS data)

IRS LISS-IV MX of 5.8m spatial resolution acquired during 2018-19 (Figure 5.2) and merged product of CARTOSAT-1 PAN and IRS LISS-IV Mx datasets acquired during 2015-16, from SIS-DP Phase-II in Natural Colour Composite i.e. NCC mode of 2.5m spatial resolution were used for GPSDP planning (Figure 5.3).



Figure 5-2 Shankarnarayana GP as seen through HRS data in FCC mode (5.8m)

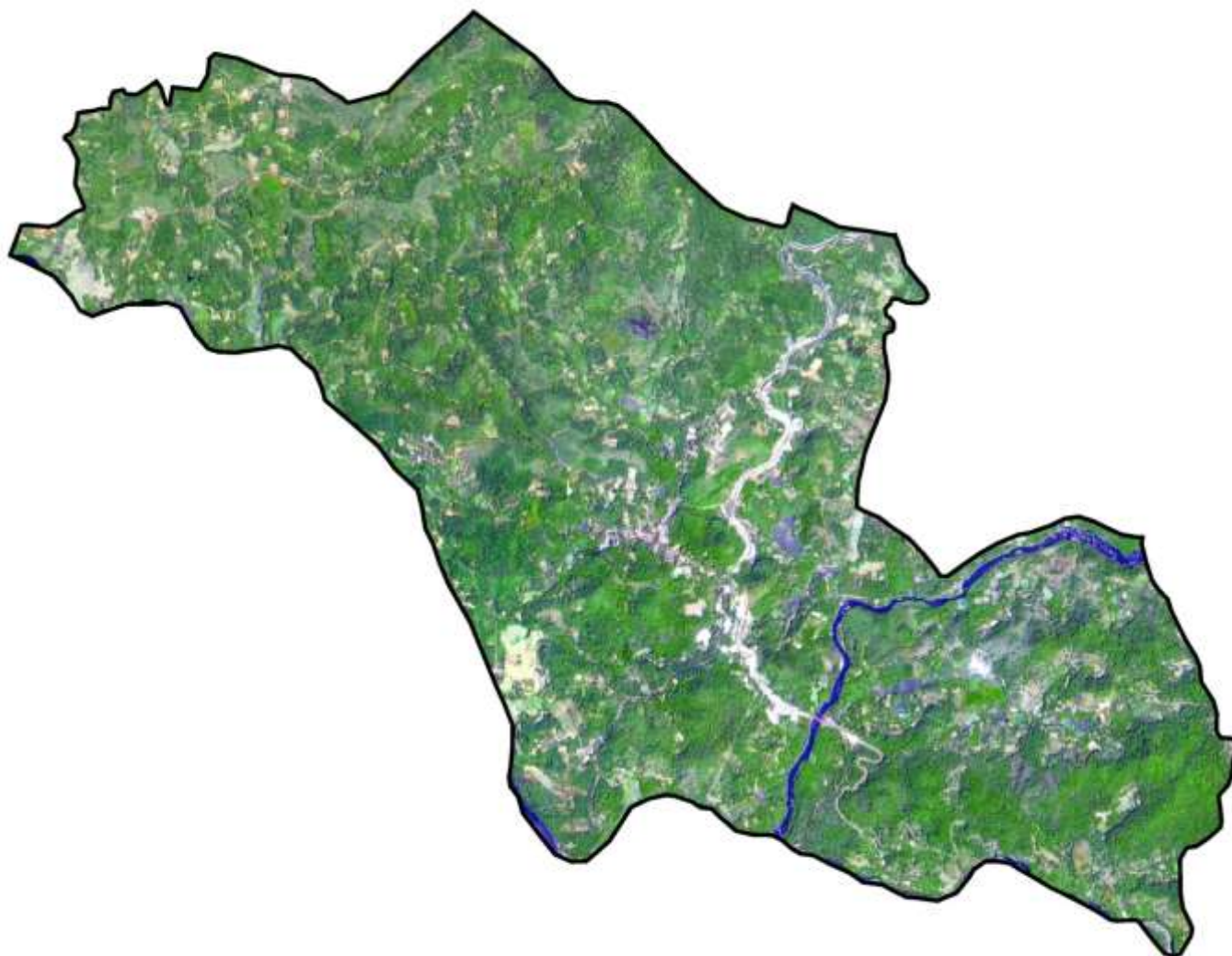


Figure 5-3 Shankarnarayana GP as seen through HRS data in NCC mode (2.5m)

5.4.2. Digital Elevation Model (DEM)



DEM is one of the important parameters for developmental activities and was derived from CARTOSAT-1 stereo data. The elevation data is very much essential for generation of slope and contour maps, which are essential requisites for spatial planning purposes. DEM of the study area is shown as Figure 5.4.

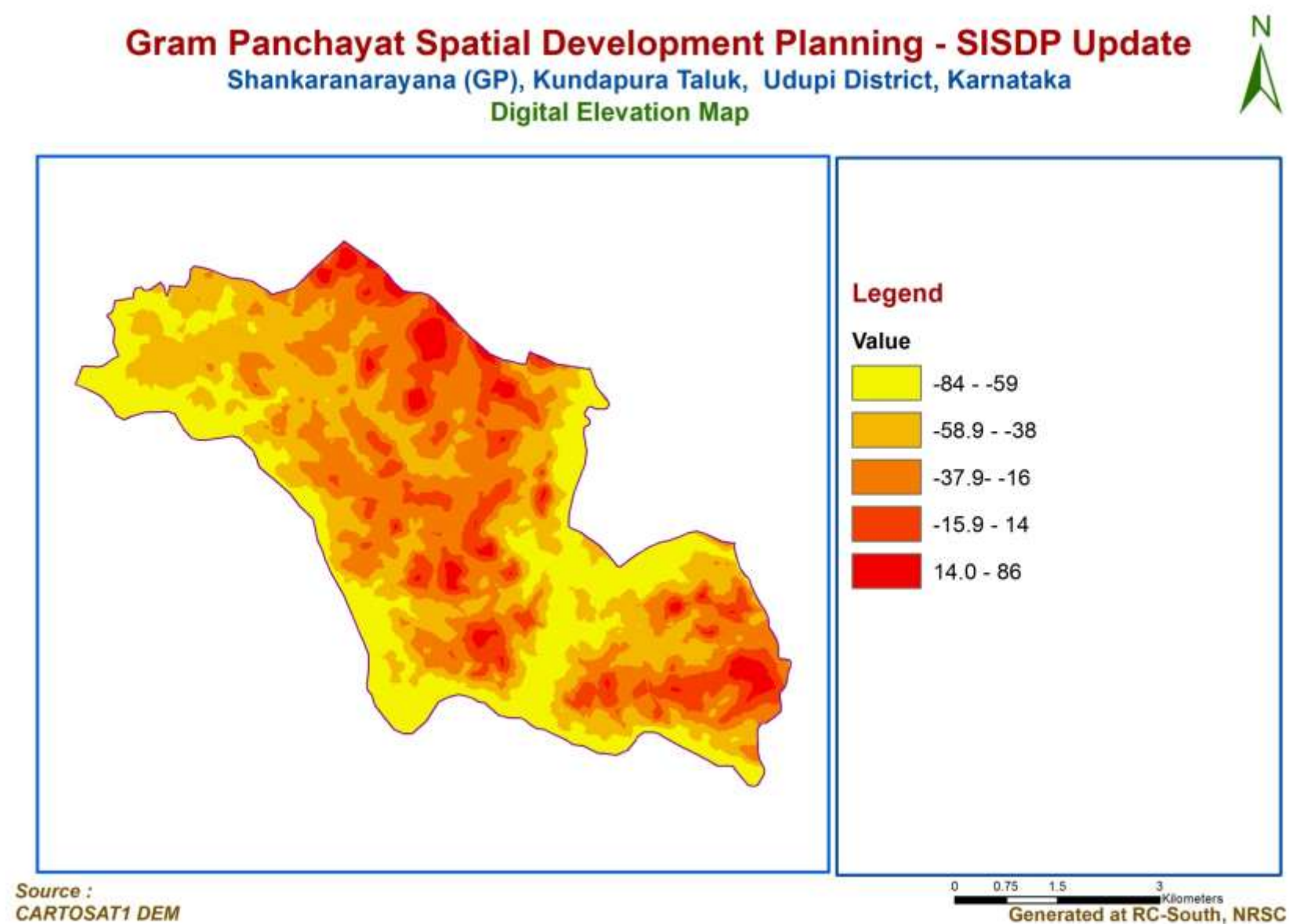


Figure 5-4 Digital Elevation Model of Shankarnarayana

5.5. Spatial Layers

Spatial layers representing the synoptic view of GP were generated at 1:10,000 and 1: 50,000 scales.

5.5.1. Settlement and Transportation Layer

For Shankaranarayana GP, Settlement and Transportation Layer generated using HRS data at 1: 10,000 scale (Figure 5.5). The statistics of road types and Settlement categories are given in Tables 5.3 and 5.4 respectively. Rural settlement growth in different directions can be analyzed using satellite data more explicitly.

Table 5-3 Road length for different Road categories in Shankaranarayana GP

| S.No. | ROAD CATEGORY | ROAD LENGTH (KM) |
|-------|---------------|------------------|
| 1 | State Highway | 10.05 |
| 2 | Village Road | 47.51 |
| 3 | Cart Track | 14.18 |
| 4 | Foot Path | 02.40 |
| | TOTAL | 74.14 |

Table 5-4: Areal spread of different Settlement categories in Shankaranarayana GP

| S. No. | Settlement CATEGORY | Area (ha) |
|--------|-----------------------------------|---------------|
| 1 | Village Settlement (VS) | 57.95 |
| 2 | Mixed Village Settlement (MV) | 73.06 |
| 3 | Built up (Rural) | 8.02 |
| 4 | Hamlet & Dispersed Household (HD) | 91.95 |
| | TOTAL | 230.98 |

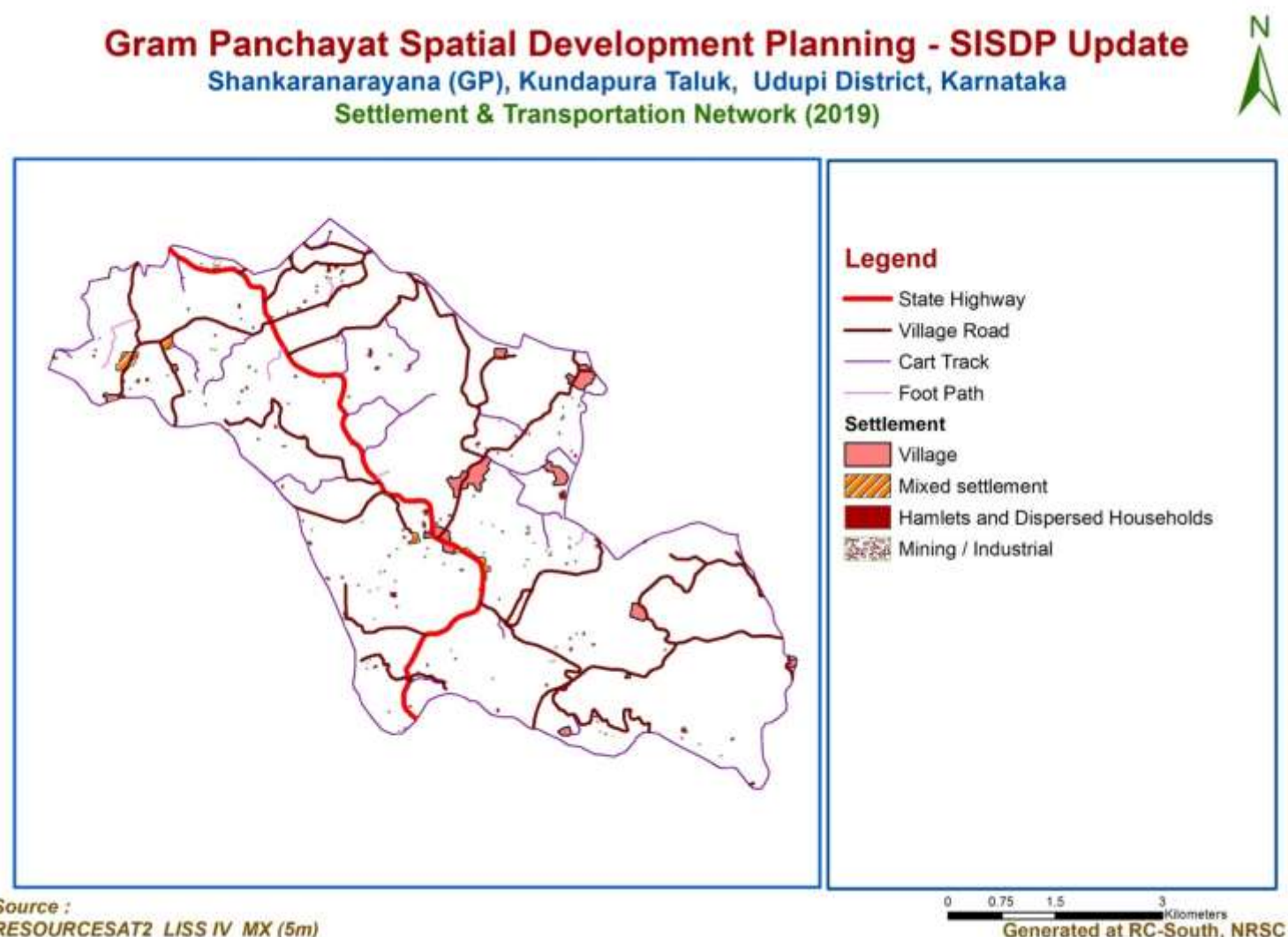


Figure 5-5: Settlement and Transportation Network of Shankarnarayana GP

5.5.2. Land Use Land Cover Map (1:10,000 scale)

High resolution satellite datasets of CARTOSAT-1 PAN and IRS LISS-IV Mx datasets of acquired during 2015-16, from SIS-DP Phase-II were merged by data fusion and utilized for preparation of detailed Land Use / Land Cover (LULC) map of Shankaranarayana GP at 1: 10,000 scale (Figure 5.6). This was used in Natural Colour Composite i.e. NCC mode of 2.5m spatial resolution. This LULC map was updated using IRS LISS-IV MX of 5.8m spatial resolution acquired during 2018-19. Onscreen visual interpretation technique was adopted in GIS environment for delineating boundaries of various classes using ArcMap 10.5 software. Overall, the GP area was divided into 6 major classes, namely, cropland / agricultural plantations, forest /forest plantations, settlement, wasteland, water and other land use / land cover classes. These classes were further subdivided into sub-classes as indicated in Table 5.5. Majority of the area under Shankaranarayana GP is under forest (1602.06 ha), followed by agricultural plantations/orchards (1221.85 ha). These two classes cover about 3/4th of the entire GP area (74.5%). Crops occupy an area of 344.3 ha.

**Gram Panchayat Spatial Development Planning - SISDP Update**

Shankaranarayana (GP), Kundapura Taluk, Udupi District, Karnataka

Land use / Land cover (2019)

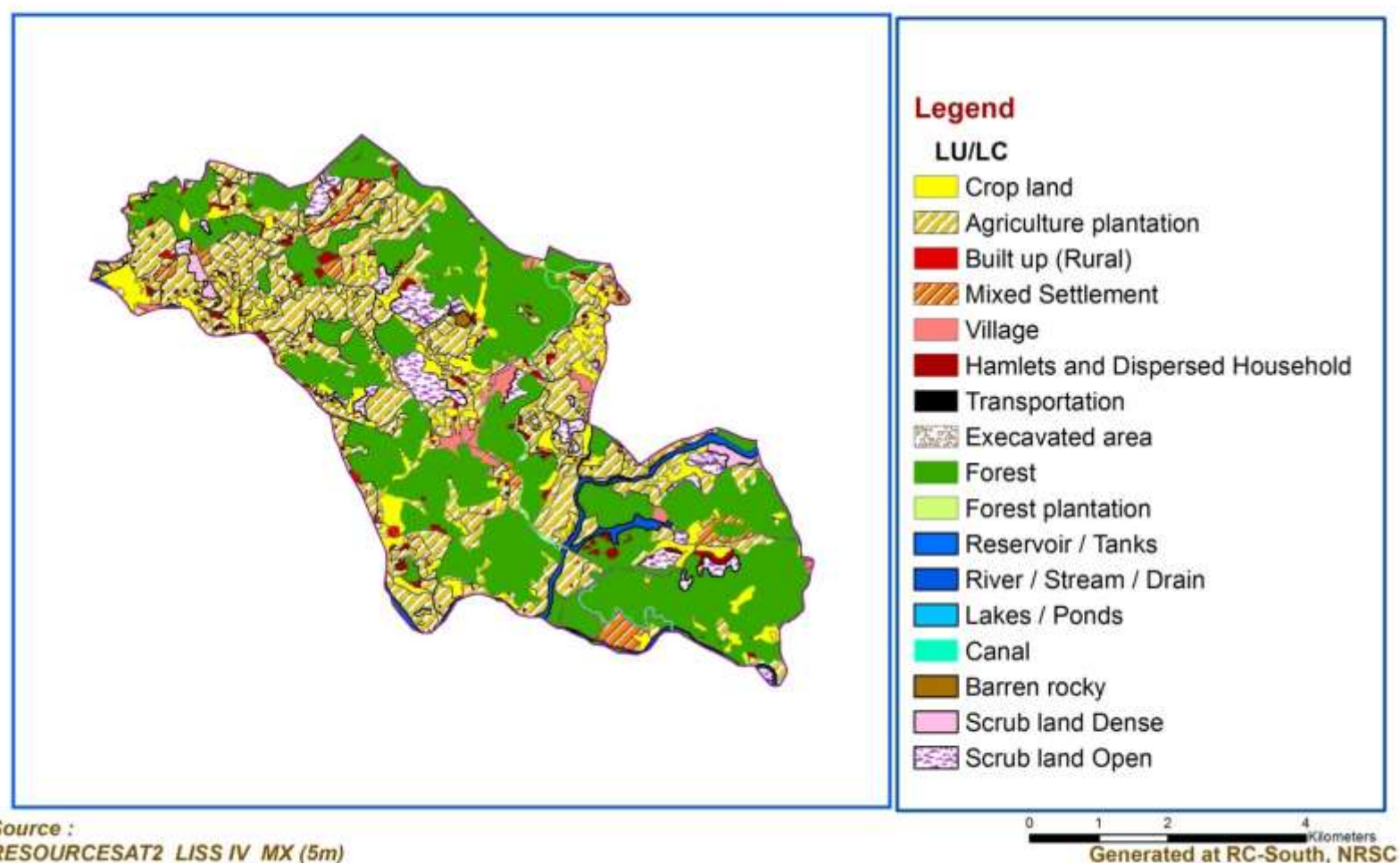


Figure 5-6: LULC map of Shankarnarayana GP at 1:10k scale

The settlement / built-up area in the GP covered about 230.98 ha, which was further delineated as village settlement (57.95 ha), mixed village settlement (73.06 ha), built-up rural (8.02 ha) and hamlet & dispersed household (91.95 ha). Wastelands occupied 219.81 ha area, comprising of scrub land dense (21.65 ha), scrub land sparse (193.7 ha), and barren/rocky area (4.46 ha). Water bodies covered an area of 95.7 ha. Other LULC classes covered the remaining area of 72.68 ha (Table 5.5).

Table 5-5 Area estimates of various LULC classes in Shankaranarayana GP (1:10k map)

| S.No. | CLASS CATEGORY / NAME | AREA (Ha) |
|-----------|--|----------------|
| A. | CROPLAND/AGRICULTURAL PLANTATIONS | |
| 1 | Crop Land (CL) | 344.30 |
| 2 | Agriculture Plantation / Orchards (AP) | 1221.85 |
| | Sub-total | 1566.15 |
| B. | FOREST / FOREST PLANTATIONS | |
| 3 | Forest | 1602.06 |
| 4 | Forest Plantation | 0.38 |
| | Sub-total | 1602.44 |
| C. | SETTLEMENTS | |
| 5 | Village Settlement (VS) | 57.95 |
| 6 | Mixed Village Settlement (MV) | 73.06 |
| 7 | Built up (Rural) | 8.02 |
| 8 | Hamlet & Dispersed Household (HD) | 91.95 |
| | Sub-total | 230.98 |

| | | |
|------------------|------------------------|----------------|
| D. | WASTELAND | |
| 9 | Scrub Land Dense | 21.65 |
| 10 | Scrub Land Open | 193.70 |
| 11 | Barren/Rocky | 4.46 |
| <i>Sub-total</i> | | 219.81 |
| E. | WATER | |
| 12 | River / Stream / Drain | 83.48 |
| 13 | Lakes / Pond (LP) | 1.03 |
| 14 | Canal | 10.75 |
| 15 | Reservoir / Tanks | 0.44 |
| <i>Sub-total</i> | | 95.7 |
| F. | OTHERS | |
| 16 | Transportation | 66.35 |
| 17 | Mining / Industrial | 6.33 |
| <i>Sub-total</i> | | 72.68 |
| TOTAL | | 3787.76 |

5.5.3. Drainage network & surface water bodies

Rivers/streams are natural course of water flowing on the land surface along a definite channel and its spatial distribution in the GP is shown as Figure 5.7. The statistics of drain length are given in Table 5.3. Areal spread of Surface water bodies is given in Table 5.6.

Table 5-6 Statistics of drain length for Shankaranarayana GP

| S.No. | DRAIN CATEGORY | DRAIN LENGTH (KM) |
|--------------|-----------------------|--------------------------|
| 1 | River | 6.32 |
| 2 | Stream | 3.87 |
| 3 | Drain | 49.04 |
| 4 | Canal | 10.24 |
| | TOTAL | 69.47 |

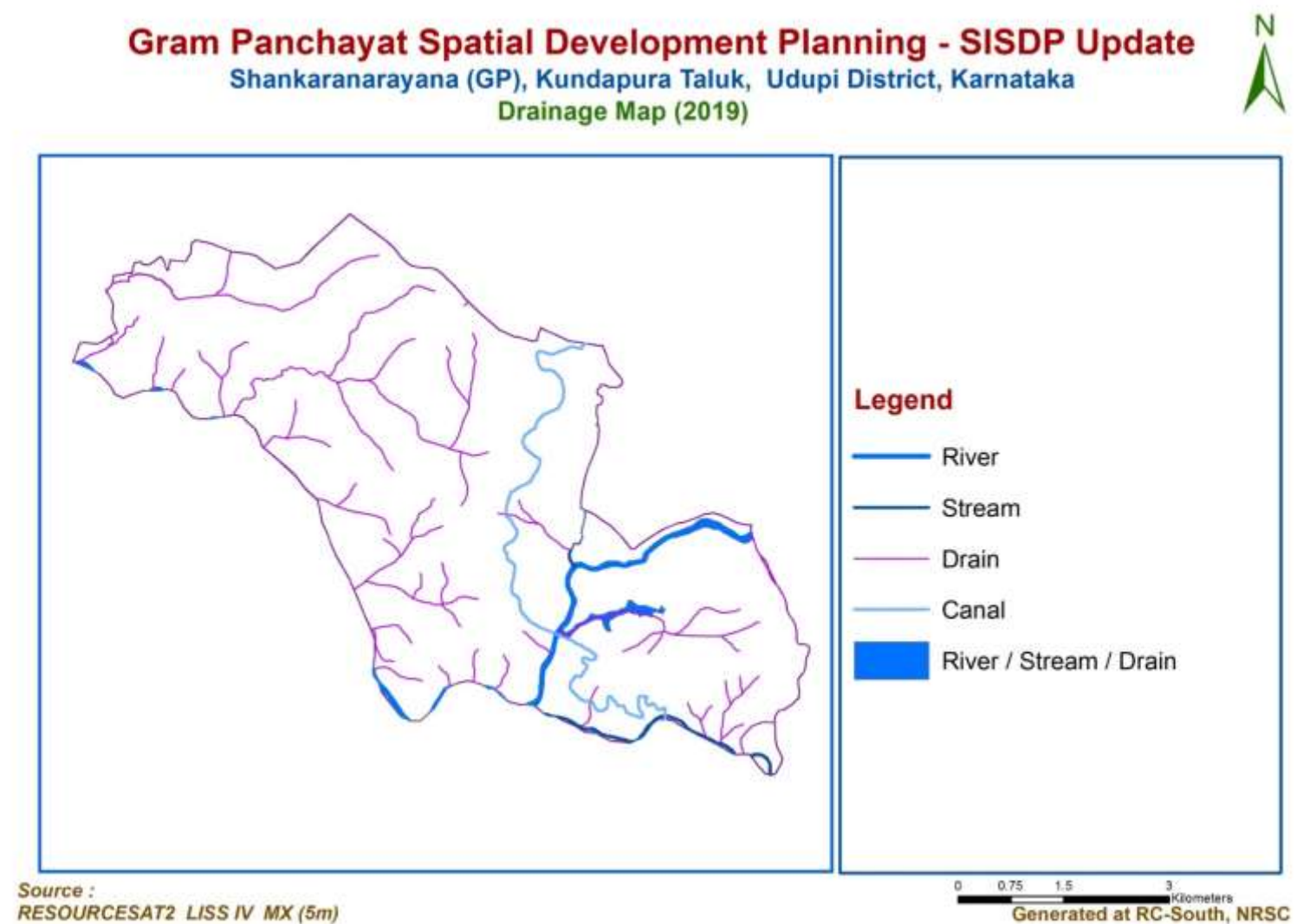


Figure 5-7 Drainage and surface water bodies of Shankarnarayana GP

5.5.4. Slope Map

CARTODEM was used for generation of the slope layer and it plays an important role in developing the Land and Water Resource Development Plans (Figure 5.8).

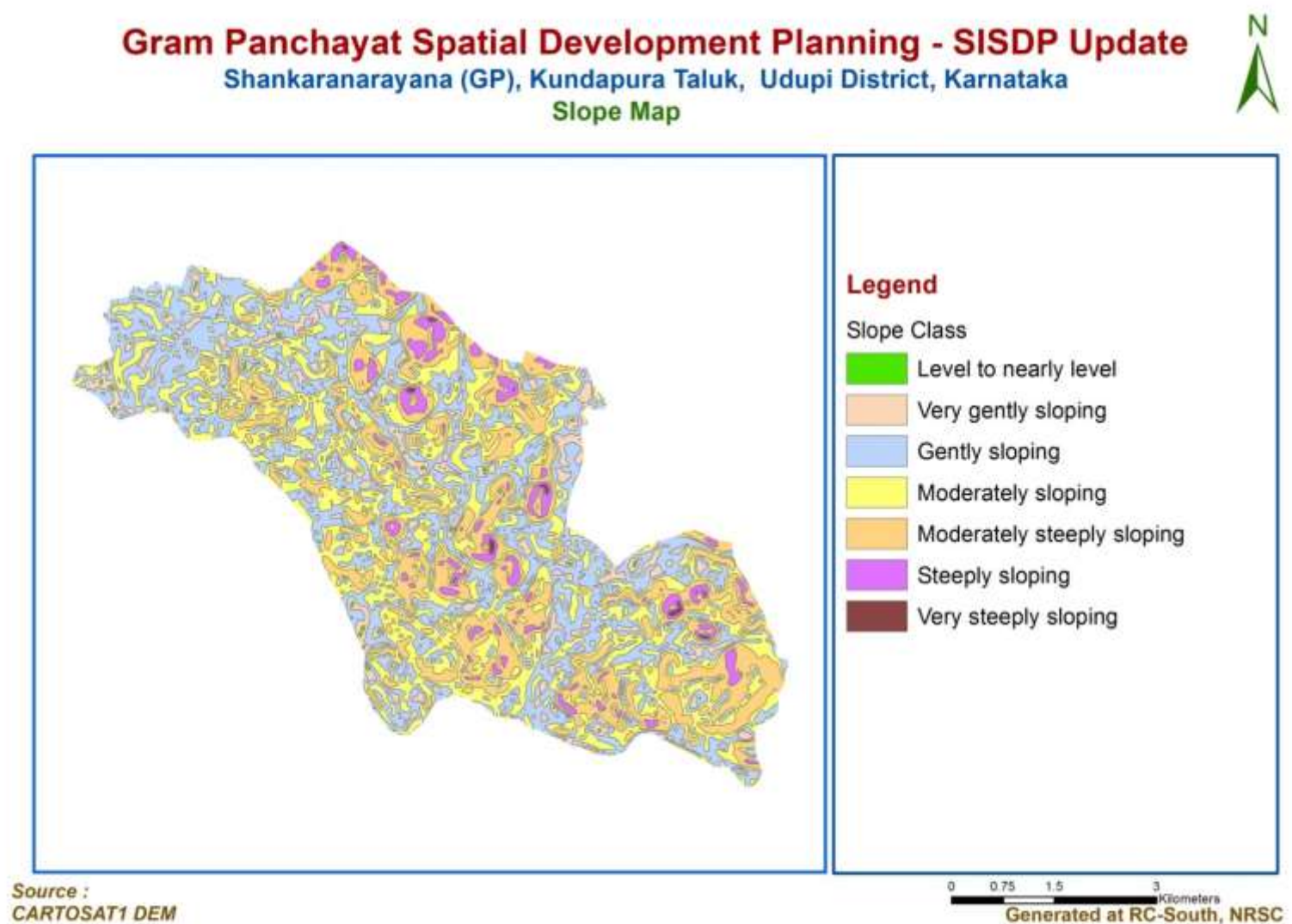


Figure 5-8: Slope map of Shankaranarayana GP

5.5.5. Geomorphology Map

Hydro-geomorphological maps depict major geomorphic units, landforms and provide an understanding of the processes relating to groundwater occurrence as well as groundwater prospects. Geomorphological map was updated based on the morphological expressions in the high resolution satellite data and other collateral data (Figure 5.9).

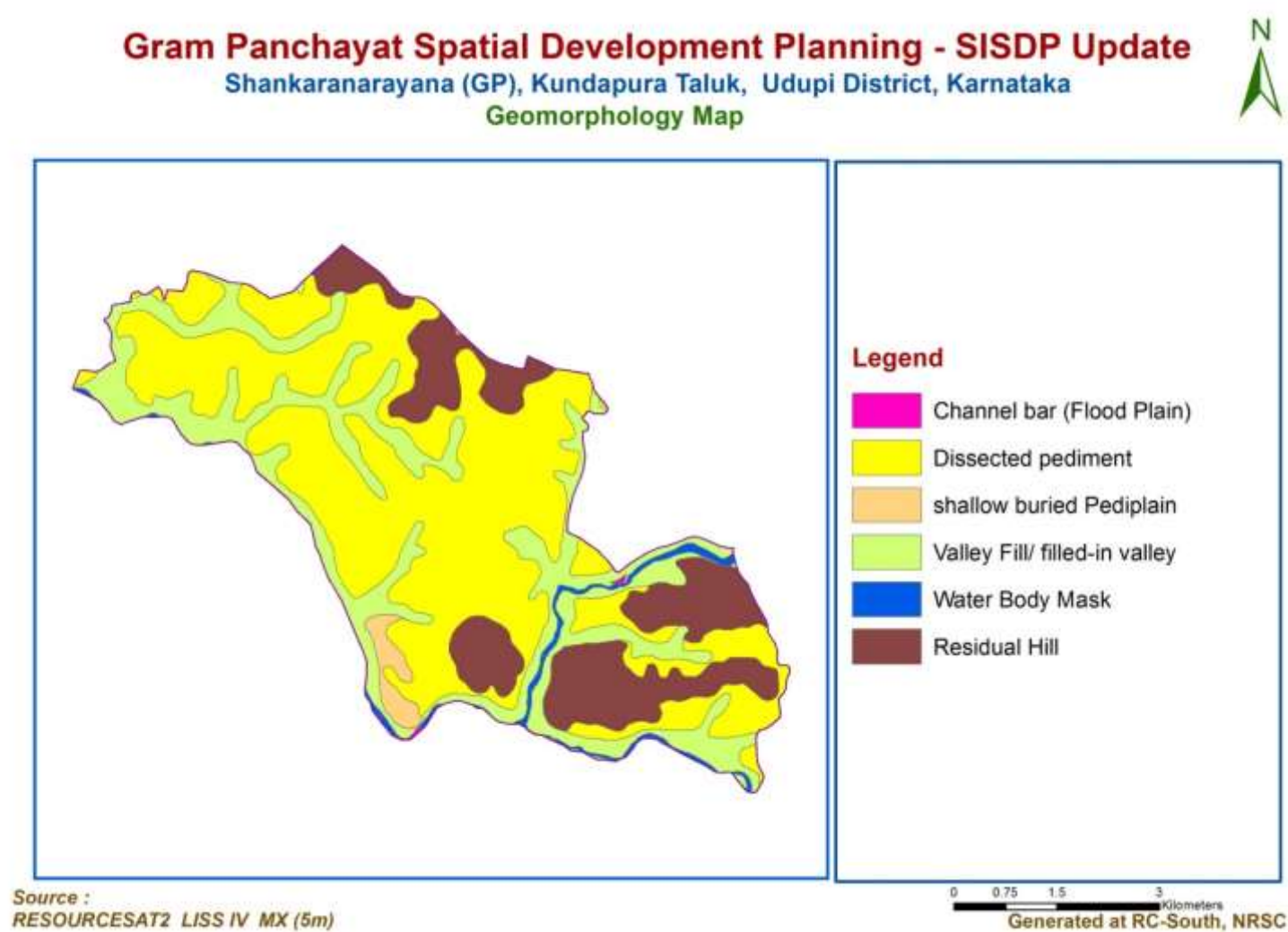


Figure 5-9: Geomorphology map of Shankarnarayana GP.

5.5.6. Soil Texture Map

Spatial distribution of soil texture in Shankaranarayana GP is shown in Figure 5.10. Majority of the area under GP has loamy sand soil texture. Other soil texture types in the region include clay loam and gravelly sand.

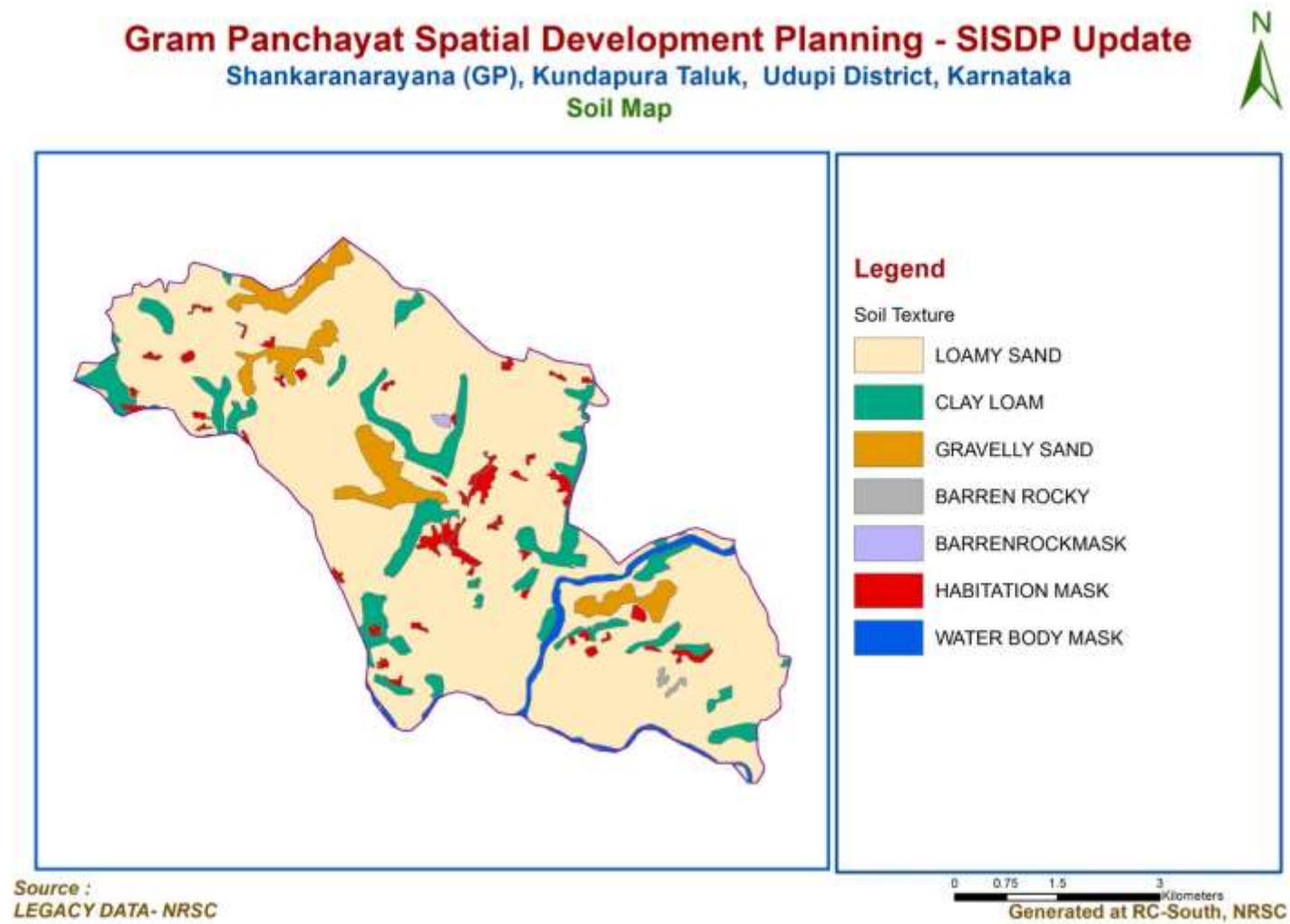


Figure 5-10 Soil texture map of Shankaranarayana GP

5.5.7. Contour Map

Contours at 5m contour interval generated using CARTODEM are shown in Figure 5.11.

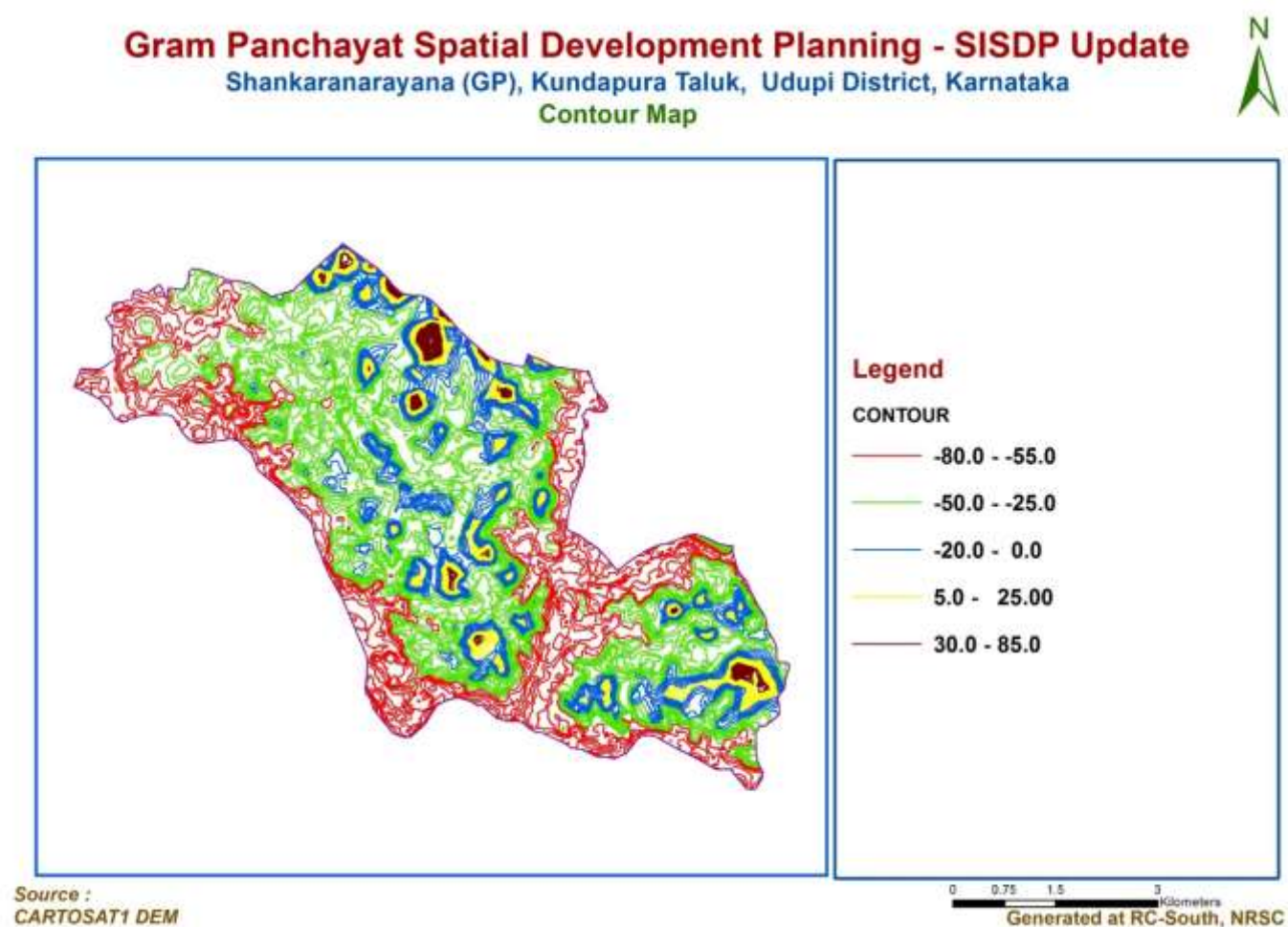


Figure 5-11 Contour map of Shankarnarayana GP

5.6. Derived spatial layers

5.6.1. Proximity analysis

In order to analyze the proximity of Shankaranarayana GP to nearest towns, Kundapura and Udupi, distance buffers were overlaid from Shankaranarayana for a distance of 5km, 10 km, 20km and 30 km (Figure 6.1).

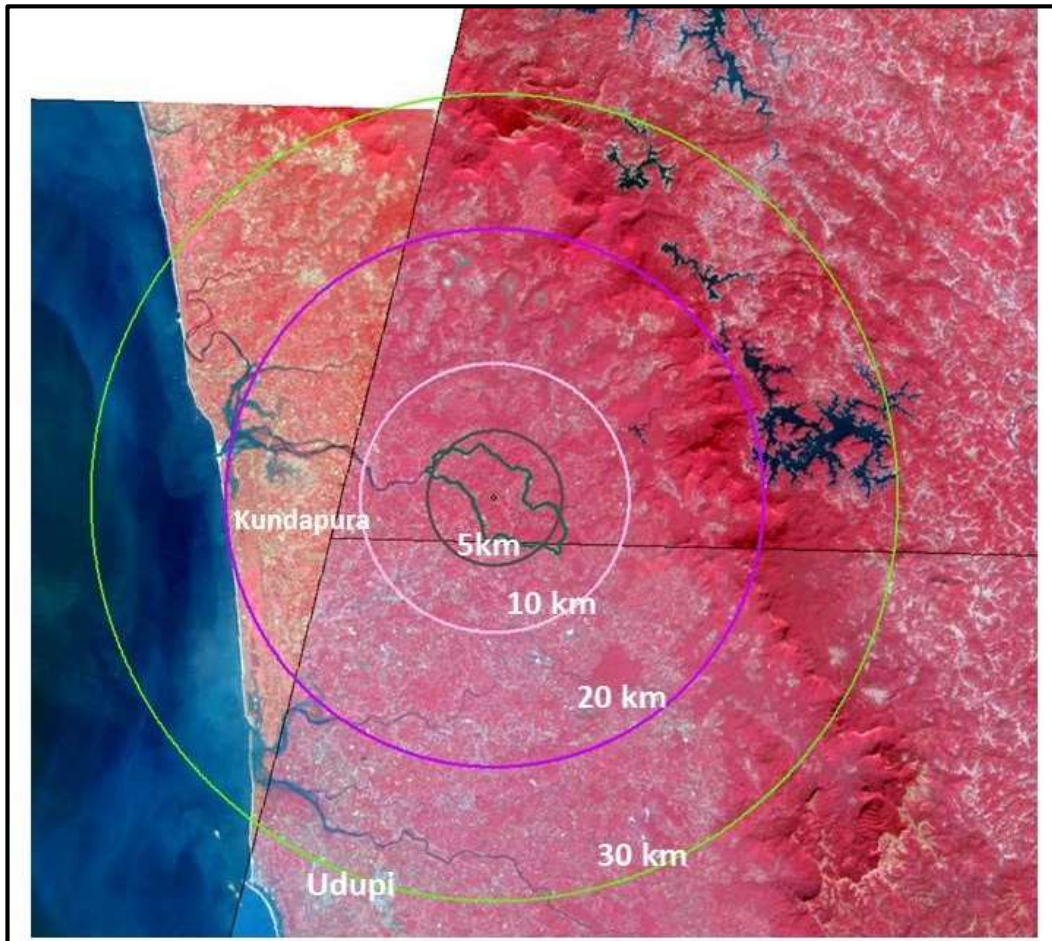


Figure 5-12 Proximity of Shankaranarayana GP to nearest towns

5.6.2. Agriculture Map

Agricultural areas under Gram Panchayat were derived from LU/LC layer at 1:10,000 scale (Figure 5-13) depicting crop land and agricultural plantations.



Gram Panchayat Spatial Development Planning - SISDP Update

Shankaranarayana (GP), Kundapura Taluk, Udupi District, Karnataka

Agriculture Map (2019)

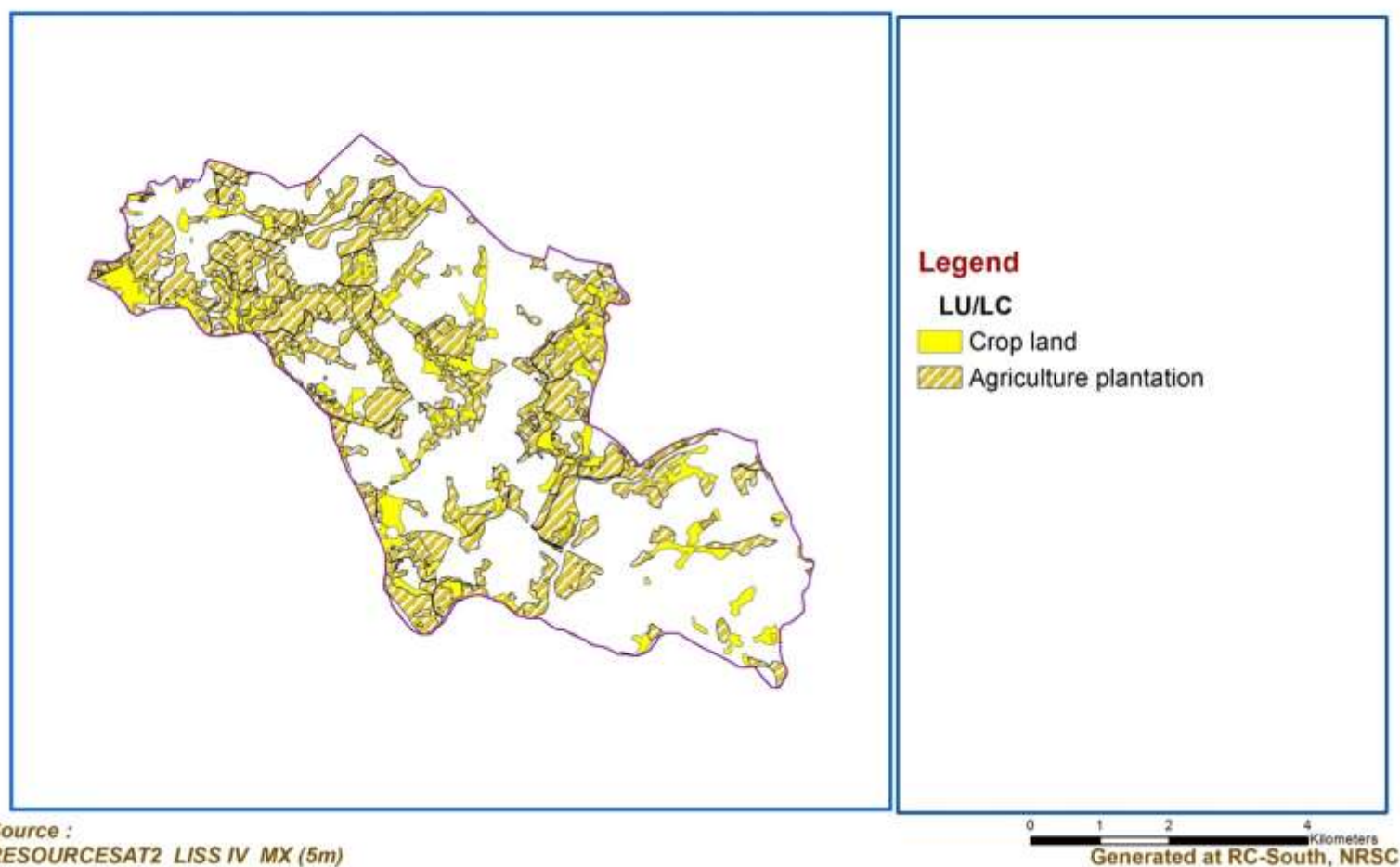


Figure 5-13 Agriculture Map of Shankarnarayana GP

5.6.3. Ground water quality Bore well location map

Ground water quality map shows bore well location (Figure 5-15 and ground water quality parameters are given in Table 5-7.

Gram Panchayat Spatial Development Planning - SISDP Update

Shankaranarayana (GP), Kundapura Taluk, Udupi District, Karnataka

Ground Water Quality Location Map

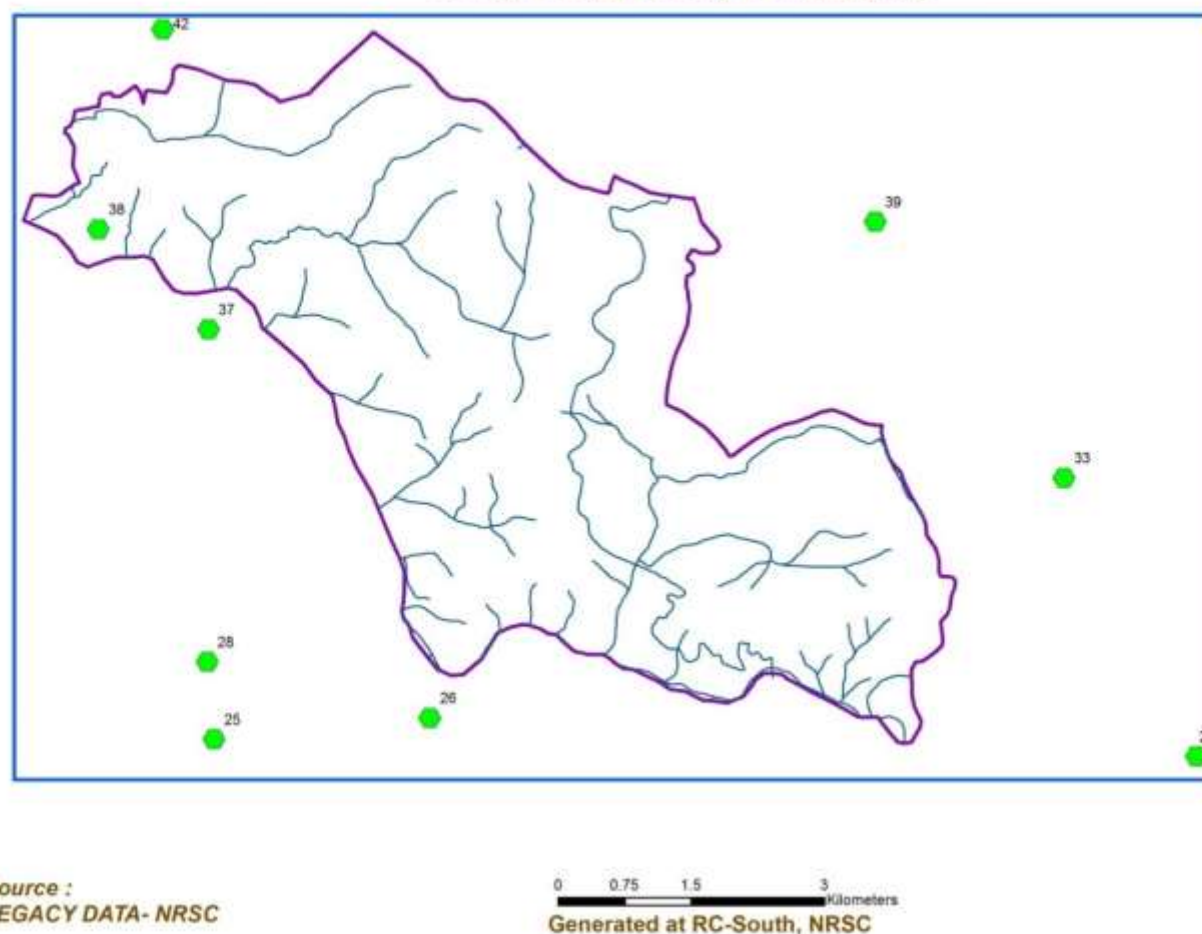


Figure 5-14 Ground water Quality borewell location map of Shankarnarayana GP.

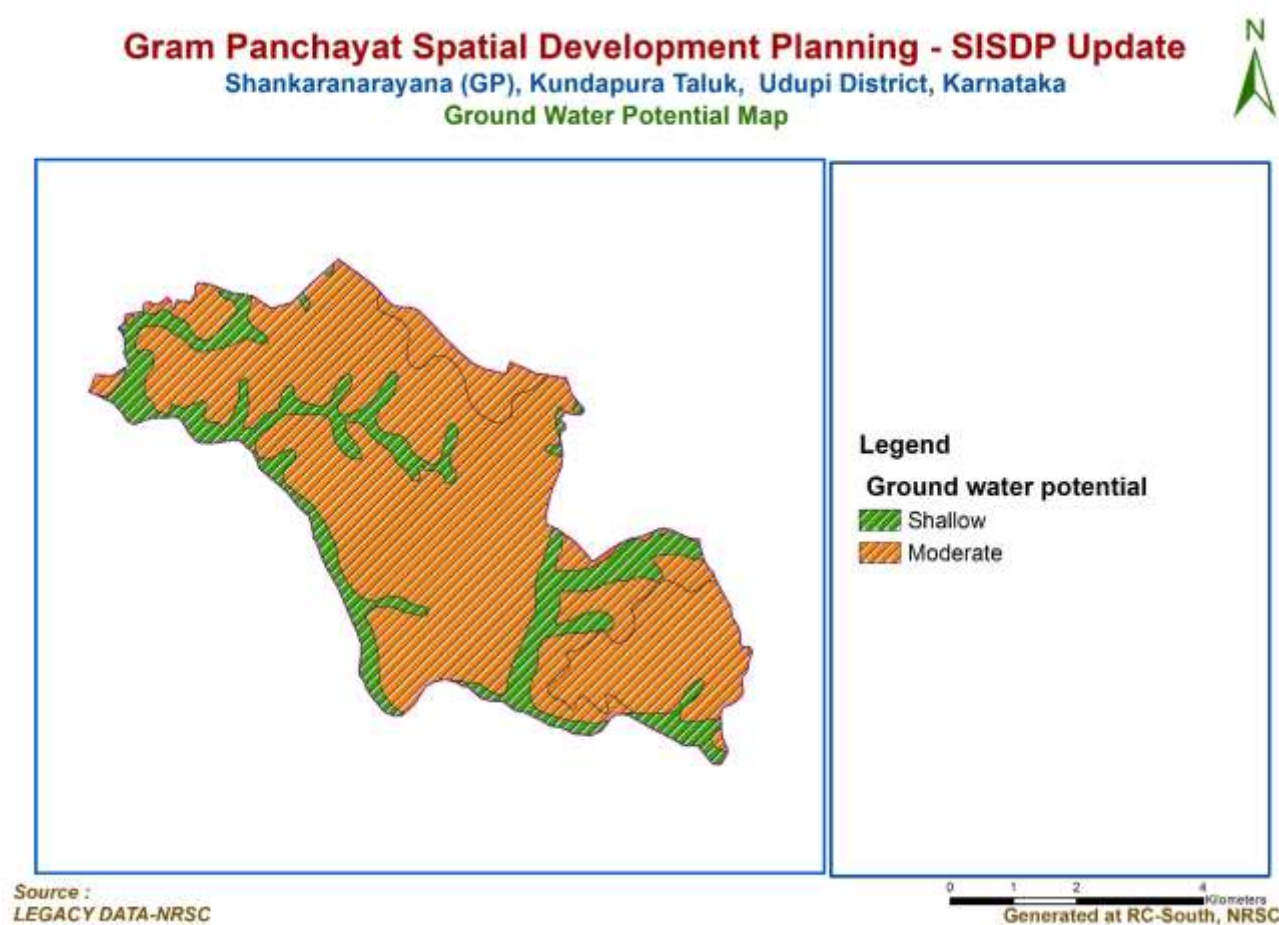


Figure 5-15 Ground water potential Map of Shankaranarayan GP

Table 5-7: Ground Water Quality Parameters – Shankaranarayana GP

| Sr.No | pH | HARDNESS | FLUORIDE | CHLORIDE | IRON | NITRATE |
|-------|------|----------|----------|----------|------|---------|
| 24 | 7.00 | 75.00 | 0.20 | 0.00 | 0.30 | 10.00 |
| 25 | 7.00 | 85.00 | 0.10 | 0.00 | 0.20 | 5.00 |
| 26 | 7.00 | 80.00 | 0.10 | 0.00 | 0.30 | 10.00 |
| 28 | 7.50 | 120.00 | 0.20 | 0.00 | 0.30 | 10.00 |
| 33 | 7.00 | 90.00 | 0.20 | 0.00 | 0.20 | 10.00 |
| 37 | 6.50 | 15.00 | 0.10 | 0.00 | 0.10 | 10.00 |
| 38 | 7.00 | 80.00 | 0.10 | 0.00 | 0.50 | 5.00 |
| 39 | 7.00 | 75.00 | 0.10 | 0.00 | 0.30 | 5.00 |
| 42 | 7.00 | 95.00 | 0.10 | 0.00 | 0.20 | 10.00 |

5.6.4. Ground water potential map

Availability of groundwater cannot be assessed directly from remotely sensed data. Hence, its presence must be inferred from manifestation of surface features which act as an indicator of groundwater. Ground water potential map generated under Rajiv Gandhi Drinking Water Mission carried by NRSC was used for planning purpose after updating with high resolution satellite data (Figure 5-14).

5.6.5. Rainfall & Runoff estimates

The rainfall data for Shankaranarayana has been obtained from IMD Daily Gridded Rainfall Data Set Over India with grid cell size of (0.25 x 0.25 degree). The annual rainfall of Shankaranarayana varied between 3575mm to 4944 mm during the period 1979-2010 indicating the temporal variability.

Runoff is a general term to indicate the accumulation of excess rainfall, which traverses over surface/sub surface and occurs when rainfall intensity is greater than the rate at which it is able to infiltrate the soil. In this study, one of the most widely used technique USDA Natural Resources Conservation Service (NRCS) Curve Number (CN) method was used for assessment of runoff potential for GP (USDA-SCS, 1985). The spatial distribution of runoff in the study area was computed. Quantitative assessment of runoff serves as basic information for adopting suitable soil and water conservation measures in a watershed/Gram Panchayat. The rainfall and runoff estimates have been given in Table 5-8 From the table it is seen that the runoff coefficient varies between 0.18 to 0.28



Table 5-8 Temporal variability of Rainfall and Runoff estimates for Shankarnarayana GP

| year | Rainfall | Runoff | Rainy-day | year | Meteorological Year | runoff coefficient |
|------|----------|--------|-----------|------|---------------------|--------------------|
| 1979 | 3574.5 | 727.2 | 126 | 1979 | Dry | 0.20344 |
| 1987 | 3966.8 | 830.4 | 149 | 1987 | Normal | 0.20934 |
| 1988 | 4123.3 | 932.2 | 141 | 1988 | Normal | 0.22608 |
| 1989 | 4003 | 783.1 | 146 | 1989 | Normal | 0.19563 |
| 1991 | 4859.1 | 1293 | 137 | 1991 | Normal | 0.2661 |
| 1993 | 4241.9 | 949.3 | 148 | 1993 | Normal | 0.22379 |
| 1995 | 3915.2 | 897.7 | 137 | 1995 | Normal | 0.22929 |
| 1996 | 3780.1 | 813.1 | 142 | 1996 | Normal | 0.2151 |
| 1997 | 4473.8 | 1259.6 | 133 | 1997 | Normal | 0.28155 |
| 1998 | 4943.5 | 1236.5 | 157 | 1998 | Normal | 0.25013 |
| 1999 | 4566.9 | 1054.4 | 162 | 1999 | Normal | 0.23088 |
| 2000 | 4339.6 | 956 | 149 | 2000 | Normal | 0.2203 |
| 2001 | 4172.7 | 805.2 | 141 | 2001 | Normal | 0.19297 |
| 2002 | 3580.5 | 667.6 | 151 | 2002 | Dry | 0.18645 |
| 2003 | 3836.9 | 835.2 | 126 | 2003 | Normal | 0.21768 |
| 2004 | 3944.5 | 791.1 | 148 | 2004 | Normal | 0.20056 |
| 2005 | 4042.1 | 1102.7 | 116 | 2005 | Normal | 0.2728 |
| 2006 | 4776.5 | 1189.8 | 142 | 2006 | Normal | 0.24909 |
| 2010 | 4824.9 | 1011 | 180 | 2010 | Normal | 0.20954 |

5.6.6. Household survey Data Analytics

A few of the important Household survey data analytics are given below.

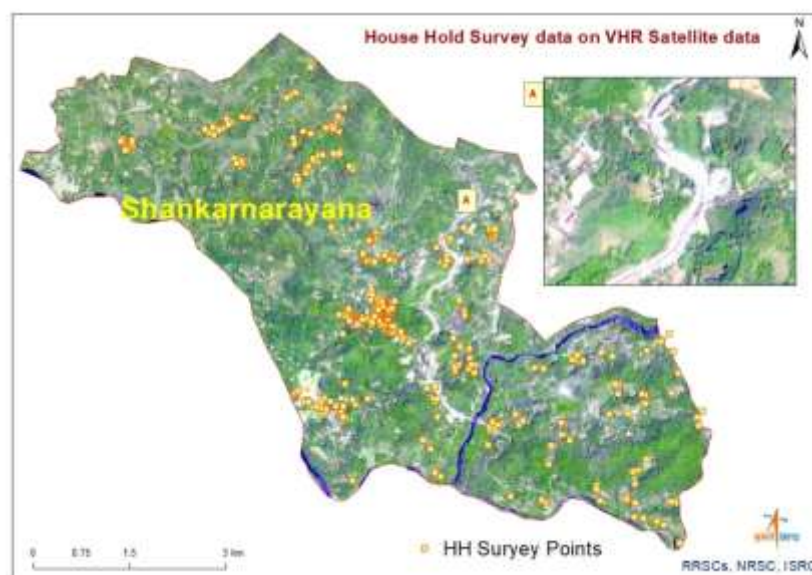


Figure 5-17 Location of household survey

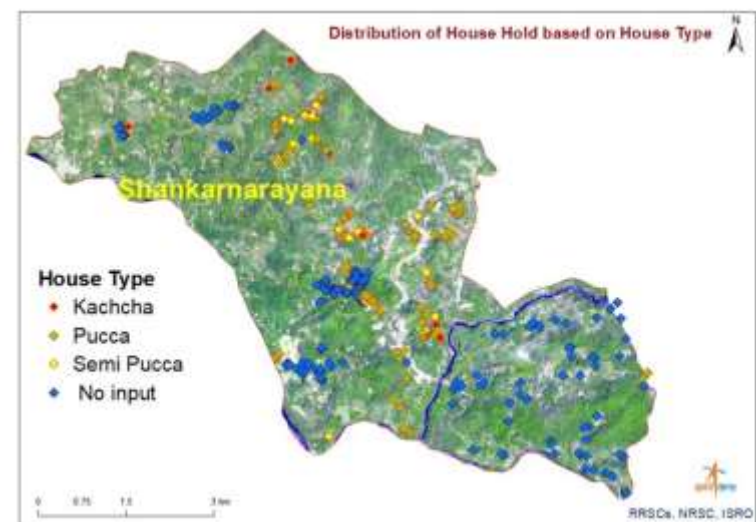


Figure 5-16 Distribution of Household based on house type

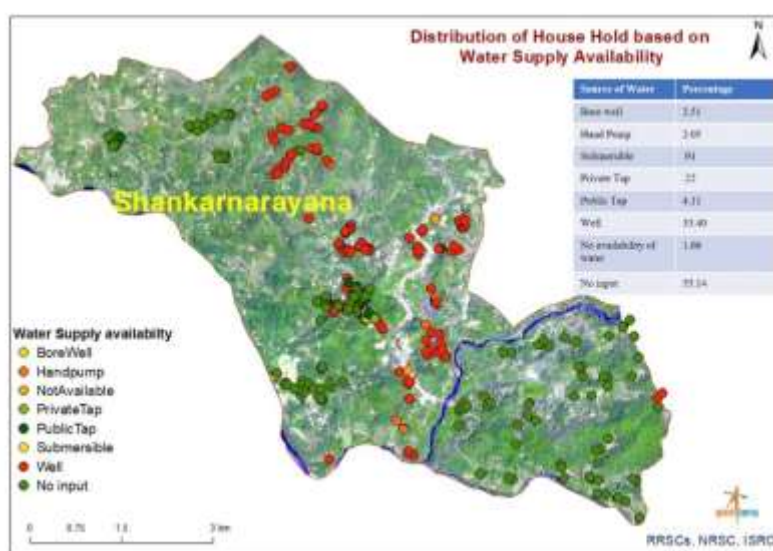


Figure 5-19 Distribution of Household based on water supply availability

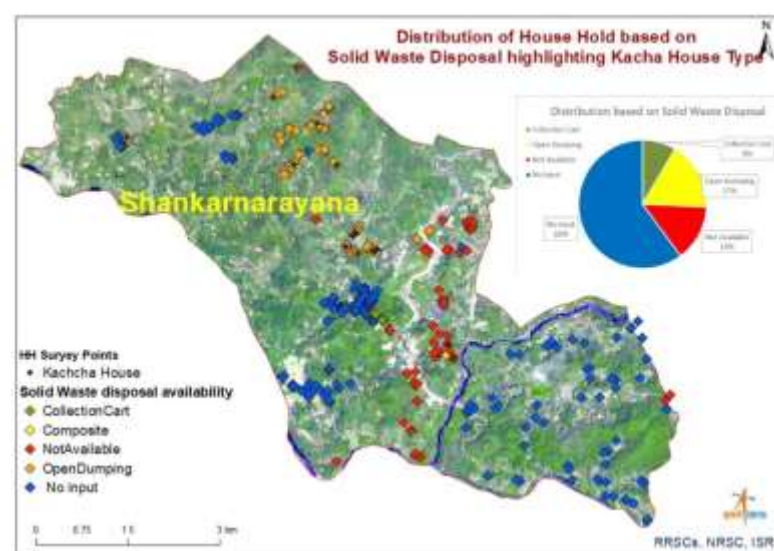


Figure 5-18 Distribution of household based on Solid waste Disposal highlighting Kaccha house types

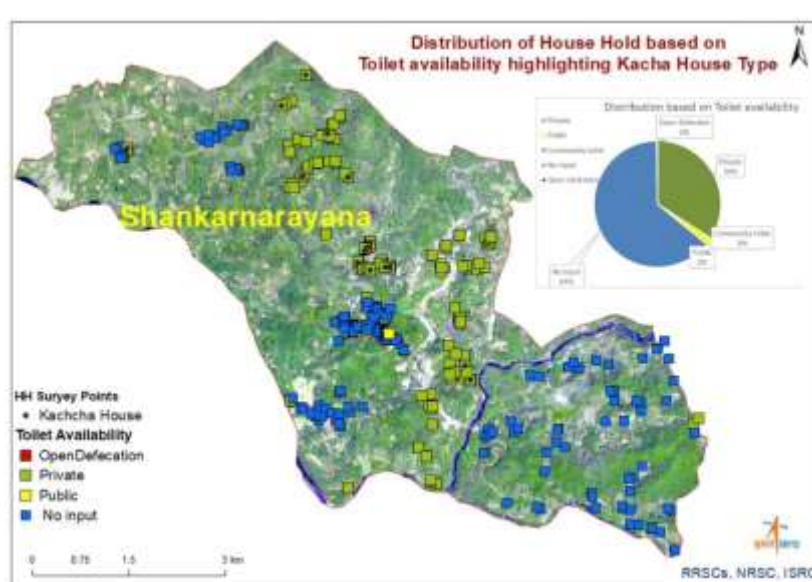


Figure 5-20 Distribution of Household based on Toilet availability highlighting Kaccha House type

5.7. Generation of comprehensive development plan for GP

Conservation and sustainable management practices requires the adoption of basic ecological principles in the management of natural resources to ensure the sustainability. To improve the land resources, it is imperative to first improve the water resources of the region. So both the plans should complement each other.

5.7.1. Water Resources Development Plan

In the present study, WRDP has been achieved using a decision model that involves the logical combination of thematic maps as well as the ground and field knowledge shared by the Partner institution. The water resource development plan includes identification of suitable zones for taking up locale specific activities in the study area which are generally the areas, where certain type of water resource activity is recommended for implementation. Water conservation measures like check dam, percolation tank, bore wells, dug wells etc. fall under location specific activities. The main purpose of these activities is to improve the ground water condition within the GP area which means measures need to be taken to store the water as well as allow water to percolate in to the ground by holding the water in water harvesting structures as much as possible.

In order to identify the suitable zones for location of recharge structures, different thematic layers viz., drainage network with drainage order buffer map, soil, slope and land use/cover and runoff potential were integrated. Subsequently, zones in which the defined conditions of the different thematic layers were fulfilled are identified for location specific activity. The guidelines for the selection of suitable zones for planning location specific activities are adopted from literature (IMSD, 1995). The water resource development is shown in Fig. 5-20

Implementation strategies of some of the recommendations for improving water resources are given in detail

5.7.1.1. Rainwater harvesting



Rainwater harvesting in the site has two components viz., harvesting the roof water and the other, harvesting the surface runoff. In addition, treated waste water is one important source of water.

a) Roof Water Harvesting to meet drinking water requirement of villages

Roof water from the buildings and other paved areas to be collected and stored in sumps for reuse and also for recharging the bore wells after filtering (using pebble, charcoal, sand beds). It would be advantageous to plan this activity while constructing any new building to collect as much roof water as possible and further for diverting this water to the sumps nearby and to the bore wells, after necessary filtering. Designs in this regard need to be worked out separately, taking into consideration of the roof area, rain fall, slope etc.

Roof water could be harvested by connecting the pipes and bringing the rainwater to a common pipe and then to sumps (size depends on roof area and requirement) after passing through filter beds. This water can be used for flushing, gardening, washing etc. For the new buildings under construction, harvesting of roof water, through sumps and recharging bore wells could be planned.

b) Groundwater Recharging through rain water harvested: Some of the common suggestions for ground water recharge and rain water harvesting to be adopted are

- Depth to Water levels during pre and post rainy seasons of all existing bore wells are to be monitored at regular intervals
- All existing bore wells to be directly recharged (after filtering the roof water)
- Existing drain / water ways should be cleaned & maintained and linked
- Direct recharging of bore wells will help in recharging depleted fractures and fissures to have sustainable yield from bore wells

5.7.1.2. Surface Water Harvesting

Surface water may be harvested near bigger settlement and stored in ground level reservoir which can be subsequently pumped to an overhead tank after treatment and supplied.

5.7.1.3. Setting up of STPs

Setting-up of small STPs to recycle waste water which can be used for secondary uses like gardening, industrial cooling, flushing and other secondary purposes. A dual water supply system can be planned within the GP for potable and non-potable water separately, as a viable option to minimize the pressure on fresh water supply.

5.7.1.4. Construction of proposed structures / measures - Check Dams

Small barriers or dams constructed of stone, bagged sand or gravel, or other durable material across a stream/drainage. Creation of check dams is helpful for micro irrigation as well as underground water recharge. Proposed on the 2nd and 3rd order streams along the foot hill zones and in the areas with 0-5% slope. Chain of such check dams along the stream helps in storing rain water which can be subsequently used for irrigation and replenish the ground water.

5.7.1.5. Rejuvenation/ Restoration/ Desilting of Tanks:

The Rejuvenation / Restoration / Desilting of tanks is recommended for all bigger tanks which are partially silted up. Lakes are created basically for hydrological reasons for checking floods, recharging and maintaining the ground water table. They also act as sediment traps, prevent clogging up of natural valleys and reduce erosion by regulating runoff. Lakes and Tanks belong to wetland ecosystem and have a larger biological and ecological role. Hence, measures for rejuvenation / restoration / desiltation of tanks and lakes in the Gram-Panchayat will definitely build up ground water resources.

5.7.1.6. Drip irrigation

Drip irrigation systems deliver water directly to a plant's roots, reducing the evaporation that happens with spray watering systems. Timers can be used to schedule watering for the cooler parts of the day, further reducing water loss. Properly installed drip irrigation can save up to [80 percent](#) more water than conventional irrigation, and can even contribute to increased crop yields.

5.7.1.7. Farm Ponds / dug out ponds

Capturing and Storing Water in small to medium sized Farm Ponds is another method of storing water. Polythene sheets were used to reduce the seepage / infiltration losses. Many farms rely on municipal water or wells (groundwater), while some have built their own ponds to capture and store rainfall for use throughout the year. Properly managed ponds can also help to minimize their impact on the surrounding watershed. This practice may be further encouraged to sustain horticulture, flori-culture & vegetable growing.

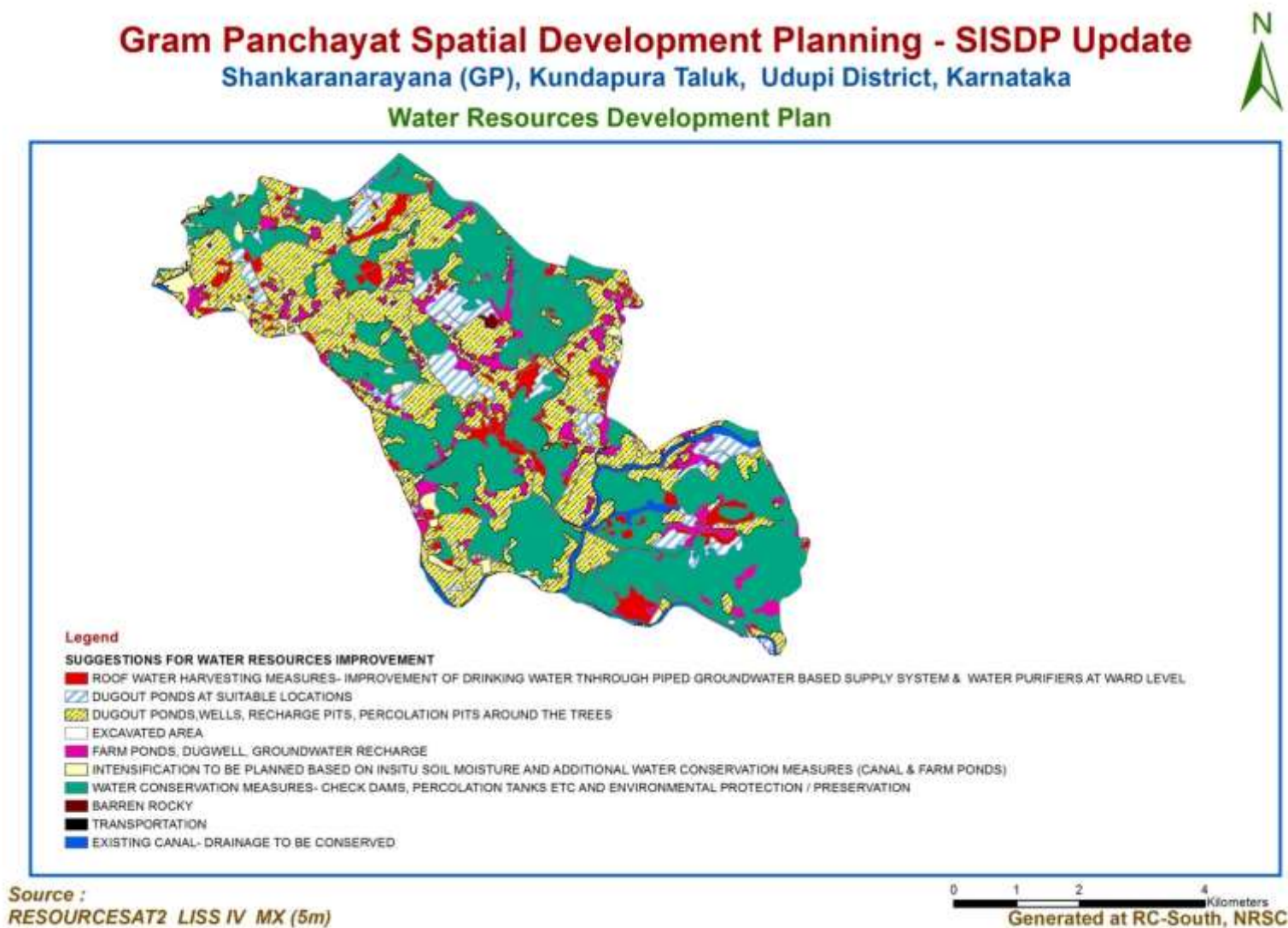


Figure 5-21 Water resource Development Plan

5.7.2. Land Resources Development Plan (LRDP)

In the present study, LRDP has been achieved using a decision model that involves the logical combination of thematic maps as well as the ground and field knowledge shared by the Partner institution. For arriving at the suitability of a particular land use activity in the study area, thematic maps viz. land use/cover, soil, slope and groundwater potential maps which were generated using remote sensing and GIS were integrated. Expert's knowledge and the field situation was also considered for formulating the alternate landuse plans. Methodology adopted from the GIS based land use planning project initiated in India entitled 'Integrated Mission for Sustainable Development', which generates, analyzes and integrates natural resource thematic data in 1:50000 scale, together with satellite remote sensing data has also been a guiding factor in the development plan formulations (IMSD, 1995). The land resource development is shown in Fig. 5-21.

5.7.2.1. Land Resources Development Plan general guidelines

- Improved Agro-horticulture / Agro-forestry practices (Horticulture Forestry plantations with interspaced cultivation) to bring better returns than the field crops.
- **Intercropping** in horticulture plantations with vegetables in both seasons may bring better benefits to farmers. Different drought resistant tree-species are recommended for forest nurseries.

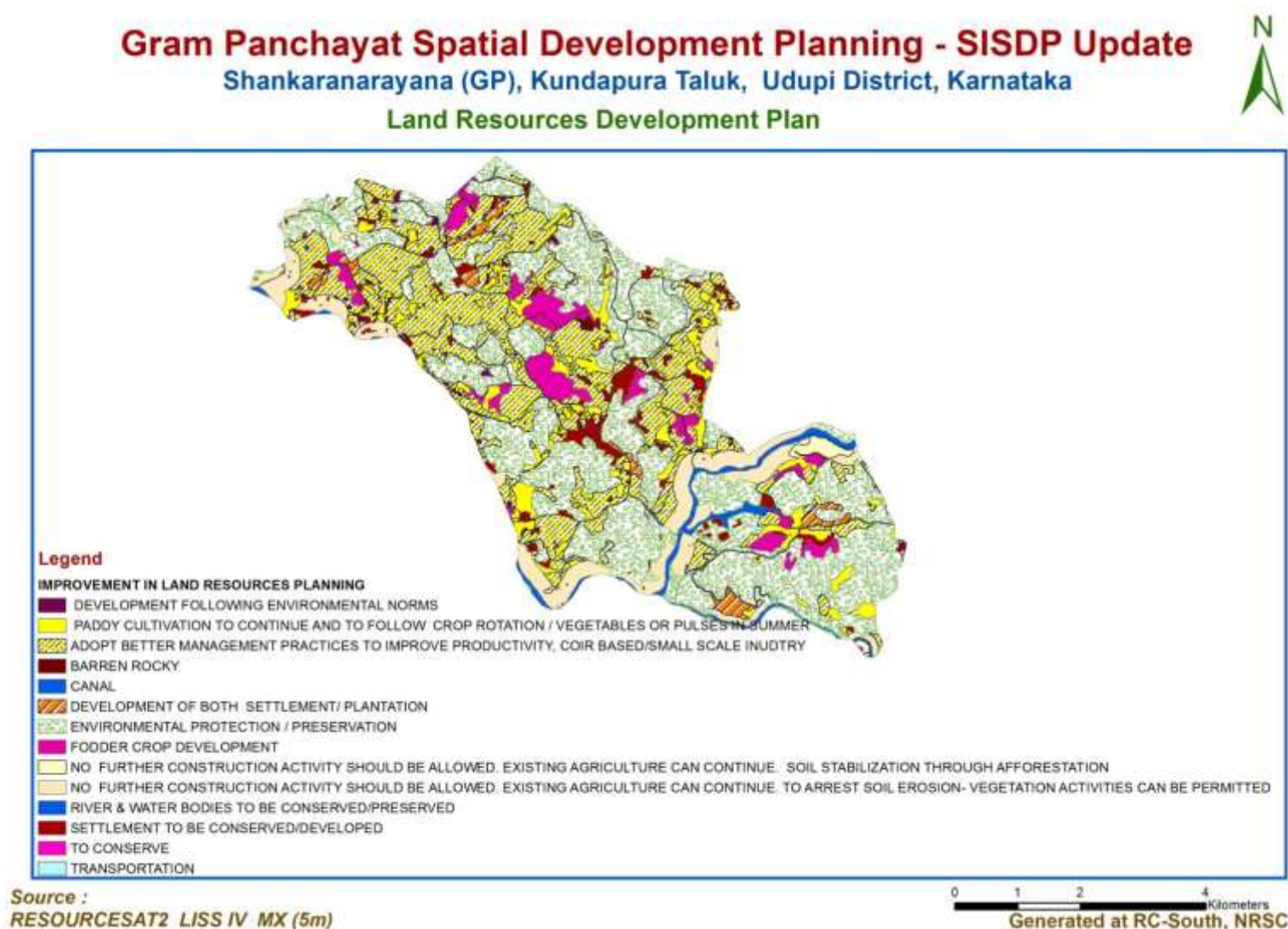


Figure 5-21 Land Resource Development Plan

5.7.2.2. Soil and water conservation measures:

The surface run off could be channelized to recharge the existing and failed bore wells after due filtering. Soil conservation measures such as boulder / vegetative checks in the upper reaches, terracing of the sloppy areas; contour trenches; pits around trees could also be taken up in open areas. Vegetation cover to be improved with planting of trees, plants, etc. within the open spaces in the village settlement area

- 1) **Fodder / Tree Plantations:** These are suggested in the marginal lands with poor groundwater potential areas and not able to sustain crops. The open forest areas may be converted into grazing lands by over seeding grasses and fuel wood species and these are recommended to meet the demands of local cattle feeding and fuel requirement of local people.
- 2) **Afforestation:** Afforestation is proposed in the forest blanks / open forest areas to increase the density of vegetation. These gaps may have been caused due to several reasons which include grazing in the initial stage and unauthorized tree felling. The economic forest plantations are suggested for compensating forest degradation.
- 3) **Wasteland development:** Land with or without scrub (Scrub Lands) come under this category. Over seeding of grasses and agro-forestry plantation are recommended on upland with or without scrub. Water conservation and harvesting structures like loose boulder check dam's / Rock dams using available local stones in middle slopes that will help in raising soil moisture. In higher slopes at higher reaches brushwood dams and rubble dams will arrest soil erosion.
- 4) **Crop cultivation based on soil texture** Sandy soil is not good for plants. However, Melon and Coconut can grow in sandy soil. If water is available for irrigation, then crops such as pulses Millets can be grown.
- 5) **Setting up of Industry:** Setting up of small scale industry

5.7.3. Recommendations & Suggestions for improving natural resources in Shankarnarayana GP

- SN has about 42% area under forest and forest plantations which needs to be protected and conserved and it is an area of no development. However, water structures viz., farm ponds have been suggested within the forested area. Soil and water conservation measures are a must to arrest landslides etc.
- Agricultural plantations mostly coconut plantations are the next major category which requires adoption of better management practices to improve its yield as well as setting up small scale industries for increasing the livelihood

of the locals. Here in these areas, farm ponds, recharge pits around the trees, percolation pits have been suggested based on the soil category.

- This area has only one crop during Kharif, which can be increased to grow vegetables/pulses in the summer with appropriate water resources planning.
- A buffer for river (250m) has been considered as an area of no development but allowing the existing landuse and settlement to continue.
- Fodder crop development has been suggested in the scrub lands to increase the fodder for the livestock. For this Dug out ponds are to be constructed within this area.
- Check dams & Nalabunds have to be constructed on the 1st order & 2nd order streams at confluence point of higher order streams.
- Dug wells / bore wells have been suggested within the Valley fills and dissected pediments
- Roof water harvesting measures suggested for the buildings/houses within the settlements / Rural Built-up / Hamlets & dispersed households.
- In this GP, mixed settlements are commonly found, a house in the midst of plantations. In this case, both can be developed.
- Solar power for street lighting, suitable expansion of roads and improve road connectivity for ease of movement
- The strategic planning is defined as the future directions for the development of land and water resources in the GP establishing the long-term objectives and mobilizing the financial resources and government policy to achieve hierarchical goals. Further, involvement of local people is quite necessary as part of education, awareness and consensus. Implementation, monitoring and maintenance of the schemes and evaluation of implemented schemes for their end benefits are also the part of strategic planning activities.
- For successful implementation of land and water resource development plan in the study GP, suitable working scale needs to be identified for data analysis and implementation within the GIS framework. Most of the implementation by the implementing authorities of the government is being carried out with cadastral maps. The large-scale cadastral maps overlaid on the action plan details would be the best format for implementation.

5.8. References

Abdel Rahman A. (2016). *The Use of AHP within GIS in Selecting Potential Sites for Water Harvesting Sites in the Azraq Basin—Jordan*. Journal of Geographic Information System, 2016, 8, 73-88, <http://www.scirp.org/journal/jgis>, <http://dx.doi.org/10.4236/jgis.2016.81008>

Ahmad I., Verma M. K., 2016. *Site Suitability Mapping for Water Storage Structures using Remote Sensing & GIS for Sheonath Basin in Chhattisgarh State*. International Journal of Applied Engineering Research, 11(6): 4155-4160

Bamne Y., Patil K. A., Vikhe S. D., 2014. *Selection of Appropriate Sites for Structures of Water Harvesting In a Watershed Using Remote Sensing and GIS*. International Journal of Emerging Technology and Advance Engineering, 4(11): 270-275

Birthe Riisnes Erle Kristvik. (2015). *Hydrological Assessment of Water Resources in Bergen*. Master of Science in Civil and Environmental Engineering Submission date: 10 June 2015.

Central Ground Water Board (2007). *Manual on Artificial Recharge of Ground Water*. Ministry of Water Resources, Government of India, New Delhi.

García, A., Sainz, A., Revilla, J.A., Álvarez, C., Juanes, J.A., Puente, A., 2008. *Surface water resources assessment in scarcely gauged basins in the north of Spain*. J. Hydrol. 356, 312–326. doi:10.1016/j.jhydrol.2008.04.019

Government of India Ministry of Water Resources. *Guidelines for Repair, Renovation and Restoration of Water Bodies with External Assistance*. (2009).

ISRO Guest House Report. (2019). *Augmentation of water supply at ISRO Guest House, Devanahalli, Bengaluru, Karnataka Using Geo-spatial Techniques*. Indian Space Research Organisation (ISRO) Hqrs. Department of Space, Bengaluru.

I. Ahmad and M.K. Verma. (2017) *GIS based analytic hierarchy process in determination of suitable site for water storage*. European Water 60: 139-146, 2017. © 2017 E.W. Publications.



IMSD, 1995. *Integrated Mission for Sustainable Development: Technical Guidelines*. NRSA, Hyderabad, India, 1-27. LULC, Bhuvan (ISRO) - bhuvan.nrsc.gov.in/gis/thematic/index.php

IPRC Campus Report. 2018. Water Resources Development and Management Plans for ISRO Propulsion Complex (IPRC) Campus, Mahendragiri, Tirunelveli District, Tamil Nadu. RRSC–South, NRSC, ISRO. Bengaluru. NRSC-RC-REGBANG-RRSC-BANG-APRIL-2018-TR-1138-1.0

ISITE Campus Report. 2017. Water Resources Development and Management Plan for the ISRO Satellite Integration and Test Establishment (ISITE) Campus. RRSC–South, NRSC, ISRO. Bengaluru.

James Batchelor. (April 2013). *Using GIS and SWAT analysis to assess water scarcity and WASH services levels in rural Andhra Pradesh*.

Kumar, P., Tiwari, K.N. and Pal, D.K. (1997). *Establishing SCS runoff curve number from IRS digital database*, Journal of Indian Society of Remote Sensing, 19(4): 246–251.

Manual for Local Level Assessment of Land Degradation, Sustainable Land Management and Livelihoods Part 2. *Water resources assessment*. Field methodology and tools. Land Degradation Assessment in Drylands (Lada) Project.

MCF Campus Report. 2018. Water Resources Development and Management Plans for Master Control Facility (MCF), Hassan district, Karnataka. RRSC–South, NRSC, ISRO. Bengaluru. NRSC-RC-REGBANG-JAN-2018-TR-1110-1.0.

Murthy, V.V.N. (2003). *Land and Water Management Engineering*. Kalyani Publishers, New Delhi.

Narsimha Kota¹, Nallaganthula Ramudu, S. Ravikumar, M.Suresh. *Hydrogeomorphological Mapping Upto Cadastral Level, By Using High Resolution Satellite Data In Gokaphaslwada Watershed, Doulthabad Mandal, Mahabubnagar District*. IOSR Journal of Applied Geology and Geophysics (IOSR-JAGG) e-ISSN: 2321–0990, p-ISSN: 2321–0982. Volume 5, Issue 1 Ver. II (Jan. - Feb. 2017), PP 46-51 www.iosrjournals.org

Nyatuame M, Owusu-Gyimah V and Ampia F (2014) *Statistical Analysis of Rainfall Trend for Volta Region in Ghana*. Int. J. Atmos. Sci. 67(2) 1-11.

Rajendran V, Venkatasubramani R and Vijayakumar G (2016) *Rainfall variation and frequency analysis study in Dharmapuri district (India)*. Indian J. Geo. Mar. Sci. 45(11) 1560-5.

Padmavathy A. S., Ganesha Raj. K., Yogarajan N., Thangavel P., 1993. *Check Dam Site Selection Using GIS Approach*. Advance Space Research, 13(11): 123-127

Rao, K.V., Bhattacharya, A.K. and Mishra, K. (1996). *Runoff estimation by curve number method- case studies*, Journal of Soil and Water Conservation, 40: 1–7.

Ramesh, K.S., S. Rama Subramoniam and K. Ganesharaj. 2019. Water Resources Assessment and Generation of Comprehensive Water Resources Development and Management Plans for Indlawadi Gram-Panchayat, Anekal Taluk Using Geospatial Technology. A technical Report. Published at RRSC-South, NRSC, Bengaluru.

Ranjit Kumar Sahu. (May 2015) *Hydrological Analysis for Urban Water Management*.

Sethupathi A.S, Lakshmi Narasimhan C, Vasanthamohan. (2012) *Evaluation of hydrogeomorphological landforms and lineaments using GIS and Remote Sensing techniques in Bargur – Mathur subwatersheds, Ponnaiyar River basin, India*. International Journal of Geomatics and Geosciences, Volume 3, No 1, 2012. ISSN 0976 – 4380.

Saraf A.K. et al., (1996). *Integrated use of remote sensing and GIS methods for Groundwater exploration in Hydrology and water resources*, New Delhi, 251-259.

Shivakumar BL, *Artificial recharge of groundwater using rooftop rain water harvesting*. RV College of Engineering, Department of Civil Engineering, Mysore Road, Bengaluru.

Sharma, S.K., Kansal, M.L., Tyagi, A., 2015. *Resource assessment and strategic planning for improvement of water supply to Shimla city in India using geo-spatial techniques*. Egypt. J. Remote Sens. Space Sci. 18, 85–97. doi:10.1016/j.ejrs.2015.04.001

Spatial data for GPSDP. 2020. Standards of Spatial data Provided for Gram Panchayat Spatial Development Planning. NRSC, Hyderabad. Document No.: NRSC-RC-RCDELHI-SEPT-2020-TR-1656-V1.0.

Tera Marahi Moses. (July 2012) *Assessment of Water Resources Utilization and Management in Chahi Sub-Catchment, Kisoro District, Uganda.*



6. History and Heritage- Loka







6.1. History of South Canara

Karnataka's history has presented here briefly. The time-line traces back to the 3rd century, and it also talks about the current administrative bodies in the region. Traditionally, it is believed that parts of Karnataka were subjected to the Nandas and the Mauryas. Maurya Chandragupta is believed to have visited Shravanabelgola and spent his last years there. Satavahanas rule started from 250 BC and went up till 230 AD. The Gangas and the Kadambas ruled from c.345 AD; the Chalukyas of Badami in Bagalkot district (c.540 to 753 AD) overthrowing the Kadambas and subjugating the Gangas; the Alupas ruling in the coastal region as minor rulers for more than 1000 years; the Rashtrakutas of Malkhed from Gulbarga district (753 to 973 AD) succeeding the Badami Chalukyas, and they, in turn, were overthrown by the Chalukyas of Kalyana (973 to 1189 A.D), ruling from modern BasavaKalyana, in Bidar district. The Gangas who continued in the Southern parts, earlier as sovereign rulers (350 to 550 A. D) and later as allies or feudatories of either Badami or Malkhed rulers till 1004 AD, paved the way for the Chola rule when their territory viz., Gangawadi-96,000 (Southern Karnataka) was occupied by the Cholas. The Cholas, who dominated over Southern Karnataka from about 1004 AD, were overthrown by Hoysala Vishnuvardhana in circa 1114 AD. During the KalyanaChalukya rule came the Kalachuri Interregnum (1162-1184). It witnessed Basava and his Veerashaiva movement. The KalyanaChalukyas were overshadowed by their feudatories, viz., the Sevunas of Devagiri and the Hoysalas of Dwarasamudra, who divided Karnataka between themselves; when the armies of the Delhi Sultanate overthrew these two dynasties, the Vijayanagara Empire (1336) and the Bahamani Sultanate (1347) came to rule over Karnataka. The former had control over the greater part of Karnataka. Of the five Shahi Sultanates, which succeeded the Bahamanis, Bijapur's dilshahis (1489-1686) and the Baridshahis of Bidar (1504-1619), who held sway over northern parts of Karnataka and at a later stage, the former dynasty overthrew the latter. The city of Vijayanagara was sacked by the combined Shahi forces of Deccan in 1565. They fled away Vijayanagara commander Venkatapatiraya and Tirumalaraya decided to shift the empire's capital first to Penugonda (1565), and later, to Chandragiri both in Andhra Pradesh and subsequently to Vellore (Tamilnadu), beyond the frontiers of Karnataka. It continued as capital till 1646. Of Vijayanagar's successors in Karnataka, among their numerous feudatories, the Mysore Odeyars, ChitradurgaPalegars, MagadiPalegars, and the Keladi Nayakas were the most important. The northern regions were under the control of the Adilshahis of Bijapur till 1686, when they were overthrown by the Mughals. With the weakening of the Mughal power in the north, the Marathas came to control Karnataka's northern districts. Haidar Ali, who usurped power from the Odeyars of Mysore in 1761, captured both Keladi and Chitradurga Kingdoms in 1763 and 1779 extended his sway over Mangalore. Later, Karnataka came under British rule immediately after Tipu's overthrow, Haidar's son, in 1799 and the Marathas in 1818, when the Peshwa was defeated by the British. But after having been subjected to several administrations during the British rule and witnessed active participation in the freedom struggle for Self-rule, it became a single State in 1956, and in 1973 it was renamed 'Karnataka.'









6.2. Historical timeline of rulers in South Canara






South Kanara was annexed by the British East India Company following the defeat of Tipu Sultan in the Fourth Mysore War 1799 and along with North Kanara formed the district of Kanara in the Madras Presidency. In 1859, Kanara was split into two districts, North and South. North Kanara was transferred to the Bombay Presidency, and South was retained by Madras. Mangalore was the administrative headquarters of the district. The district covered an area of 10,410 square kilometres (4,021 sq. mi).

6.2.1. Historical time-line of rulers in South Canara

| Sr. No. | Ruling Period | Map | Sr. No. | Ruling Period | Map |
|---------|------------------------------|--|---------|-----------------|--|
| 1 | Starting Period around 3 BCE |  <p>Figure 6-1 Shatavahana Empire</p> | 5 | CE. 757 – 973 |  <p>Figure 6-2 Ratrakutha of Malakeada</p> |
| 2 | CE. 325 – 540 |  <p>Figure 6-3 BanavasiKadamba</p> | 6 | CE. 973 – 1198 |  <p>Figure 6-4 Chalukyas of Kalyana</p> |
| 3 | CE. 325 – 999 |  <p>Figure 6-5 Gangas of Talakad</p> | 7 | CE. 1198 – 1312 |  <p>Figure 6-6 Sevunas of Devagiri</p> |

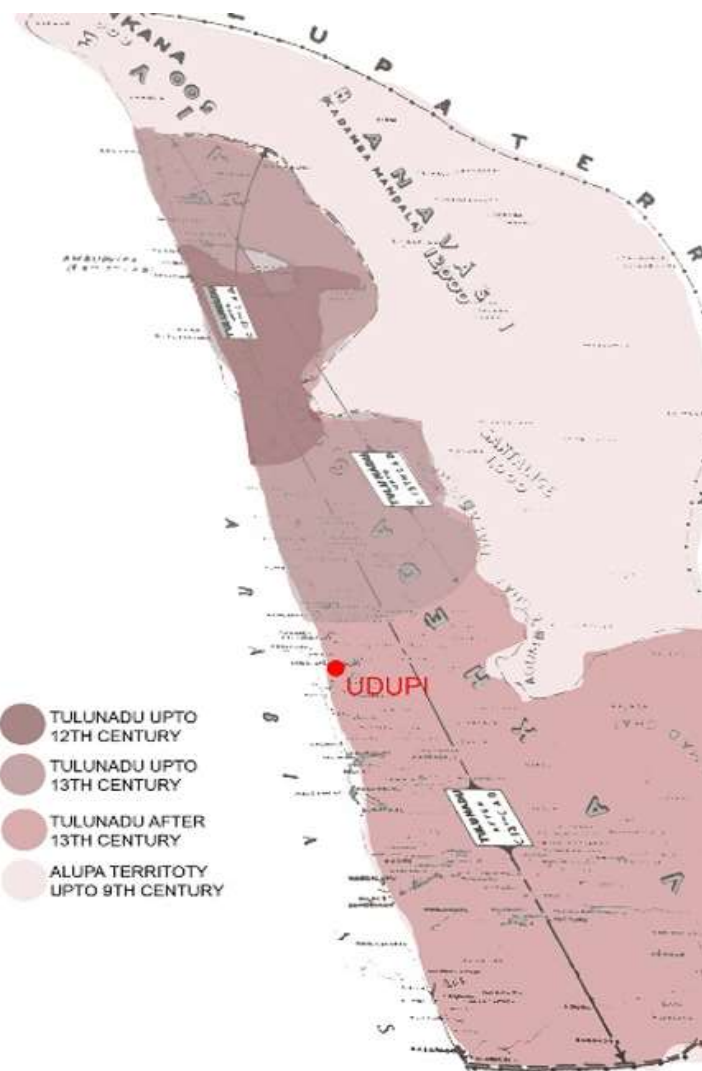


| | | | | | |
|----|-----------------|--|----|-----------------|--|
| 4 | CE. 500 – 757 |  <p>Figure 6-7 Chalukyas of Badami</p> | 8 | CE. 1000 – 1346 |  <p>Figure 6-8 Hoysalas of Dwarasamudra</p> |
| 9 | CE. 1336 – 1565 |  <p>Figure 6-9 Vijayanagara</p> | 13 | CE. 1399 – 1761 |  <p>Figure 6-10 Odeyars of Mysore</p> |
| 10 | CE. 1347 – 1527 |  <p>Figure 6-11 Bahmani</p> | 14 | CE. 1588 – 1779 |  <p>Figure 6-12 Nayakas of Chitradurga</p> |
| 11 | CE. 1490 – 1686 |  <p>Figure 6-13 Sultans of Bijapur</p> | 15 | CE. 1761 – 1799 |  <p>Figure 6-14 Sultanate of Srirangapatana</p> |

| | | | | | |
|----|--------------------------|---|----|-----------------------|---|
| 12 | CE. 1500 – 1763 |  <p>Figure 6-15 Nayakas of Kelaedi</p> | 16 | CE. 1800 – 1831 |  |
| 17 | CE. 1831 – 1881 |  <p>Figure 6-17 British Takeover</p> | | | |
| 18 | CE. 1881 – 1950 |  <p>Figure 6-18 Mysore Wodeyars</p> | | | |
| 19 | CE. 1956 – Present |  <p>Figure 6-19 Karnataka Govt</p> | | | |

(Source: Dreiser, T. (2015). Chapter II. Sister Carrie. [tps://doi.org/10.9783/9780812291575.12](https://doi.org/10.9783/9780812291575.12))

Figure 6-1 Evolution of Tulunadu_: Udupi study report





6.3. History of Udupi District at a Glance

Udupi is one of the twenty-seven districts in the state of Karnataka. It was formed on August 24, 1997, carved out of the erstwhile Dakshina Kannada (South Kanara) community with three taluks, namely Udupi, Karkala, and Kundapura. Udupi city is the District Head Quarters. Administratively, the district has 248 villages, 146 GPs, one city municipality (Udupi city), two town municipalities (Karkala and Kundapura), and one town panchayat (Saligrama). Udupi is sheltered by the Western Ghats and bordered by the Arabian Sea in the east. Due to the natural setting, Udupi district is blessed with abundant rainfall, fertile soil and ample vegetation. The community is well known for Yakshagana- a fabulous costumed dance-drama form, Kambala- the sport of buffalo racing by farmers, Kori-Katta (Cock Fight), and Bootha Kola. The district is a hub for Cashew Processing Industries and outsourcing companies. Historically, the culture of other regions influenced and fused with the local culture and evolved into a distinctly different culture from other cultures known as Tuluva culture. Tuluva culture got a lot of importance at the Vijayanagar Empire's time in the early 14th century. The Udupi district, along with Dakshina Kannada, was, after that, commonly known as "Tulunadu." Tulu was the spoken language of the people. Tuluva culture is known for nature worship, particularly Naga-Aradhana-snake worship and Boota-Aradhana-spirit worship. The district is also known for the birth of the Advaitaphilosophy of Shankaracharya in the ninth century and the Dvaitaphilosophy of Madhwacharya in the thirteenth century. The community now has more than 50 important temples, 12 churches, 10 mosques, and a Jain religious basis.



Figure 6-2 Udupi District Tourism Map Source: District Government Website

6.3.1. Saptakshetra – Parshurama Kshetra

The sapta-kshetra region is 409 kms which includes:

- Gokarna
- Kolluru
- Shankaranarayana
- Koteshwara
- Kumbhakashi
- Udupi
- Subramanaya

The legend behind this region is the retrieval of Western coast from the sea, by Parasurama, a warrior sage. It suggests that Parasurama, an Avatar of Mahavishnu, threw his battle axe into the sea. As a result, the land of Western coast arose, and thus was reclaimed from the waters.

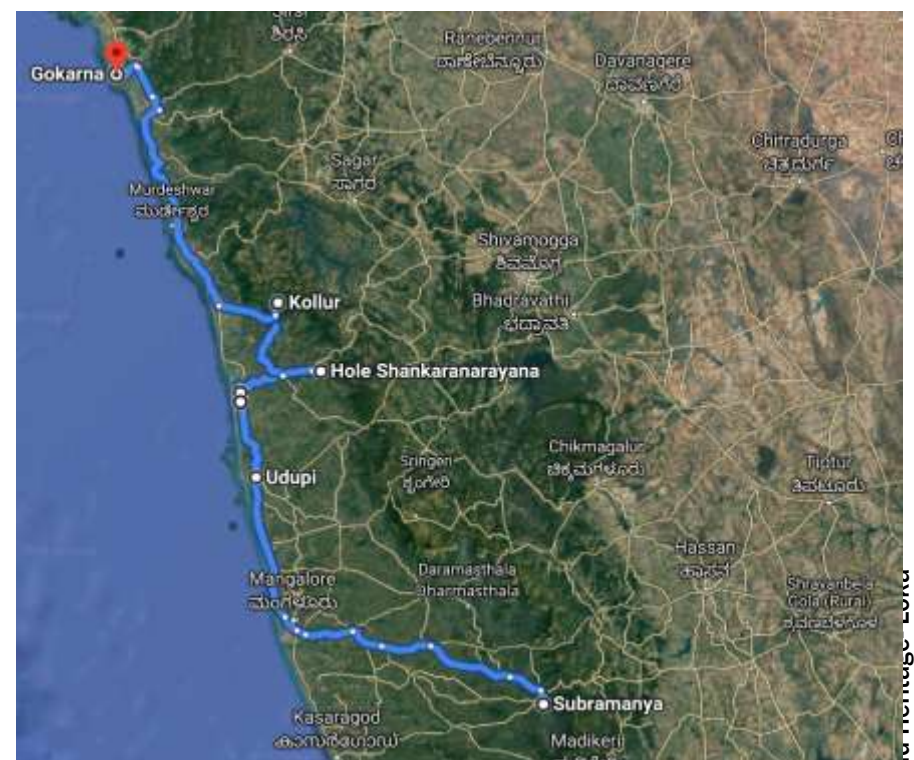


Figure 6-3 Satellite Image, (Source: Google Maps)

6.3.2. Varahi River

Varahi River, located in Kudapura, originates and flows through the Western Ghats. It is also known as Haley or Haladi river in downstream areas. The river joins the Arabian sea after flowing through Halady, Basrur, Kundapura, and Gangolli and later joins with the Souparnika River, Kedaka River, and Chakra River, and Kubja River, which are known as

Panchagangavali river and merges into the Arabian Sea. Varaha (boar) is one of the incarnations of Hindu Lord Vishnu, and the river Varahi is the consort of Varaha. It originates at a place called "Hebbagilu" near Agumbe in Thirthahalli taluk in the district of Shivamogga.



Figure 6-4 Varahi River, (Source: District Attractions)

6.4. Shankaranarayana Gram Panchayat

Shankaranarayana is a village in Kundapura taluk of Udupi district in the state of Karnataka in India. It is situated amid coconut and Arecanut plantations along with forests adjoining the Western Ghats. Earlier, this village was called Golikatte. Shankara (Hara) and Narayana (Hari) are jointly worshipped here, and there are five Shankaranarayana temples within a radius of about 15 kilometers. Shankaranarayana jaatre, which is the annual fair, is held every year on January 16 and attracts many people from the surrounding villages. Shankaranarayana is one of the Saptakshetra from the land of the Parashurama. Gokarna, Kolluru, Shankaranarayan, Koteshwara, Kumbhakshi, Udupi, and Subhramanya are the seven places under Saptrakshetra land. This route is 409 km long.

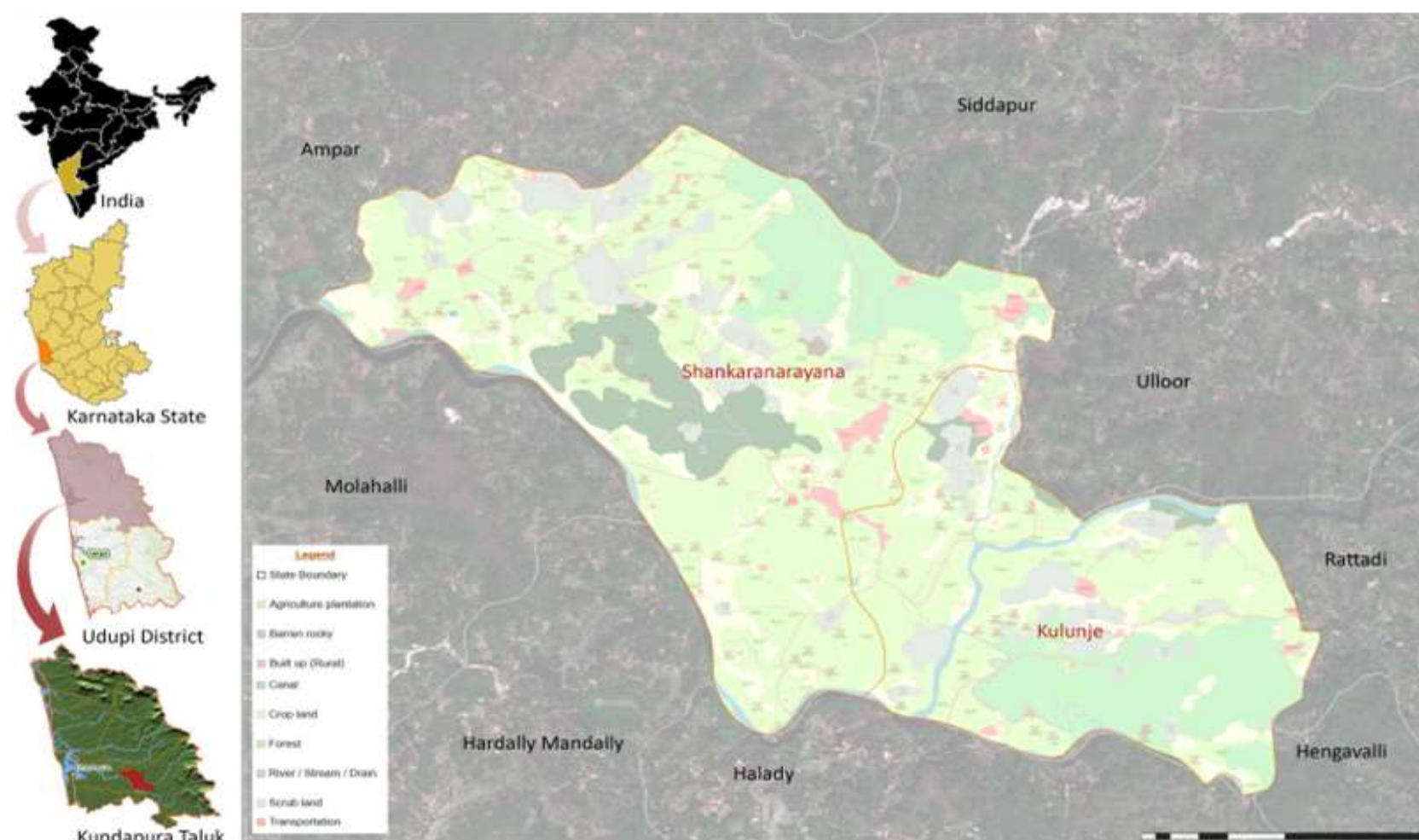


Figure 6-5 Map Showing the Shankaranarayana GP and the Surrounding Villages, (Source: Google Maps, NRSC)



6.4.1. Shankaranarayana Village

Taluk - Kundapura

Gram Panchayat – Shankaranarayana

Pin-code – 608716

Area – 2312.5 hectares

Total Population – 5144 (2011 Census) / 6066 (Gram Panchayat Record 2020)

Total Households – 1026 (2011 Census) / 1401 (Gram Panchayat Record 2020)

Languages – Tulu, Kannada, Konkani, Beary, Bashe, Hindi, And English.

Elevation – 13mt above Sea Level

Current Cattle Population – 1818

Paddy filed Area – 417.04 Hectares



Figure 6-6 Sree Shankaranarayana Sewa Samithi, Source: MSAP survey team

6.4.2. Kulanje Village

Taluk – Kundapura

Gram Panchayat – Shankaranarayana

Pin-code – 608724

Area – 1440.7 hectares

Total Population – 1987 (2011 Census) / 2128 (Gram Panchayat Record 2020)

Total Households – 411 (2011 Census) / 441 (Gram Panchayat Record 2020)

Languages – Tulu, Kannada, Konkani, Beary, Bashe, Hindi, And English.

Elevation – 13 meter Above Sea Level

Current Cattle Population – 1346

Paddy filed Area – 204.24 Hectares



Figure 6-7 Kulanje village road, Source: MSAP survey team

6.5. Shankaranarayana Temple

In the 24 chapters in the Padma Purana Pushkara stem, Srikoda Sankaranarayana Kshetra is described as dainty in Sanskrit verses. In the first printing, the original Sanskrit texts were translated into Kannada.

6.5.1. Mythology

In ancient times in the pre-Kalyuga period, Khara and Rattasuremba brother Rakkas were known for their violent acts, which were considered as the worst, the most invincible. Devendra, who had assassinated his father, Jambasasura, took time to seek revenge on Devendra. Similarly, the two men undertook a rigorous course of action. Sankara, impressed by the devotion of Irvara, said that he had asked the groom to be an eyewitness. Khirattasuras, who wanted to take full advantage of the opportunity available to us were neither Sura, nor Nara, nor Udag, Gandharva. When the Harihars come to the Ivory with one body and fight among themselves.

Only death would come to you, or else death would have been a boon to us, that death would never have been arrogant and believing in such pleasures. When he urged the citizens to worship him, Shankara, the merciful man, passed a law titled "Tathastu." The troops could prevent this subterfuge by supplying these tremendous boons to the helpless devotees by their own virtue. He became an intercessor without divine favor. Find happiness simultaneously, in the foothills of the people's social, moral, and religious mountain range, the Kandavasi taluk in present-day Kundapur taluk is very critical. It is the name of Shiva in the name of the Vedanta. Previously, it was the capital of Kharasura, the capital of Rattasur, the Vishnu Maelu, the Shivabhakas, the Vishnu pilgrims, the Rattadi, a mile away. What a puja. In which of these places did the Birrattasuras worship the God of Ishwar? Devotion was important, conquered many worlds in many forms, and became famous. People are the basic principle that God is the only one in Shankara's names.

To protect the wicked from the evil Khararattasuras, the Indradee deities, these mighty people should live in peace in the world. Despite the distress, Shiva Shankara Narayana became a devotee of the lord as a devotee to perform a dreadful penance. Since then, the sport has become known as 'Kotagiri.'

Devendra Briyasatyacharya preached to the Rattasuras that the "Charvaka Vemba" was "taught" to the hill to enlighten the giant Haran sent the Khroda Maharishi of the Khararttasuras, who gained a great fortune. To be killed as a Narashi Maharishi activist, Harihara is one victory over the same body. Since the Pararattasuras were to be called

Charvaka Ivas as their preaching, the Kroda Maharshis abandoned the Shivasana completely as heresies. At the same time by the gods of Indradei to co-operate and follow Jamadagni, Iomasa, mandavya, and Agastya four saints in the sages virarattasurara capital caturdikkugalalli holy isolated places, choosing a different Shankaranarayana God's great tapassannacarisida Agastya Maharishi sankarsanatmakana the aghoranannu about the mandavyanamaka sage abhinaya the pradyummatmaka sadyojatanannu Jamadagni sage aniruddhatmakana the vamadeva him about the Iomasa Muni vasudevatmakana the tatpura my devotion to purvaka Meditating on the heartstrings. The influence of the simultaneous penance of the five Indradi goddesses who are growing and spreading to the world Move over to Vaikuntha and Kailash with Maharishi from Lord Krishtasasur to Lord Himself and the world, in Lord Shiva Offer the containers, and kill the wicked. He prayed to the deities of the Harihara, who were impressed with the devotion of Munipungavana, as a body of Shivayutthakasi. Surprising form If one sees the little part of the same body, Srimannarayana! Shankara! Sankara is wearing a beaded skull, holding the conch chakras and crowned. Even muni praised God in this way, the transcendental monotheism.

He then prayed that Lokodara should be made a sermon on the slaughter of Khararattasura. Shri Shankaranarayana Tedakka should reside in these places for the devotional propaganda of the devotees who worshiped God because there is no difference among the Hariharas. Appreciating Pancha Munipunga's piety, he hoped that Sri Shankaranarayana would fulfill his conscience.

The giants prepared for battle, knowing that they were all together in the five bodies in the vicinity of the capital of Khararattasura, in the same body of Rudra and Vishnu. The Karaladi ministers' advice who survived the misdeeds of the time was the age of Queen Renuka! In the five places where you have to fight in the Pancha Sankaranarayana, you must always be amid the military marches, defying the people's wishes, and ignorant retirement. Nodded. Fierce fighting took place on both sides of the battlefield.

The bored gulls climbed down. Brahmadei deities, Gandharva, Munisheshthas, and all the people praised Sri Shankara Narainaruna with various voices, meditations, and meditations.

Brahmadeva, who had joined the Rishis on this occasion, distinguished himself in Sri Sankaranarayana. "Hey, Kodadi Narayana invokes His presence in these five places where the darshan will gather the divine nature of the five sages. "In these places, the dual sex form, along with the celibacy of the Brahmadei, the river tirtha, the rivers of Kottiritha are all pure and peaceful.

The great sage Maharshi preached by the great sage of Nara, the Birarattasuras, who are total atheists of this kind of fanaticism, have directly witnessed the people's discrimination. The moment of death was imminent. So, as he had prayed to Lord Shiva in the past, Harihara became a businessman, uniformly, to make his sacrifice. An enraged Sri Machchankaranarayana took Shula with the evil Rattasur and Kuttara from Purasura as a headdress to the earth.

The world was very happy with the vicious monsters—decades of triumphs. Sivayoga in Magha Maasa every year nowadays in the penchant for penance, qurrattasura marsana, and the sacraments, the lord has attained the history of the lingam he has acquired in the past. The pilgrimage to Panchasankaranarayana Yatra dates back to the pre-Kalyuga period. These are the five places - 1, long after this crocodile fell, "Sankaranarayana," 2, the sacred Sankaranarayana position in the village of Machuttu. "Silver Sankaranarayanan" 5, in the silver village, was the area in the Averse village. No one knew this shrine. In this "Awarsay Shankaranarayana," Khadavas and Rattadi places of worship were performed by the priests.

Most of the devotees visited these five places in the past, the shrines' shrines, which still stands in the cave at Krodagiri, where Lord Krishna gave Sri Sankaranarayana darshan. This place (Aditya: Adi Shankara Narayana is known as the place where Shankara Narayana Gennari is to be worshiped daily by the idol of the deity of the old age. This place is worthy of penance and greatness.

Thus the Brahmin saw Kamadhenu standing on his own bouquet from the herd of cattle at his home one day, and then some Kaliyuga. That Brahmin saw. He left the pointer in a curiously tested source and looked up at the rocks like snow on one side. The elderly Brahmin came to his house, minding the amazing event as he watched the Brahmin.

When Brahmadei came near the end of the Viratratasura, the angels, sages prayed that the cattle were milking uniformly and spreading them after prayer. Shri Shankara Narayana, the body physician, emerged as a linguist who looked like a diver, clean in the water and blue on the other side, diving into the lowlands of Kodagiri for the welfare of the world. Manimayya Prasadha, a beautiful and purely constructed mansion, was placed in Prasadam, where the deities came and offered Sri Shankara Narayana, without ever seeing him at the place. Likewise, the Siddhartha's came and praised the elephants. The symbol of the Holy Apostle's feet, which appeared as he dived down the hill, is still visible on the rock today.



At that time, the region was ruled by a devout Buddhist monk named "Kaulava," who had a very religious mind and alluded to an old Brahmin king. It was self-evident in the same subject as the precedent for the king. It is the kings' dream that the Harihara arises as a lingam where the Kamadhenu Milk is sucked and that the gender should be kept full). The king thus placed 2 containers of Ramadhan milking place. But curiously, within seven days, the vessels were removed on the third day, and the reality checked out that gender growth had stopped. The king built a temple decorated with Hema peaks for his mistake. Worshipping God and making the enthusiasts walk. The temple offered Umbil Uttaradhis and treasures for the temple.

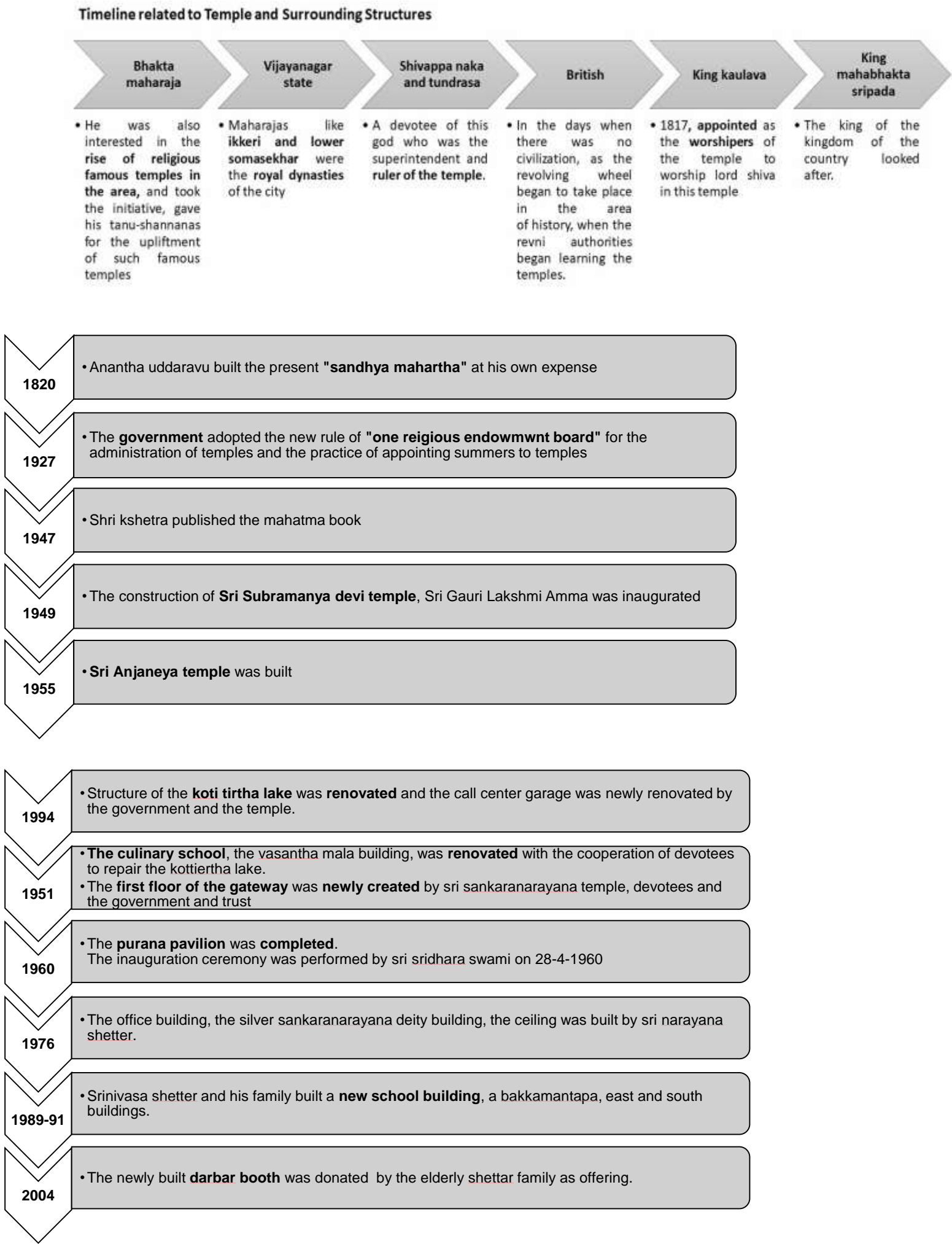


Figure 6-8 Swami Shridhar. Shree Shankaranarayana Kshetra Mahatma

The temple is dedicated to gold and silver, and the history of the ancient Maharajas of ancient times is attributed to the temple's elevation. He was also interested in the rise of such famous temples in the area and took the initiative. While such kings' names may not be

heard from time to time, the Bhakta Mahaja is the king's first duty to try and gave his Tanu-Shannan as for the upliftment of such famous temples. Historically known as the royal dynasty of Vijayanagar State, Maharajas like Ikkeri and Lower Somasekhar were the city's royal dynasties, and later Shivappa Nayak, a Tundrasa, was a devotee of this God who was the superintendent and ruler of the temple. The British rule began when there was no civilization, as the revolving wheel began to take place in the area of history when the Revni authorities began learning the temples. In 1817, "King Kaulava appointed the worshipers of the temple to worship Lord Shiva in this temple in a place where Sri Sankaranarayana erection is the most sacred sight of Bapu Umbali Uttara Japti Viagra. Following the designation, the Sriman Maha Rathotsav of the Panchaparvati festivals presented the temple administration to the Goddess of the temple in possession of the sovereigns of the authorities' silver lord, Lord Shiva. Even though the Harihara stemmed from the temple's efforts to produce regular products in the form of muni's successive rice-paddy fields, the place got stuck in the wheel for a while, and the authorities were able to secure the treasury. From that output officially, the authorities arranged for the temple to be overseen by the temple's administration. At that time, the Umbali Uttaradis needed by the Raithapi was the temple's golden dome, and this floating king of the temple was administering the temple. King Koulava made the idea of the temple for a long time gloriously and sincerely tried to prosper. King Mahabhakta Sripada, the king of the country's kingdom, the trustees appointed to this temple by the Reverend Officers, know the few' names and times. For a long time, this place was known as the Udupa House, where many of the temple's trustee's work for the temple.

Earlier in the 1820s, Anantha Uddaravu built the present "Sandhya Mahartha at his own expense. The chariot is now 182 years old and is written to the temples by a government-appointed voting committee. From 1820 to 1839, appointing the trustees of the 1839s (who used to appoint the Moser as a ruler) began in many ways for the upliftment of the temple. How many logmaku Rovin is an official of Annappa, Ramakrishna Aitala, Subraya Shastri Rama Adiga, Manjunath British government, over time, all the land of the acharya, Kasthacharya, Manjunatha Uddhavaru, who was appointed by the Kamyam the administration of the temple was taken over by Subraya Uddara, son of Anantha Uddara in 1898. The government had authorized the move. Since then, Paddy has been appointed by the committee to be the summons of the temple of rice. Instead, he played an important role in the upliftment of this temple of Lord Shiva in the name of judgment money. The repository is known to have been produced by the peasantry. During his time, the temple was worshiped and celebrated by the ritualists and Jumma Rupa in the 8th discipline of the Sridevara repository. Gradually, this amount is heard as a form of government by the peasants. The chantry built by his father was directly leased to Shankaranarayana and Amparu at that time. Realizing that the system was severely digested, he inserted both chakras into the temple with the new name Raspiya, titled Tasdeeku. The temple began to exist.

This is the date of the 9/11/1840 numbered silver colossal title that appears in the Title Deed. Sri Ramacharya was made in the 1840s. Many other works have been accomplished by him, and Sri Shankaranarayana Adigars have gained fame from the authorities of Raveen, who was the temple trustee of the temple for 7 years. The administration of the bamboo regime was seen. After his time, Ananthamanjaru, the north's land, is still in the repository of Lord Shiva today. In the year 1906, Subraya Uddara appointed Sivarama Uddara as the temple administrator. Sankaranarayana issue has already been brought to the notice of the government by Shastri Manjunatha Shastri. We were there for a long. These mokkatesars have been used in the temple when the silver nectar of the temple was used for the expense of the temple's treasury.

In January 1947, he erected several buildings for the administration of the temple. Since the flagstone has fallen: Yogurt is a mess with no one. In this case, January is a new flagpole, and the replica function has to be completed within a month. U, Venkatramana Rai was made in the time of the cooperation of the devotees. He received homemade money and performed the chariot ceremony. He then performs the rituals of worship that were to be performed daily in the temple for a few months. I regret to say that he has not even fully ceased to exist, such as 1906, sacrifice.

In 1927, the government adopted the new rule of "one Religious Endowment Board" for the administration of temples and the practice of appointing summers to temples. Shivarama Uddura left the Temple administration in 1931 and was appointed by the Endowment Board. Kakkunje Sri Chandrasekhar Adiga, Cullunje Pathele, Sri B. Sankaranarayana Rao, Shri. Shri. Surappaiah, Sri Way. H, Vasudeva Bhatta, Sri B. Ananda Waramballi Shri Shm | Mahabaleshwar Adiga, Shri. From 1931 to 1947, great people like Krishnaraya Koddi became a monument to the temple's administration. Mr. H. When Mahadeva was a Mokesar, the pantheon was placed in the sanctum sanctorum in the presence of Sri Deva, made of silver plates. The pilgrims have received financial support for this work. Dr. U. Venkatramana Rai, who co-operated this administration in many ways, died on 18-1-1948. In his place was Mr. B. Laxminarayanarayas was appointed as Mokesar. In 1952, he submitted his resignation. From 1954 to 1959, the village Mr. Seshappa was a totalitarian with the Chakras. This administration was a favorite of the Mokkesaras, and on many occasions, the Shri A. Krishnaraya Koddi also died in



1957; in 1947, the temple was taken over by Shri. Put a lot of effort into developing the Srinivasa Uduparu Temple. In 1979, Mr. Hari joined the foot. During her 32-year tenure, the following was restored by the immortal hands of the renowned Sridhara Swamis. Sri Swamis have paid the full cost of these tasks are accomplished. In 1947, Shri Kshetra published and published the Mahatma Book Fall of the Flag Hall in 1956, and the new flag was commissioned by Sri Sridhara Swami on 9-1-1957. In 1949, the construction of Sri Subramanya Devi Temple, Sri Gauri Lakshmi Amma, was inaugurated. Buildings and dialogue pavilions are built with the cooperation of believers. In 1956, a new wheel was introduced to the existing Mahanta of Skanda.

In 1950, the campus was built for the state-of-the-art lake. Built on: In 1951, the culinary school, the Vasantha Mala Building, was renovated with the cooperation of devotees to repair the Kottiertha Lake. In 1952 a brass plaque was purchased by Mr. K. Laxminarayana was offered to Lord Shri as a form of service by Urala. One hundred thousand rupees donated by Shri Gyanendra Bharati Swamy of Sri Tirtha Muktapuri Math in 1952 will fulfill the Yagshala building's work. In 1953, concrete was laid around the inner type. In 1954, Lord Sri Sridhara Swamiji was chosen as the Chairman of the Dhiroddhara Samiti, and the work of the Purana Mandapam Building was started. Shri Anjaneya Temple was built in 1955.

In 1960, the Purana Pavilion was completed. The inauguration ceremony was performed by Sri Sridhara Swami on 28-4-1960. The gateway was built in 1964-66. Charamakki Narayana Shettar has given financial support for this. Rs. Three thousand subsidies, second edition of Sri Kshetra Mahatma Book in 1967, were made. In 1968, the temple was provided with the cooperation of devotees. In 1972 Chitradurga Sri N. A small chariot was rendered by Vasudeva Rai as a service form and was dedicated to the temple. In 1976, the office building, the silver Sankaranarayanan deity building, the ceiling was built by Sri Narayana Shetter. The work of Sri Venkatarayanarayana is in the Sadri building Ta. On 4-4-1976, the building constructed by Sri Balakudru Sri Shankarashrama Swamy and Sri Gaurilakshmi Amman was built. In 1976 Mr. H. Narasimha's leaders built a new building. On 19th - 1976, the new rock idol "Sri Gopalakrishna Saraswati Swamiji" was completed. The prestige of God was fulfilled by Sri Prasavartha Sreepatham, the papacy of Sri Pejvara.

In 1977, the government of Karnataka paid Rs. 50,000 to build a Yogashala building, Ta. Inaugurated by Sri Jnanendra Bharathi Swamiji of Tirthamuktapuri Math on 1-1-1979. In January 1979, a new carnival was celebrated with a new festival statue. The help of believers has been sought in this regard. After the untimely demise of Srinivasa Udupara, Sadri's s. According to the Hukum of the Endowment Commissioners, Sridhara Uduparu has taken over the administration and performed many renovations work, which has led to the temple's success. With the blessings of Sri Sankaranarayana Swami, with devotees' help, the following renovation works are performed.

In 1979. Shri Sachidananda Swamiji, the presiding deity of Sri Partheeswara, was built in the Narasimha leaders' temple. In 1983, fifteen thousand grants were received from the Government of Karnataka. In 1993, Kavali Sri Ramachandra mediated Sankaranarayana! The facade of the dome has been designed to serve as a building. Kavali Sri Sankara Mediators in Rathbidhi in 1993 | The Basavanagudi building is built as a service. In 1993, Mr. S. Ramakrishna Adigar (Vidyarthi Bhavan Bangalore) had donated the silver seat, impact, and cover to the Shree Gauri Lakshmi Utsavam statue. In 1994, with devotees' help, four-wheelers of the Brahmarata were newly created and installed as a steering wheel. In 1994, the Koti Tirtha Lake's field structure was renovated, and the call center garage was newly renovated by the government and the temple. In 1994, S. Since Sridhara Udupari was old, his sons, Shri. Lakshminarayana Uduparu (hereditary trustees) is taking over the temple administration as per the endowment commission Hukum and is working on the development of the temple. The Koti Tirtha Lake's field structure was renovated, and the call center garage was newly renovated by the government and the temple. In 1995-1997, the gateway's first floor was newly created by Sri Sankaranarayana Temple, devotees, and the government and trust. In 1960, the Purana Pavilion was completed. The inauguration ceremony was performed by Sri Sridhara Swami on 28-4-1960. In January 1979, a new carnival was celebrated with a new festival statue. The help of believers has been sought in this regard. In 2004, the newly built darbar booth was donated to the elderly Shettar family for an estimated cost of Rs 15 lakh.

In 1986, the Department of Works worked on the road to the temple of Sri Sankaranarayanan in 1950, the campus was built for the state-of-the-art lake. In 1989-91, Srinivasa Shetter and his family built a new school building, a bakkamantapa, east and south buildings. In 1951, the culinary school, the Vasantha Mala Building, was renovated with devotees' cooperation to repair the Kottiertha Lake. In January 1979, a new carnival was celebrated with a new festival statue. The help of believers has been sought in this regard. In 1977, the government of Karnataka paid Rs. 50,000 to build a Yogashala building, Ta. Inaugurated by Sri Jnanendra Bharathi Swamiji of Tirthamuktapuri Math on 1-1-1979. In 1998, Shri KK. Ramachandra mediators are made into service form. Slipping to the floor of the inner courtyard of the temple in 1999-2000. Mrs and Sri Charmacki Narayana Shetter and family have done the service in the form of revival work such

as the inner bowl and the marble floor to the ground. The spring pavilion where God sat in 2001. In 2003, Sawadi was the son of Mrs. and Mr. B. Krishnamurthy, Bangalore, has dedicated slabs of stone from the bottom to the top of the mountain, from bottom to top.

In 2004, the newly built darbar booth was donated to the elderly Shettar family for an estimated cost of Rs 15 lakh. In 2006, a new silver idol of Sri Sankaranarayana was produced by the Kondalli Adiga family (Bangalore) for Rs.25 lakhs. In 2007, the Kondalli Adiga family had a new stone slab stone for the four-story floor of the Korakkal, and the work was done finely. In 2008, the Kondalli Sankaranarayana Adiga family completed crores of tirtha at the cost of Rs.3lakh. In 2009, the Kondachi Adiga family donated a new silver chariot to the service at an estimated Rs 30 lakh cost. In 2009, Goddess of silverware was donated by Mrs. Vijayalakshmi Achar w / o. G. The Ramaraya Ajayaka. Kesaranarayana has been disrupted in-service form at the cost of 12500000.

In 2010, Mr. Sarja Rajagopal and his family (Koti Koppa Araga, Tirthahalli) paid Rs. 19,000 /- a large iron donation. Ta. Mr. S at 29-1-2010. Ramakrishna Adigar Vidhyarthi Bhavan, Bangalore Rudrakshi Kandihara and Saligrama Kandihara, two necklaces of gold, O 2 necklace weighing 169 grams. 429 mg. The estimated price does. 2, 64.000 / - India. In 2013, the beautiful new shrine, sanctum sanctorum, gateway building, Sri Ayyappa Devi Gudi, Sri Gowri Lakshmi Devi Gudu, Sarva, Shrimati, and Sri Charmakki Narayana Shetty were pleased to inform the family and devotees. As part of it. From 5-12-2013 to 13-12-2013, the Brahmakalasha and Ashtabandha programs are pleased to announce that Sringeri Jagadguru was accompanied by thousands of devotees in the divine presence of Sri Bharatheetheer Swamiji. On this occasion, Sringeri Swamiji presents a large jug of silver to Sri Sankaranarayana God: On the same occasion, the new Shilamaya Sri Sankaranarayana God. About 15 kg per idol. Kondalli Shri Radhakrishna Adigar dedicates the silver cover to the silver. In 2014, two new mangoes of mango trees were offered at a regular rate of Rs. Shri Sarja Neelakantharao and his family, as well as Andru Smt.

In 2014, Maharatha had a new tree-lined and seated altar of God sitting at an ordinary Rs. 2 lakhs. The cost is incurred by the temple and Sri Sankaranarayana Trust. Shri Radha Krishna Adigars of Kondalli dedicate a silver basket and a large gift pack costing about Rs 45,000.

In 2015, Shri Ramakrishna Adigar and Vidhyarthi Bhavan, Bangalore, presented a silver vase, a Cambridge, a silver pilgrimage, a kavali, and a silver platter to God. Every Monday from November 2015, devotees are happy to announce that the devotional service is initiated in the temple.

. In 2016, 20kg worth of 7 lakhs 85 thousand was used to anoint God in the womb. 438 grams of the water-filled silver vessel was made by Sri Ramakrishna Adigars and devotees in Bangalore. About Rs. 5800000 Price Water Filter by Sankaranarayana Rotary Club Hegde's offer in the form of service. The four-lamp stand is dedicated to the service of Khadi Smriti and Shri Sudhakar Shetty for lighting the Rangpooja time. In 2016, the beautiful Sri Parthaswara God Goody Sri! The Sri Darsukku Narayana Shetter family and devotees were assisted by its pilgrimage from April 2 to 4. Shri Nagabhushana Sheet, Inkadu, and Udupi offer the silver mask of the Goddess Partheswara. Sri Sankaranarayana Kshetra Mahatme 6th printing in 2016 was made. Thus many acts of grace of Sri Swami Will be fulfilled. Essential rejuvenation work that needs to happen Estimated cost 2 crores 1 crore 3 crores, Welfare Pavilion, Shree Shankara Narayana Goddess, Kodagu, lighting in Kodagiri, Guest House, toilet bathroom construction all these tasks should be accomplished as quickly as possible 25 lakhs. Pray in Sri Sankaranarayana Swamy and help the devotees expect government assistance.

6.5.2. History

Their strong leverage prevented the king's circles from starting from the front. Then the Pancha Shankaranarayana Yatra is celebrated and his Khajadhi) is a cure for Naravi. Srikala Lokarayanarayana Swami was very amazed to see this kind of glory. By the time of the jubilee, all of my preconceived notions had been moved by the influence of counseling. Before I left for his capital, he had come to his capital, where he had performed the Shastra thinking and received the blessings of the Brahmin of Harihar. At that time, Sulochana had his dead body as if he had the power of God. In time, Sulochana came to the town with all the glory of the princely states, and the sultana of his former king Sulochana, who was righteous, philosopher, and wise, was enthroned by the eulogy. Shri Shankara Narayan meditated on Nirmiti with earnestness. And offered to the pious. Many festive ornaments of gold, gold jewelry, white parchment in the mythological sense, this temple and the magnificence of this field are a great backdrop for this region's greatness. He saw some of the traditions of the past and the festivals of the temple that we see today as a symbol of his eternal service. From all these ancient treasures, the people of ancient times have come to realize the temple's fame. The king ruled as the philosopher Sulochana. He received a cure and came to his planet from the field. From all over, the king made the Suraprnadis of Mardava with lust,



renounced the king's religions, and left the governorship as a prostitute. Lingaraja, who was abducted by the state, took charge of Durrani, the son of Senapati, at the time. King Kalingamana, the ruler of Karnataka, awaiting the occasion, invaded the country and defeated Durmana in battle. King Sulochana left the state for fear of risking his life and went into exile. Soon after that, Dhanhanika, who had come to Agrahara from Sulochana, was in Brahmin. Did. One day, Sri Shankararanarayana Swamy Darshana came to the realm of my son Shankaranarayana, who was suffering from leprosy. In the field, the trio's hearts were consumed by bathing saris, devotionally visiting Sri Shankara Narayana, and receiving a tirtha prasadam, a loyal millennial village of Sridevara Lord God Bhandara.

This leper is a brahmana Tanaya who prays before God Gem Bangaradi presented many decorative medals of gold and silver. In this way, the Maharaja of Sulochana obtained the full moon of Sri Sankaranarayana Swamy, and the Maharaja of the state known as Bhaktakshreshtha Maa Dhaadi became the saint of Sri Shankararanarayana, the achandarka kirtisali. Ikkari, formerly a devotee of God in the Hosanagar taluk of Mysore State, is a devotee of God. The Bhog mantapa of the temple, the silver kopparika, formerly "a Brahmin who loved, renounced the Dharma and in the things such as silver foot lamps," became the abuser of the lower Somasekhara Rai and became his husband.

The devotion of the evil mind can be seen to be what is written. Instead of benefiting the people as a grammarian who had graduated from a husband Brahmin, the king realized that he was enjoying himself by tormenting the self-defeating people. The temple was intimately connected to the state when the city was still in existence. It is understood that the state's royal family, sometime later, took issue with the temple of the Divine Yoga.

Every year the Sagittarius Day begins with the carnival of Muhurta Bali, the festival god leaving the city, and the glorious return with the Raj Parivar, who is so ashamed of his sin that he has come to the temple of the penance. On the seventh day of the walk from Gurmukhi, the Srimanta mahathottasam and the eighth, ninth day, the elation of the eternal happiness, the emanation of the flag, the emancipation of the deity, the emancipation of the deity, the deity of the deity. That is to say, the Shankara Narayana was celebrated for a month on the eve of the Sagittarius, who had come to this sacred field, and devoted himself to Sri Shankar Narayana. By removing the clusters of time, he changed to the grace of the Supreme Lord, but now, as a symbol of Sagittarius in the temple, he attained the eternal life of excellence. This is the day the "Muhurta Bali" festival is held. Knowing the glory of the region, Sri Shankara Narayana Swamy was close to the king of the city and the temple. There is no doubt that salvation is in favor. In the past, the Maharaja of Vijayanagara State was a great devotee of this God, who offered many gold and silver ornaments to the deity and was interested in the temple's development.

Shivappa is nothing like the festive festivities that are happening now. "Shivappa Naka" was a devotee of this God after the kings of the city-state. Many people still attribute this great devotion to the temple's greatness as "the discipline of the Naka." Later, when the king of Mysore Tipu Sultan returned to Sriranga during the Digvijaya, he knew the



Figure 6-9 Shankaranarayana Temple,

Source: <https://shankaranarayana.org/history/>

field's glory and devoted a large bell of the sunglasses that she had brought with him at that time. No other temple in the district can make such a huge bell. Roo, a Tipu Musalman, can only convert his mind from this God's very first vision. This is the main thing to know in context.

6.5.3. Architectural features of the temple

At the temple entrance stands the golden Kodimaram and sculptures of the Gods on either side. The huge mural painting on the top depicts the stories from mythology. Inside the sanctum are the silver-plated idols of Lord Shankara and Lord Narayana. UdbhavaLinga is placed just ahead of these deities. The doors to the sanctum are



Figure 6-10 Temple Precincts, Source: <https://shankaranarayana.org/history/>

carved with various forms of Vishnu and Shiva. There are smaller shrines of Ganapathi, Gowri-Lakshmi, Partheshwara, Anjaneya, and Krishna. There is a Kotitheertha next to the temple.

6.5.4. Deity of the Temple

Orientation: In the center of the sanctum sanctorum of the shrine is below the ground level. The lingam is the main deity Sri Sankaranarayana Swami. On the other hand, the left vision aspirants can see it. The part of Vadiraja Mahaswamy, the enlightened man who was formerly enlightened, has been painted with clouds of goggles. These are the Shankara Narayana Lingayavas of this Advaita Kroda constituency. From the front of the sanctum sanctorum, a Shiva-worshipping monastery, devotees, from the front of the sanctum sanctorum of the lingam, the lingam is in the low water, and the devotees are not able to praise the deity of Sri Sankaranarayana.



Figure 6-11 GarbhaGudi Linga,

Source:

<https://web.archive.org/web/20061103061257/http://www.shankaranarayana.org/history.html>

"Shankaranarayana" is considered as one of the seven holy places created by Maharshi Parashurama. We can see the Sangam (confluence) of Shankara (Lord Shiva) and Narayana (Lord Vishnu). It was built 400 years ago. Shankara Linga, which is round, is on the right, and

Narayana Linga is flat with the cow's footprint on the left. The cow is believed to be that of the Kamadhenu, stood dripping milk over the Linga. There is water around Udbhava Linga at any time of the year. This holy water is called Suddhamrita Theertha. The silver-plated idols of Lor Shankara and Lord Narayana are also installed inside the Garbjagudi.

Garbha Gudi: The naturally formed lingam of Lord Shankara and Lord Narayana is one foot below the ground, inside the Garbhagudi. The devotees can only see the mirror image of the lingam.

6.5.5. Detail of Sub Deities in the temple

In front of the sanctum sanctorum of the temple, the deaconess, "Sri Mahaganapati, receives the first worship of God. On the south side of the outer genre is Sri Gopalakrishna God "Sri Panchamukhi Veeranjanya" God, "Sri Partheshwara" God "Sri Subramanya God" Sri Gowri Lakshi "God" Ayyappa Silver Sankaranarayana God. The silver Sankaranarayanan idol is six feet high, Hari Prancha | Vishnancha | Rudrancha | Always Namaste | The Stotram Swami Goddess of Sri Vadiraja Swami is intrinsic to the northeast. As explained earlier in the storyline of the field, this beautiful idol on the right side is Shiva, the left side is Vishnu, and in the chronicles, the people show the glory of this field and this God. Knowing this easily, I wish Sri Sankaranarayana Swamy to attain full bliss as a devotee of this God. "When Lord Shri Sridhara Swamiji entered the field, the Guru nobleman restored the digested Anjaneya Gudhi at his own expense and installed the



new Sri Panchamukhi Veeranjaneya Swami Shila idol with his divine hands in the holy Chaitra of Girija (Taraikku 1-4-1955). Sri Anjaneya Swamy Deva from that moment Pilgrimage Tirthas, Stamps are objects: As explained in the description of the Tirthas, Sri Shankara Narayana originated in the "Siddaramrita Theertha" shrine around the lingam, "Bhargava Theertha," "Nagatheertha" temple artistry, and the "Kottiartha" - "Paththivarth" and "Kottirtha" are the forerunners of the Rang Pooja special services by devotees. Accepting, Sri Swamy favors believers' motives. In the outer courtyard of the temple, "Basaveshwara" Shri Gopinatha "" Shri Gopalakrishna. " Gods like "Sri Mahalingeshwara" is a place where Sri Nandikeshwar is famous for its distance. Situated on the south side of the temple is the "Kodagiri." In this song, "Kodashrama still shines. Nearby, there is a cave gate where Sri Sankaranarayana gave direct observation to the Kodamunis. It is known as the Adi place. These are all fascinating places. There will be sacred places like "Sri Veera Kalukuttika." Rajaji Maharaja and his devotees in the east devoted themselves to the Goddess. The golden pallakki and the jeweled mantapa, which were offered to the deity by the king Sulochana, as seen in history, we cannot find in the temple today. Our ancestors were aware of the evil that lay ahead. We are unable to confirm today that the treasures were hidden in the temple underground or that these ornaments were stolen in times of Pindari rebellion and Muslim rebellion. Today, the golden shrine of the golden Sri Shankaranarayana, whose name is cut in the temple, is the diamond turquoise's golden mask. We can find golden necklaces, medals, and silver items such as silver pallocki, jaggery, silver chariots, and silver bracelets. Devotees can see the Bhoga Mantapa 'silver Shankaranarayana idol' in the temple, the famous "big bell," the great chariot of Sindhan, and so on.

6.5.6. Description of Tirtha

In the sacredness of this place, Kodanagari (Sankaranarayana) is the equivalent of two vessels in a place called Kavuchi (ft field) Kashi (7 feet long) and the river Varahi Shuktimati, which flows in this region, is similar to the Ganges. In the past, Lord Shiva returned, wearing the form of Varaha. Seeing the Veda Movement after the slaying of Sri Shankara Narayana in the lingam of Hiranyaksha, the sacred footprints of the Supreme Lord, at the summit of the splendidly growing Sahyadri, embodied in the spot, flowed westward into the river. This was called "warahee." The Varahi River flows in many three directions, often crossing the two banks of the river. The river flowing towards the west is called "Shuktimati" and "Sivaganga," and it is believed that bathing in this pilgrimage is very beneficial. It crosses the Warahi River and joins the four rivers Kubdanai, Chakrini River, Bettini River, and Souaparni River, named "Panchgangavali" at Gangolki. So they describe the Warahi River as the equivalent of the Ganges. Bathing here attracts people to salvation. Since then, this shrine and this shrine have been home to nature shrines. This Croda field is one of them. Lokavi became famous in this field. Here is the story summary of Vidhya Mahatma. From then to the present, readers will learn about the historical background and governance issues presented by Alka in this book. There is a very good pilgrimage in this area. The greatest of them is the "Siddhamrutha Tirtha," surrounded by Sri Sankaranarayana's erection. To the south-east of the temple is the "Durga Theertham" to the south and the "Agastathi Partha" and "Kapilatheertha." In the foothills of Krudagiri, there is also "tirtha." This pilgrimage is popularly known as the "Kroda Thirtha" because it performs bathing's spiritual practices. In the southwest, Lakshmi Tirtha "Poo" in the northwest, "Gauri Gurthum" in the northwest, "Somithartha" in the north and "Savitirtha" in the north, "Agnitheertha" in the south of Vig's sanctum, "Ganesha Martha" Getting there. Sri Shankara Narayana Kshatriya, a form of Maharishi's fame, is an exquisite decoration for the Mandala, as many of the Tirthas are called in the names of the Rishis. Here is a description of the Tirthas. When Parasurama came into this realm, he had "Akshartha Pirthu" in his northeastern direction, "Kasikati Perth," Vashishthirtha. The rock has broken down by Parashurama by his axe and caused this pilgrimage. There are many tirthas, such as the "Virtue Tirtha." This pilgrimage is only 3 feet wide by 2 feet deep. There is a lake called "Kotirthirtha," also known as "Sarvarthirtha" Koti theertha is in front of the temple.

Devotees coming to this temple first make prokshana of this theertha and then make darshan of Lord Shankaranarayana. The stone enclosure and the surrounding coconut and areca nut groves enhance the beauty of the pond. The pond has a rich spiritual bearing. Rituals such as Pitratarpa and Theerthasana are held at this pond. Koti theertha stands out as the most beautiful and vast of all the twenty-one ponds found around this place. On the western side of the shrine is the "Nagathirtha." Lord Subramanya is near this pilgrimage. This teertha is 10 feet wide, 20 feet long, and 3 feet deep, and it is very convenient for people to bathe in this lake.

6.6. Festivals and Celebrations

6.6.1. Shankaranarayana Jaatre

In the current scenario, the village hosts around 10000 devotees during the Shankaranarayana Jaatre. The details of the festival are as follows:

- Usthava Murthy:

Shankaranarayana Jaatre is the most celebrated festival in Shankaranarayana. This festival starts 4 days before Sankranti and runs for a week. During the first 6 days, various rituals are devoted to Lord Shankaranarayana. The final day is the main festival when Rathotsava is celebrated. This day generally falls on January 16 (including the one next year). On the day of Rathotsava, Ustava Murthy (placed in the Garbhagudi) is decorated with Attekuppasa and garlands of flowers.

- Bali Murthy:

The Utsava Murthy, also called Bali Murthy on Rathotsava, is being taken out of the Sanctum Sanctorum for the procession.

- Bali Dharaka:

The designated priest, called Bali dharaka, carries the Utsava Murthy over his head. Bali Dharaka makes a pradakshina of the Sanctum Sanctorum. A lot of other rituals are also followed as the pradakshina goes on. The whole process is named Bali Seve.

- The Chariot:

After Bali Seve, Bali Murthy is taken into the decorated chariot (Syandhana Ratha) in front of the temple. The enthusiastic crowd pulls the Syandhana Ratha from the entrance of the temple till Ratha Cottage. Bali Murthy is taken to the Kroda Giri, and pooja is conducted over the hill.

Around 10 thousand people visit this Shankaranarayana

Jaatre on the day of Rathotsava. Many people from various parts of India (including Bangalore, Bombay, etc.) also visit this place during the festival.



Figure 6-12 Shankaranarayana Jaatre Rathotsava,

Source:

<https://web.archive.org/web/20061103061257/http://www.shankaranarayana.org/history.html>

6.6.2. Description of Jubilee Celebration

Sri Shankara Narayana. Every month, beginning a bright new moon and Vaisakha new moon, every new moon is celebrated every day. The festival does not occur during the four months of Jyeshtha, Asha, Sravan, and Bhadrapada.

- Chaitra masa:

During these 15 days, Sri Panchamukhi performs special worship rituals to Lord Veeranjaneya and performs the Mahanganpujaadi festivals at night. This is the day of Hanuman Jayanti.

- Vaisakha masa:

All 15 days, Shri Sankaranarayana Goddess of the Spring is celebrating the night.

Shravan masa: In between the first 8 days, "The" Yogurt Drink "festival offering is celebrated for deity Lord Krishna's.

- Bhadrapada masa :

During the first 4 days, "Vinayakar Chaturthi" is celebrated by performing Ganama Homa on the day.

- Bhadrapada :

The 14th-day offering will be provided to God with fruit panchamurtha, and Utsav is celebrated.

- Aashwija:

After 9 -The festival will be followed by a special puja to goddess Sri Gowri Lakshmi Amma

- Ashwija masa:



Starting 10 days, a special worship service to Sri Shankara Narayana at noon on the day after the homilies' invocation. Later on, Vijayadashami- Vijaya Utsav is celebrated

During the Kartika month, devotees in this field will come more frequently and take advantage of Sri Darshanaramana Swami's darshan. Kartik Mondays are a very special day of the place. On the 4th Monday of the 2nd Monday of Kartika month, a special letter of worship is presented to God. This worship is called "Lakshya Patra Puja." This day is auspicious for the transit of Capricorn. On this transitory day, Sri Sankaranarayana is adorned with all the ornaments of God. There is the custom of going to Kodagu for the festival god Krodha Shri.

Special Worship Home days on Kartika New Moon Day Initially, the old Brahmin would go to the forest searching for his Go, the Mahangarpu Pooja at night, and, subsequently, the triumphs of Sri Shankararanarayana in the Gulka area when the lakhs arrived, by Dipotsava, Teppotsawa, Rathotsavasi. The same nectar transmitted on Friday morning

On this day, Sri Shankara Narayana Swami Rathotsavam is celebrated "seven days before," on the eve of the dawn of the day, "the celebration of the dawn of the dawn," Fulfillment.

2nd day- Mahapooja, Rangapuja, "Panagavahavotsava"

3rd day- Mahapooja, Rangapuja, "Vrushabanostava"

4th day - Mahapooja, Ranga Pooja, "Kunjaravhanostava".

5th day - Mahapooja, Ranga Pooja, "Ashwavanostsava."

6th day - Mahapooja, Ranga puja, "Simha vehicle carnival" is a small carnival is conducted.

On the 7th day - after the special Mahapooja has been fulfilled, "Srimanamahasandhara Rathaotsavam is held. The great dedication of the afternoon will be accomplished. Afternoon, the charioteer stepped forward and descended on the chariot of Lord Devi, who had finished the service and entered the temple. Demon sacrifice that night, dark gift, shayanotsava is organized. Every year, this is the day of Makar Shriman Maharootsavam celebrated. In January, from 15 to 16, many pilgrims come to this field during the celebration.

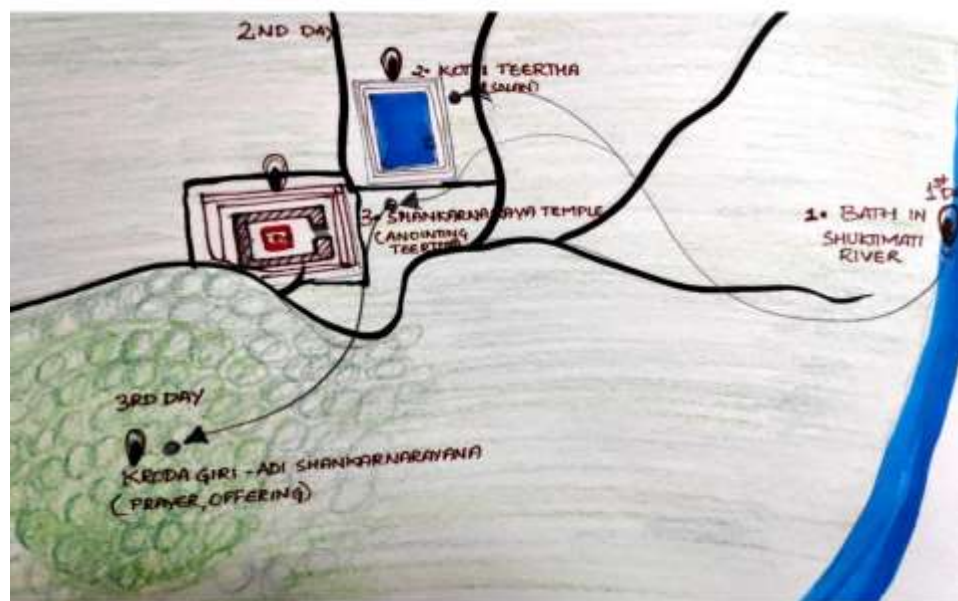


Figure 6-13 Schematic diagram of the temple visit route,

Source: MSAP

In the east, the story of cow-milking in the forest region was known by the Kaulava king of that time as Brahmin in the

Capricorn transitory day, and on the same day as the two vessels in the gulramdar, the third day of Makara transit, Good day. It is conceived that Sri Manmahatrotsava is being held.

On the 8th morning - Sri Gaurilakshi in the morning Shayanotsavam: The spring festival occurs after the devotees have raised Sri Sankaranarayana Deva with a hymn. That night, the festival called teppostava, charanotsva, is celebrated.

On the morning of the 9th, the carnival performers, the mantraksha, the delivery of Prasada, offering, and flag hoisting is made. On that night, the festival of chariot festivals ends with a celebration of the activities of Mruga Yatra (animal yatra, conversation).

On four auspicious days, one day, they perform a ritual to God and thank him by performing pooja to bhava linga.

On the 13th Siva Yoga Day, Sri Sankaranarayana Deva is celebrated with special Mahapooja, Rangpooja, Deepa worship, and enthusiasts. Devotees perform special services to God. On this auspicious day, many devotees perform the Pancha Sankaranarayan Yatra. Pilgrims of the pilgrimage are aware of these bright days in the field and wish that this field would be very helpful for God's worship.

6.6.3. Rituals and Practices of the Temple

Pilgrims visiting this field will spend the first night alone in the area, accompanied by Sri Shankara Narayana Swamy. A bath in the Shuktimati River, on the next day, will bring the river tirtha to the temple for anointing. In the afternoon, take a

bath in Kottiertha Lake, perform Nitya Nasthanasana, offerings of worship, worship Lord Sri Shankara Narayana, perform pujas and worshipers, perform prayers after Mahamangalarata, perform birthdays, offer pranasadyas, offer pranasadyas, sridevara Nevadas, sridevara nyalas After receiving the darshan of Shankara Narayana Swami, receiving the tirtha prasad after the pooja, spend the night with a calm mind. On the third day, visit the remaining sacred shrines in the field and take a bath or purification. Visit the Adi Shankara Narayana at Kodagiri, the Krodashrama, perform worship rituals there, take advantage of Shri Shankara Narayana Swamy's darshan at noon Mahapooja, receive the Lord Goddess Tirtha Prasad, and then have dinner. See Mecca's objects in the realm in the field afternoon, with items in mind Sri Sankaranarayana Doing the darshan of God, eating the tirtha prasad, and spending that night in the field with a pure mind. Pilgrims stay in this field for three days, worshipping Sri Sankaranarayana Swamy with devotion and spending nights enjoying the fruits of the pilgrimage. Pilgrims must remain in the area for a day if there is no chance of three days. The convenience and opportunity are that the pilgrimage Mahashayas can complete the Sri Pancha Sankaranarayana Yatra on the fourth day after three days, and Sri Panchakaranarayana Swamy can attain full grace. The following services may be performed by the devotees in the presence of Sri Sankaranarayana Swamy Sri Sankaranarayana to God,

- The Milky Way
- The anointing of the Panchamruta
- Singular Rudrabhishek
- Pavamata Abhisheka Ekadasha Rudrabhishek
- Centaurium
- With the dedication of Shatha Rudra Abhishek
- Tulsi offerings with a bishopric
- Shiva is the millennium
- The Vishnu millennium
- Sankaranarayana millennium
- The Samhita Parayana
- Pans
- Milk with Harivana Panchamruta is Paraman's incense
- Karpura Mangalarathi
- The cult
- The Mahangapuja
- Sarvabharana Festival with the Sarvabharana Chariot Festival
- The silver chariot
- Mahapooja Seva

6.7. Communities and it's a lifestyle

In the village, people have their own individual houses, and those are Pakka and Kachha houses. Lands are mostly owned by the Localities, and they grow vegetation for their own use and for selling purposes. Almost all the houses have one pet with them, Animals they have like Cow, Buffalo, Hens, Dogs, etc. Major Agriculture crops are Coconut trees, Arecanut, and Paper plant. Few communities have government housing. Most people work in Cashew industries; in Ward 4, Males are involved in agricultural activities where Females are involved in Cashew factories. The area totals of 39 habitations in Shankaranarayana and 9 habitations in Kulanje village.

Shankaranarayana villager society is a simple living society. The people are bound up with the agricultural routine. Activities like sowing, weeding, harvesting, and marketing engage most people throughout the year. Therefore, most of the village people's cultural activities run parallel to the agriculture calendar and their traditional practices related to

Shankar Narayana temple. Their festivals, fairs,





folksongs, and folktales have all resemblance to their agriculture and Parasuraman kshetra. The collective life of the people revolves around the agricultural practices and climate calendar. Their traditional local cuisine consists of having food in banana leaf. A few dishes that are very well prepared here comprise masala dosa, neer dosa, idly, sambar, steam brown rice, fish fry/curry, prawn fry, nati chicken dishes.



Figure 6-16 Katte near GP
Figure 6-19 Shankaranarayana B

Source: GP survey Team, MSAP



Figure 6-14 Shankarnaryana Temple,

Source: GP Survey Team, MSAP



Figure 6-15 Madaghas,

vt. College,


Figure 6-17 Health Care Clinic,















Source: GP survey Team, MSAP

- Ashwatha Katte near GP office: This area act as a waiting area for sub-register office and informal community gathering space. This is a kind of traditional space that holds socio-cultural importance to villagers.
- Shankaranarayana temple: It is a holy temple that holds traditional and cultural importance to the community. People believe in Lord Shankar and Narayana as their main deity.
- Madaghas: These are the traditional method of conserving rainwater for agricultural practices. It was even serving as drinking water for nearby communities of madghas. It is also known as kolla.
- Bus stop: This acts as a landmark and node for villagers. This also serves as a gathering point to travel from one place to another.
- College: it's an opportunity for village students to learn and develop their social science, technological abilities.
- Clinic: This is a small built where minor treatments are looked after for the whole village.
- Aanganwadi: This is an early learning platform for kids in the village, where kids can develop their intellect and knowledge.



6.8. Tangible and Intangible Heritage

Tangible heritage includes buildings and historical places, monuments, and artifacts worthy of the future. These objects have significant to the archelogy, architecture, science, or technology of specific culture. Items are important to the study of human history because they provide a concrete basis for ideas and validate them. Their preservation demonstrates recognition of the necessity of the past and of things that tell its story. Preserve objects also validate memories, and the actuality of the item, as opposed to reproduction or surrogate, draws people in and gives them a way of touching the past.

| Sr. No | Type | Conservation of heritage | Description-key points |
|--------|----------------|--|--|
| 1. | Built elements |  <p>- Tangible Heritage</p> | <p>Shankar-Narayana Temple is one of the Sapta-Kshetra from the land of Parasuraman.</p> <p>Temple has historical importance with a lot of folklore and mythological stories</p> |

| | | | |
|----|-------------------|--|--|
| 2. | |   - Tangible Heritage | Sub – Registrar Office – Located in Ward no. 4 – 100-year-old structure (As per Field Survey) |
| 3. | | NA. | Brahmin family Residence near Shankar Narayan Temple – Located in Ward no. 4 – 125-year-old structure (As per Field Survey) |
| 4. | |   - Tangible Heritage | Ashwath Katte- This area act as a waiting area for the sub-register office and informal community gathering space |
| 5. | Cultural elements |   - Tangible Heritage | Tipu sultan-Bell about 775 kg, this is rung 2 times a day, and its sound spreads up to 7-8km |
| 6. | |   - Tangible Heritage | Wall Painting depicting the mythological story of Shankar Narayan in front of the temple |
| 7. | |   - Tangible Heritage | Lord Vishu and Shankar incarnations depicted on the door of Garba Gudi |
| 8. | Water bodies |   - Tangible Heritage | 'Koti-Tirtha' is a temple tank (Water tank), which has a high cultural and spiritual value. It is located near Shankar- Narayana Temple in the foothill of Krodhagiri mountain. |
| 9. | |   - Tangible Heritage | Varahi river -On the southern-western side of Shankar Narayana village Varahi-Haladi river flows. On the eastern side, western ghats are surrounded where these two places hold a historical / heritage and natural importance |



| | | | |
|-----|--------------------|--|--|
| 10. | Natural heritage |  <p>- Tangible Heritage</p> | Kroda-Giri mountain, which is situated behind the temple, has mythological, historical, and natural importance |
| 11. | Cultural practices |  <p>- Intangible Heritage</p> | Shankar-Narayana Jaatre' is the biggest festival they celebrate every year in the January month – Makarsankranti time. Around 10,000 people visit the temple during this festival time, which is celebrated with great pomp. 'Kola – Varshika' is one another festival where we can notice the same number of floating people for the celebration. |

6.9. Data & Analysis

6.9.1. Religious & Cultural Structures of the GP

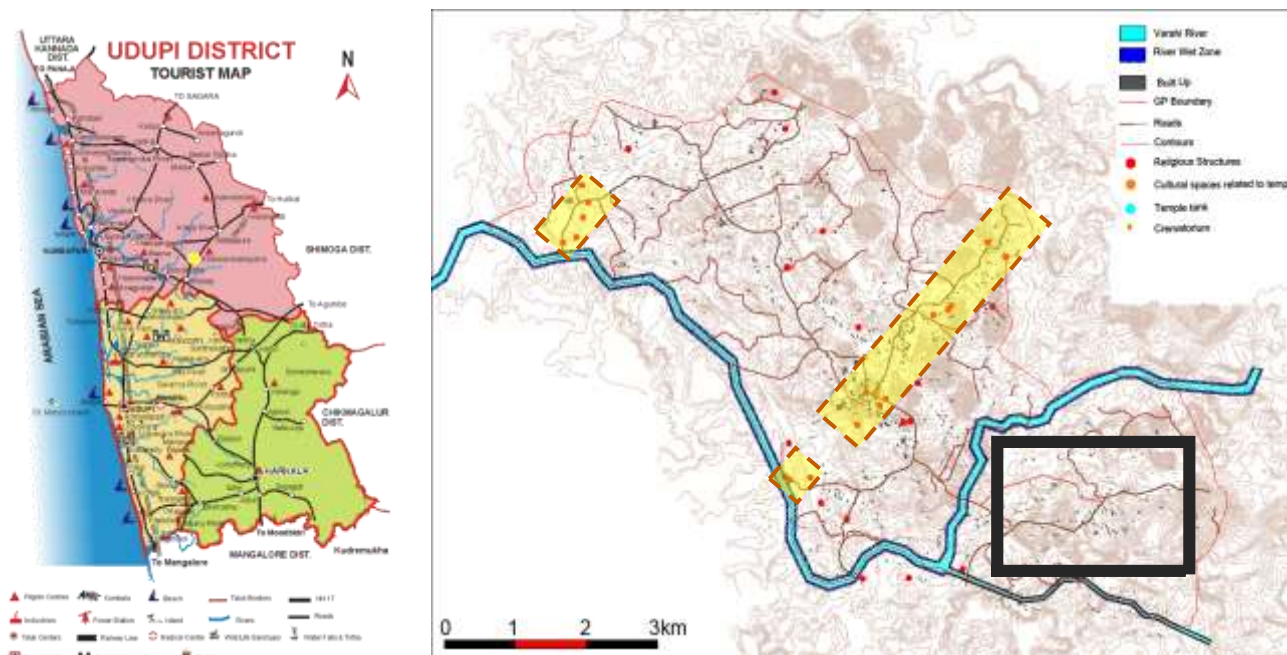


Figure 6-21 Udupi District Tourism Map Figure 6-20 Map showing Religious and cultural spaces,

Source: District Government Website

Source: Base Map – NRSC, Mapped by GP Survey Team, MSAP

In the Shankaranarayana Gram Panchayat, the data collected highlights 27 Hindu temples, temple tanks, 2 Rangamandiras where cultural activities are performed and 1 community hall for marriages and other rituals. Ward 3 hosts a crematorium of the village. The Shankaranarayana temple is a major landmark of the village. A water tank is located in the temple precinct. Other important temples include Sri Durgaparmeshwari Temple, Sri Adi krodagiri temple, Swami Naga temple, and Sri Siddhi Vinayak temple.

The following list includes religious temples observed in Shankaranarayana Gram Panchayat,

1. Shri kroda Shankaranarayana Temple
2. Amma Sabhabhavana
3. SRI Mahavishnu Temple
4. Swami Naga Temple
5. Adhi Sri Kroda Shankarnarayana Temple
6. Sri Mahaganpathi Temple
7. Sri Sambasadashiva Temple
8. Sri Venkataramana Temple
9. Nandhi chikkamma dhaivasthana yadamakki

10. Kattemakki Temple
11. Sri Marlchikku Temple
12. Halady Sri Lakshmi Narasimha Swamy Temple
13. Sri Durgaparameshwari Temple, Mundkodu
14. Sri Pathala Durgaparameshwari Temple
15. Shri Veera Kallukutika Temple
16. Abyadi Sri Mahishamardhini Temple
17. Sri Siddivinayaka temple
18. Gopalakrishna Temple
19. Naga Temple
20. Mebail Temple
21. Shree Mahalingeshwara Devasthanam
22. Shree Siddhi Vinayaka Devasthanam
23. Haiguli Temple
24. Ravu Temple
25. Bajana Mandhira, Krodabailur
26. Shri Mahishamardhini Temple. Krodha Bailoor
27. Swami Naga Temple

In the above map, the zones marked in yellow show concentration of religious and cultural spaces. They are observed in wards 1, 3, 4, 5 in Shankaranarayana and ward 1 in Kulanje respectively. However, ward 2 in Kulanje has a single temple and is without any other spaces for cultural and religious activities. This region has been demarcated with a black border in the above map.

6.9.2. Natural Elements in the Gram Panchayat

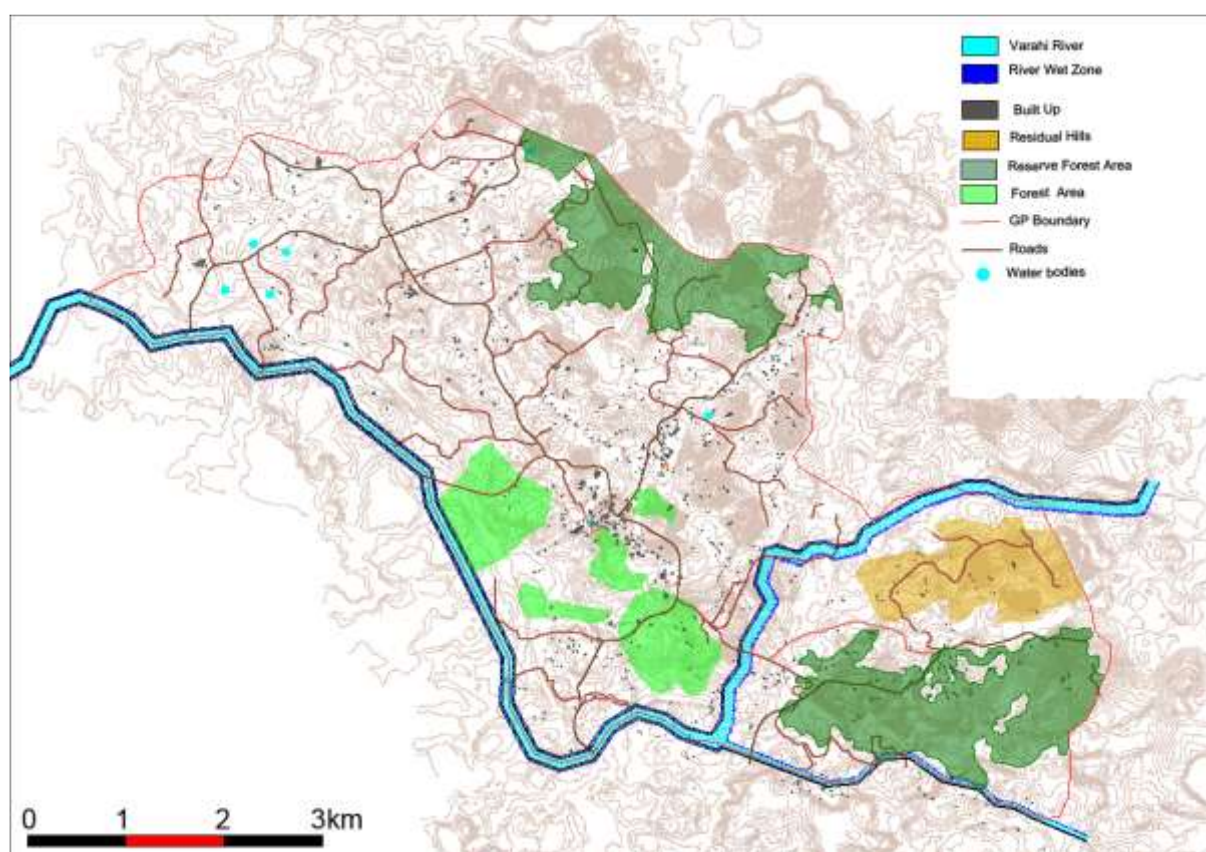


Figure 6-22 Map showing natural sites within GP, Source: Base Map – NRSC, Mapped by GP Survey Team, MSAP

The above map highlights the natural sites within Shankaranarayana Gram Panchayat. These include reserved forest areas under the central government, dense local forest, residual hills located in ward 1 of Kulanje, madagas and a temple located on the Krodhagiri hill. The residual hills cannot be used for plantation or any agriculture activities.

Madagas are ponds where traditionally rainwater was conserved for agricultural practices. It even served as drinking water sources for nearby communities.



6.9.3. Inferences

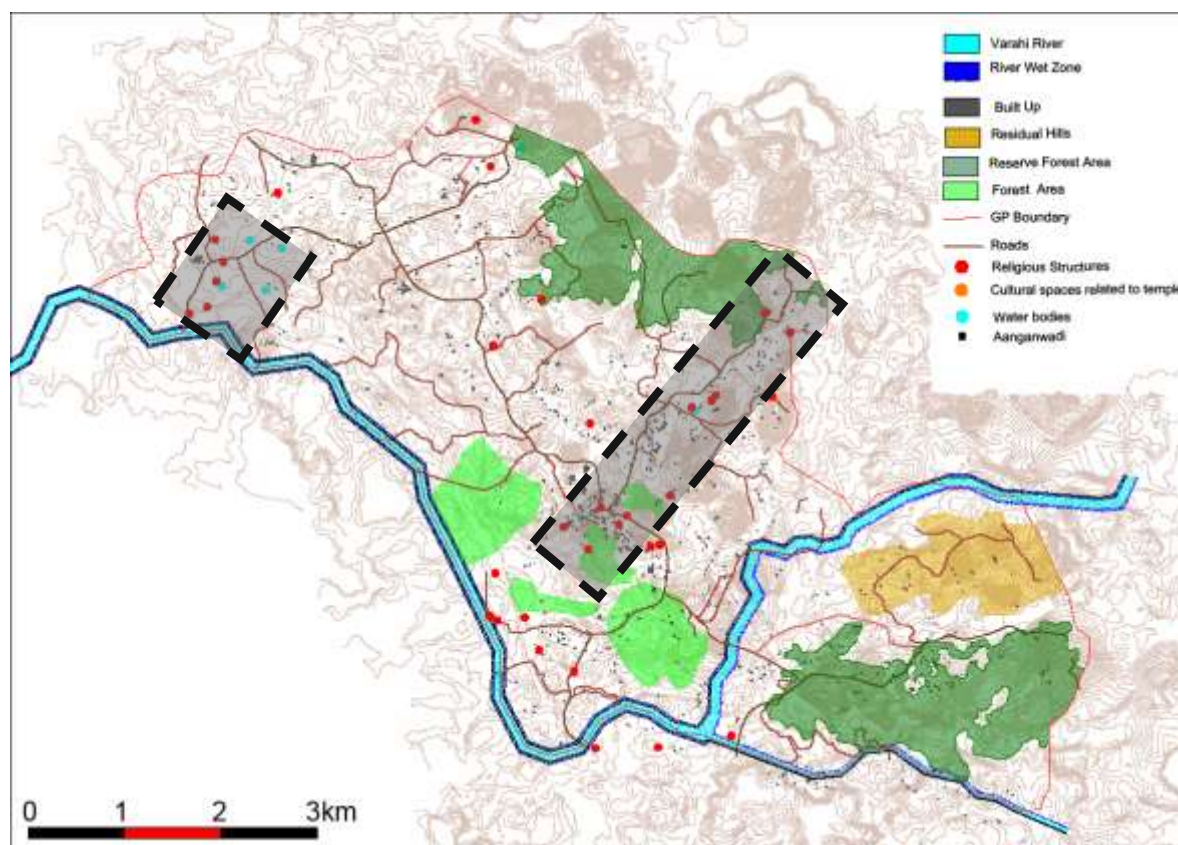
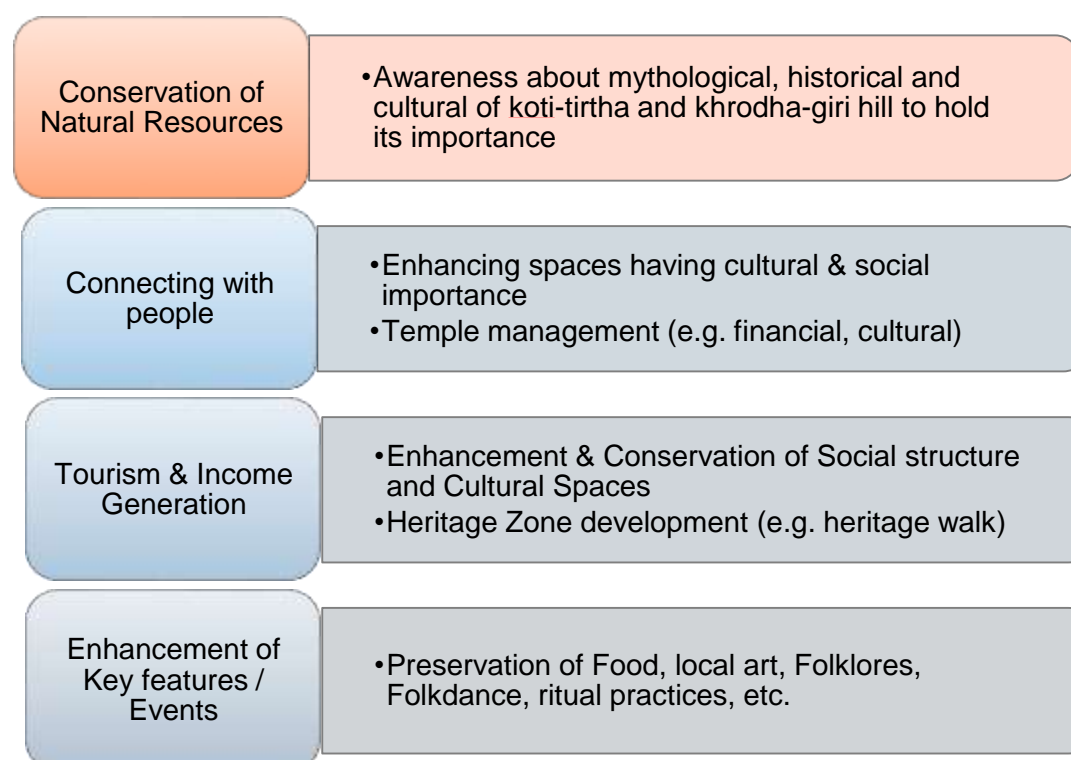


Table 6-23 Map showing densely packed area of natural and religious sites within GP, Source: Base Map – NRSC, Mapped by GP Survey Team, MSAP

The above map is an overlay of religious, culture and natural sites within Shankaranarayana Gram Panchayat. The two highlighted zones observe higher density of built up areas. Many religious and traditional structures are located along the Kundapura – Agumbe Highway in Ward no. 4; and along the bank of Varahi river. Within the village boundary two major water bodies are located, one is 'Koti-tirtha' (temple tank) and 'Bettadakera Lake'. The village is flanked with temple tanks in the east, madagas in the north and Varahi river in the south. The residual hills could be treated as a spot to appreciate sunrise/sunset in a natural trail due to its altitude potential. Beginning from Krodha Giri hill to the forest area in the North-east side of the village, has all major landmarks in a linear stretch of 5 to 7 kms.

6.10. Strategies



- **Religious and Cultural Monuments-** built area in the vicinity should be restricted to G+1 structure, use of locally available material (e.g. Mangalore tile roofing) to be encouraged, no hoardings to be allowed in heritage zone.

- **Heritage as a tool for development and employment generation-** Maximum visitors come to the temple during *Jaatre*, so a zone can be defined where temporal structures can be proposed for vending activity and during regular days it can be an open space for gathering.
- Signage and Information Board for directions to heritage zones should be proposed. Material that can be used is stone, tile or wooden board.
- Mythological stories could be depicted on walls of temple area or near the ceremonial route by wall murals or painting. This would also uplift image of the village.
- Additions of street furniture, pavement material, lighting, etc. can add to the experience and appreciation of the heritage.
- Adaptive re-use of the residence of Brahmin family and sub-registrar office. This is an effective strategy to conserve architectural heritage, particularly by retaining these built structures as museum or interpretation centers to enhance the village Identity.



7. Socio-economic-political structure- Desa

7.1. Demographic Study

The Udupi District contributes to 1.93% of the total Karnataka's (state) population and is one of the key economy contributor to the GSDP (Gross State Domestic Product) The figure 6.1 shows the Taluk Wise Population Growth rate in the District from 1991-2011. It can be observed that the total population at both District and Taluk level is increasing with lower decadal growth rate as compared to census (1991-2001). 1.29% at the Udupi district level, 0.4% at the Udupi Taluk level, 1.75% at the Kundapura Taluk level and 2.73% at the Karkala Taluk level.

A negative graph can be observed in figure 6.2 showing taluk wise Rural population growth in the Udupi District level (-6.91%) as well as in the Udupi Taluk level (-19.78%) whereas there has only been a slight increase in the growth rate of 2.57% & 1.62% in Kundapura and Karkala Taluk respectively. Although by comparing the total number of rural and urban population, it can be seen that the district houses more rural population than urban, but the negative growth rate indicates the probability of rural to urban migration. This could be for various reasons like better economic opportunities, health and education facilities.

In the figure 6.3 showing Taluk Wise Urban Population growth in the district, the growth rate seems to be tremendously high when compared to the rural population growth, again only to further prove the phenomenon of rural to urban migration and need for improving socio-economic aspects of the rural sectors.

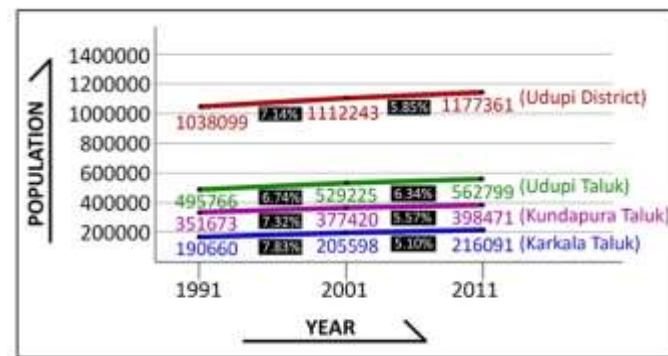


Figure 7-1 Graph Showing Taluk wise Population growth in the District (1991-2011)

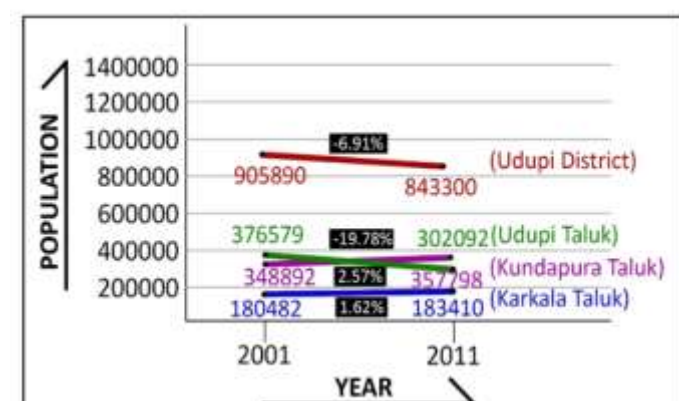


Figure 7-2 Graph Showing Taluk wise Rural Population growth in the District (1991-2011)

7.1.1. The Demography is studied under three levels

i. Macro level – At the Udupi District scale

The total population of Udupi District as per census 2011 is 11,77,361 of which 5,62,131 are Male population and 6,15,230 are female population. The percentage of population living in Rural areas is 71.63% and the percentage of population living in Urban areas is 28.37%. The average density of Population is 329 persons per sq.km. The literacy rate is 86.24% and ranks top 3rd in the state. The percentage of working population is 43.59% while that of non-working population is 56.41% which brings in the scope for employment opportunities, entrepreneurship, self-employment to improve income generation. There is need for women empowerment and facilitation of schemes as only 28.91% of working population are women. The Economic Profile of the district shows the majority as other workers (73.28%) followed by agricultural laborers (12.35%) followed by cultivators (12.3%) and the least involved in household industry (2.06%)

ii. Mid-level – At the Kundapura Taluk scale

The total population of Kundapura Taluk as per census 2011 is 3,98,471 of which the majority i.e. 3,57,798 live in rural areas and 40,673 of the total population lives in urban area. The percentage of Population living in Rural areas is 89.79% and the percentage of population living in Urban areas is 10.2%. Although the decadal growth rate is higher in urban areas (42.26%) compared to the decadal growth rate in rural areas (2.57%). The total number of inhabited villages in the taluk is 98. The literacy rate at Kundapura taluk level is 81.63% with a gap in male female literacy rate of 13%. The

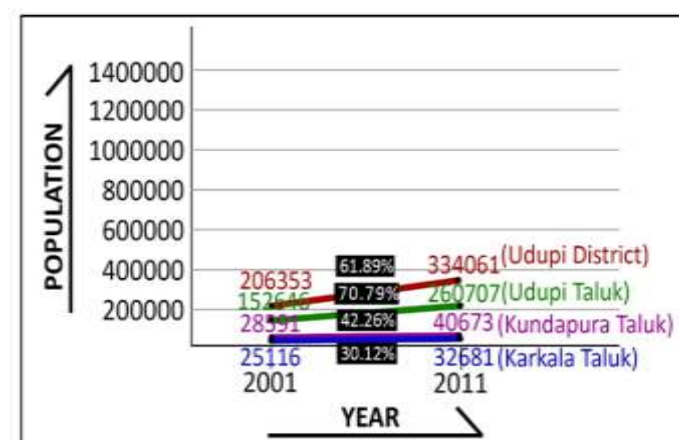


Figure 7-3 Graph Showing Taluk wise Urban Population growth in the District (1991-2011)

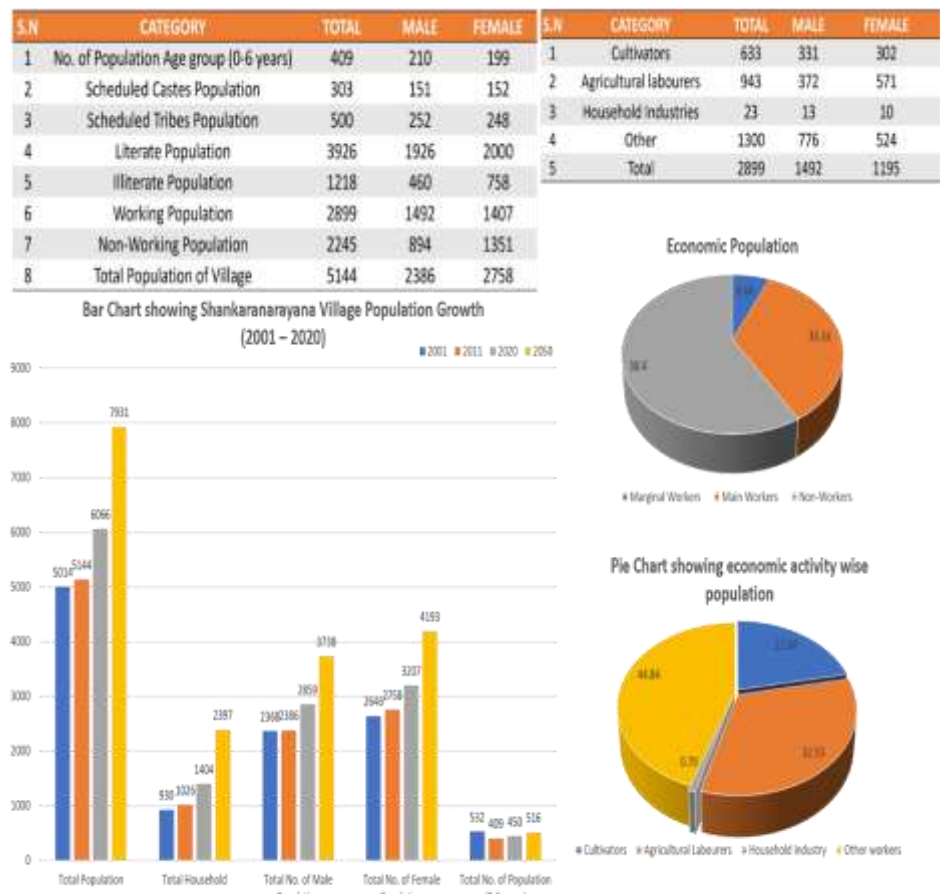


Figure 7-5 Graph Showing demographic division of Shankaranarayana village (Source: Office records of GP)

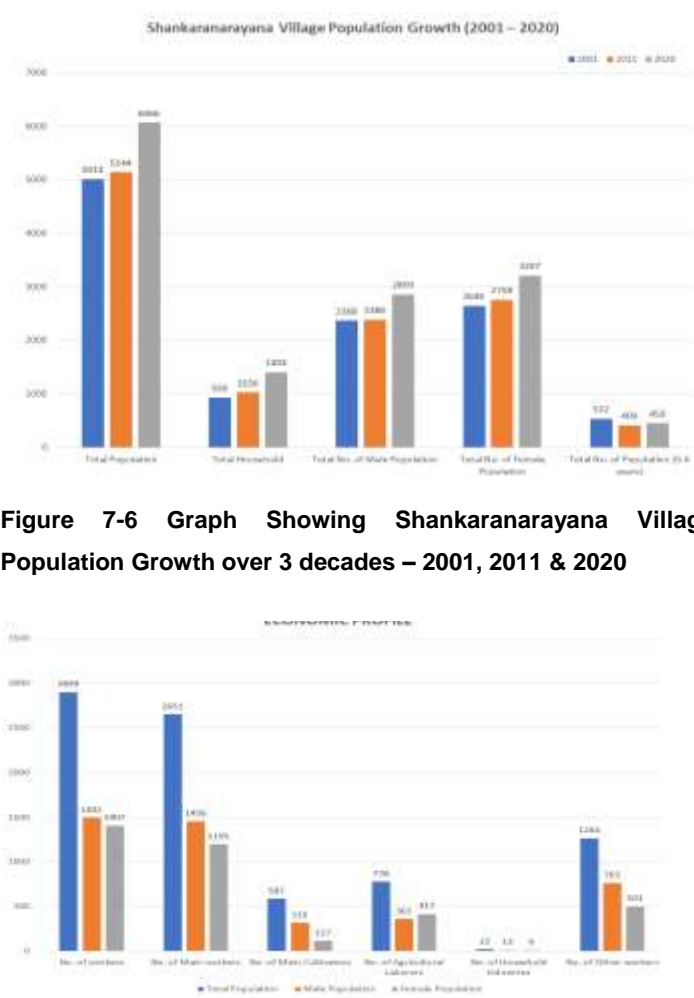


Figure 7-6 Graph Showing Shankaranarayana Village Population Growth over 3 decades – 2001, 2011 & 2020

Figure 7-4 Graph Showing the gender wise economic profile of Shankaranarayana village (Source: Office records of GP)

percentage of non-working population is 58.4%, the percentage of main workers is 35.16% and the percentage of marginal workers is 6.44%. The Economic Profile of the taluk shows the majority as other workers (63.88%), followed by Agricultural laborers (18.72%), followed by cultivators (15.83%) and the least involved in household industry (1.57%). The percentage of male population is 47.08% and female population is 52.92%. The total percentage of working population at Taluk level is 41.6% of which 66.86% is male population and only 33.14% female population that are employed suggesting the need to provide more economic opportunities for women empowerment.

iii. Micro level – At the Gram Panchayat scale

The two villages governed under Shankaranarayana GP are Shankaranarayana Village & Kline Village having total recorded population 8194 as of 2020, where 4313 is Female population and 3880 is male population. The total number of 1845 households is spread across a geographical area of 3753.18 hectares.

7.2. The Demographic division of Shankarnarayana Village

The total population being 5144 (male 2386 & Female 2758) with 41.6% being working population and 58.4% is non-working population (Census 2011). Growth rate calculated from 2001-2011 is 2.59% and the population growth rate from 2011-2020 is 17.92%, where the average population growth rate can be calculated – 10.25% as shown in figure 6.4. The Population can be projected for the next 30 years using the average growth rate of two decades which is 7931 by the year 2050. The geographical area of the village is 2312.48 Ha. With a total number of households of 1026 as per 2011 census and 1404 as per 2020 panchayat records. The Literacy rate is 76.32% where 49.06% are Male and 50.94% are female.



7.2.1. The classification of working population in Shankarnarayana village.

The major working population in Shankarnarayana village is engaged in various other means of employment 47.68% and the next large portion of main workers which is nearly 29.35% are engaged in Agriculture. The need for economic upliftment can be understood by analyzing the share of marginal workers engaged in agricultural activity 66.53% who remain unemployed for more than 6 months in a year. This indicates the need for Skill development to promote employment to improve income generation amongst these people. (Figure 7.7).

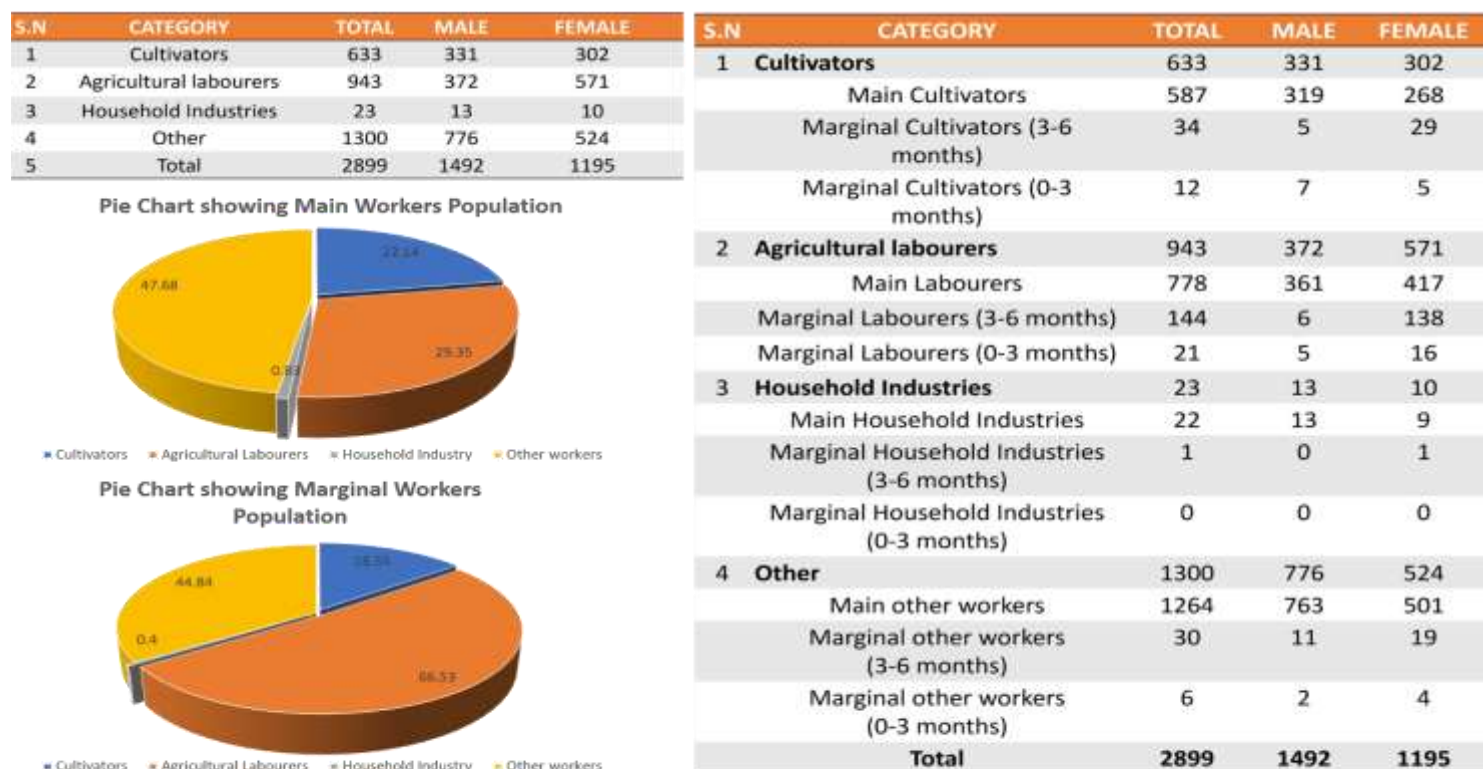


Figure 7-7 Graph Showing economic division in Shankarnarayana village (Source: Office records of GP)

7.2.2. The Socio-Economic infrastructure in Shankarnarayana village.

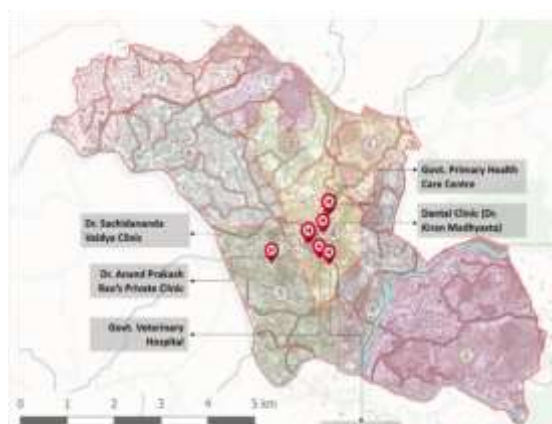


Figure 7-8 Map showing the Health Care Facilities located in the GP (Source: Base data – NRSC)

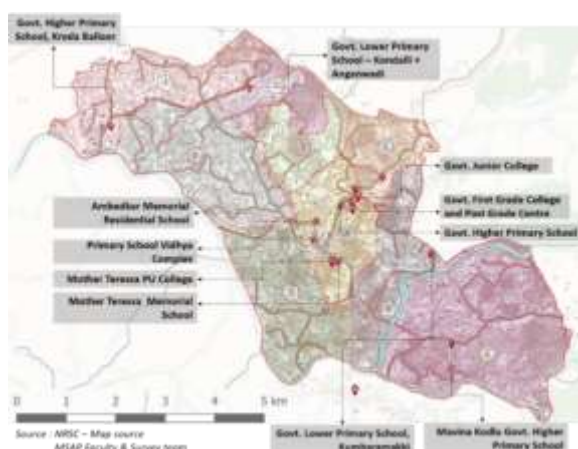


Figure 7-9 Map showing the Education Facilities located in the GP (Source: Base data – NRSC)

| PARAMETERS | Numbers & Approx. distance of facility |
|--|--|
| Education Facilities | 15 |
| Pre-Primary Private school | 1 |
| Govt. Primary school | 5 |
| Private Primary school | 1 |
| Govt. Middle School | 2 |
| Private Middle School | 1 |
| Govt. Secondary school | 1 |
| Private Secondary school | 1 |
| Govt. Senior secondary school | 1 |
| Private Senior secondary school | 1 |
| Govt. Arts & Science Degree college | 1 |
| The nearest facilities that are not available within the village | 10+km away, Udupi |
| Pre-Primary Private school | 1 |
| Health Care facilities | 6 |
| Primary Health Care Centre | 1 |
| Primary Health Sub- Centre | 1 |
| Maternity & Child welfare Centre | 1 |
| TB Clinic | 1 |
| Veterinary Hospital | 1 |
| Family Welfare Centre | 1 |
| The nearest facilities that are not available within the village | 10+km away, Udupi, Kundapura |

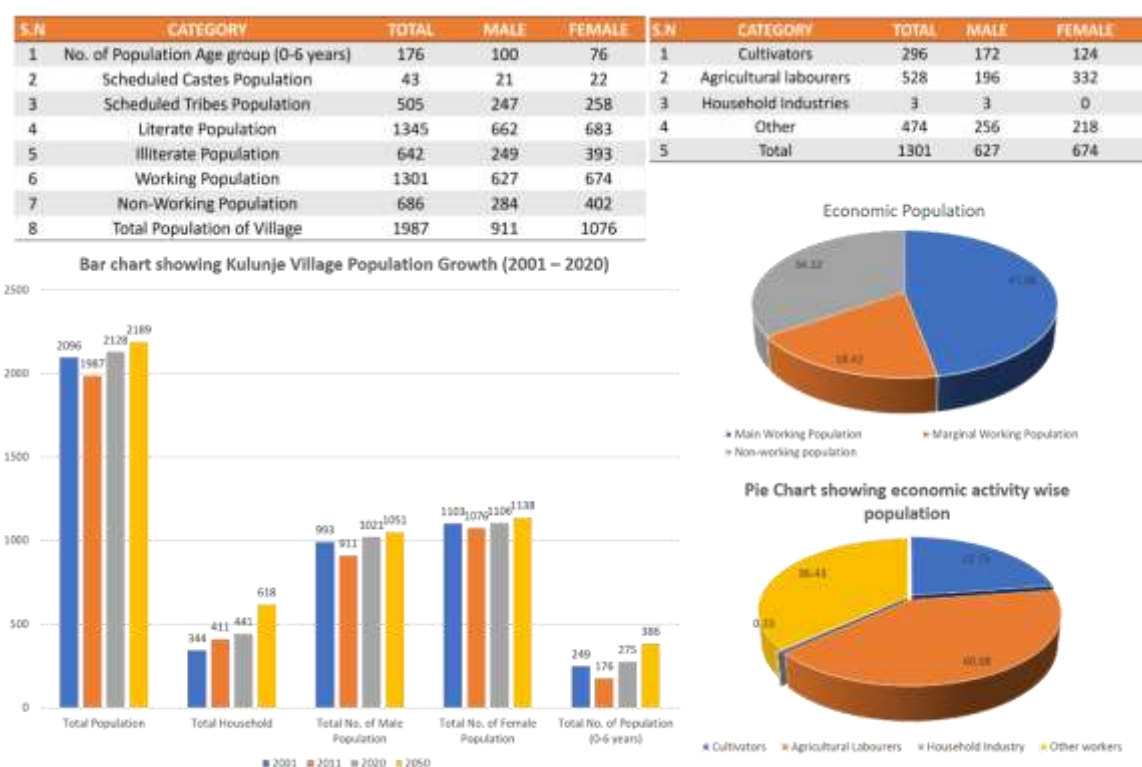


Figure 7-10 Graph Showing demographic division of Shankaranarayana village (Source: Office records of GP)

The total population being 1987 (male 911 & Female 1076) with 65.48% being working population and 34.52% is non-working population (Census 2011) which is far lesser when compared to Shankarnarayana village. The Growth rate calculated from 2001-2011 is -5.2% and the population growth rate from 2011-2020 is 7.10%, where the average population growth rate can be calculated - 0.95 %. The Population can be projected for the next 30 years using the average growth rate of two decades which is 2189 by the year 2050. The geographical area of the village is 1440.7 Ha. With a total number of households of 411 as per 2011 census and 441 as per 2020 panchayat records. The Literacy rate is 67.69% where 49.22% are Male and 50.78% are female. (figure 7.10). Kulunje village exhibits self-motivated interest towards progressive growth with higher literacy rate, lesser non-working population and higher rural to urban migration. Which can be encouraged towards leadership and entrepreneurial growth to achieve better economic development.

7.3.1. The classification of working population in Kulunje village.

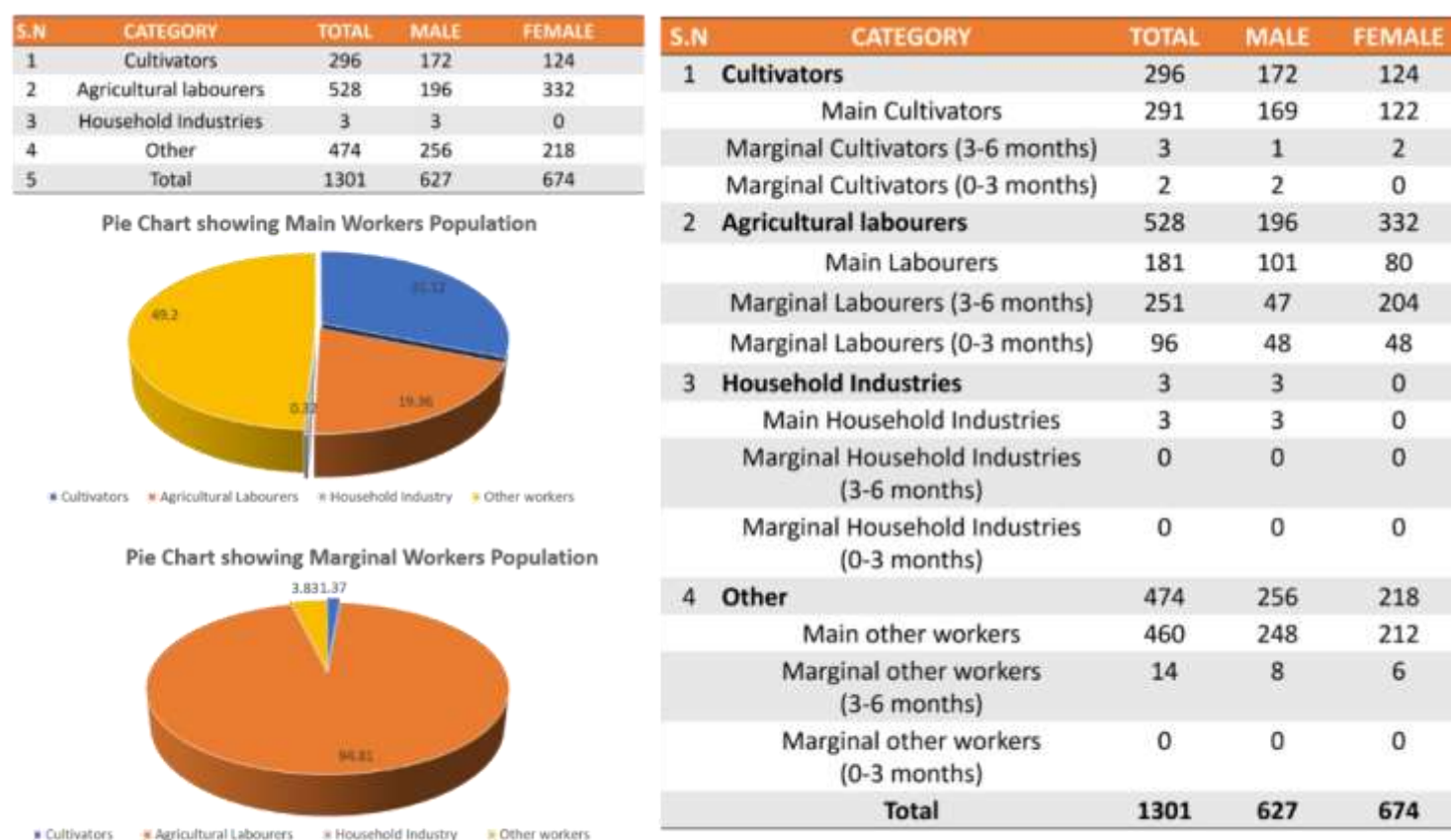


Figure 7-11 Graph Showing economic division in Kulunje village (Source: Office records of

The major working population in Kulunje village is engaged in various other means of employment 49.2% and the next large portion of main workers which is nearly 31.12% are engaged in Agriculture. The need for economic development can be understood by analyzing the share of marginal workers engaged in agricultural activity 94.81% who remain



unemployed for more than 6 months in a year. This indicates the need for Skill development to promote employment to improve income generation amongst these people. (Figure 7.11).

7.3.2. The Socio-Economic infrastructure in Kulunje village.

Table 7-2 Showing the number of Education and Health care facilities available within Kulunje village – Census 2011

| PARAMETERS | Numbers & Approx. distance to the facility |
|---|--|
| Education Facilities | |
| Govt. Primary School | 3 |
| Govt. Middle School | 2 |
| The nearest facilities that are not available within the village is 5-10km away | Shankaranarayana & Hosangadi, 10+km away, Udupi & Kundapura, Ampar |
| Govt. Primary School | 3 |
| Govt. Middle School | 2 |
| The nearest facilities that are not available within the village is 5-10km away | Shankaranarayana & Hosangadi, 10+km away, Udupi & Kundapura, Ampar |
| Health Care Facilities | |
| Primary Health Sub-center | 1 |
| Family welfare center | 1 |
| The nearest facilities that are not available within the village is 5-10km away | Shankaranarayana & Hosangadi, 10+km away, Udupi & Kundapura, Ampar |

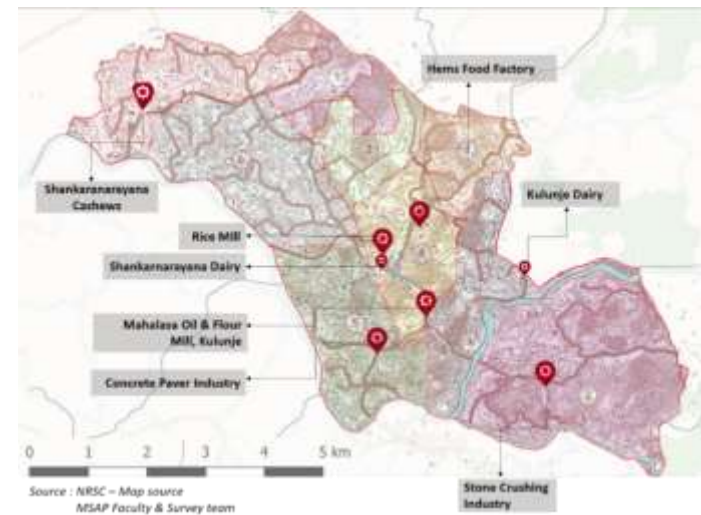


Figure 7-12 Map showing the Economic Facilities & opportunities located in the GP (Source: Base data – NRSC)

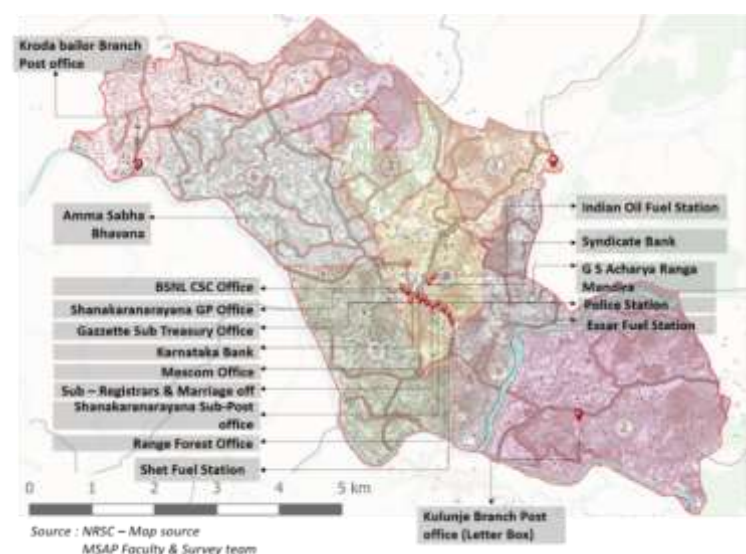


Figure 7-13 Map showing the Economic Facilities & opportunities located in the GP (Source: Base data – NRSC)

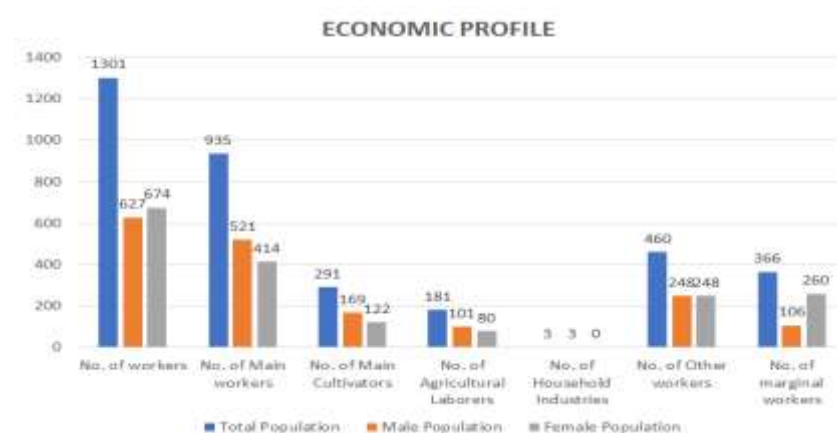


Figure 7-14 Graph Showing the gender wise economic profile of Kulunje village, (Source: Office records of GP)

Analysis:

- No opportunity for employment other than primary sector, hence almost half the population is non-working.
- Irregular income
- More engagement in informal sector.
- Less opportunity to retain people with high education qualification

Inferences on current Socio-Economic scenario –

- The Administrative and Commercial Centre of the village is in Ward 4 of Shanakaranarayana village.
- Lack of centralized data capturing and assessment at Panchayat level

- Lack of Digital Sava Service, the residents have to travel to Siddapura, Kundapura and Baindoor for any Govt. related work.
- Any agricultural related products if required. residents have to travel to Siddapura or Kundapura.
- Lack of Godowns and Silos in the Panchayat makes it difficult to store the harvest.

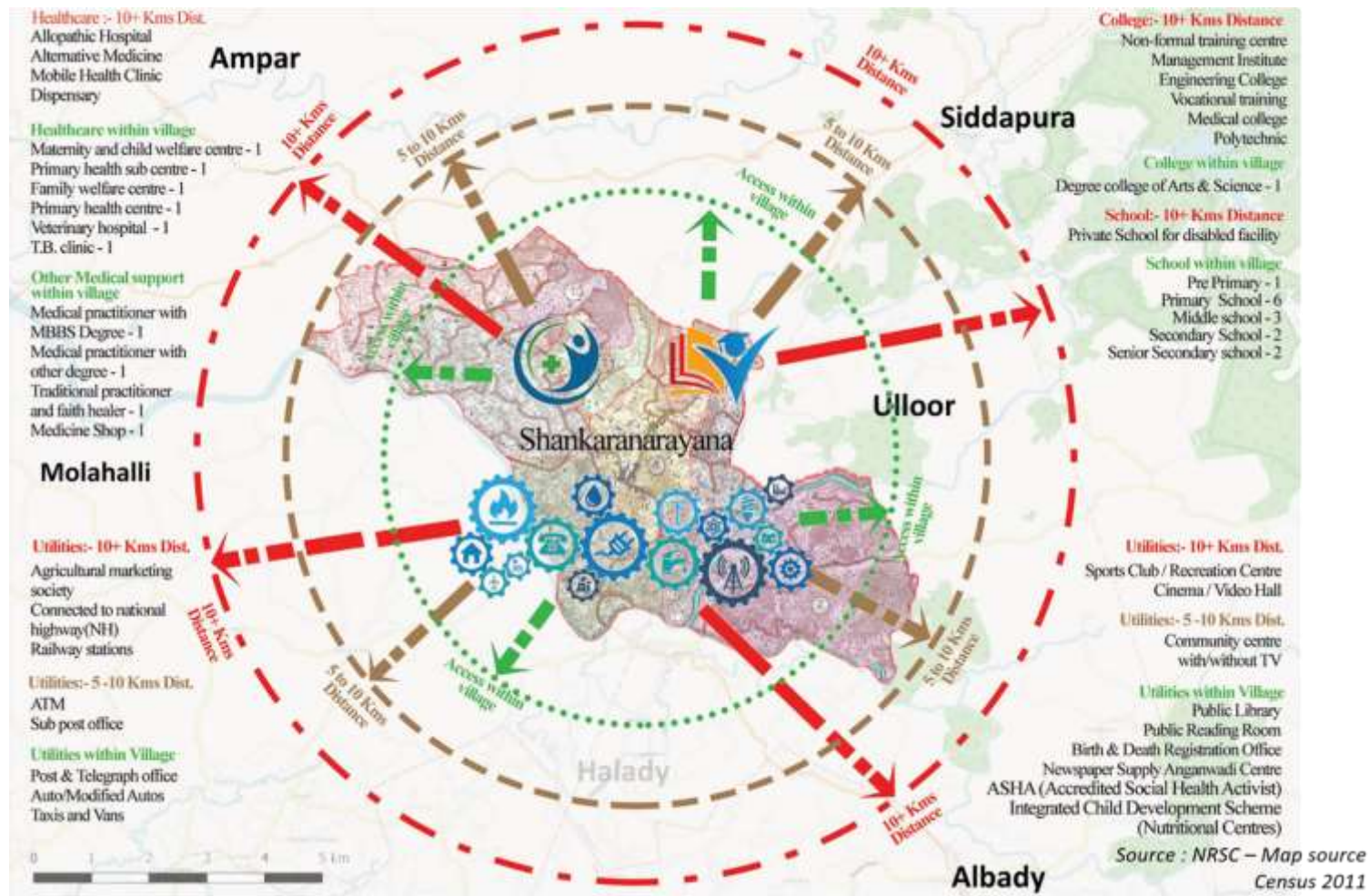


Figure 7-15 Map showing influences and dependency in Shankarnarayana GP

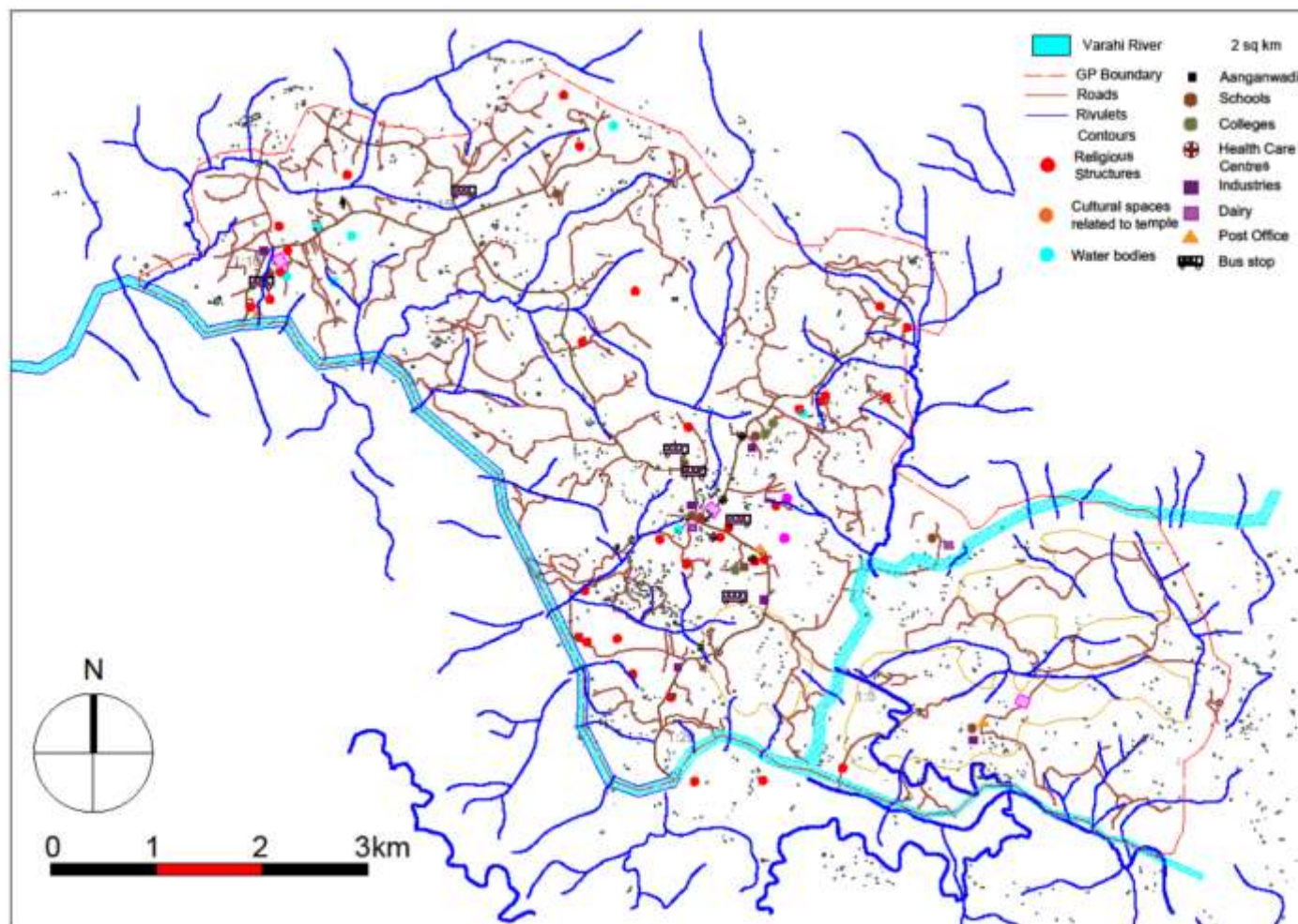


Figure 7-16 Map showing the drainage pattern with infrastructure of Shankarnarayana GP

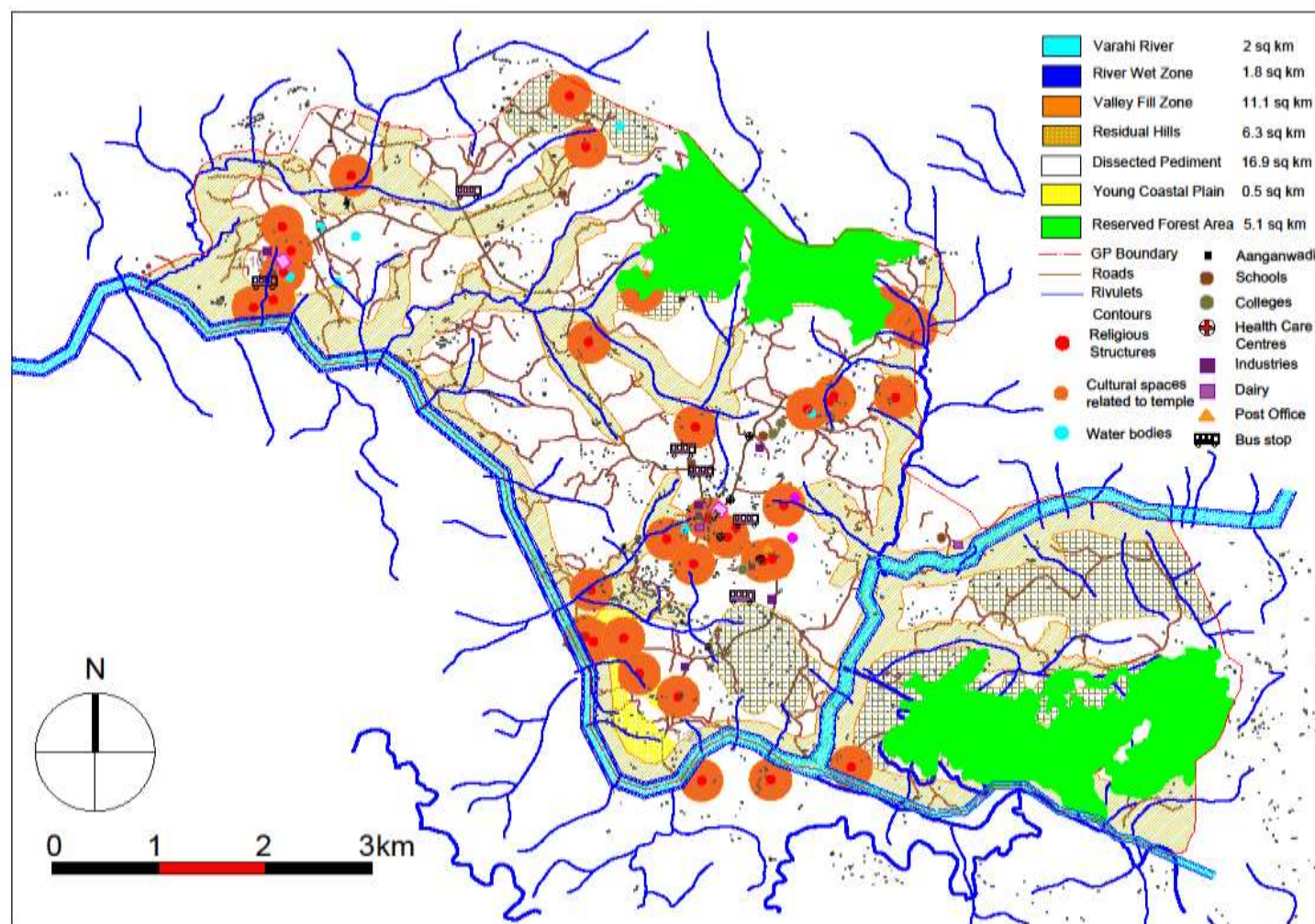


Figure 7-17 Map showing the Natural Composite map along with the Social Infrastructure.

7.4. Household Survey and Inferences

In the given Figure 7.16, showing map of the GP ward boundaries along with the HH survey conducted is marked in pink. Enough household survey was conducted for each of the wards to understand the existing issues of each of the wards and address them accordingly

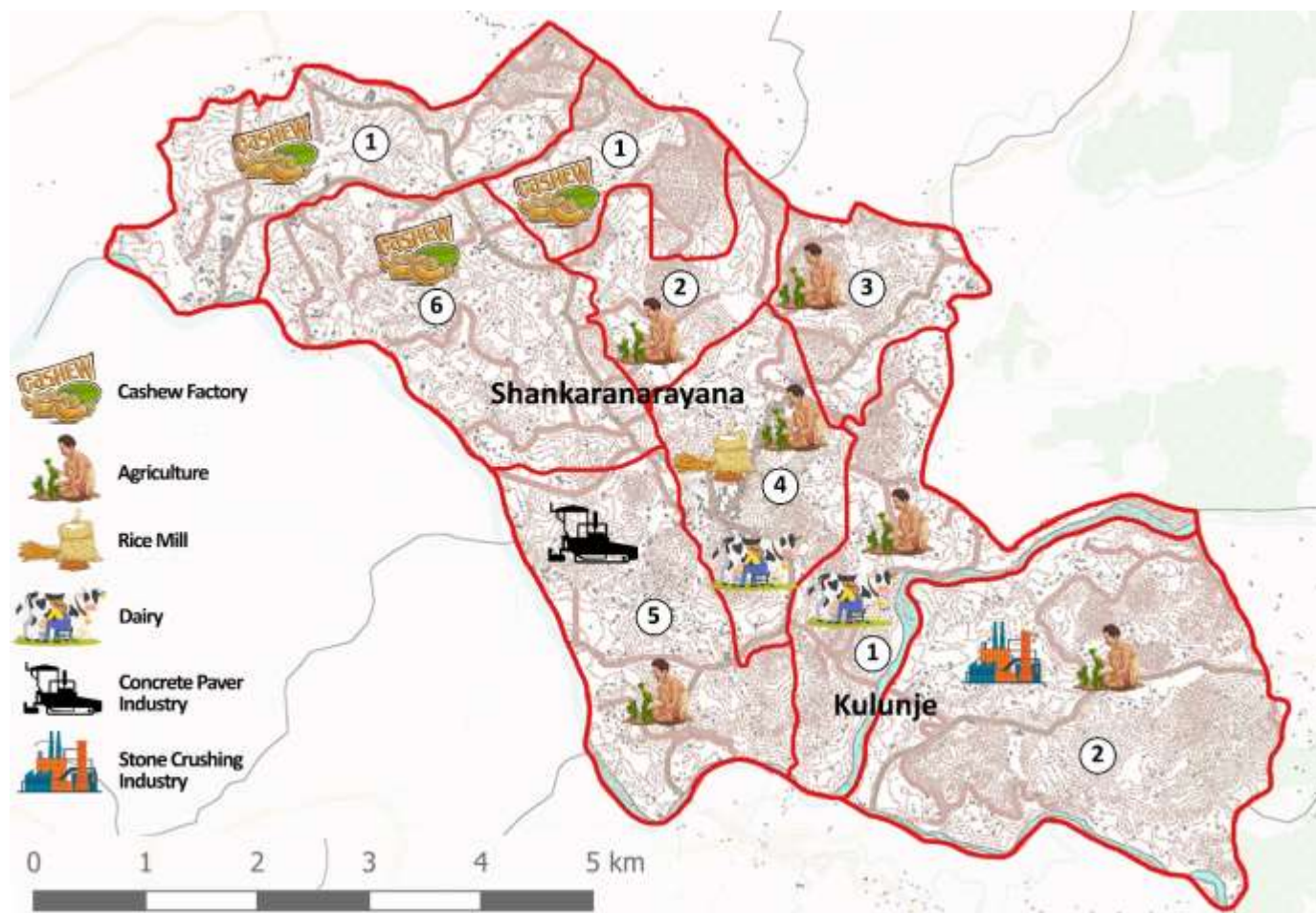


Figure 7-18 Map Showing GP Ward boundaries and HH Survey locations

WARD WISE OCCUPATION

Shankaranarayana Village -

Ward 1 -Shankaranarayana Cashew Factory

Ward 2 - 33% Households involved in Agriculture

Ward 3 - Commercial center 6% Households involved in Agriculture

Ward 4 - Commercial center, Rice Mill, Shankaranarayana Dairy, Hems Food Factory, 7% Households involved in Agriculture

Ward 5 - Concrete Paver Industry, 39% Households involved in Agriculture

Kulunje Village -

Ward 1 -Kulunje Dairy, Mahalasa Oil & Flour Mill, 52% involved in Agriculture

Ward 2 -Stone Crushing Industry, 75% Households involved in Agriculture



Figure 7-19 Pie chart showing ratio of BPL card holders and Non-BPL card holders

A Household survey was conducted, 30 households in Shankaranarayana ward 1, 69 households in Shankaranarayana ward 2, 87 households in Shankaranarayana ward 3, 82 households in Shankaranarayana ward 4, 13 households in Shankaranarayana ward 5 and 63 households in Kulunje ward 2. From the sample survey, the Household size varies from 1 person per house to 11 people per house and the ratio of female population is higher by 5.45%. The percentage of BPL card holders is 78% whereas the remaining 22% are non-BPL card holders as shown in Fig 7.17. Many of the household's own ration cards.

From the Fig 7.18. map, it is clear that the majority of the households are involved in the primary sector (agriculture), scope for other possible income generating activities can be derived from the existing resources. Few of the households carry out farming (cattle and poultry) activities as well, these can be enhanced further by providing enough land to carry out these activities.

Due to the terrain as shown in Fig. 7.19, setting up large scale industries is not an option, as bigger footprints

cannot be constructed here, hence there is a need to enhance the rural-rural linkage. The Nearby Villages are; Siddapura, Ampar, Balkur and Albady

In all of these villages, cashew industries are present where people can go to for work, hence there is a need to improve public transport and infrastructure towards these villages. Another option would be to promote interaction between both villages at the collection zone, where markets can be set up and would prove beneficial to both villages.

Marketing Channels – Rural primary markets, Assembly markets, Wholesale markets, Retail Markets

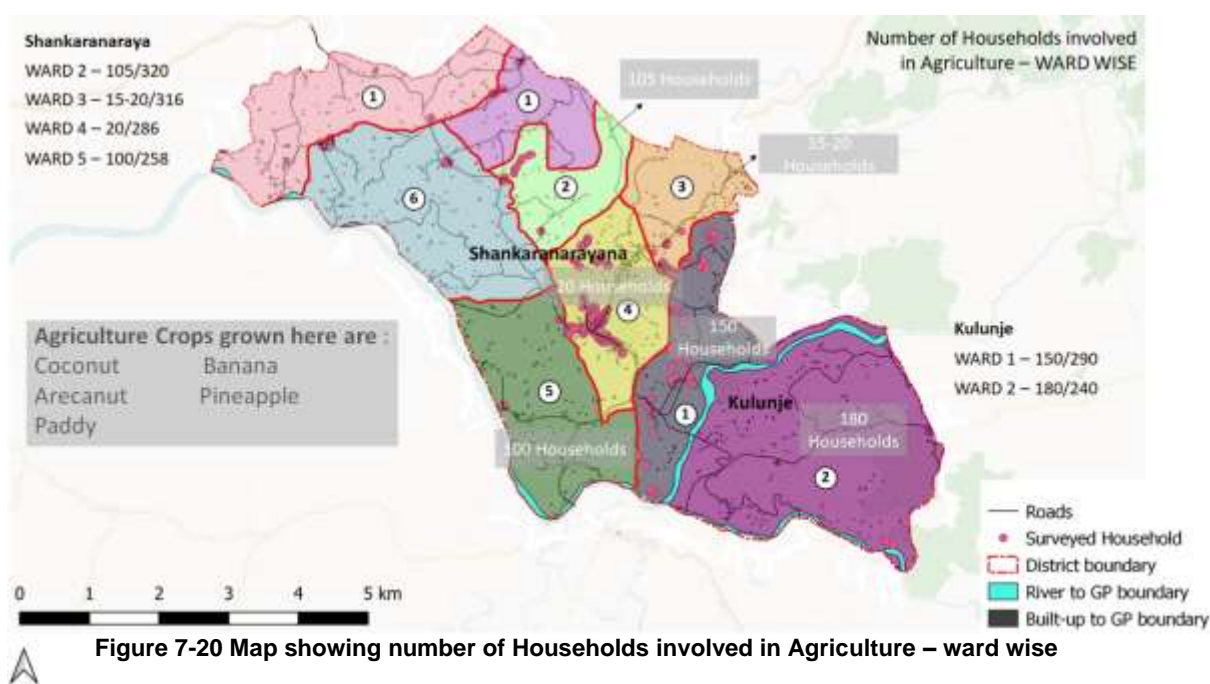


Figure 7-20 Map showing number of Households involved in Agriculture – ward wise

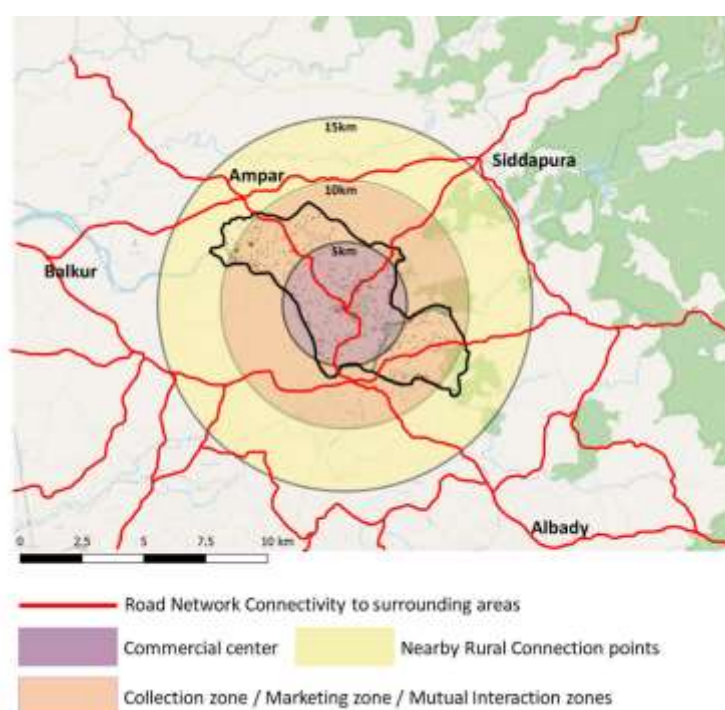


Figure 7-21 Map showing proximity to economically dependent villages

7.5. Policies and Way Forward



7.5.1. Skill Development Mission Policy for Karnataka

The policy on skill development in Karnataka will primarily focus on youth in the age group of 16 to 35 years. The target group of youth in the age group of 16-35 years will consist of i) Students completing secondary or higher secondary education and interested in the acquisition of skills in the technical or non-technical trades through ITIs, Polytechnics and other formal institutions. ii) Dropouts from the school without completing secondary education, who are interested in acquiring skills in the technical or non-technical trades through informal institutions. iii) Unorganized workers interested in acquiring new skills, re-skilling or up-skilling through formal or informal institutions depending on educational qualification. iv) Organized workers interested in re-skilling and up-skilling for new or better employment.

7.5.2. Gram Panchayat Skill Mission

The Gram Panchayat Skill Mission will be constituted under the Chairpersonship of the Adhyaksha of the Gram Panchayat. The Village level/ Sub Taluk level officers of concerned Departments will be members of the Mission. The Panchayat Development Officer, Gram Panchayat of the concerned Gram Panchayat will be the Member Secretary. A District level officer will be nominated by the District Commissioner to facilitate the functioning of the Gram Panchayat Skill mission as per the guidance of the District Commissioner. The main Functions of the Gram Panchayat Skill Mission are: i) Planning, Monitoring, implementation of the Skill Development, Entrepreneurship and Livelihood activities at Village level. ii) Establishment of Backward-Forward linkages. iii) Inter Departmental Coordination. iv) Selection of beneficiary of various schemes and maintenance of unified database v) Any other subject pertaining to Skill Development, Entrepreneurship and Livelihood Department assigned by the Karnataka Skill Mission and District Skill Mission of the concerned District.

7.5.3. National Rural Livelihood Mission

National Rural Livelihood Mission (NRLM) is a poverty alleviation project implemented by Ministry of Rural Development, Government of India. This scheme is focused on promoting self-employment and organization of rural poor. The basic idea behind this Programme is to organize the poor into SHG (Self Help Groups) groups and make them capable for self-employment. In 1999 after restructuring Integrated Rural Development Programme (IRDP), Ministry of Rural Development (MoRD) launched Swarnajayanti Grameen Swarojgar Yojana (SGSY) to focus on promoting self-employment among rural poor. SGSY is now remodeled to form NRLM thereby plugging the shortfalls of SGSY Programme

7.5.4. Training of Rural Youth for Self-Employment (TRYSEM)

The Programme is in vogue since 1979. Its main thrust is on equipping rural youth in the age group of 18-35 years with marketable skills and technology to take up vocations of self-employment in agriculture and allied activities, industry, services and business. The other objectives of this Programme are: i) to achieve an overall socio-economic improvement in the rural areas. ii) To provide modern facilities and technical know-how in order to increase the production and per capita income. iii) On an average 3,00,000 rural youths are trained every year. On completion of training, the TRYSEM beneficiaries are assisted under the IRDP

7.5.5. Role of TVET in Rural Development

TVET (Technical and Vocational Education and Training) is essential for development of skilled human resource. So far, TVET has played subdued role in rural development because of the low educational status of rural population. However, the TRYSEM Programme which is an important training programmer for inducting rural youth to viable self or wage employment ventures has been revamped. It is now provided in recognized institutions like Industrial Training Institutions, Farm Science Centres, Polytechnics, etc. In addition, there are several other organizations and agencies which organize short and long duration training programs for upgrading the skills. Some of these agencies are: Non-Government Organizations, Schools in rural areas offering vocational courses, State Government Departments like Agriculture, Horticulture,

Sericulture, Animal Husbandry and Dairying, Fisheries, Social Welfare, Health and Family Welfare, Product-wise Boards such as Coffee, Tea, and Cashew nut, Horticulture, Khadi and Village Industries Commission

7.5.6. Key areas to be taken care for Gram Panchayat Development

i) Formation of institution like labor banks self-help group and farmer's producer organization ii) Increased local consumption of locality produced and value added products iii) Initiating and developing handholding of individual/group enterprises and promoting local small scale start-ups iv) Special focus on Health care, Education, Skill development & promoting local production v) Special focus on policies and schemes related to gram panchayat or rural development

7.5.7. Special focus on Gram panchayat local economic development plan

i) Maximized production and employment opportunities through agriculture, animal husbandry and by adoption of best technologies and practices. ii) Assured employment opportunities for all households in the village. iii) Ensuring equitable wages for men and women, zero child labor. iv) Employment opportunities for persons with disabilities.

7.6. Strategies for skill development/ Vocational Training center at Shankaranarayana GP.

7.6.1. Data Capturing

i) Capture the Economical profile of Shankarnarayana and Kulanje to identify the Working, Non-Working and Marginal Working population of the GP, ii) Record the education profile, and Type of work and available employment opportunities within the Gram Panchayat in Shankarnarayana Informal sectors like Cashew Factory, Food processing unit, Coolies. Tailoring, welding, Farm sectors including agriculture and animal husbandry were found. In Kulanje Informal sectors like Coolies, Tailoring, welding, etc. Farm sectors including agriculture and animal husbandry, Fish Farming - only one practice found in this village

7.6.2. Gap Identification

i) identify the informal working population with level of skill in all the sector ii) Categories the Informal sector to value the skill 1. Small or micro enterprise, 2. Household based sector, 3. Independent service sector iii) Occupational distribution of youth (16 to 35 years) iv) Formal and informal employment among youth Labour force participation within the GP. v) Demand and supply of skilled workforce within the GP vi) Track Language known and the level of educational qualification among informal sector

7.6.3. Facilitate Formal Sector & Integrate Informal Sector

i) Provision for E-learning Platform for both Formal & Informal sector to encourage E-learning & E-Working. ii) Identify potential and early stage entrepreneurs within the GP and encourage entrepreneurs with the help of ICT. iii) Establish E-governance & E-management for panchayat with the help of ICT. iv) Digitalization of panchayat with the help of government and private bodies to developed a comprehensive digital environment

7.6.4. Facilities for Shankaranarayana & Kulunje

i) Internet facility with the help of ICT. ii) E- Platform in local language. iii) Integrated digital platform for panchayat demography records iv) E-Trade and E-Commerce Platform. v) Online communication and information networking platform. vi) E- Governance platform to manage Govt. policies and schemes.

7.6.5. General Guidelines for Vocational Training Centre

- All the walls of workshop, classroom, Principal room, staff room, Library, store, washroom, boundary wall of Institute etc. should be plastered and colour /distemper/ whitewashed.



- The minimum size of classroom shall be 25 Sq.m. With minimum width of 3 m.
- The walls of workshop made of tin sheet are not allowed.
- The minimum height of workshop must be 10 feet (3.048 meter) for RCC roof and 12 feet (3.65 meter) for tin shed roof from lower end.
- All the door, window, ventilator, gate, grill, railing of the institute should be painted/polished.
- All built- up areas of Institute should be at least cemented/ tiled. Class rooms and Administrative areas, IT lab will be preferred flooring with tiles. The floor of workshop Institute should be at least cemented.
- Keeping in view the escalating cost of land and non-availability of required land in urban areas, metropolitan and other cities, the National Council for Vocational Training (NCVT) deliberated and approved vertical expansion, with multi storied design for workshop with a condition that trades with heavy machineries to be housed only in the ground floor and remaining trades may be housed at any floor.
- The space norm to accommodate 10 computers for 100 trainees per shift is to be 25sq.m. And 2.5sq.m. For each additional computer.
- The space for Class Room, Principal Room, Staff Room, Drawing Room, Store Room, Auditorium, Library, Dispensary, Playground, Veranda and Washing Room etc., each should be available as mentioned in proposed norms.
- Building plan shall be approved by Town Planning Department/ District Magistrate (Collector)/ Development Authority / Municipal Authority/ Any other Competent Authority as per State government / UT.
-

7.7. Information and Communication Technologies (ICT) Integration

Panchayat Raj Institutions and ICTs

Panchayat Raj Institutions (PRIs) works as a third tier of administration that incorporates Gram Panchayats as basic unit of local level governance. Gram Panchayat is designated as the corner stone of local self-governments in India.

State Data Centres (SDCs)

Under NeGP, the infrastructure is being developed to make available effective e- service delivery of i) Government to Government (G2G) ii) Government to Customer (G2C) iii) Government to Business (G2B) services. Each State Data Centre is providing Online Service Deliveries, state intranet portal, citizens information portal, secure storage of data etc., and become central repository of the State.

7.7.1. Major ICT Initiatives in India

There have been some initiatives in India, using ICT Warana Wired Village project (Maharashtra), I - Kisan project of the Nagarjuna group of companies (Andhra Pradesh), Automated Milk Collection Centres of Amul dairy cooperatives (Gujarat), Land Record Computerisation - Bhoomi (Karnataka), Computer-Aided Online Registration Department (Andhra Pradesh), Online Marketing and CAD in Northern Karnataka (Karnataka).

7.7.2. Major ICT Initiatives in India

Akshaya is a project of Kerala government to extend the benefits of new ICTs to all its citizens. It began with an e-literacy campaign & the target of teaching basic computer skills to at least one person in every family. Malappuram is India's first e-literate district. With over 600,000 individuals having basic knowledge of computers, including the Internet. This is part of the Akshaya Project to bring e-Literacy to its people. The project involves setting up around 3000 multipurpose community technology centers called Akshaya e-Kendra's across Kerala. Each e-Kendra set up within 2-3 kilometres of every household run by private entrepreneurs; cater to the requirements of around 1000-3000 families. The locations of these e-Kendra are strategically planned and spatially distributed even in the remotest part of the district to make available the power of networking and connectivity to common man. These e-Kendra's have the potential to provide G2C, G2G. And C2C. B2B and G2B services and act as decentralized information access hubs and service delivery points. A variety of corporate services like Business Process Outsourcing, hardware sales and services. Travel and tour population through e-

Kendra's. Arrangements, multimedia aided training programmes. IT enabled vocational training, product selling and financial services including rural e-banking have been made available to rural.

7.8. Intervention for Vocational/Skill and Economic Development Centre

7.8.1. Vocational & Skill Development Centre

National Skill Development Corporation

The National Skill Development Corporation India (NSDC) was set up as one of its kind, Public-Private Partnership Company with the primary mandate of catalysing the skills landscape in India. NSDC is a unique model created with a well thought through underlying philosophy based on the following pillars: (Source: NSDC draft)

1. Create: Proactively catalyse creation of large, quality vocational training institutions.
2. Fund: Reduce risk by providing patient capital. Including grants and equity.
3. Enable: the creation and sustainability of the support system required for skill development. This includes the industry-led Sector skill councils.

There are different schemes formulated for skill training which are Jan Shikshan Sansthan, Integrated Rural Development Programme (IRDP), Training Rural Youths for Self-Employment (TRYSEM), National Rural Employment Programme (NREP), Jawahar Rozgar Yojana (JRY), Pradhan Mantri Kaushal Vikas Yojana (PMKVY).

From the identified schemes Jan Shikshan Sansthan (JSS), is considered for setting up Skill Development /Vocational Training center in Shankarnarayana as a centralized training center and Pradhan Mantri Kaushal Vikas Yojana (PMKVY) is considered for setting up Skill Development/ Vocational Training center in Shankarnarayana and Kulanje as a decentralized training center.

7.8.2. Jan Shikshan Sansthan

Jan Shikshan Sansthan aims to provide vocational training to non-literates, neo-literates as well as school drop-outs in rural regions by identifying skills that have a relevant market in that region. The objective of JSS is to uplift this rural population economically by imparting essential skills training, thereby enabling local trades to grow and creating new opportunities for the natives of the region

7.8.3. Skill Development center under Pradhan Mantri Kaushal Kendra. (Decentralized Model)

I. Centre Category

| S.no | Category of Centres | District Population Range ² (for the age group of 15-35 years) | No of Districts | Minimum area proposed for each centre (in Sq.ft) |
|------|---------------------|---|-----------------|--|
| 1 | Category A | Above 4 lakh | 437 | 8,000 |
| 2 | Category B | Between 1-4 lakh | 178 | 5,000 |
| 3 | Category C | Below 1 lakh | 68 | 3,000 |

Figure 7-22 Showing category for Skill development Under PMKVY

II. Sectors & Mandate



| S. No | Sector/Mandate description | Category A | Category B | Category C |
|-------|---|------------|------------|------------|
| 1 | Minimum number of sectors | 2 | 2 | 1 |
| 2 | Minimum number of trades | 5 | 3 | 2 |
| | 2a. Minimum Manufacturing trades | 2 | 1 | 1 |
| 3 | Minimum annual mandate under PMKVY/other schemes under MSDE | 1000 | 750 | 500 |

Figure 7-23 Showing Sector & Mandate for Skill development Under PMKVY

7.8.4. Guidelines for Setting up a skill development center under Pradhan Mantri Kaushal Kendra

| S.no | Attribute | Parameter | Conditionality | Remarks |
|------|---|--|----------------|--|
| 1 | Size of Centre | Category A – Minimum. 8000 Sq. ft Category B – Minimum. 5000 Sq. ft Category C – Minimum. 3000 Sq. ft | Mandatory | |
| 2 | Ownership | Yes/No | Desired | |
| 3 | Lease/Rental/Maintenance Agreement Terms | Registered Rent Agreement for 3 years OR Lease agreement for a period of 11 months along with an undertaking to renew the lease at the end of every 11 months, during the period of three years. | Mandatory | Applicable to all leased or rented centers |
| 4 | Open Area (Area other than built area within boundary wall) | Category A – Minimum. 800 Sq. ft Category B – Minimum. 500 Sq. ft Category C – Minimum. 300 Sq. ft | Desired | |
| 5 | Parking | 10 two-wheelers, Cycle stand | Desired | |
| 6 | Approach | Located near (at walking distance) from a major approach road (highway/main market road) Conveniently close to public transport facility (Bus stand/Railway station/Metro station) Having adequate road lights and public movement | Desired | |
| 7 | Approach Road | The approach road should preferably be a pucca main road with a minimum width of 12 ft, If the center is on an arterial road then the distance should not be more than 500 meters from main road and that arterial road should be at least 8 ft wide | | |
| 8 | Distance to nearest Public Transport | Distance to nearest public transport: Access to nearest public transport | Mandatory | |

| | | | | |
|----|----------------------|--|-----------|--|
| | | facility, which could be a bus stand, auto stand or railway station should not be more than 5 km away from the center location | | |
| 9 | Number of Classrooms | Category A – Minimum 5 Category B – Minimum 3 Category C – Minimum 2 | Mandatory | |
| 10 | Class Room Area | 10 Sq.ft per trainee | Mandatory | Classroom size for a particular job area to be as per defined SSC specifications |

Table 7-3 Guidelines for Setting up of Pradhan Mantri Kaushal Kendra

| S.no | Attribute | Parameter | Conditionality | Remarks |
|------|---|--|----------------|---|
| 11 | Number of Training Labs | Category A – Minimum 2 Category B – Minimum 2 Category C – Minimum 1 | Mandatory | Labs as per machinery setup & SSC/MES standards |
| 12 | Lab Area | As per SSC Guidelines | Mandatory | Actual area will be a factor of sector, type of machinery and no. of trainees to be trained (would be updated/modified/changed given the scope of the scheme implemented in PMKK) |
| 13 | Computer Lab | 20- 30 computers | Mandatory | |
| 14 | Number of Washrooms/Urinals | Category A – Minimum 3 For Males and 3 for Females Category B – Minimum 3 For Males and 3 for Females Category C – Minimum 2 For Males and 2 for Females | Mandatory | |
| 15 | Number of Washbasins | One per Urinal/Toilet + 3 common basins at eating area | Desired | |
| 16 | Eating Area/Canteen | 200 Sq.ft | Desired | |
| 17 | Reception Area | 200 Sq.ft | Mandatory | |
| 18 | Counselling Room | 75 Sq.ft | Mandatory | |
| 19 | Common Area (Area except lab area and classrooms) | Category A – Minimum. 1600 Sq. ft Category B – Minimum. 1000 Sq. ft Category C – Minimum. 600 Sq. ft | Desired | |
| 20 | Flooring | Preferred Flooring Specifications - Glazed Vitrified Tiles; Colour Grey/White; Size 60cm x 60cm | Desired | Flooring should be consistent and bring out uniformity throughout the center. The flooring specifications for the labs shall be as per SSC guidelines |
| 21 | Power Connection | 3 Phase Connection | Mandatory | |
| 22 | Power Backup | Adequate Power back-up should be available | Mandatory | Desired Specifications: Either |



| | | | | |
|--|--|--|--|---|
| | | | | 7.5 KW online UPS and 10*150 (Ah), (ampere hour) SMF (Self Maintenance Free) battery or Genset to back up lab utilization, minimum 10KW |
|--|--|--|--|---|

| S.no | Attribute | Parameter | Conditionality | Remarks |
|------|---|--|----------------|---|
| 23 | Water Proofing of building | As per building standards | Desired | |
| 24 | Electrical Wiring | Fully covered, secured and taped | Desired | |
| 25 | Switch Boards and Panel Boards | Fully covered, secured and taped | Mandatory | |
| 26 | Seating – Waiting Area | Seating minimum for 10 people | Mandatory | |
| 27 | Fire Safety Norms | Instructions to be displayed at key areas along with fire extinguishers | Desired | As per Government prescribed norms |
| 28 | White Board | | Mandatory | |
| 29 | Classroom projector with adequate AV facilities | | Mandatory | |
| 30 | Smart Classroom | Having technology-enabled audio-visual and web-enabled access capability | Mandatory | At least one such classroom in the center |
| 31 | CCTV with Recording Facility | In every classroom/lab | Mandatory | |
| 32 | Internet Connection | Minimum speed of 256 kbps | Mandatory | |
| 33 | Classroom Chairs | All Chairs to have attached writing desk | Mandatory | Colour of the chairs to be as per branding guidelines |
| 34 | Classroom/Labs Walls | Concrete, brick or prefabricated sheets of minimum width of 3 inch for sound absorption | Desired | |
| 35 | Student History File | Individual file for each individual having the following: i. Trainee Registration form. ii. Parent Consent form | Desired | |

| | | | | |
|-----------|-----------------------------------|--|-----------|--|
| | | iii. Address Proof. iv. Aadhar Copy v. Proof of last academic qualification vi. Assessment Results vii. Placement Proof | | |
| 36 | General Safety Instructions Board | Will be as per the trade requirements | Mandatory | All Relevant safety instructions, Do's & Don'ts to be listed |

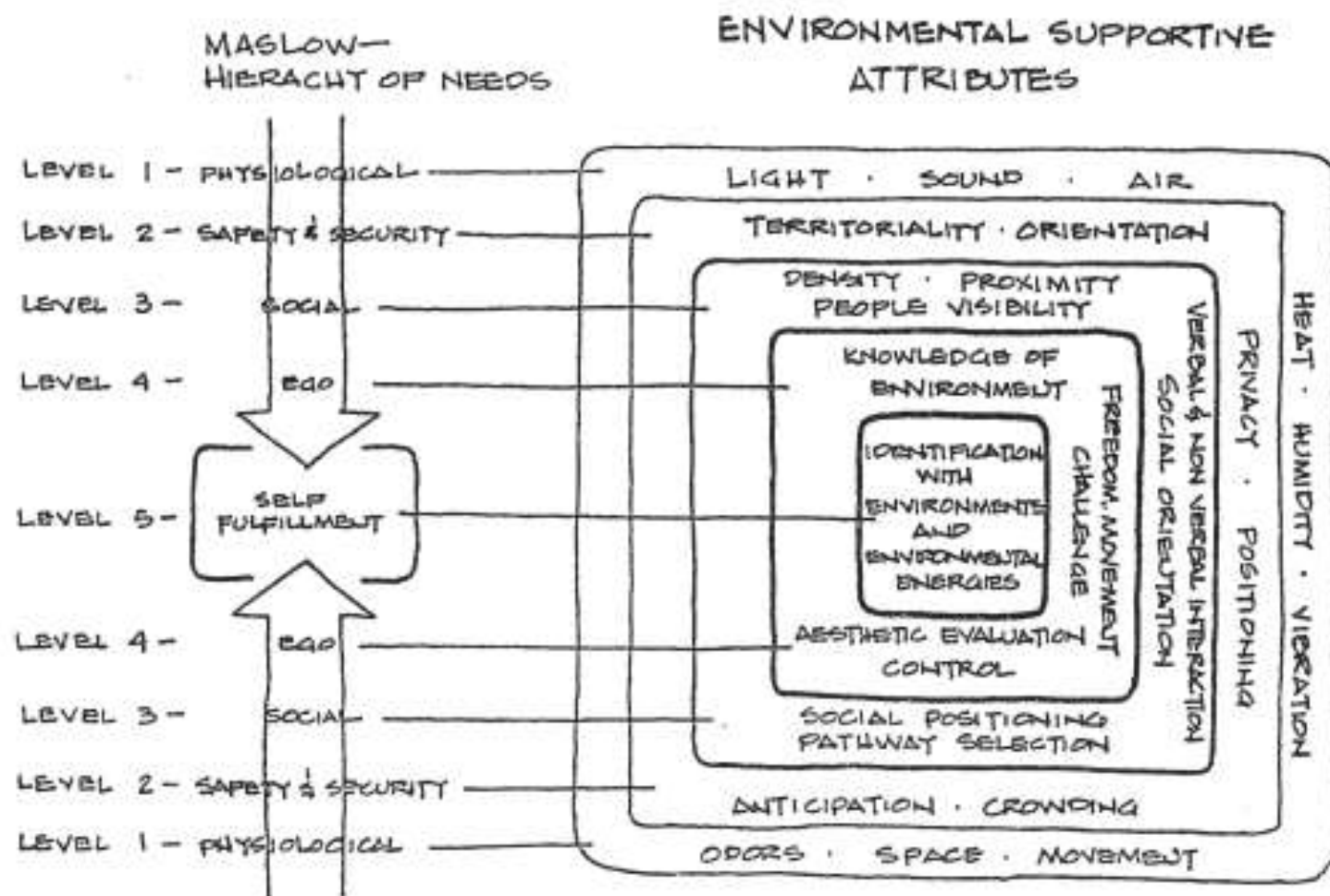
Table 7-4 Guidelines for Setting up of Pradhan Mantri Kaushal Kendra



8. Physical Infrastructure- Sthana- Mana

A residential Environment is defined as a system of setting in which system of activities take place that forms a sub-system (a dwelling unit) of the environment (Zwarts). The sub-systems are again classified based on the different parameters like the density of the dwelling units in the society. A residential environment design needs to follow all the factors that related to human comfort and human need. As per Maslow's diagram the factors are:

1. Physiological Needs: Food, Water, Air, Shelter, Clothing
2. Safety & Security: Health, Employment, Property, Family, Stability
3. Belongingness & Love Needs: Friendship, Family, Connections
4. Self-Actualization: Morality, Acceptance, Creativity
5. Esteem Needs: Confidence, Connections, Need for individuality
6. Environmental Issues: Waste Disposal, Pollutions related to air and water



Infrastructure is a set of facility and system serving a village, city, country, or any other area. It also includes all the services required for the economy of the place to function. Infrastructure is considered as the basic systems that

undergird the structure of economy. (O'Sullivan & Sheffrin, 2003). It is primarily composed of public and private infrastructures such as roads, bridges, water supply, waste management, housing, and telecommunication.

8.1. Housing

In an ideal setting neighborhood forms the fabric of the village, both physically and socially. The concept of Neighborhood is a basic unit of planning. It is a popular and accepted element of social and physical organisation. It becomes a symbol and means to preserve the socio-cultural values of the everyday life which helps in the improvement in physical conditions

Figure 8-1 Maslow Hierarchy of people Need (Poirier)

of a

neighborhood. In developing the neighborhood, we must consider the existing organic pattern of spaces and design around it to enhance and improve the system.

Basic amenities that an individual requires would be – housing needs, sanitation, water supply, power and socio-economic facilities for a sustainable neighborhood system. Hence, one should tie all spaces and build around the existing resources that exists to complete a neighborhood and give a feeling of wholeness to the community.

8.1.1. Housing issues prevalent in Shankarnarayana GP.

As per the household survey conducted it was observed that approximately 37.8% of the houses are pucca and around 13% were under Kutcha to semi pucca house types. During the survey most of the houses fell under the category of good and livable condition which accounted for almost 90% of the settlements. Although 8% of them were to be found in a dilapidated state owing to the existing financial conditions of the residents who are unable to gather enough funds to renovate their houses.

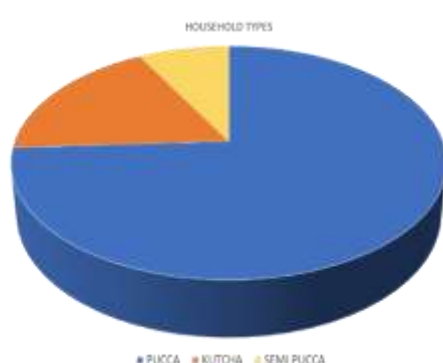


Figure 8-4 Percentage of Household types

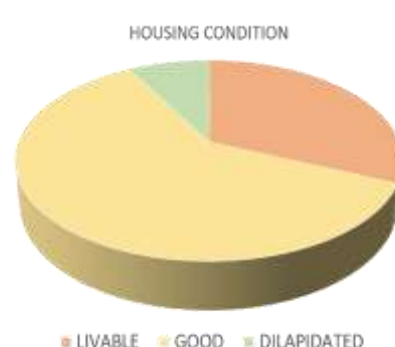


Figure 8-2 Percentage of Housing Condition



Figure 8-3 Percentage of ownership status

Along with these observations, there were various issues to be found regarding basic amenities and facilities at the household level:

1. Waste management system:

Collection of waste on a daily basis is seen only in Ward 3. The waste collected in collection cart is segregated in the Panchayat's main Waste Segregation Unit. Other wards have opted open dumping system. Composting is practiced in all the anganwadi where waste food is put in and the same is used as manure for their kitchen gardens. But this restricted only to the anganwadi and schools and not practiced in the household and community level.

2. Grey water management:

During rainy season, the houses along the river side have issues of the leach pit flooding.

3. Condition of houses:

Most of the old dilapidated structures need to be renovated to sustain the rains. Most of the houses has an extension for washing clothes & dishes & also for parking outside the building which has been covered by coconut leaf and polythene sheets and asbestos. Extensions supports are weak in terms of structural aspects which is a prevalent issue in most of the houses. Materials that are mainly observed in the GP are, mortar and stone, unburned bricks, Mud wall and clay tiles, bamboo or thatch for roofing.

4. Safety & Security:

No specific boundary or compound wall for residential areas.

5. Water supply:

Water scarcity problem only during the summers. The water supply for most of the houses here are provided through panchayat's main well, which is supplied on alternate days. Some of the houses also have built up their own wells.

6. Storm-water drainage:

Storm water drains have been left uncovered and untreated, does not create any blockages.

7. No open spaces:

The village has no open and recreational spaces like a park or a playground.

8. Alternate energy sources:

The use of Biogas is not seen in the GP. All the households of the GP use LPG stove for cooking purposes which is expensive to be afforded by all. More than 75% of the households have option for firewood cooking. And this leads to



destruction of trees. Only selected houses have implemented solar powered equipment's. The use of solar power and rainwater harvesting is not seen in the GP.

Table 8-1 Ward wise Household data; Data Source: Site survey team.

| WARD NO. | TYPE OF STRUCTURE | CONDITION | AGE OF STRUCTURE | ISSUES / OBSERVATIONS | IMAGES |
|----------|-------------------|--------------|-----------------------|---|--------|
| 1 | PUCCA | GOOD LIVABLE | <10 years | 1. Open dumping system of solid waste management. 2. On an average of 20+ hours of power supply. 3. Mostly Ground floor structures. 4. Source of water supply is wells at individual levels and Public tap. | |
| | KACHCHA | LIVABLE | 10- 20 years | | |
| | SEMI-PUCCA | LIVABLE | 10- 20 years | | |
| 2 | PUCCA | GOOD-LIVABLE | 10 YEARS TO >50 YEARS | 1. No solid waste management system available. 2. Source of water supply is mainly well at individual households and hand pumps and public taps are also available. 3. Constant power supply is available. 4. Most of the houses avail solar equipment's. 5. Structures range from G to G+3 structures. | |
| | SEMI-PUCCA | LIVABLE | 10- 50 YEARS | | |
| 3 | PUCCA | GOOD-LIVABLE | 10-50 YEARS | 1. Collection cart system of solid waste management on a daily basis. 2. Constant power supply. 3. Water supply is from the panchayat and few manually bring water from the nearby well. 4. Structures range from G to G+1. | |
| 4 | PUCCA | GOOD | <10 TO >50 YEARS | 1. Collection cart system of solid waste management on a daily basis. 2. Supply of water is through wells at individual households and Public taps. 3. Constant power supply available. 4. Structures range from G to G+2 structures. | |
| | SEMI-PUCCA | DILAPIDATED | <10 TO>50 YEARS | | |
| | SEMI-PUCCA | LIVABLE | 20-Oct | | |
| 5 | PUCCA | GOOD LIVABLE | <10 30YEARS | 1. No solid waste management system available and open dumping is observed. 2. Water supply is through wells at individual households and public taps. 3. Constant power supply. Structures range from G to G+1 structures. | |
| | KACHCHA | GOOD | 20-Oct | | |

8.1.2. The settlement pattern in the Gram Panchayat
It can be classified into two types:

1. Settlement 1: Near the State Highway 27 and commercial Centre.

Typologies of buildings

- Type 1 – Residential (Vernacular)
- Type 2- Residential (Ground floor)
- Type 3 – Residential (G+1)
- Type 4 – Residential (G+2)
- Type 5 – Commercial
- Type 6- Institutional

Characteristics of the settlement

- The area is characterized by both planned and scattered organic patterns. The built spaces are coarse-grained. It has commercial and institutional typologies surrounded by residential typologies.
- Open spaces are seen as vacant lands and are also available inside the institutional campuses as playgrounds.
- Residential plots have open spaces scattered around them which act as an extension of the house or space for a small gathering. Residential plots are limited to G and G+1, Commercial range from G to G+3, and Institutes from G to G+2.



Figure 8-5 Typical Section of Settlement Type 1, Source: GP Survey Team. MSAP

Settlement 2: Near the River and Agricultural Land.

Typologies of buildings

Type 1 – Residential (Vernacular)

Type 2 – Residential – Ground floor structure

Characteristics of the settlement

- The area is characterized by a scattered organic pattern of settlement.
- The built spaces are fine-grained. It has residential typologies surrounded by cropland or agricultural plantations.
- Open spaces are seen as agricultural lands or vacant lands. Residential plots have open spaces scattered around them which act as an extension of the house or space for a small gathering.
- Residential plots are limited to the Ground floor.



Figure 8-6 Typical Section of Settlement Type 2, Source: GP Survey Team. MSAP

8.1.3. Policies in force related to Housing in Shankarnarayana Village

The following schemes are availed by the population of the GP.

- **Basava Vasati Yojana:** Provision of Rs. 1.2 lakhs for the construction of houses.
- **MNREGA:** In addition to the 1.2 lakhs, under the scheme 90 days of labor wages is provided.
- **House Repairs:** Subsidy of Rs. 15000 is provided for house renovation/ repair works for SC/ST category.
- **Rajiv Gandhi Awaas Yojana:** 3-acre land is allotted for house construction for the homeless. Each household is provided with 2.50 cents of land for house construction.
- **PMY-2020:** Yet to be launched in the GP
- **Well Construction:** Subsidy of Rs. 1.28 Lakhs is provided for the construction of well, either for household or agriculture purpose. (For SC/ST/ General Category)
- **2013- Nirmala Bharat Abhiyan and 2015- Swachh Baharat Mission:** 364 Households were provided with toilet facilities. A subsidy of Rs. 2000 for toilet construction is provided and free 1 unit of W.C per household.



Various policies are offered by the Central and State Ministries for the benefit of the population, The Ministry of Rural Development aims to tackle issues related to rural housing by providing 'Housing for all' under the Pradhan Mantri Awaas Yojana-Gramin (PMAYG).

Pradhan Mantri Awaas Yojana – Gramin (PMAYG), earlier known as Indira Awaas Yojana (IAY), is a scheme for rural housing by the Indian Government. This social welfare program was initiated to meet the objectives of the "Housing for All" scheme by the year 2022. It aims to provide a 25-square meter pucca house including basic amenities to beneficiaries of the scheme. The houses provided will have certain special features such as it would be disaster-resilient, low cost, and will be built keeping in mind the socio-cultural and geo-climatic factors. (Raj, 2018)

The major deliverables to be made by the Department of Rural Development are:

- Housing for all
- All eligible habitations connected by all-weather roads
- All deprived households as members of SHGs with bank linkage
- Solid and liquid Waste Management
- Wage employment and community as well as individual durable assets under MGNREGA (Mahatma Gandhi National Rural Employment Guarantee Act)
- Mission Water Conservation under MGNREGA
- Pension for old, widow and disabled
- Placement based and self-employment skills for all eligible youths
- Village roads with MGNREGA

The core aims of the State/ UTs is to provide the beneficiary a bouquet of options of house designs according to local conditions, using appropriate technologies suitable to the region of the residences. The core house design should include:

- Dedicated space for hygienic cooking
- Toilet and bathing area.
- Adequate space for pursuing livelihood activities.
- Rain water harvesting system
- A veranda

To implement a multi-dimensional approach, it is necessary to have the right kind of intervention programmes so that objectives laid out are achieved within the target time (Raj, 2018). Hence, following strategic interventions are suggested:

-

- Limit Government Capital subsidy to the extreme poor and destitute families under Indira Awas Yojana and /or any other Scheme.
- Introduce Interest Subsidy Scheme whereby borrowers in the category of economically weaker sections get a loan at concessional and affordable rates.
- To encourage primary lending institutions to enhance their credit flow to the rural populations and actively involve the existing institutional mechanisms of SHGs to extend loans to rural populations.
- To develop mechanisms that will focus on 'Productive Housing' i.e. house in rural areas to be used as a base for income generation which would lead to asset building, women empowerment, family development, hygienic housing, improved health facilities, better education for children leading to human capital formation as well as sound collateral for various finances.
- Encourage small and medium developers to take up housing in rural areas through a mix of fiscal incentives and business volumes after necessary environment and social impact assessments and clearances from the Panchayati Raj Institutions.
- Consider housing at par with rural infrastructure as far as funding and concessions are concerned, in order to encourage investments in the sector.

- There is a strong case for people with occupations, like weavers, farmers, fishermen, etc., forming a habitat, which can house the entire range of facilities like water supply, sanitation, power, internal roads and common workshop, that contribute to the quality of life. As far as possible, local manpower – skilled and unskilled must be employed in habitat development and house construction in villages. This will counter migration to urban areas.

8.1.4. Design Guidelines for Built Forms

Based on the topography, (Figure 7.7) the regions marked in green (variant) are more feasible for settlements as it provides lesser level differences/discrepancies. It also represents feasibility for the direction of future development of the village and can be considered as future spots for developing infrastructure, housing, services etc. (except for forest areas).

The Current center of gram panchayat is also in line with the understanding of the physical attributes of the village, therefore, the development should be focused more towards the north and north eastern and in some parts of the south eastern parts across the river system. The maximum value observed is 535 ft.(red). The minimum value is 13 ft. (blue).

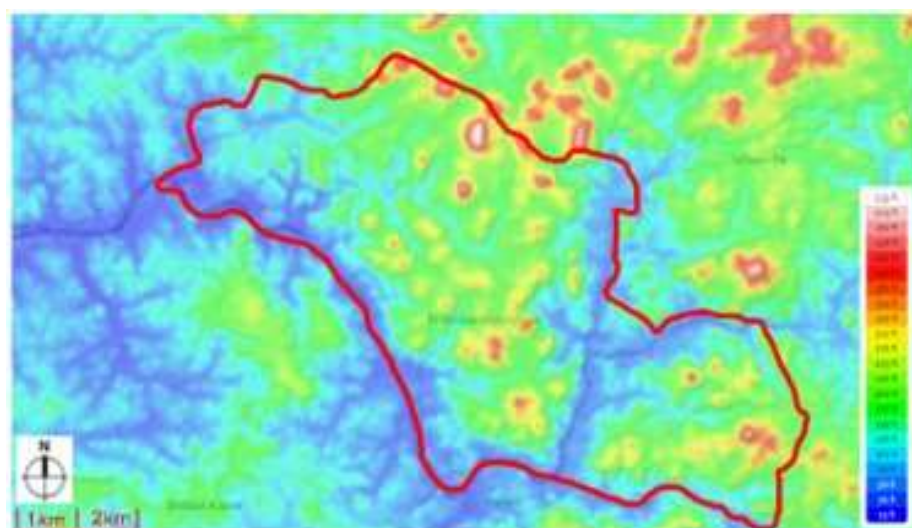
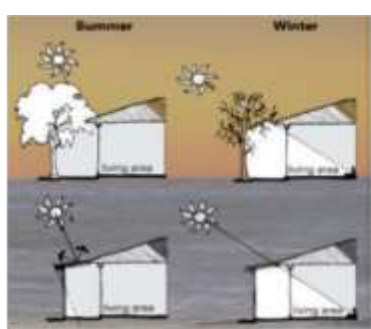


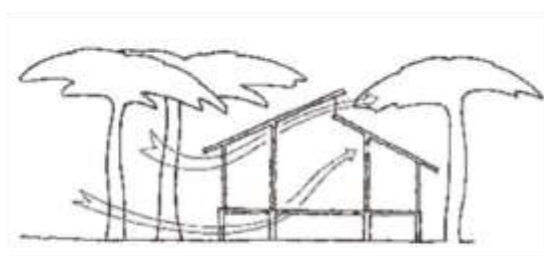
Figure 8-7 Level gradient map (htt3)

1. Design Layouts

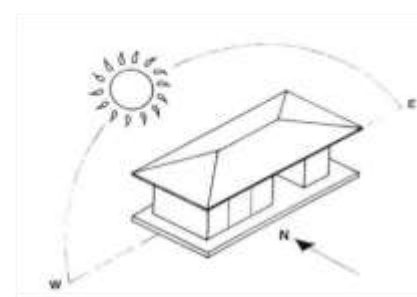
As per the traditional housing, courtyards and verandas formed the basic feature of any planning. Buildings were constructed of low thermal capacity and locally available materials like wood which is abundant, mud walls, thatched roofing. A pitched roof is used to protect the walls and interior from rain. The housing mostly faces the North and sometimes east to allow morning sunlight to enter the house. Courtyards were a typical feature in most of the houses for daily activities and also for ventilation and deep overhangs with verandas to prevent the indoor temperature from increasing. The front veranda is a semi-public area where community activities are held, the central house is for family activities, and a backyard for services or agrarian activities. Vegetation, like banyan, Jack is preferred around the site for gentle breezes and is placed away from the building foundation. Trees like coconut, areca nut, etc. are planted to protect from monsoon winds and the glare of the sun.



Verandah is used for ventilation and protection from sun radiation and rains. Semi open spaces like these can be used for day time activities.



Ventilation can be increased by use of vegetation around the house. Cross ventilation with large openings for unobstructed air path.



House with hipped roof, elongated in E-W direction provides best shading

Figure 8-8 Traditional Housing Techniques (The Architecture of Bunt Community)

2. Design Guidelines



- Buildings should be oriented concerning sun and wind patterns. Minimizing the area which receives the sun radiation reduces the indoor temperature.

- The façade, roofing, ceiling, and other external surfaces should be painted with light colours to reduce the absorption of heat by the surfaces.

- Roof overhangs should be at least 0.7m to 1m to protect from sun radiation and rains.

- A large opening in outer walls and multiple openings on both sides to be provided to facilitate cross ventilation. Buildings should be oriented towards the windward side.

- Verandas should be provided in all houses, which can be used for homes based activities or community gathering space.

- Surrounding plants can be used to protect the walls and windows from solar radiation. Trees with high canopies can reduce the solar heat gain with a small blockage of the wind.

- Vines climbing over the walls and next to windows can also reduce the heat gain.

- Constructed boundary walls should be avoided and trees or other native vegetation should be used for demarcation boundaries, which facilitates ventilation and cool breeze.

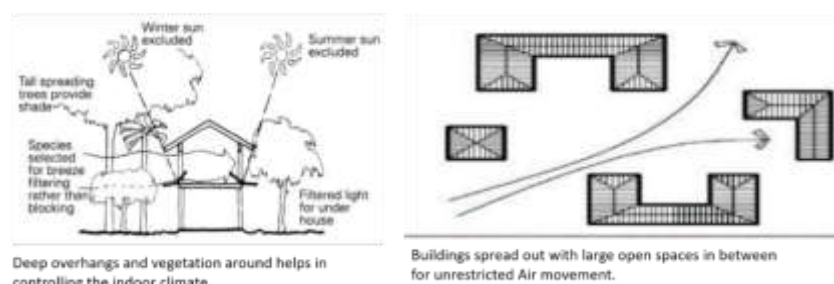


Figure 8-9 Traditional Housing Layout (Koeinsberger)

3. Construction Material & Techniques.

Following local materials are identified that can be used for construction in Shankarnarayana GP:

(i). Masonry Bricks and Clay tiles:

- Solid or perforated bricks of all shapes and sizes for standard masonry constructions, including foundations, floors, and load-bearing walls.
- Roof tiles of various shapes and sizes for roof slopes ranging between 1: 3 (18°30') and 1: 1 (45°).
- Weather-resistant
- Pleasant indoor environment

(ii). Laterite bricks:

- Easily available
- The cost of procuring is low.
- No specialized skilled labor required
- Favours climatic performance due to high thermal capacity and porosity.
- Used in foundations too.
- Extra reinforcement for earthquake resistance.

(iii). Mud:

- Extraction can be made from the plot itself
- A more solid material is needed for the foundation.
- Climate responsive
- Adobe, Compressed earth blocks, Rammed earth are different ways of mud walls.
- Construction limited to G or G+1 structures only.
- Protecting the wall from either rain or sun is to have a good big overhang to the roof.
- Provide trenches around the house to receive dripping water and drain it away.
- Should be reinforced with another material like bamboo to make it earthquake resistant

(iv) Foundation types:

It is observed that the GP has two soil types – clayey and loamy.

- For clayey soil: 900-1200mm subject to movement due to expansion and shrinkage because of moisture. Foundation should be below this zone. Strip foundation and stepped foundation (sloping site) are suitable for this soil. Damp-proof coating for footing should be done.
- For Loamy soil: Ideal soil for construction with a combination of silt, sand, and clay. Zone with the higher organic matter should be avoided and a deeper foundation should be considered. Isolated pad footing is suitable for this soil.

(v) Water proofing of the structures:

Damp proof course in plinth:

Foundation is always in contact with the sub soil, which sometimes contain water and enters the building. Due to capillary action the water rises into the walls of the building and indicates dampness. So DPC is provided to prevent this capillary action.

The rich cement concrete, generally of M20 grade with water proofing compound added to it can be used as DPC. Sometimes Tar is also applied below DPC to prevent entry of water. Above DPC, regular structure is done.

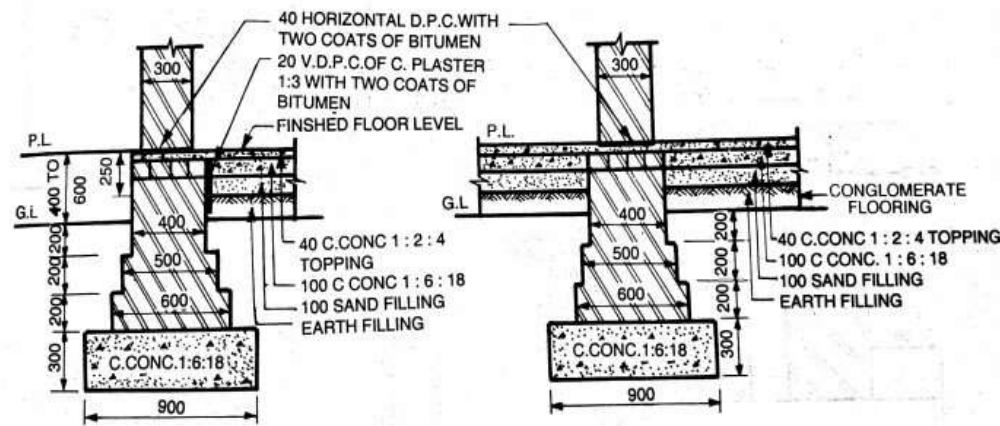


Figure 8-10 Damp proof Course at plinth level (htt2)

(vi) Other General Guidelines

- Plants and shrubs to be used to prevent erosion. Trees of strong roots to be planted to avoid landslides. The bare ground around trees can be planted with creepers to avoid open soil. Existing vegetation should be retained to preserve topsoil.
- All buildings should have gutters or pipes to drain water effectively to avoid loss of topsoil.
- Minimal area to be disturbed while excavating or cut and fill.
- Veranda to be provided that provides shade and also space to work with the community.
- The slope above 30% should restrict development.
- Landslide inventory mapping needs to be done for the Gram panchayat and the areas under high risk should restrict development.
- Early identification of environmental features, on or below ground level is crucial.
- Subsurface water should be checked for as these can form cavities and invite landslides.
- Locally available construction materials- laterite stone, mud bricks should be used for construction as it has a good climatic response, maintain indoor comfort conditions, blends well with the surrounding and will have minimal impact on the surrounding environment.
- The building should go along with the contour. The cutting and filling method of site development should be minimal and the debris produced after cutting of hills should be used to fill parts within the site.
- The minimum plinth of 45 cm to be provided.
- With a rainfall average of 3500mm annually, sloping Mangalore tiled roof should be made mandatory so the water is drained off easily.
- No solid walls should be used for the construction of the boundary wall. Native plants, shrubs, or trees can be used to demarcate the boundary.



4. Design considerations for Disaster Management (New Construction)

- Seismic bands in brick walls should be provided through all external and internal walls at the plinth level, window, and doors lintel level, at the ceiling level of roofs consisting of tiles or prefabricated planks, and at eave gable level in sloping roofs with tiles.
- The bars for the seismic bands should have a minimum cover of 25 mm below and above them.
- For achieving full strength of brickwork, all vertical joints between the bricks must be filled with mortar, that is, the longitudinal joint between two bricks should be filled with mortar.
- Door and window openings shall be at least 45 cm from the wall corners. The distance between the two openings shall be not less than 60 cm.
- The cover to any bar (main or distribution) should be kept 15mm minimum and 20 mm maximum in concrete slabs used as floor or roof. The cover in beams to the main bars should not be less than 25 mm and to the stirrups not less than 15 mm.
- Shear walls and cross braces can be used to transfer the load to the foundation.
- Bracing can be provided in between columns.

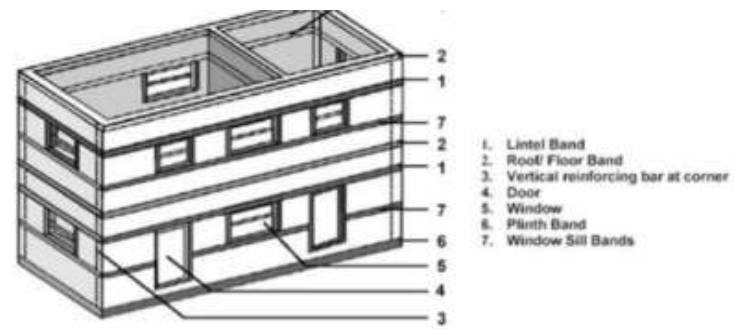


Figure 8-11 Seismic bands at different levels (Providing vertical reinforcement at important locations such as corners, internal and external wall junctions)

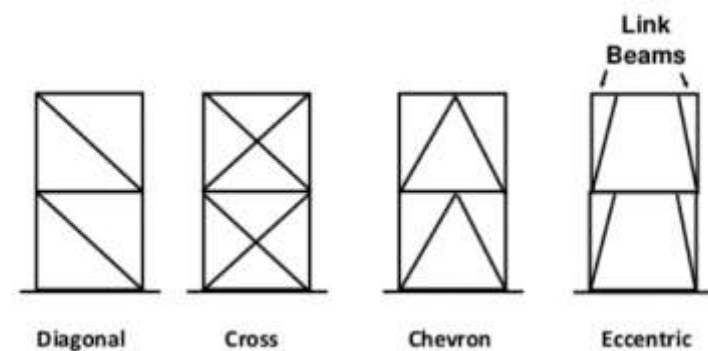


Figure 8-12 Different types of cross bracing

7. Design considerations for Disaster Management (existing masonry buildings)

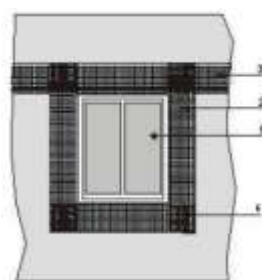


Figure 8-13 Addition of Seismic bands (ARYA)



Figure 8-14 Reinforcement of Openings (ARYA)

1. Seismic belt above opening and below roof at eave level
2. Seismic belt on gable wall
3. Tie at eave band level
4. Door
5. Window
6. Rafter with collar tie
7. Tying of rafter with band

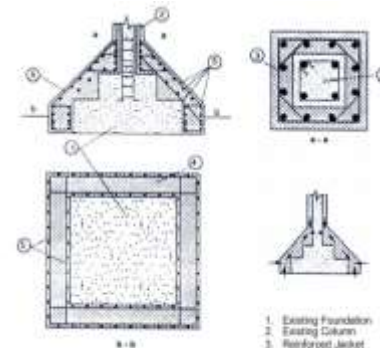


Figure 8-15 Retrofitting existing foundations (NID)

- Large openings should be reinforced with a mesh of gauge 13 with wires at 25mm in a width of 250mm around the opening. Foundations of dilapidated structures to be retrofitted by strengthening the existing foundation.
- To prevent short column failure, the special confining stirrups should be provided throughout the height of the column at short spacing as required near the ends of the columns.

Design Considerations using alternate material for construction- BAMBOO

- Alternate material that can be used in Shankarnarayana GP is Bamboo
- It is fastest growing plant that can be cultivated in SN and is quickly replaced after harvesting. Bamboo grows very fast: 1.2m/day and the first harvest can be taken in 3-5 years.
- Climate and soil of the GP is suitable for cultivation and growth of plants

- Cultivation in the village saves transportation and fuel costs and also provides local employment at the plantation, treatments, and processing centers.
- Bamboo should be treated before use to make it workable and resistant.
- Can be used for foundations, building frame, beams, and roofs.
- Composite Bamboo-concrete foundations are provided.
- Provides comfortable living conditions.
- Withstands earthquakes.
- Reconstruction is possible in a short time if damaged.
- Can be used in combination with other types of construction materials

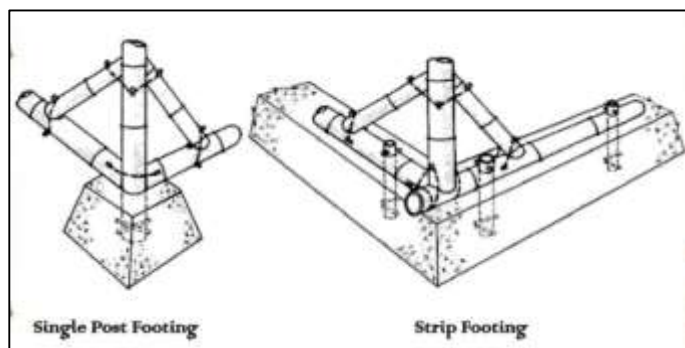


Figure 8-17 Composite bamboo-concrete foundation (www1)

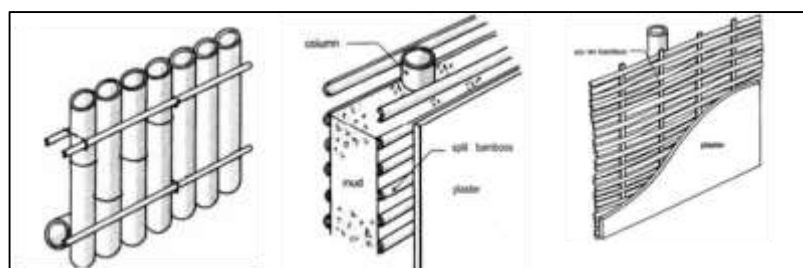


Figure 8-16 Types of Bamboo well (www1)

Guidelines for safety provision of bamboo structures.

- Use only a mature variety of bamboo for structural posts and main beams.
- All structural bamboo should be treated chemically to conform to IS.
- The distance between the two posts shall be not more than 1.2 m center to center.
- The unsupported height of the post shall be not more than 3.0 m. If the height of the post is longer, a horizontal tie of the bamboo shall be provided.
- A 30 cm deep and 100 mm dia. hole shall be made in the plinth beam and the foundation pile/pier below to embed and fix the bamboo post. The post shall be erected in this hole and clean sand shall be filled and compacted around the post in the hole.
- Diagonal bracing between the posts in each wall at the corners from plinth level end to attic level end shall be provided.

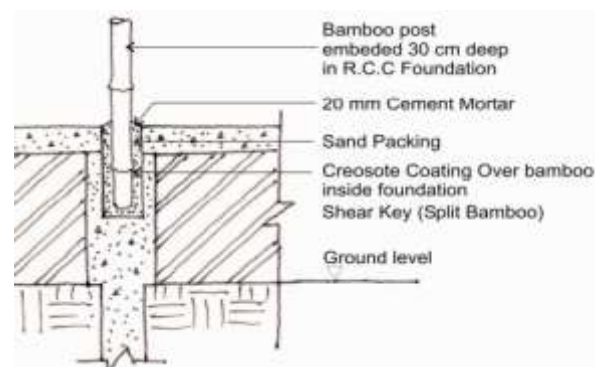


Figure 8-18 Foundation detail - Bamboo Construction (NID)

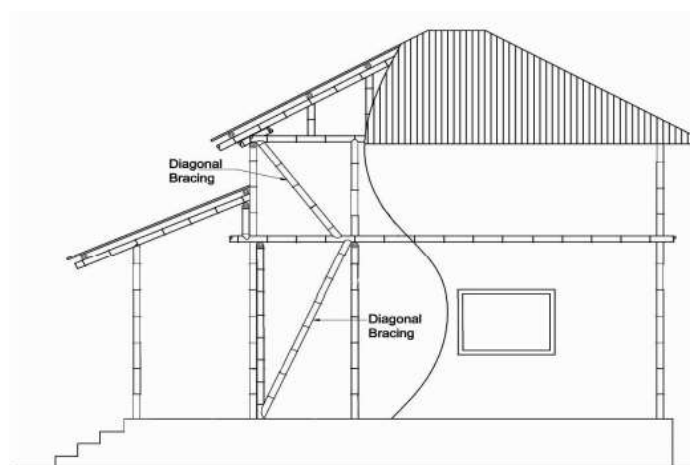


Figure 8-19 Diagonal Bracing (NID)

8.2. Road Network:

Rural roads are an important sector in rural development, which deals in all aspects of development including agriculture, health, education, forestry, fisheries, small-scale industries, trade, commerce etc. that depends on good communication. Rural transportation network will give shape to the living environment of villagers; rather roads of rural transportation are the connectivity elements in our society.

The connotation of rural roads for a developing country like India is different from that in the Western countries, in the sense that, it is not the road which passes through rural and agricultural areas. It is because a road passing through rural area can be a National Highway, State Highway and Major District Road (MDR) (Swaminathan et al, 1980). As per the definition and classification of road system adopted in Road Development Plan of India (1981-2000), rural roads are the



tertiary road system which comprises of Other District Roads (ODR) and Village Roads (M.O.S.T., 1984). These roads serve as feeder roads to the main network and link villages with the nearest market centers, or any other village. Traffic volume on these roads is low, comprising mainly of slow-moving vehicles like cycles and animal drawn vehicles and pedestrians who are generally cultivators of abutting land. There are other lower level roads also, such as paths and tracks, which serve the important functions in rural areas and are not covered under the above definition and classification of roads. These are farm roads and intra-village roads. The farm roads traverse the agricultural fields and are mainly unsurfaced linking agricultural farms with the main village. Intra-village roads connect the clusters of small size settlements in a village, known with different names in different states (Srinivasan, 1985). All these types of road constitute the whole range of rural roads for all practical purposes in India. However, from network planning point of view rural road is an all-weather road that connects a village with any other village, to the market centers, or to the primary and secondary road systems. This constitutes the Other District Roads and Village Roads as per the definition of Road Development Plan (1981-2001) of the country.

Quality rural roads are necessary to ensure that even the rural parts of the country have access to basic products and services that a country's citizens are entitled to. Quality roads ensure that the rural parts of the country have faster access to outside products, information, services and social linkages. It also opens new markets for existing business due to easy connectivity and reduced costs of entering new markets. Connectivity enables communities to access existing government services and aids created especially for them.

Increased connectivity ensures that newer markets are opened and are serviced at the best possible prices for existing businesses. Connectivity serves as an opportunity for local communities to spread the reach of their businesses further outside to nearby villages and cities and eventually the rest of the country. Connectivity ensures that the once ignored rural areas are actively considered for new industrial set ups, thereby generating employment and increasing the standard of living of the local communities. Connectivity directly impacts the development of infrastructure and incorporation of local cash run businesses into the mainstream economy of the country.

Availability of quality rural roads would ensure that people living in rural parts of the country find adequate livelihood and opportunities within reasonable distance from their hometowns. Restricting the need for migration to other parts of the country and creating an imbalance. Availability of quality road also ensures that people do not have to be uprooted from their homes, family and community for search of a decent livelihood. Additionally, people having opportunities closer to home ensures that the rural parts of the country are incorporated into the mainstream economy of the country thereby adding to the development of the country.

Rural road connectivity is a basic requisite that once met will ensure that the roads are opened for expansion of existing business and new businesses opening whilst supported with a growing infrastructure and industrialization.

8.2.1. Schemes pertaining to Rural Road Development in India:

8.2.1.1 Pradhan Mantri Gram Sadak Yojana (PMGSY):

This programme was launched on 25th December 2000 as a Centrally Sponsored Scheme to assist the States. The primary objective of PMGSY is to provide connectivity by way of an All-Weather road (with necessary culverts and cross-drainage structures, which is operable throughout the year), to the eligible unconnected habitations as per Core Network with a population of 500 persons (as per 2001 Census) and above in plain areas.

8.2.1.2 Pradhan Mantri Gram Sadak Yojana (PMGSY-II):

The programme was conceived on sharing basis between the Centre and States/Uts on 75:25 basis for the plain areas and 90:10 basis for the special areas. The objective of this programme is to consolidate existing rural road network by up-gradation, renewal and maintenance of the vast network already created. It would cover up-gradation of existing selected rural roads based on a criterion to make the road-network vibrant. The selection of routes would be with the objective of identification of rural growth centers and other critical rural hubs, rural places of importance (connectivity to other growth poles, market, rural hub, tourist places etc.).

8.2.1.3 Bharat Nirman:

Bharat Nirman, one of the important programmes launched by the Government of India in December 2005 identified six core infrastructure sectors in rural areas viz rural housing, irrigation, drinking water, rural roads, rural electrification and rural telephone connectivity. Initially, it was launched as a time bound programme of construction of rural infrastructure for implementation during the four-year period 2005-09. Rural Road, one of the six components of the program with a goal to provide with an all-weather road connectivity to all eligible unconnected habitations with a population of 1,000 persons and above (as per 2001 census) in plain areas and 500 persons and above in the case of Hilly or Tribal (Schedule V) areas. The Bharat Nirman Programme envisages a massive scaling up in terms of habitation connectivity coverage, construction targets, and financial investment.

8.2.1.3 Rural Infrastructure Development Fund (RIDF):

Government of India, instituted Rural Infrastructure Development Fund (RIDF) in 1995 in NABARD, entrusting it with the responsibility of channelizing financial resources to the State Governments for rural infrastructure development. Its major objective is to aid and encourage private investment in agriculture and further support the development of rural infrastructure. Since inception of RIDF, around 5.37 lakh projects involving an amount of Rs. 1,84,107 crores were sanctioned under various tranches. Out of the cumulative RIDF loans sanctioned as on 31 March 2014, agriculture and related sectors accounted for 43 percent (including 29 percent for irrigation), rural roads 31 percent and bridges 12 percent. The balance 14 percent of the loans was sanctioned under social sector projects. The RIDF investments have resulted in multitude of benefits including, creation of additional irrigation potential of 218.4 lakh, provision of rural connectivity through 3.8 lakh km. rural road network and 8.8 lakh meters long rural bridges.

8.2.1.4 MGNREGA:

Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) has also provision to take up rural connectivity to provide all weather access. More than 16% of MGNREGA works currently relate to rural connectivity. In February 2009, the MoRD has issued guidelines for the convergence between MGNREGA and PMGSY. Convergence between MGNREGA and PMGSY is mutually beneficial. The PMGSY guideline acknowledge the critical importance of the institutional framework for effective maintenance and call for the ultimate devolution of PMGSY roads management and ownership to local governments and the Panchayati Raj Institutions (PRIs). Therefore, road maintenance projects will be prepared accordingly. Works required and covered under MGNREGA will be selected under MGNREGA. Works not allowed under MGNREGA but permissible under PMGSY will be selected under PMGSY. There is possibility of synergies between the MGNREGA and the PMGSY project as the latter contributes to the creation of durable infrastructure and improves accessibility to social facilities like education, health care, etc. This can be achieved as per the guidelines provided by Ministry of Rural Development from time to time.

8.2.1.5 CM Grameena Sumarga Project: (Karnataka State Fund)

To maintain the prioritized 24,246 km of rural black-topped roads in motorable condition, the Department of Rural Development and Panchayat Raj (RDPR) has come up with 'Chief Minister Grameena Sumarga' project. The ₹7,182-crore project to be taken up over five years in phases was approved by the State Cabinet. Although the Centre has come up with Pradhan Mantri Gram Sadak Yojana (PMGSY) for repairing rural roads and providing rural connectivity, Karnataka has not got any funds under this scheme as it had already provided rural connectivity using State funds. This scheme funds can be clubbed with the central fund when made available.

By carefully understanding the visions and missions of the above mentioned Government schemes and



initiatives, the broad objectives can be summarized as follows:

1. To provide connectivity by way of an All-Weather road (with necessary culverts and cross-drainage structures, which is operable throughout the year), to the eligible unconnected habitations.
2. To increase connectivity and access to major district centers and other growth poles, market, rural hub, tourist places etc.
3. To reduce the rural to urban migration by improving the rural infrastructure.
4. To generate employment opportunity within the rural areas.

8.2.2. Existing Scenario of Road Network:

The State Highway 27 passes through Shankarnarayana Gram Panchayat. It covers a length of almost 11 km within the Gram Panchayat Limits. It passes by ward no. 1,2,4,5 and 6. It serves as the major route for Buses connecting Shankarnarayana to other major villages and district centers. Apart from the SH 27, there are few major roads that connects to other villages which are the major work centers where the locals travel to for work etc. (Fig:8-20).

Siddapura road connects Shankarnarayana to Siddapura. Siddapura is another village towards the N-E of Shankarnarayana. It derives its name from Siddeshwara Devastana. It is mainly known for its market, cashew and food related industries.

Bailoor road is another prominent road in ward no.6 which and major work centers like the Shankarnarayana Cashewnut factory and Bailoor Poultry farm. It also has an arecanut farm and many small to large religious places.

Balkattu road in ward no.1, Passes through the Kondalli and finally connect to SH 52, i.e. Kundapura- Shimoga road.

The Sowda Road which passes through ward no. 4&5 originating from the main Shankarnarayana cross, has potential to develop as a major road connecting other surrounding villages like Molahalli, which is also a major work center for the locals.

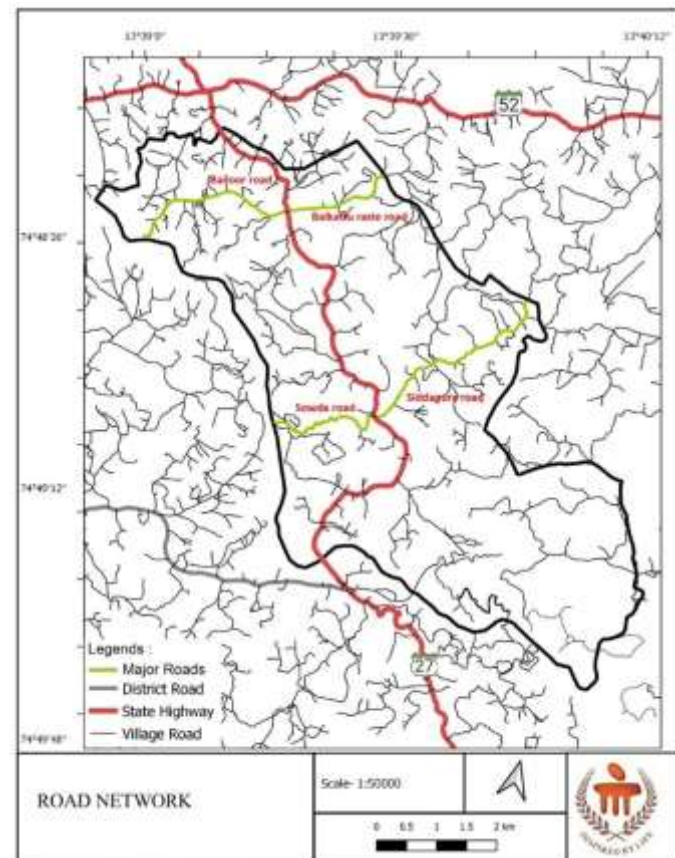


Figure 8-20 Shows the Major Road network at Shankarnarayana, Source: NRSC

8.2.2.1 Road Characteristics:

The SH 27 road is a Two-way, Two-Lane bitumen road of 7.5 meters' width. The roads which are leading to the interiors of the village are Kutcha roads. The demarcated district roads are of bitumen laid. The village roads proportionately one fourth is bitumen and concrete roads where the remaining are mud roads.

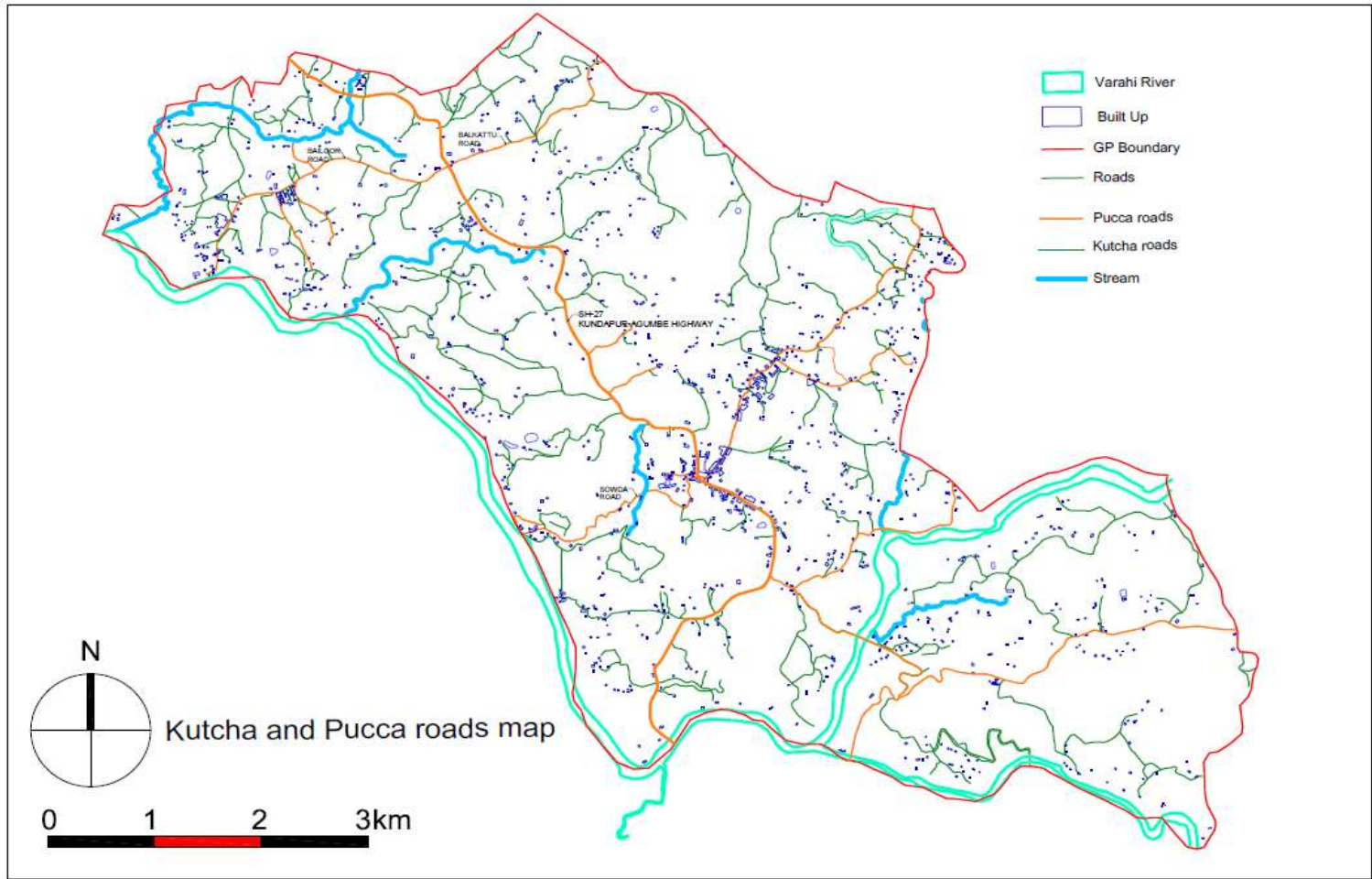


Figure 8-21 Map showing the Road Characteristics at Shankarnarayana Gram Panchayat. Source: NRSC

8.2.2.2 Road Condition:

The major roads like the State Highway SH-27, Siddapura road, Sowda road are in good condition. Because of heavy rains in the region, asphalt roads get eroded, therefore the concrete roads of required width needs to be proposed. Majority of internal roads connecting to individual residences are mud roads which needs to be converted to all weather concrete roads.

| | | | | | | |
|--|---|---|---|---|--|--|
| | | | | | | |
| SH 27 Kundapur-Agumbe Highway 13° 35'38.54823" N 74° 51'42.15384" E | Kondalli Road 13° 38'1.42152" N 74° 50'29.28552" E | Bailoor Road 13° 37'56.05"N 74° 50'18.63"E | Haleagrahara Road 13 37'35.16132"N 74° 49'36.0408" E | Ward-5 13° 35'16.44828" N 74° 51'24.70104" E | Ward-5 13° 37' 39.0"N 74° 49' 15.0" E | Ward 1 13° 37' 48.40"N 74° 49' 20.32" E |
| Condition: Good | Condition: Surface course eroded | Condition: Potholes | Condition: Intermediate course exposed | Mud Road leading to block making factory | Narrow internal mud road leading to madaga. | New concrete road leading to bailor poultry farm |

Figure 8-22 Showing the existing condition of roads Shankarnarayana Gram Panchayat.



8.2.2.3 Road Significance:

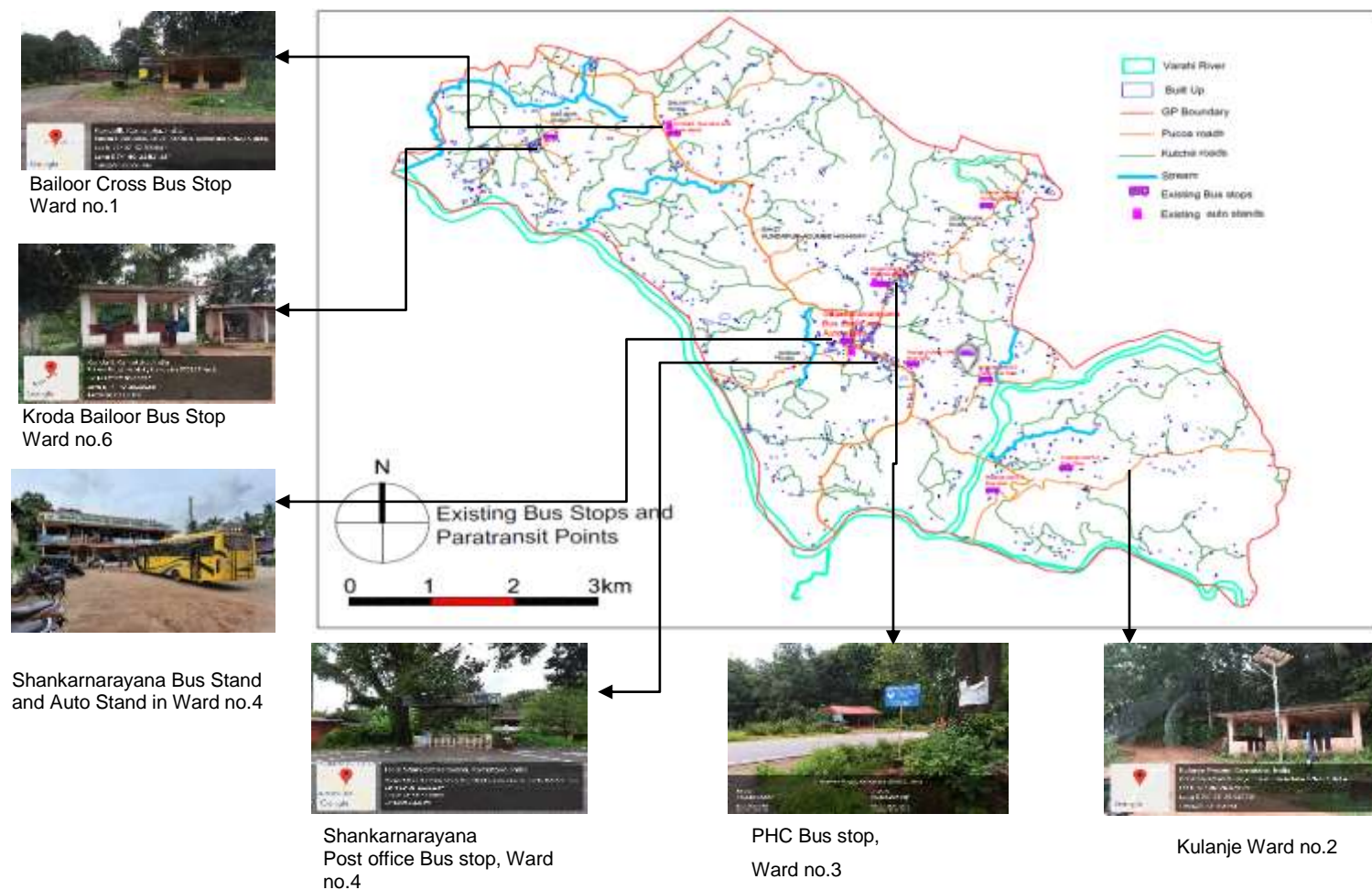


Figure 8-23 Map showing the location of Bus Stops in Shankarnarayana., Source: NRSC

The Shankarnarayana Temple Road ($13^{\circ} 36'21.96''N$ $74^{\circ} 51'27.58''E$)

has religious significance as the road is used during the Shankarnarayana Jaatre, which is held during the month of January, which runs for about 6 days and the final day Ratha-utsava is celebrated.



Figure 8-24 (a) Temple road during Rathostava; (b) Temple road; (c) Bus stand; (d) Shankarnarayana Cross

The Shankarnarayana cross is the core area of the Shankarnarayana Village, as it forms a major node and intersection point where the Siddapura road joins the SH 27 from the east side and the Sowda road from the west. It has the bus stand at the junction along with a daily market and many other utility stores flanked along the stretch. Administrative buildings like the Gram Panchayat office and treasury office are also located in close vicinity.

8.2.2.4 Transport Infrastructure along the Roads:

There are notable 9 bus stops spread across different wards of the village. The bus stand is located at the core of the village.

Though the bus frequency in the village is not good, but the infrastructure is present. These shelters of bus stops can be potential hotspots for proposing ICT shelters for locals.

There are very limited auto-rickshaw stands which are located at three locations: one near the bus-stand, second near the Bailoor cross and third near the Government PHC, along Siddapura road.

8.2.3. Issue Identification:

1. After the rainy season, the mud roads get spoiled, the people face extreme difficulty travelling through those roads.
2. In ward no. 4 along the road there is no provision for parking. People park their vehicles encroaching into the main road.
3. Because of the hilly terrain the roads are meandering, at some places there is no signage's or speed breakers at steep turns, due to which vehicles speed up and accidents are caused.
4. As it is a forest area, there are wild animals crossing the roads, which leads to accidents.
5. Because of no storm water drains along roads.
6. Extremely narrow road not enough for two-way traffic. Maneuvering large vehicle is difficult.
7. As there are no streetlights along internal roads people find it very difficult to move out during the night also face difficulty in accessing their residences during rainy season.
8. Narrow internal roads difficult to travel, especially during rainy season.
9. There is only 1 bus that comes to the Bailoor area in ward-6 in the entire day that goes to Shankarnarayana bus stand and then to Siddapura. Less frequency of busses in the interior areas have forced people to depend on private vehicles or must walk to the nearest auto rickshaw stand.
10. Lack of bus facilities during the evenings, affects travelling of working women.



9. Proposed Gram Panchayat Spatial Development Plan

9.1. Vision:

A sustainable village that embraces its natural assets, encourages community development, empowers the people and provides opportunities to improve their livelihood.

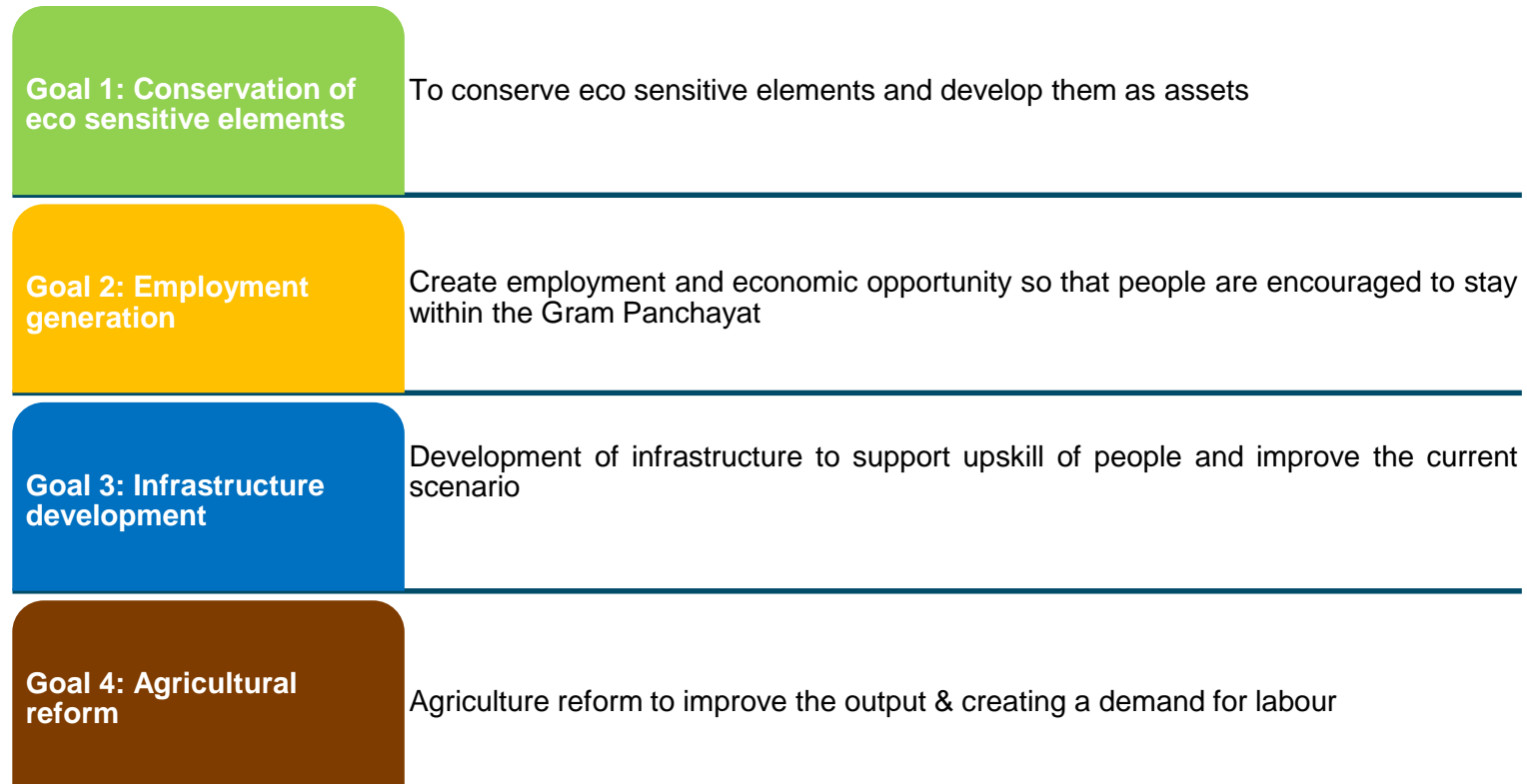


Figure 9-1 Key goals of proposals of Shankaranarayana Gram Panchayat.

Source: Author

The coastal area is fragile in nature which needs special attention while visualizing any planning activities. In three tier (District,

Block and Village) Panchayat raj system, village plays a vital role as most of the planning activities can be successfully implemented when done at the grass root level. Now-a-days, the remote sensing technology along with geographical information system (GIS) can act as useful tool in any decision making process. The terrain information and its attributional data can be well analyzed through high resolution satellite images and geospatial technologies. In planning activities, the role of geospatial technology is increasing day to day. Information on different theme of the study area can be analyzed and different spatial planning in village level can be initialized. The Shankaranarayana gram panchayat with its land locked terrain contextualized by the Western Ghats, the water system typical of the region that drives the flow of natural and human settlements, aims to develop and strengthen its balance with the sensitive ecosystem the village inhabits and integrate practices that re-image the mutual growth of the village and the environment whilst preserving, protecting and regulating the natural resources.

Water Management: Controlling storm water run-off from the source, so that the filtered water can be directly sent to the river, managing water-log during heavy rains and improving slope stability by reducing infiltration.

Road Infrastructure: Proposal of roads with proper connectivity and the enhancement of existing roads will fulfil all the associated objectives the Government is aiming to achieve.

Solid Waste Management: The biodegradable wet waste at the household level can be put into a compost pit or a community compost pit which can be used for gardens or agriculture land.

Heritage Zone Development: The intent of the project is preservation of history, creating job opportunities through tourism, giving identity to the Gram Panchayat, heritage management and community participation.

Rural Community Development: The center for rural community development is an intervention for the public that specifically aims to create engagement to foster community spirit.

Resource Symbiosis Development: The project is an extension of social entrepreneurship, where the producers and consumers have feedback loops in the form of mutual benefits, which integrates into a sustainable market-based resource consumption model.

Skill Development Centre: Creating employment opportunities by engaging in informal sectors.

Women Empowerment Centre: Creating home-based training and job opportunities for enhancing economic condition of women. The center also plays a role to inculcate community interaction and recreation for women.



9.2. Masterplan

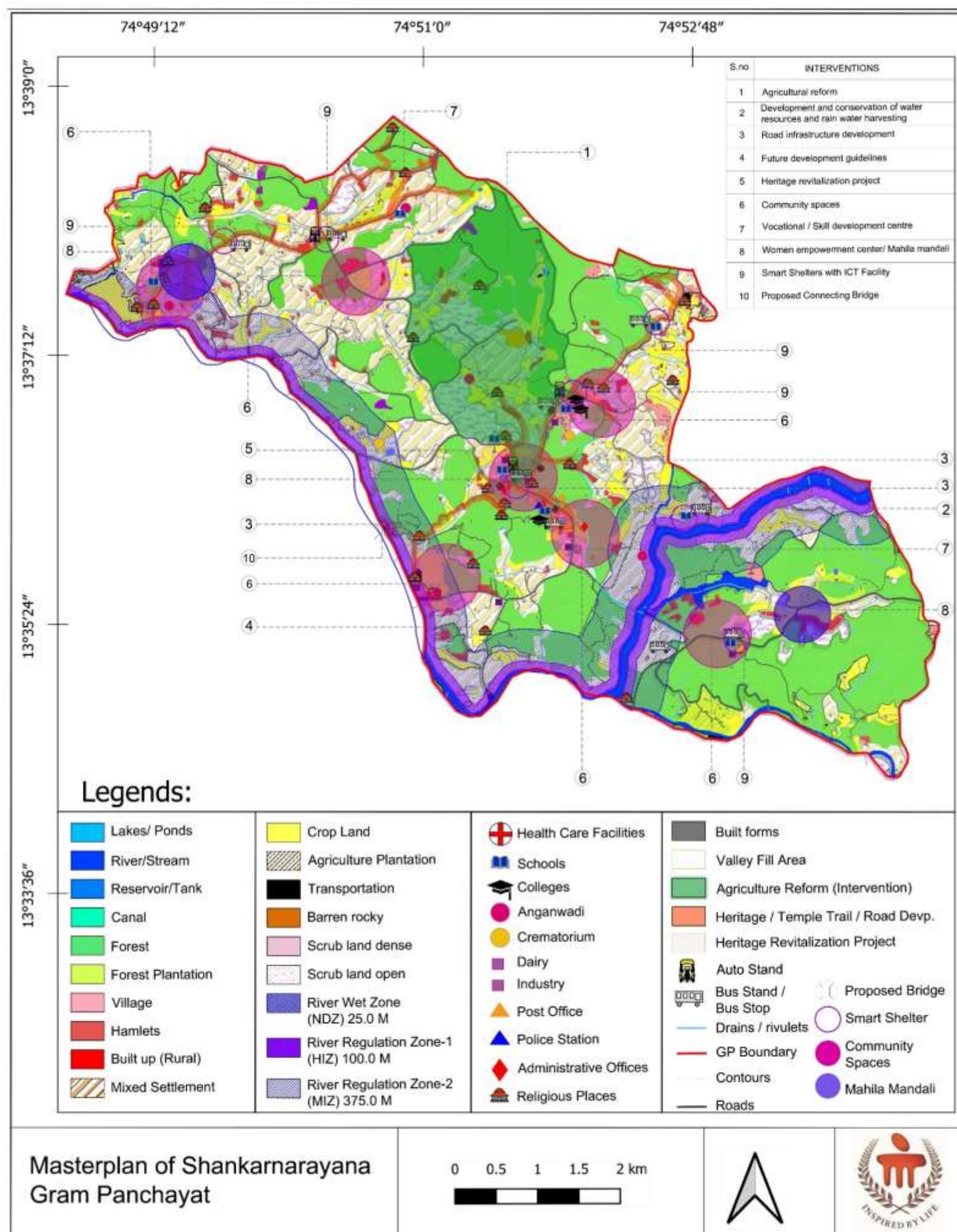


Figure 9-2 Master Plan for Development in Shankarnarayana Gram Panchayat.

Source: (NRSC+ Msap)

9.3. Forest Protection Guidelines

- More participation of local people in protection of local forest areas should be encouraged.
- To promote ecotourism activity (Botanical garden, park etc.) in the study area.
- The reserved forest areas have to be protected and no activity should be allowed.
- Buffer zones may be planted by different trees such as wild Mango and wild jack and both these zones are to be maintained at density higher of 350 trees per hectare. This will give food to animals in the forest and reduce man animal conflict.
- The roots of the native vegetation specially chosen tree species for providing slope stability and steep slope areas have to be identified and afforested.
- The buffer zones can have trees that support commercial and cattle grazing activities but they have to be maintained and no cutting or felling of trees may be encouraged.
- The restricted forest cover which coinciding with existing residential or commercial land use have to be given priority, maintained and handled as an asset – no felling of trees.

9.3.1. Afforestation:

In order to maintain the ecological stability afforestation is deadly required. The proposed plantation must have the following specification:

- Tree specifications for afforestation like (Report for landslides at Karwar, 2009):
 - Density – 350 trees per ha
 - Canopy height at 10 m
 - Multi-layer / storied vegetation
 - Basal area up of 25 sq. m
- List of native trees to be used for afforestation such as *Palaquium ellipticum*, *Artocarpus heterophyllus* (wild Jack), *Ixora brachiata* (Gurani), *Schleichera oleosa* (Sagadi), *Syzygium cumini* (Neerlu), *Terminalia paniculata* (Kindal), *Actinodaphne malabarica*, *Vernonia arborea*, Dwarf Cavendish, Robusta, Poovan, Rasa bale (Rasthali), Hill Banana, Monthan and Elakkibale (Banana types), *Holarrhena antidysenterica* (Kodasa) etc. (Report for landslides at Karwar, 2009).

9.3.2. Afforestation with native vegetation:

- The reserved forest areas have to be protected and no activity should be allowed. These are vital to the Western Ghats as both soil erosion counter mechanism and storm water infiltration systems. Buffer zones have to be provided of trees such as wild Mango and Wild jack and both these zones are to be maintained at density higher of 350 trees per hectare.
- The roots of the native vegetation, especially of certain specially chosen tree species, can act as good soil binders, thereby providing slope stability. Steep slope areas have to be identified and afforested.
- The buffer zones can have trees that support commercial and cattle grazing activities but they have to be maintained and no cutting or felling of trees should be allowed.
- In an instance of the restricted forest cover is coinciding with existing residential or commercial land use then the forests have to be given priority, maintained and handled as an asset – no felling of trees. The land owner can be incentivized to harvest the tree's produce in turn for maintaining the trees.
- Wild Jackfruit (*Artocarpus heterophyllus*), Wild Mango, Jamun (*Syzygium occidentale*), *Actinodaphne malabarica* are large trees reaching heights of up to 20m with wide and deep root systems. These trees are local species of the western ghats and improve soil strength as their roots prevent erosion and provide seepage of surface runoff water to the lower parts of the soil to the harder base rocks.
- These species also produce fruits that may not have commercial value but provide food source and habitat for the animals, birds and insects of the region, reducing animal and human conflicts.



- Dwarf Cavendish, Robusta, Poovan, Rasa bale (Rasthali), Hill Banana, Monthan and Elakkibale (Banana types) Holarrhena antidysenterica (Kodasa) - these are all types of bananas that are available in western ghats. The southern states of India have always had cultural and social space for banana and its various plant parts in their lifestyle. Integration of these plants into the daily life as packaging and handling material will be ecologically friendly, provide a revenue source or ease economically and culturally sensitive to the people.

9.3.3. Zoning regulations

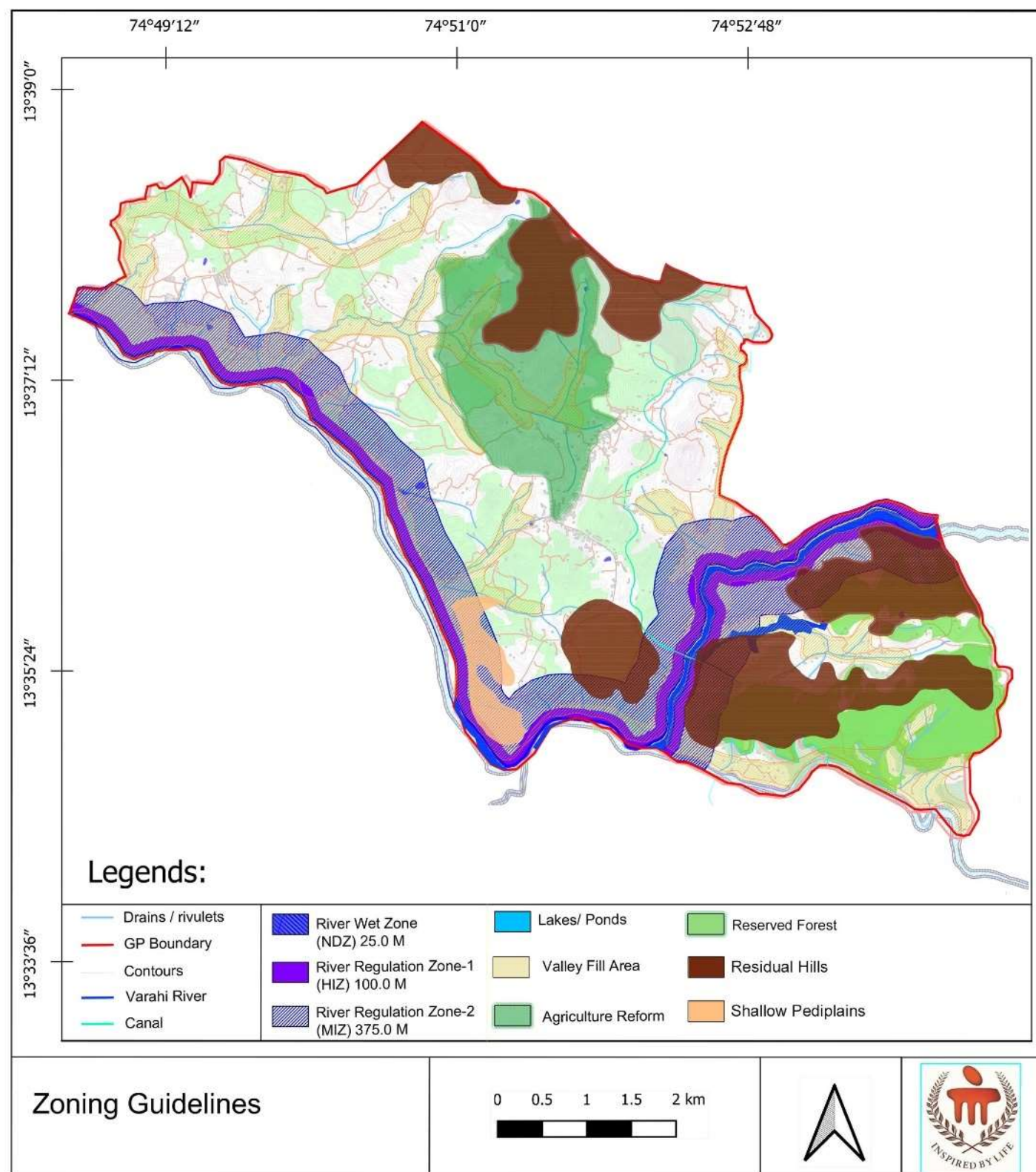


Figure 9-3 Zoning Guidelines

Source: Author

- 1) Valley fill zones are rich in Sandy loamy soil which should be best reserved for cultivation of paddy, food crops, Nursery raising for fodder, fuel, timber and horticultural species. As far as possible local species may be given priority.
- 2) Residual hills should be dealt with sensitively as the areas are prone to landslides and proper attention should be given to the advised guidelines. Deep rooted trees for hills: *Ficus benghalensis* (Aalada mara), *Ficus religiosa*, *Syzygium cumini* (Neerlu), *Mangifera indica* (wild Mango) and for moderate slopes deep rooted shrubs to be considered for planting *Gardenia gummifera*, *Holarrhena pubescens*, *Vitex negundo*.
- 3) No Development Zone: As per studies a NDZ of 25m on either bank Varahi river has been proposed at 50m from the center of the river.

- 4) High & Medium Impact Zones: A HIZ of 100m has been marked along the river from the NDZ and MIZ of 375m has been proposed from HIZ on either bank keeping local topographical conditions in mind, to be called as High impact and Medium impact zones (HIZ and MIZ). In plains where river topography is relatively flat, these distances shall not be less than 1 and 3 Km respectively from the NDZ.
- 5) Agriculture area marked to follow the guideline suggested under 9.2.2 Agriculture Reforms.

9.4. Agricultural Reform Guidelines

9.4.1. Multi- layer Farming

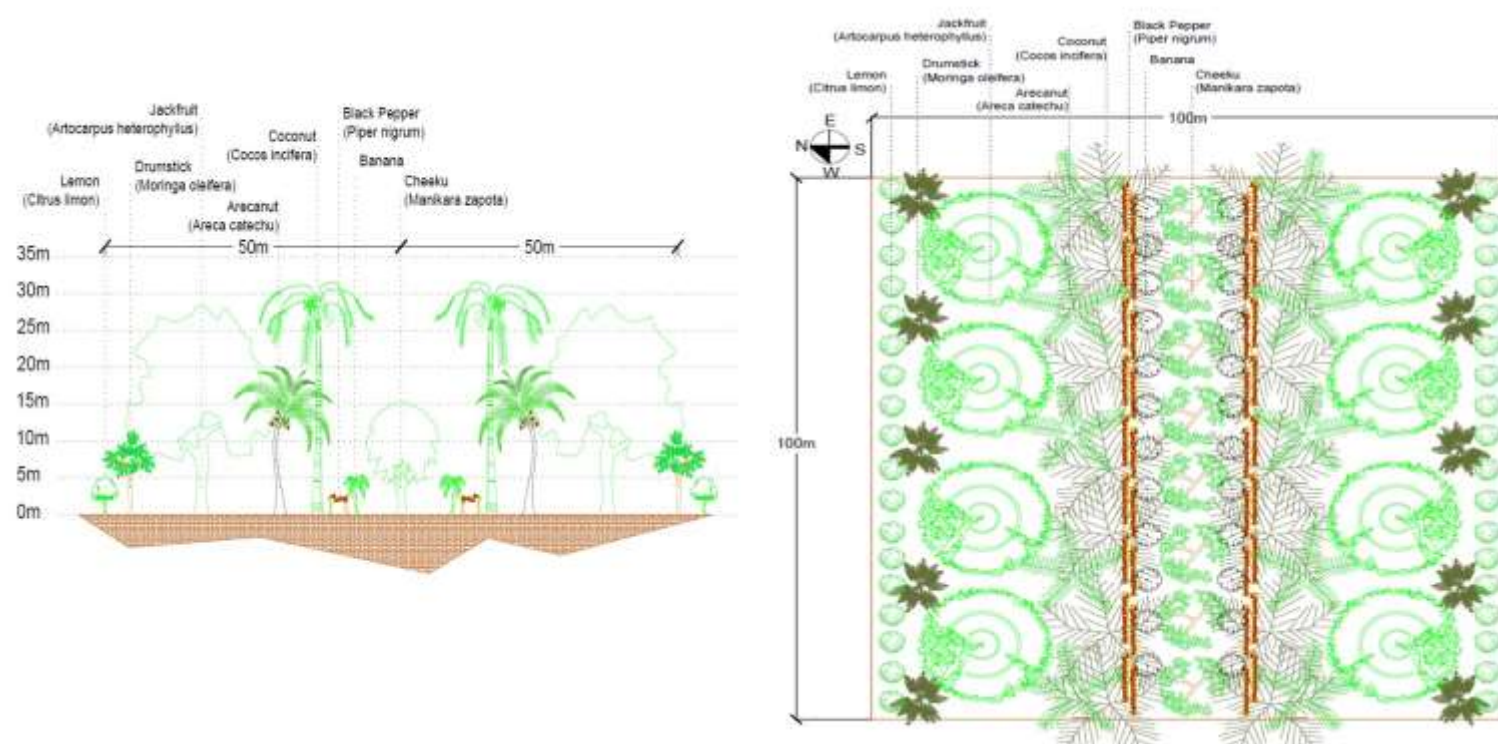


Figure 9-4 Multi-layer farming method.

Source: Author

- Integration of decentralized storm and water management systems for horticulture and Madagas for agriculture use are needed.
- In multi-layer farming, a farmer grows plants of different heights on same field at the same time to optimize the use of land (Figure 9.3).
- Farming extension service center should be encouraged (Figure 9.4) (Village forest management plan guideline, 2016), some of the important criteria should be adopted which are given below:

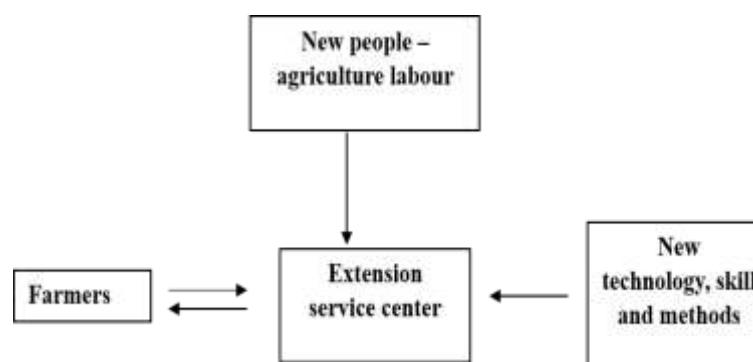


Figure 9-5 Farmer extension service framework.

- Farmer aid: an inter-mediatory between the farmers and the extension system – helps teach farming techniques and in communications, interest groups (IG) - Source: Author
- Commodity IG, Farming IG and Food security IG.

- Farm schools / training center - a regulated institute for teaching elements of farming, methods to fresh persons. Also becomes the point of integration of technology and skills.

- Local storage point for fertilizers and crop as an intermediate between farms and market.

9.4.2. Discouraging monoculture plantation:

- Crop diversification may be targeted with special emphasis on high value crops such as vegetables, vegetable seeds, orchids, spices – Cinnamon (Cinnamomum verum), Black pepper (Piper nigrum), Star anise (Illicium verum) all may be cultivated.



- In the hilly areas, crop diversification may be implemented with special emphasis on high value crops such as vegetables, orchids, spices and mushrooms etc.
- Within existing crop culture, practice of multi-layer farming and multi-crop farming of local species may be induced to improve crop produce per unit land and take advantage of shared soil moisture to counter irrigation water shortage.
- Bamboo plant may be harvested and used in construction, repair and even processed in small scale industries.

9.4.3. Land use Management Guidelines

- 1) Ridge Area Treatment: All activities required to restore the health of the catchment area by reducing the volume and velocity of surface run-off, including regeneration of vegetative cover in forest and common land, afforestation, staggered trenching, contour and graded bunding, bench terracing etc.
- 2) Drainage line treatment with a combination of vegetative and engineering structures, such as earthen checks, brushwood checks, gully plugs, loose boulder checks, gabion structures, underground dykes etc
- 3) Development of water harvesting structures such as low-cost farm ponds, nalla bunds, check-dams, percolation tanks and ground water recharge through wells, bore wells and other measures.
- 4) No fill shall be placed on native topsoil. Fill areas shall be stripped of topsoil to be stockpiled at locations noted on the site plan. This stripped top soil is to be placed back on the site to facilitate revegetation.
- 5) Land Development including in-situ soil and moisture conservation and drainage management measures like field bunds, contour and graded bunds fortified with plantation, bench terracing in hilly terrain etc can be practiced
- 6) Crop demonstrations for popularizing new crops/varieties, water saving technologies such as drip irrigation or innovative management practices. As far as possible varieties based on the local germplasm may be promoted.
- 7) Pasture development, sericulture, bee keeping, back yard poultry, small ruminant, other livestock's and other micro-enterprises
- 8) Veterinary services for livestock and other livestock improvement measures
- 9) Fisheries development in Kulanje village along the river, farm ponds etc.
- 10) Promotion and propagation of non-conventional energy saving devices, energy conservation measures, rain water harvesting at community level for farming & household level for healthy drinking water.
- 11) Permissions for removal of sand and gravel from the river bed in Category III stretches only shall be given on the basis of the guidelines as prescribed by the MOEF and upheld by the Hon'ble Supreme Court.
- 12) Industries as well as polluting activities like land fill, dumping of municipal and other solid (including construction debris) and liquid wastes, disposal of hazardous substances etc shall be color coded based upon their pollution potential as being RED (highly polluting); ORANGE (medium polluting) and GREEN (low polluting) will be governed by the Competent Authority following the Environment (Protection) Act 1986.
- 13) No permanent construction of residential, industrial, commercial, recreational and public semipublic (PSP) nature shall be permitted within No Development Zones, NDZ and also the High Impact Zones, HIZ of river stretch.
- 14) The Reserve forest areas shown in the GP map will be governed by Karnataka Forest Department and follow Forest (Conservation) Act, 2003 with amendments made in 2004.

9.5. Water Management

9.5.1. Guidelines for restoration of madagas and water bodies:

- De-weeding: Biological controls i.e., introducing aquatic animals and plants that eat or compete with waterweeds. Herbivorous animals (those that eat plants) include a wide variety of insects, snails, crayfish, tadpoles, turtles, fish (sterile, triploid grass carp), ducks which can be stocked in ponds or lakes to consume aquatic plant. Using aquatic plants (Macrophytes such as water hyacinth (*Eichhornia crassipes*) and water lettuce (*Pistia stratiotes*), Whorlleaf watermilfoil (*Myriophyllum verticillatum*), pondweed (*Potamogeton* spp.), common reed (*Phragmites communis*), and canna (*Canna indica*).
- Stabilization of earthen embankments, shoreline protection with vegetative or rock riprap to avoid soil erosion

- All the inflow drainage channels should be provided with suitable silt barriers or sediment traps or sediment detention basins at suitable intervals for control of silt especially during monsoon as seen in figure.
- Buffer Zone around a pond (at least 10m periphery) should be maintained as green belt zone or no activity zone. Within the buffer zone, no impervious cover is allowed and mainly plantation with a dense population of deeply rooted plants, trees, shrubs and grasses should be created so as to absorb nutrients as seen in figure.

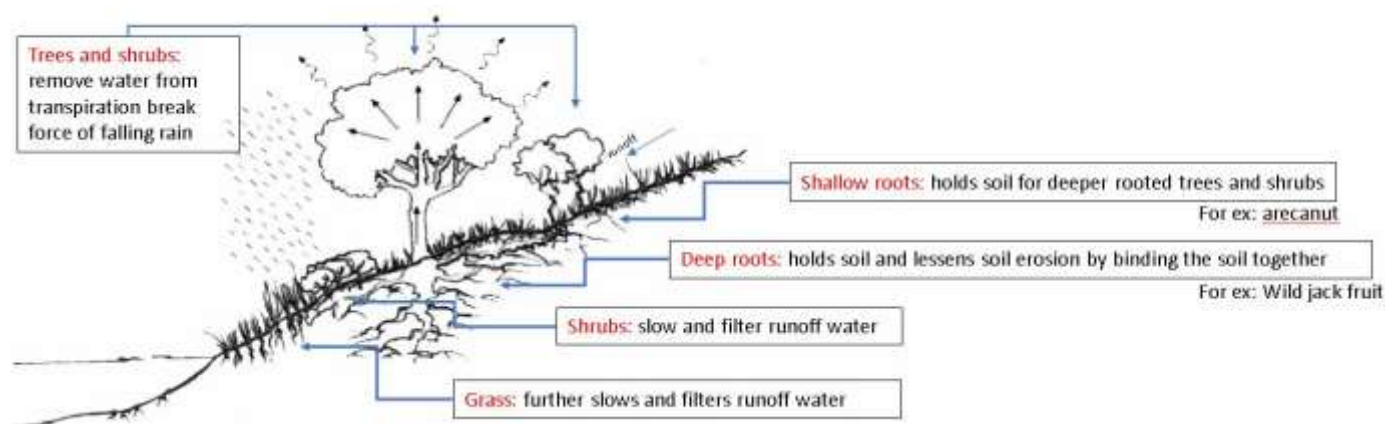


Figure 9-6 Shoreline restoration process

Source: Author

9.5.2. Guidelines for improving water network:

- Inappropriate locations of human habitations on the first and second order streams, encroachment and utilization of river wet zone for agricultural and grazing activities has to be prohibited.
- The wet zone of the river is to be void of any human activities and the riparian zones are to be well defined as such.
- The river regulation zone 1 marked 100 meters from the edge of the river is to be maintained for soil erosion and restricted activities of only temporary nature. Dumping of solid waste, land reclamation, animal grazing activities are not permitted
- The river regulation zone 2 marked 375 meters from the river edge is to be maintained with a forest cover of 300 tree per hectare density.
- In both regulation zone 1 and zone 2, for the existing built structures regulations on surface porous material and ground cover are to be checked to maintain water infiltration to the soil.
- Regulation zone 2 is alluvial rich valley fill zones and as such are suitable for paddy cultivation.

9.5.3. Guidelines for improving water quality:

- In Shankaranarayana Gram panchayat, the groundwater found to be acidic hence, the local authorities are suggested to implement the uses of surface water along with groundwater to reduce the impact and monitor it.
- The groundwater quality may improve due to inflow of freshwater of good quality during rainy season.
- Analysis reveals that the groundwater of the area, needs certain degree of treatment before consumption for drinking and irrigation purposes in Shankaranarayana Gram panchayat. It also needs to be protected from contamination.
- Protection of the river systems and water bodies (madagas, keres, etc.) should also considered importance as they are a major component of the cultivation aspect as agriculture and horticulture are the major source of revenue for the gram panchayat.



9.5.4. Storm Water Management plan

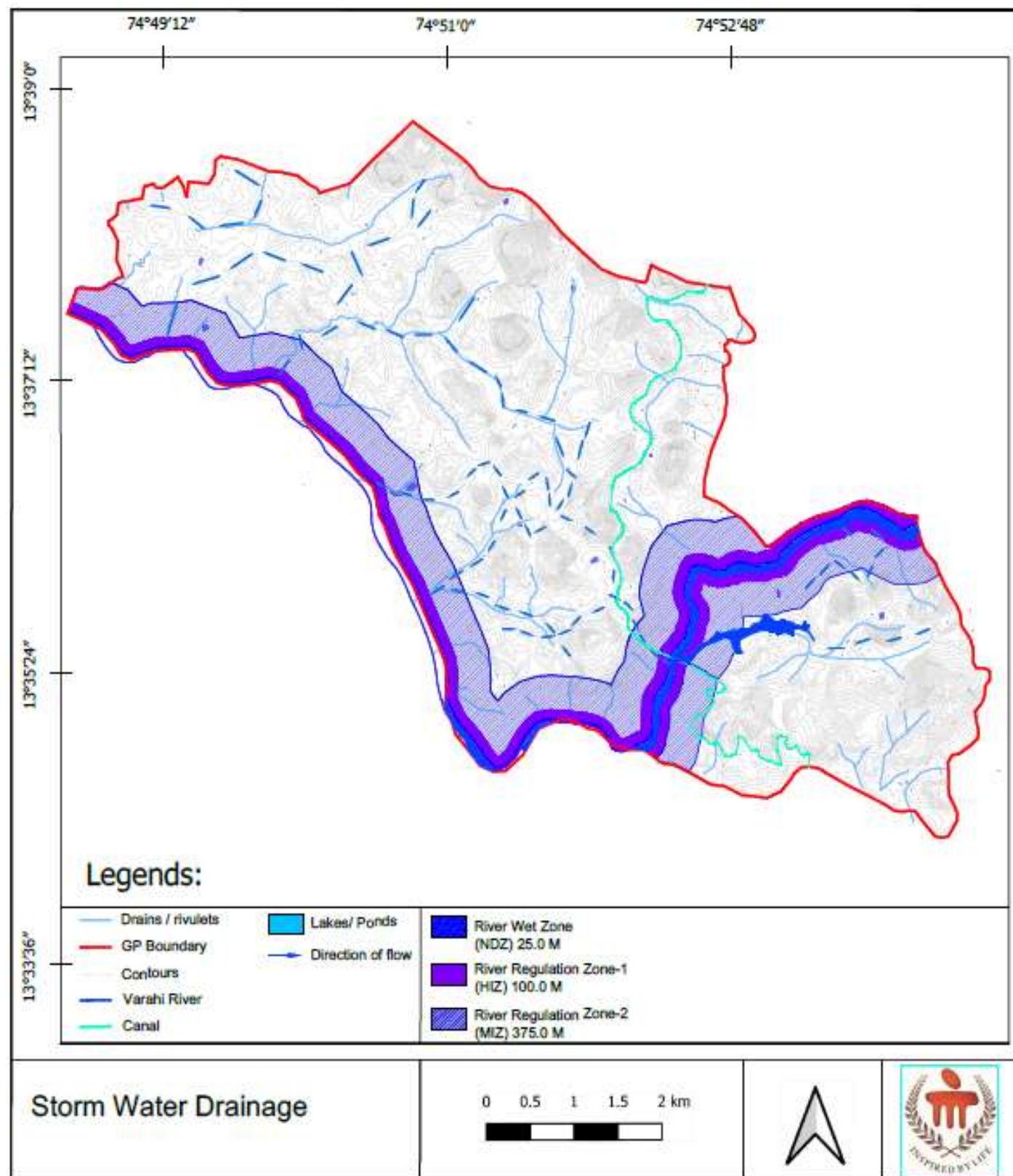


Figure 9-7 Storm Water Management

Source Author

The management of storm water helps to reduce the various impacts caused due to the storm water runoff such as to control flooding, erosion of soil and also improve the water quality. The rain water is considered as the purest form of water, during rainy season the water flows over the ground surface due to the action of gravity and reaches the nearby lake or river through the drainage. The storm water runoff gets polluted on ground surface by oil or grease dropped by vehicles, sediments of metals, bacteria, refuse etc. The storm water runoff reaching the water bodies also gets polluted due to the presence of residues from industries or residential sewers or garbage disposal. Various best management practices can be incorporated to make efficient use of the storm water and support to green infrastructure.

Shankaranarayana GP has considerable amount of rainfall for the maximum duration of the year. In such cases the rain water can be harvested to avoid shortage of water during the summer season. The rural population is dependent on the water tanker facility provided by the Panchayat during the summers. Proposals for bore wells have been put up to overcome the issue of water shortage, which is comparatively expensive. The ideal solution would be to harvest the rainwater, which is pure and free from organic matter.

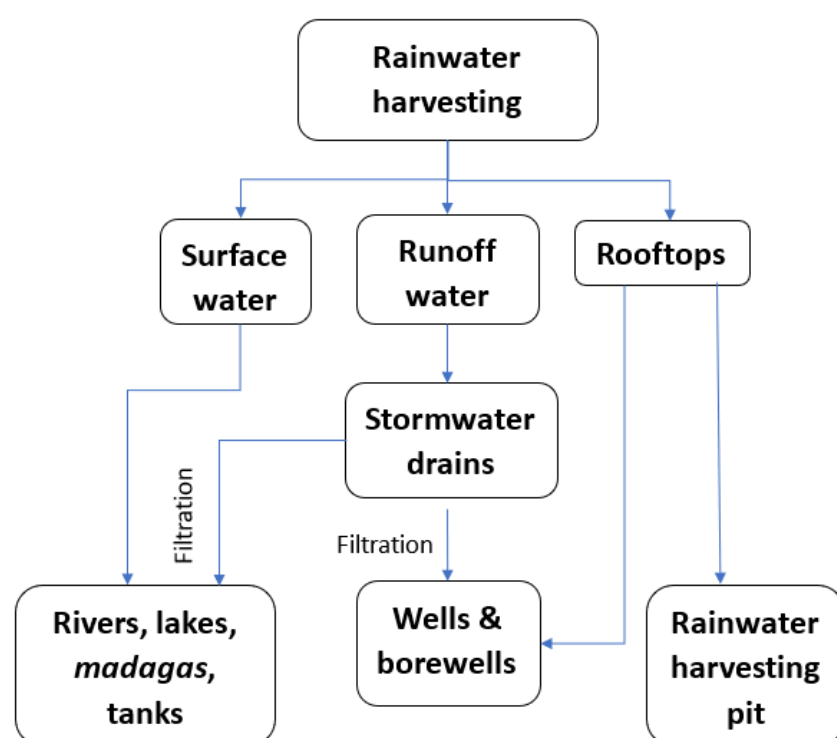


Figure 9-8 Rainwater harvesting flowchart.

Source: Author

Rainwater can be harvested and used for daily purposes or can be redirected into natural water bodies such as rivers, madagas, keres, wells, bore wells, rainwater harvesting pit, etc. as shown in figure 9.26

9.5.4.1. Desilting of Storm Water

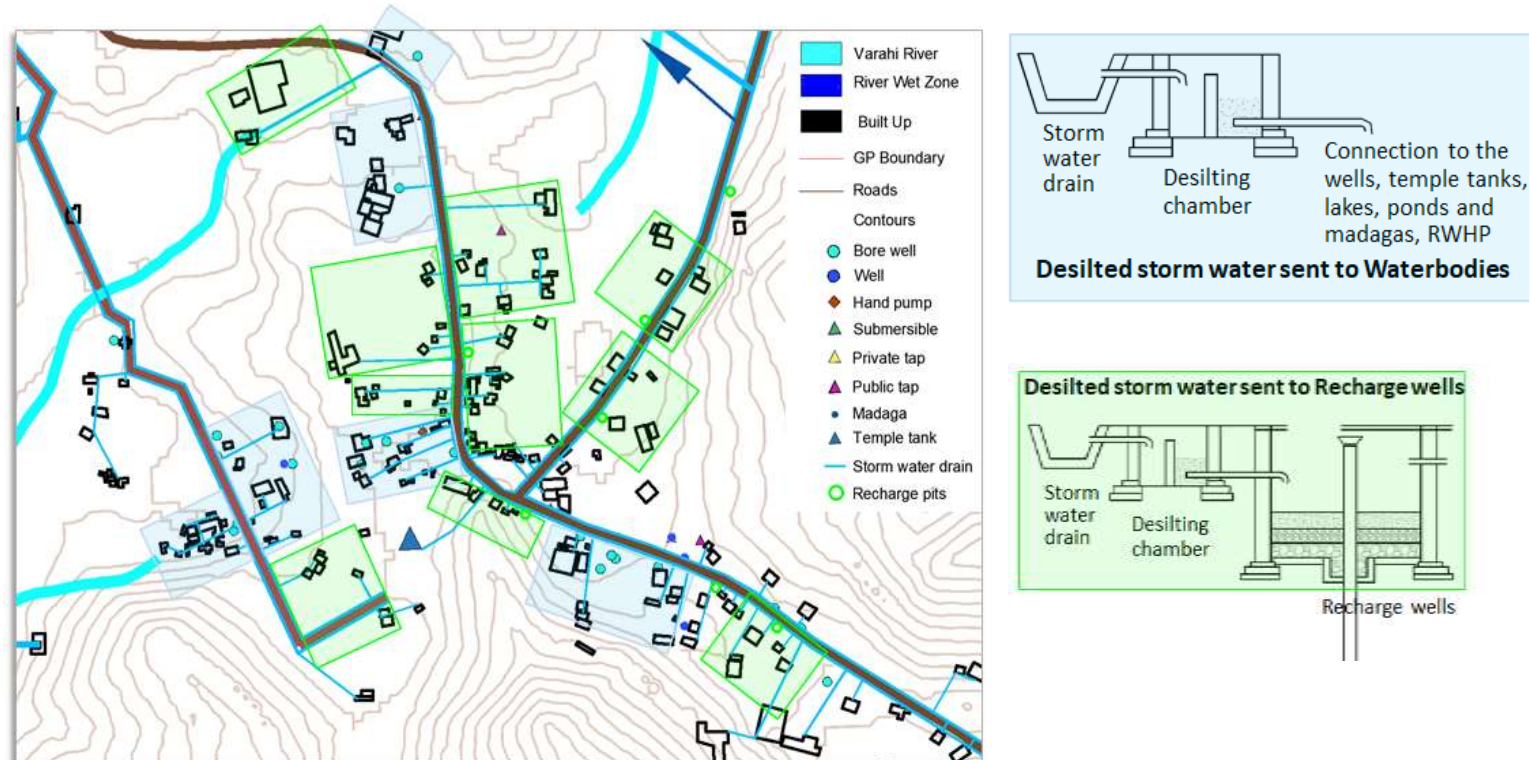


Figure 9-9 Storm water Network.

Source: Author

The settlements are compact in some areas and dispersed in other areas, the connectivity with all the settlements is done based on the topography. The settlements are all connected to the storm water drains, which further discharges the water into the rivers.

The storm water collected through drains is desilted by the Desilting chamber and sent to the existing water bodies, temple tanks, madagas, wells, and RWH pits. Remaining storm water is collected into the Recharge wells to maintain the groundwater level, which would be depleted due to the excessive usage of bore wells and hand pumps. While the water availability during wet

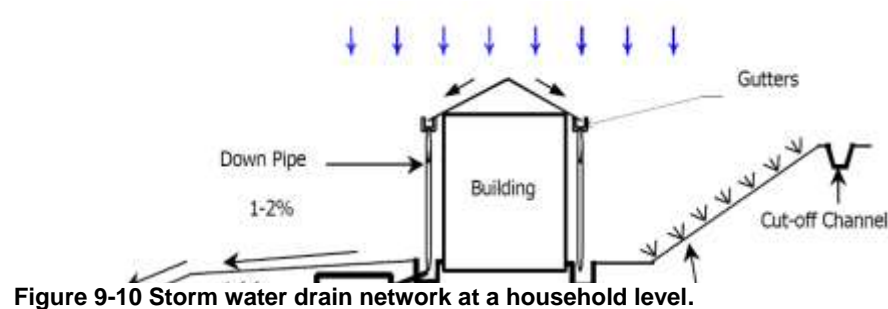


Figure 9-10 Storm water drain network at a household level.

Source: Author



seasons is rainwater, during dry seasons the desilted and stored storm water can be utilized for various purposes, after treating as per the requirement. Rainwater harvesting pits are to be made mandatory for the residences which do not have wells or bore wells. The settlements are to be connected to the storm water drains, which further discharges water to the rivers as seen in figure 9.28. Remaining storm water is collected into the Recharge wells to maintain the ground water level, which would be depleted due to the excessive usage of bore wells and hand pumps. Figure 9.29 and 9.30 shows the schematic section of recharge well at roads and residences.

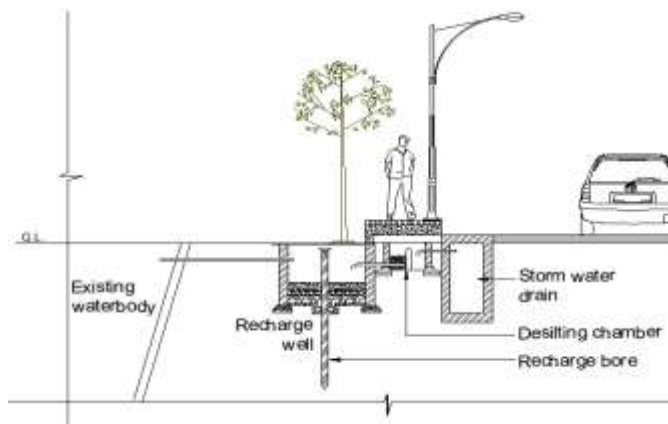


Figure 9-13 Schematic section showing detail of Recharge well.

Source: Author

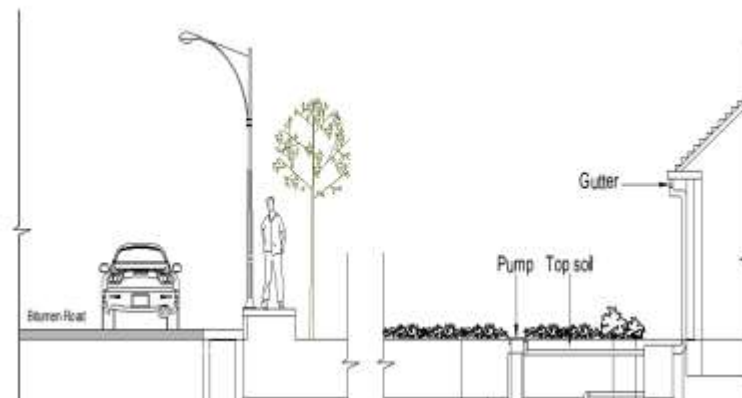


Figure 9-11 Schematic section showing detail of Rainwater harvesting pit at household.

Source: Author

9.5.4.2. Roof Top Harvesting

The rain water in the GP may be harvested as it has rainfall of considerable intensity and spread over the larger part of the year.

In this method the roof top acts as the catchment (Figure-9.31). The roofing material used should be aluminum, clay tiles, GI sheets or concrete. A waterproofing LDPE sheet can be used if it is a thatched roof. A drain (Gutter) made up of G.I sheet, bamboo, or any other locally available material should be provided along the edge of the roof for the collection of water. It should be connected to the down pipe of at least 100 mm diameter with a gentle slope for the free flow of water towards the storage tank. A mesh wire should be provided for the screening of any dry leaves at the inlet of the down pipe.

Materials such as sand, gravel, charcoal, coconut/ betel nut fibre can be used as filters. The storage tank can be either underground or above the ground. Masonry or R.C.C structure with suitable water proofing should be provided for the underground tank. G.I sheet, R.C.C, plastic or Ferro cement tank can be used for the surface tank and should be placed at an elevated platform.

An outlet pipe should be provided at the bottom of the tank for regular cleaning. The size of the tank to be constructed would be dependent on various factors such as catchment area, amount of rainfall, daily requirement of water.

In case of an underground tank a minimum of 0.3 m should remain above the ground and a hand pump is installed for the withdrawal of water. In a surface tank a tap is provided for the same. In addition, the tank should contain a man hole of 0.50 m x 0.50 m size with cover,

an over flow pipe (with screen) of 100 mm diameter and drain pipe of 100 mm diameter at the bottom.

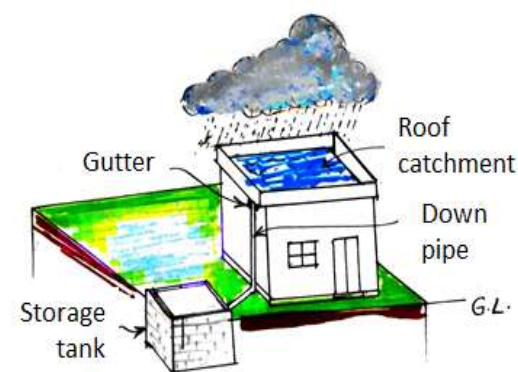


Figure 9-12 Roof top Rainwater harvesting.

Source: Author

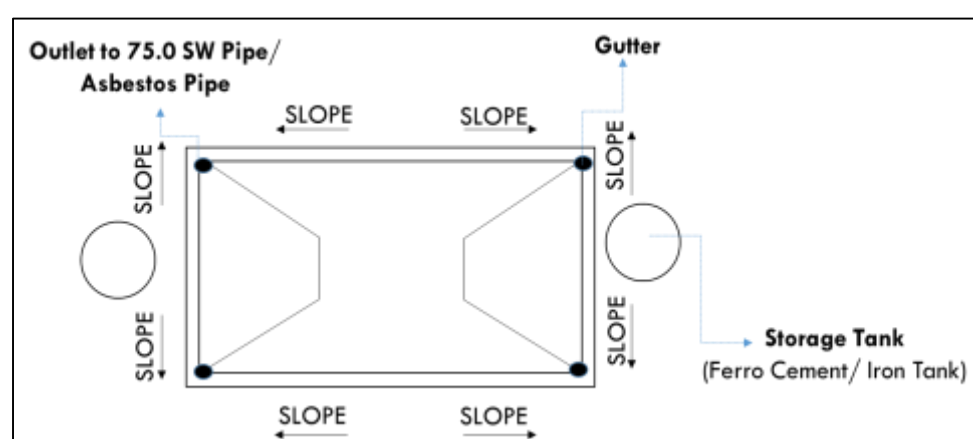


Figure 9-14 Plan of the roof catchment.

Source: Author

The tank should be cleaned with chlorine and disinfected as the water shall remain stored for a longer duration. In order to avoid the growth of any pathogenic bacteria the stored water should be periodically disinfected. The roof plan of the rain water harvesting structure is shown in the (Figure- 9.32).

Assessing the required systems

The area of the roof and the amount of rainfall received are the determining factors for the design of the storage system. These factors can be controlled only in the case of any new construction, in already existing structures modifications can be made in the roof covering so as to improve the water runoff.

The catchment area of the tank should be designed such that it can supply sufficient water during the summer season. The calculation is based on the assumption that a full tank at the start of summer season. The volume of the tank to be constructed can be calculated using the formula,

$$V = (t \times n \times q) + et$$

Where,

V = Volume of tank (liters)

t = Length of the dry season (days)

n = Number of people using the tank

q = Consumption per capita per day (liters)

et = Evaporation loss during the dry period (Since evaporation from a closed storage tank is negligible, the evaporation loss (et) can be ignored (=zero))

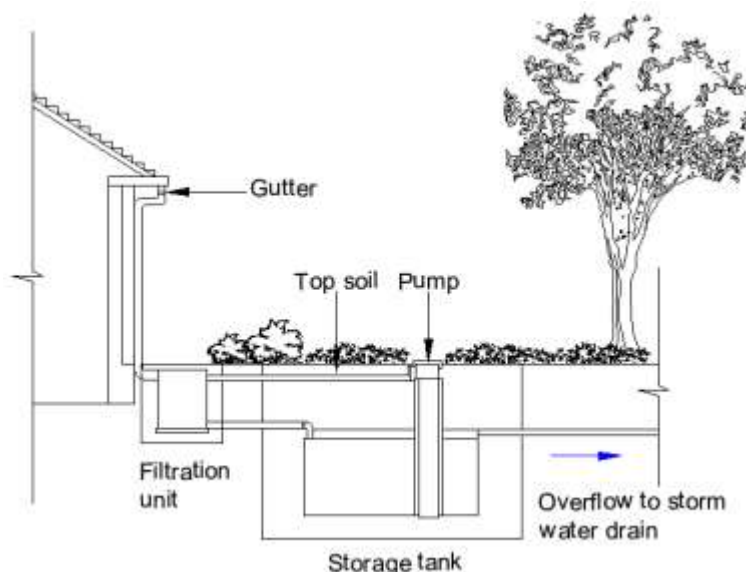


Figure 9-15 Detail of RWH pit for residences

Source: Author

Design Guidelines for the system components

The roof top catchment system mainly comprises of three components, the roof, gutters and the storage tank.

- **Roof:** The surface of the roof should be made up of smooth and non-toxic material. The size of the roof should be large enough to fill the tank with the rainfall received through the season. In case of existing roofs of public buildings and residences, the roof top can be used for the catchment system, if required additional roofed structures can be incorporated.
- **Guttering and first-flush device:** The main purpose of providing gutters in the building is to protect the building by collecting the rain water from the roof and using a down pipe direct it to the storage tank. A minimum slope of 0.5% should be provided to collect the heavy water run off with high intensity. The first rain water should be thrown out as it might contain large quantities of leaves and bird droppings. This process will help in keeping the water potable.
- **Tank:** Ferro cement tanks are available in various designs and capacity. A cylindrical tank can be built in sizes between 10 and 30 m³, while a capacity of up to 200 m³ is possible with sub-surface covered tanks. It is economical to have tank capacity exceeding 50 m³. Corrugated iron molds are used for the construction of Ferro cement tanks. Alternatively, a circular frame made of welded-mesh bars with spacing 0.15 m and covered with chicken wire mesh (2.5 cm gauge) onto a reinforced concrete base. This should be further covered with sacks or cloth on the outer side and a layer of mortar with thickness 1.5 cm shall be plastered should be done along the inner side of the tank. Waterproofing layer of only cement and water should be applied on the inner side of the tank. The roof to be reinforced with weld-mesh and chicken wire. Curing must be done on the floor, roofs and wall to maintain the quality and to moisten the surface for a minimum of 7 days.

Maintenance and Management

Similar to the other water supply systems, it is required to maintain and manage the roof top catchment tanks, this ensures that the water collected is of high quality. Following are the measures to be done for the maintenance of the system.



1. It is required to scrub and flush away all the sediments in the tank by the end of summer season or before the start of monsoons. The tank should be filled with a minimum amount of water to avoid cracking.
2. All the components of the system, the roof catchment, gutters, screens etc. to be checked and cleaned regularly after every summers.

a. Tanks

A circular shaped tank is constructed using stone masonry in cement and sand mortar (1:3) The capacity of the tanks could vary between small (3 to 4.22m diameter) by the individual households and large (6m diameter, 200 cum capacity) at community level. The depth of the tank should be equal to the diameter of the tank. Materials such as murrum soil, coal ash, gravel, and pond silt, Bentonite, soil-cement mix, lime concrete, sodium carbonate etc. can be used to treat the tanks to increase the collection of rainwater. In case of limitations in the availability of land for the construction of tank, the tank should be treated, a lope of 3 cm for a length of 1m is maintained. This helps in providing the required amount of water to fill the tank. The natural catchment outside the treatment area also contributes for the water received in the tank.

b. Selection of Site

The tank should be placed in an area which is away from any human activity and cattle grazing to prevent the pollution of water during the monsoons. The tank can be constructed in an open area of 10m x 10m with a capacity of 21 cum for an individual household. In case of a community level tank it should be of a minimum area of 30m x 30m and 200 cum capacity. A slope of 3% should be maintained for the tank.

c. Preparation of Site

The open area selected for the construction of tank should be free from vegetation. The circle of the preferred size of the tank is marked to indicate the catchment area. For a smaller size tank, it should be dressed to provide a slope of 3% from the inwards. Whereas for a community tank can be provided in one direction along the natural ground slope. Along the lower side of the tank an earthen bund to be built.

d. Structural Design Guidelines for Small tanks at Individual Household Level

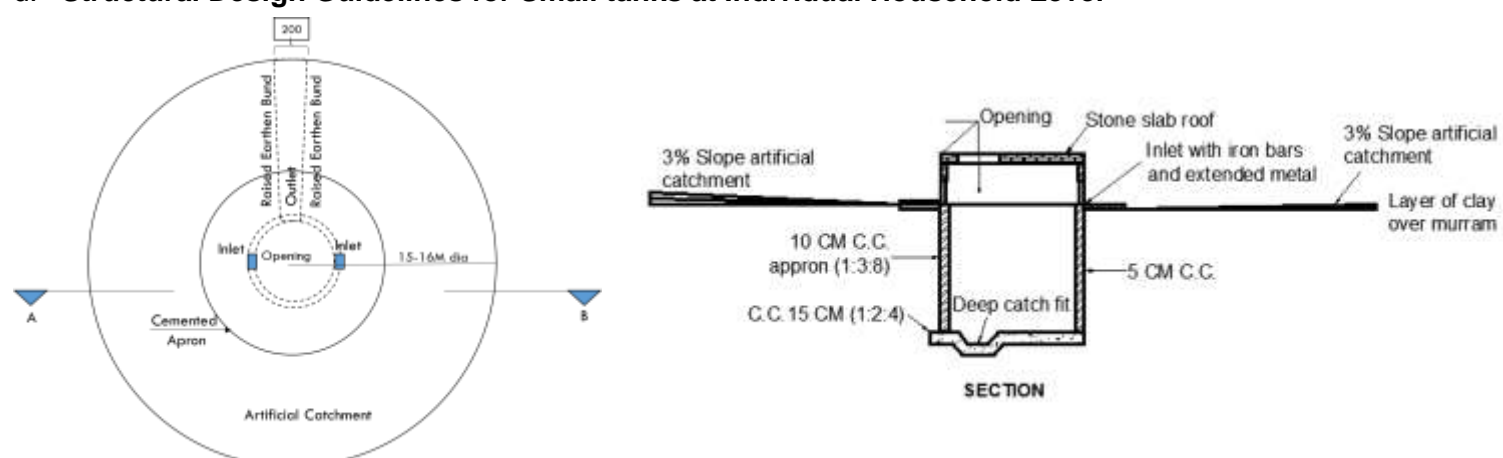


Figure 9-16 Plan and Section of small tank.

Source: (Water harvesting structures planning, design and construction)

- (i) Excavation: Area 3.9 m diameter and 3.5 m deep
- (ii) Foundation concrete: 1:3:6 CC 250 mm thick over an area of 3.9 m diameter
- (iii) Tanka Wall: 1:2:4 CC Wall 150 mm thick with 5 mm Cement Plaster
- (iv) Tanka Cover: Stone slab roof, at height of 1.0 m from G.L.
- (v) Apron around Tanka: 1:3:6 CC Apron, 1.0 m wide and 100 mm thick
- (vi) Deep Catch Pit at the bottom of Tanka: Size 1000 x 250 mm
- (vii) Slope of artificial/ treated catchment around Tanka: 3% to 4% - a fall of 3 cm in a length of 1 m
- (viii) 3 Inlets and 1 Outlet in Tanka wall at apron level: Size 0.6 x 0.3 m with Iron Bars and Expanded Metal
- (ix) Opening at the top (for drawing water): Size 1.0 x 1.0 m

Structural Design Guidelines for large tanks at Community Level

- (i) Excavation: Area 9.15 m diameter and 6.32 m deep
- (ii) Foundation concrete: 1:3:6 CC 230 mm thick over an area of 9.15 m diameter

- (iii) Tanka Wall: RR masonry 1.45 m thick at bottom in 1:3 cement-sand mortar gradually reduced in steps to 0.38 m at the top
- (iv) Tanka Cover: Stone slabs over 3 Nos. R.S. Joists of size 0.20 x 0.15 m
- (v) Apron around Tanka: 1.6 m wide and 115 mm thick
- (vi) Deep Catch Pit at the bottom of Tanka: Size 915 x 230 mm
- (vii) Silt Collecting Gutter: Size 305 x 305 mm, bottom 75 mm thick 1:2:4 Lime Concrete and 230 mm thick RR masonry, sides 230 mm thick RR masonry
- (viii) Slope of treated catchment around Tanka: 3% to 4% - a fall of 3 cm in a length of 1 m
- (ix) 3 Inlets and 1 Outlet in Tanka wall at apron level: Size 0.6 x 0.3 m with Iron Bars
- (x) Opening at the top (for drawing water): Size 0.9 x 0.9 m

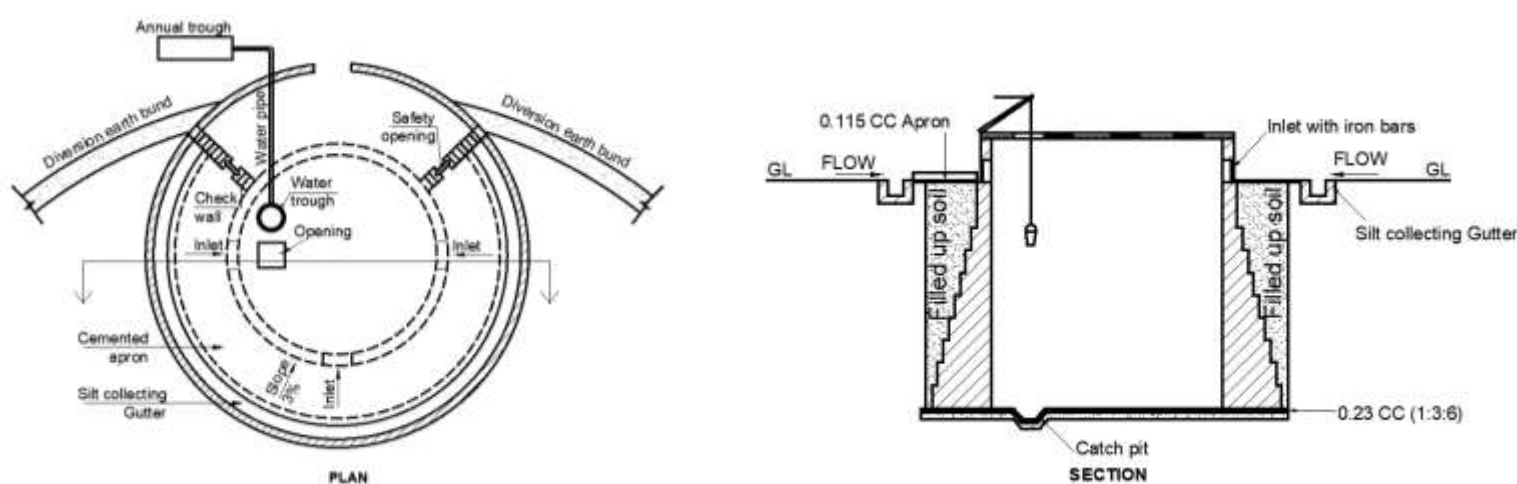


Figure 9-17 Plan and Section of large tank.

Source: (Water harvesting structures planning, design and construction)

9.5.4.3. Recharge Pits:

These are excavated pits, dug to appropriate depth such that it can infiltrate into the low-permeability layers covering the unconstrained aquifers. The infiltration process follows the walls of the pit, the lateral hydraulic conductivity is greater than that of vertical hydraulic conductivity due to the presence of layered sedimentary material. In case of availability of any quarry pits or brick kiln quarry, it can be utilized as recharge pits.

Site and design Requirements for recharge pits

The capacity of the water to be recharged in the pit is dependent on the cross section area. It is always recommended to build pits in large sizes. The penetrability of the primary strata should be determined through infiltration tests before the construction of the pits. In order to eliminate issues related to water logging and sedimentation on the walls of the pit a steep slope of 2:1 is recommended. These pits can also be used as ponds for the storage and infiltration of water. It is advisable to add a thin layer of sand at the bottom to avoid silting and water clogging at the strata. The source water should be maintained silt-free water which is further recharged.

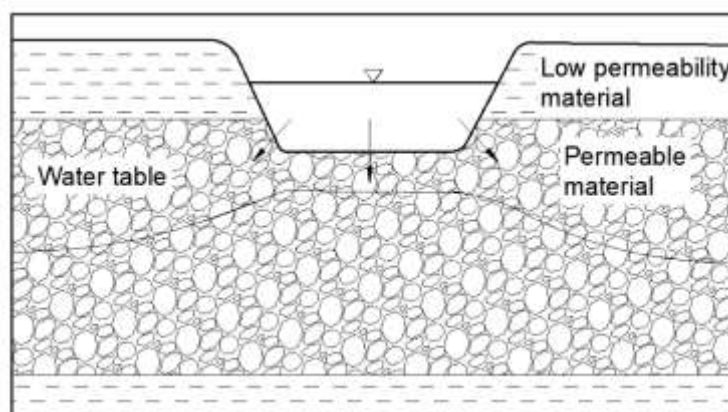


Figure 9-18 Section of Recharge Pits.

Source: (Manual on Artificial Recharge of ground water)

9.5.4.4. Low Cost Rain Water Harvesting System at Household Level



Rain water can be collected at household levels with simple and inexpensive method. The water collected can be used for drinking and other household purposes. The process involves three stages of filtration and involves easily available materials such paint buckets and PVC pipes and mesh wires.

Design of the system.

A T- pipe to be enclosed at the end of the PVC pipe which collects the rain water from the terrace. The T-pipe directs the water flow in two directions:. One, towards a soak pit that collects the initial flush water during the first 15 minutes of rainfall, as the flush water contains impurities that have accumulated on the terrace and inside the pipe. After 20 minutes, the valve to the soak pit is closed, and the one towards the filtration system to be opened up.

Using L angle stands, three pairs of paint buckets to be mounted on the wall. The lid of the bucket should have a puncture with PVC pipe inserted to allow the terrace water to enter with the help of an elbow pipe.

Stage 1 filtration:

Two paint buckets of the same quantity are required—one for water to enter and get filtered and the other for creating an outlet. The pipe carrying rainwater enters the bucket partially so that the water is received with force, so that it can push the impurities onto the sides. At the bottom of the inner-bucket, four openings to be created and a slit along the circumference, one inch above the base to insert the mesh. On the outer-bucket, at the bottom, a circular outlet to be provided for PVC pipe to carry water into the next stage. The size of the mesh should be an inch more than the circumference of the bucket. The mesh is slid into the bottom with the help of slit at the edges of the bucket, with the help of adhesives the additional part should be glued to the sides of the bucket such that gaps are prevented for water leakage. In this stage, a mesh 304 Grade stainless steel, to be provided as an insect or mosquito net. In the first level, the aim is to stop solid impurities.

Stage 2 filtration:

The second pair of buckets is positioned under the first one, it has a different arrangement and uses filters on the sides of the inner-bucket. Two large openings on the sides of the bucket and four openings at the bottom of the bucket to be provided and the mesh must be positioned to cover these openings and sealed. The mesh provided in the first stage contains bigger holes, 75 micron mesh to be used in the second stage. Smaller particles and impurities shall be collected at this level.

Stage 3 filtration

The buckets in this stage is arranged same as the first stage, 50 microns mesh is used minute particles like sand can be filtered. The water flows through this filter, and the outlet is connected to the underground tank designated for storing rainwater. The capacity of the underground tank shall be dependent on the roof catchment area. (htt6)

Maintenance of the system:

For the effective functioning of the system it is required to take away the buckets and clean the filters to remove the solid impurities present. This helps to prevent water clogging in the future and clears out any insects that were filtered. It is also necessary to keep the roof top areas clean to maintain the filtration system.

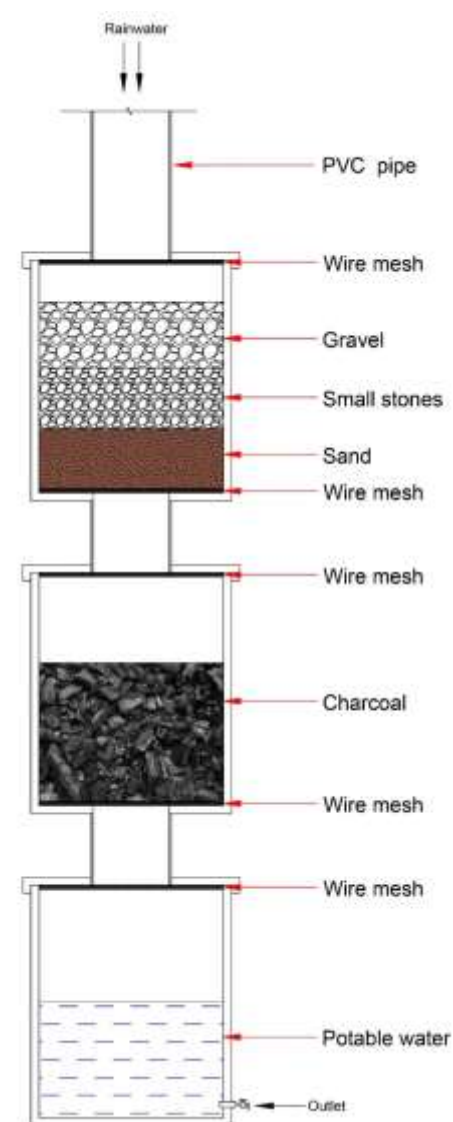


Figure 9-19 RWH using DIY methods.

Source: (htt10)

9.6. Road Infrastructure

9.6.1. Guidelines for Road safety:

- Incorporating appropriate safety design standards and features in the rural roads can enhance road safety to a great extent. In view of the lower levels of education in the rural areas, the engineering of roads to constrain users to follow safe driving and behavioral standards may be necessary to Supplement Cautionary Signboard. Some of the engineering measures that should be in built into the design of rural roads are enumerated below.

- ii. Rural roads must necessarily have a tortuous path, keeping in view the narrow land width available. All the same, the horizontal curves should be designed scientifically, conforming to the selected design speed and terrain. The horizontal curves must be provided with smooth transition curves and super-elevation. The pavements should be widened at curves.
- iii. The vertical profile of the road should be designed such that the required minimum stopping sight distance is available. Suitable summit and valley curves should be provided.
- iv. In hill roads, blind curves are a safety hazard. Suitable vision berms may be cut at such locations.
- v. Passing places must be provided at convenient locations particularly on hill roads.
- vi. The provision of rural connectivity leads to the introduction of bus services.
- vii. Properly designed bus-bays must be provided at bus stop to ensure that the buses do not hamper the normal traffic.
- viii. Where the roads pass through habitations and school, it is necessary that the motorized vehicles travel at low speeds. This can be ensured by providing adequately designed road humps or rumble strips.
- ix. The junction of rural roads with a main road is always a point of conflict and an accident-prone zone. Such junctions must be designed scientifically by providing minimum turning radii, flaring of the side road with taper, acceleration/deceleration lanes and adequate sight distances.
- x. Ramps must be provided where field paths and cattle crossings intersect the road.
- xi. Traffic signage, incorporating warning and regulatory signs, can enhance road safety, especially near habitations and school zones, sharp curves, narrow bridges, junctions, submersible bridges, and causeways. The design must incorporate these.
- xii. Hazard markers like reflectorized delineators must be provided at dangerous locations.

9.6.2. Guidelines for Model Road:

Proposal of roads with proper connectivity and the enhancement of existing roads will fulfill all the associated objectives the Government is aiming to achieve which are generally,

- a) Social and economic Upliftment of rural masses.
- b) Employment generation in rural areas by making them accessible.
- c) Creating attraction for rural areas in the surrounding and thus providing facilities there.
- d) National integration of major part of the population which is in rural India and thus promoting the primary sector.
- e) Arresting of rural-to-urban migration which has made an undesirable imbalance in the urban population and economic imbalance.

Model road infrastructure comprises of:

- i. Plantation along all the roads with native trees so as increase the groundwater recharge and acts as a canopy to the pedestrians.
- ii. Placement of utility poles which provides and acts as Non- interactive display, display charging points, and government utility points, USB charging points, Wi-Fi hotspot, energy-saving street lights with automatic lighting intensity controls, small cell units, four-way solar charging panels, cameras, and multiple sensors, dynamic display billboards, static display panic button/ alarm, and telephones.
- iii. Provision of street benches for seamless walkability.
- iv. Provision of streetlights along roads: providing solar-powered streetlights along the roads is an alternative way to light up the streets and is sustainable in the long run. This will help keep the roads active at night as well and help in accessing and using the streets even at nightfall. It will help reduce the susceptibility of accidents. Since it is a renewable source dependent technology, it will have a long life although the initial investment will be high cost. But since we receive a lot of rainfall in this area, some provision must be made to store this energy to be utilized during non-sunny days.



- v. Bus stops: since the villagers have to walk a long way to get public transport, it is advisable to locate bus stops in each ward so that the villagers can access it easily and can use it for a daily commute. It will also act as landmarks.

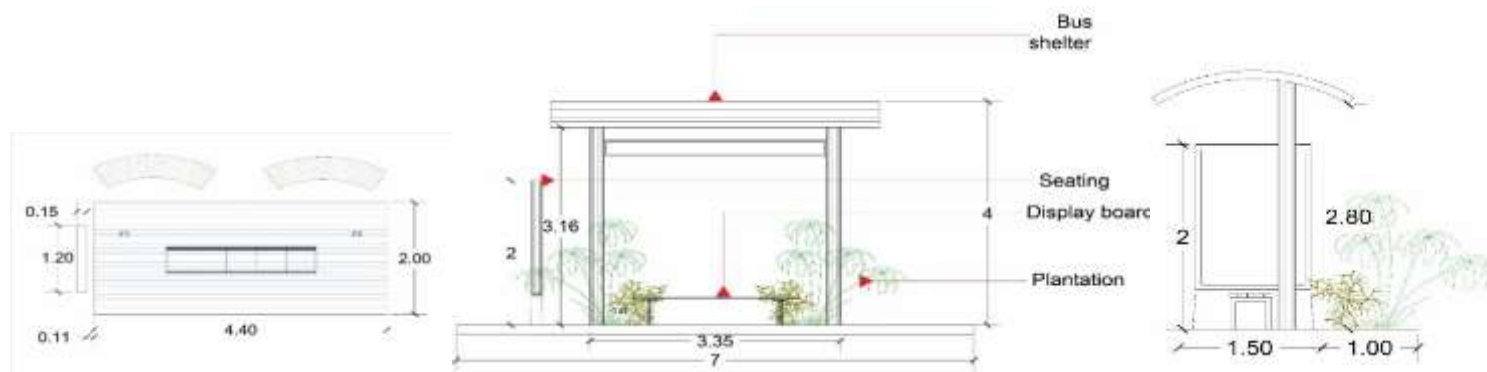


Figure 9-20 Proposed Plan, Section and Elevation for the prototype of bus shelter.

Source: Author

9.6.3. Guidelines for Plantation along the Roads

- Landscaping and tree plantation:** Trees shall be placed at a minimum distance of 10- 12 m from the centerline of the extreme traffic lane, to provide a recovery area for the vehicle that runs off the road. The second row of trees 6m further away will also be desirable and planted, wherever possible. Preferably, the first row of trees shall consist of species with thick shade and other rows of vertical growth type providing thin shade. The native tree species are that are recommended for Shankaranarayana gram panchayat based on the type of soils are listed in the Annexure. These trees are also the native species of Karnataka and belong to Western Ghats.
- The spacing of Avenue Trees:** The spacing of avenue trees will depend on the type and growth characteristics of trees, the requirement of maintenance, penetration of distant views, etc. A range of 10-15 m would meet the requirement for most varieties.
- Choice of Trees:** The following guidelines shall be kept in view while selecting the species of trees to be planted:
 - Trees shall be selected with due regard to soil, rainfall, temperature, and water level.
 - Trees which become very wide shall be avoided as their maintenance would cause interference with traffic flow.
 - The species must be capable of developing a straight and clean bole up to a height of 2.5 to 3.5 m from the ground level.
 - The selected trees shall, preferably, be fast-growing and wind-firm. These shall not be thorny or drop too many leaves.
 - The trees shall be deep-rooted as shallow roots injure pavements. (www)

9.6.4. Road Infrastructure Plan

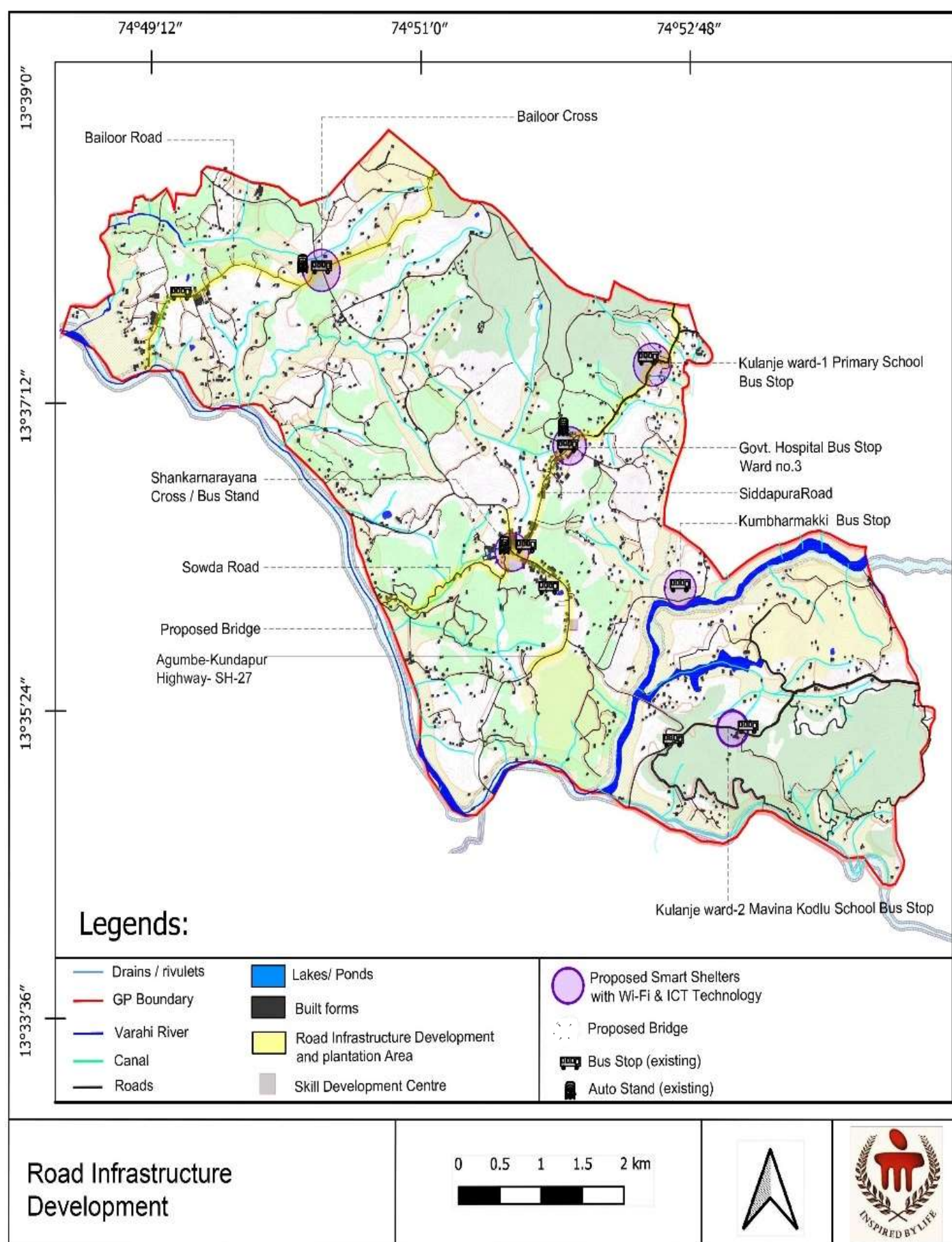


Figure 9-21 Road Infrastructure Development

9.6.4.1. Development of Siddapura Road

The identified road for development is the Siddapura Road (13°36'28.08792"N 74°51'45.17208"E). The criteria of selection of road is based on its hierarchy, it is the next major road subsequent to the state highway. It connects Shankarnarayana and Siddapura. The density of settlements and development along this road is high and shows a potential linear development along the stretch. Important structures like banks, temples, education institutes, PHC, petrol stations, industries and commercial development flank along the road.

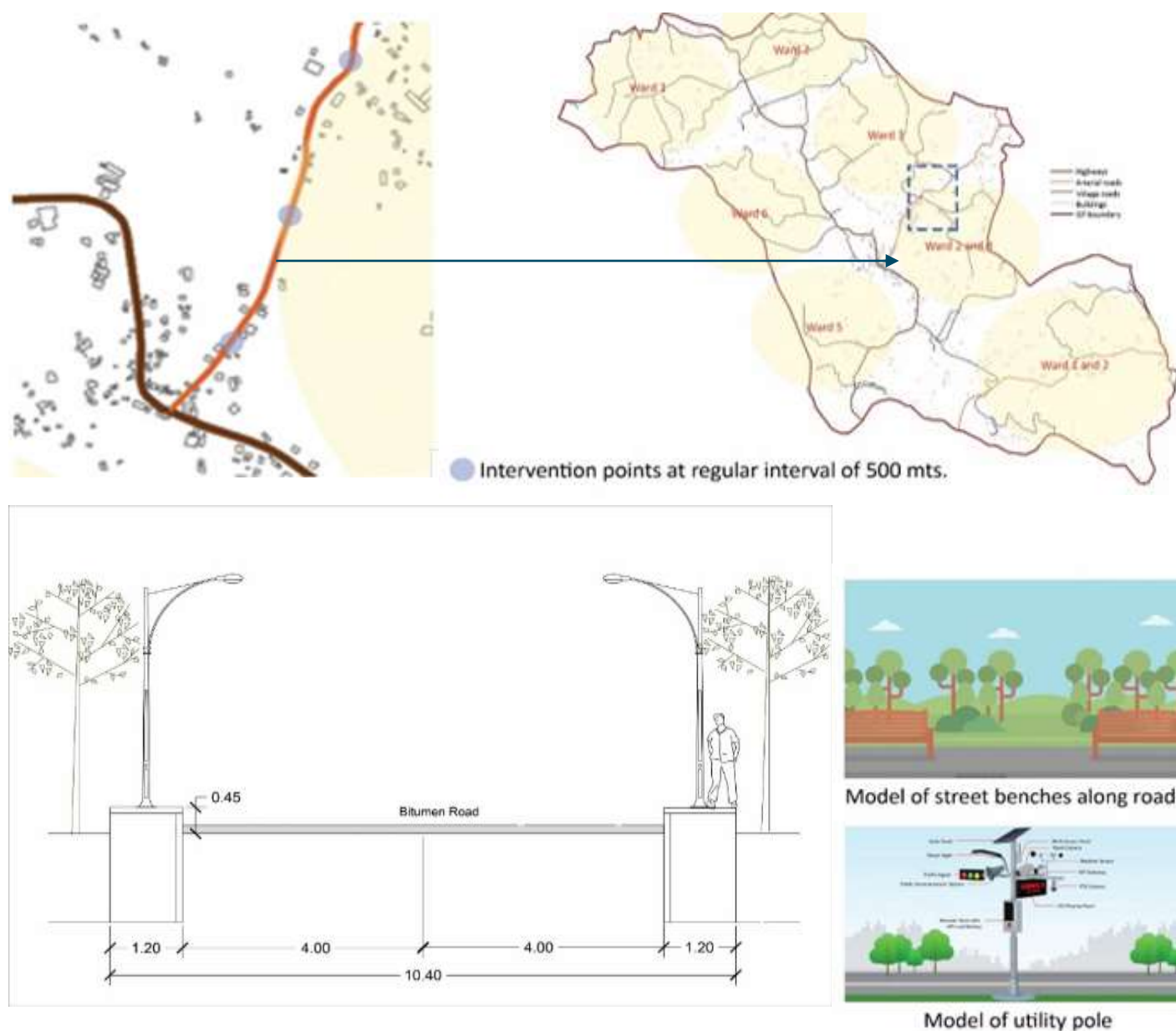


Figure 9-22 Map showing proposal for road infrastructure development along Siddapura Road.

Source: Author

Placement of utility poles at every 500 m interval which provides and acts as Non- interactive display, display charging points and government utility points, USB charging points, Wi-Fi hotspot, energy saving street lights with automatic lighting intensity controls, small cell units, four way solar charging panels, cameras and multiple sensors, dynamic display billboards, static display panic button/ alarm and telephones.

Provision of street benches for pedestrian ease and seamless walkability.

Separate waste bins for degradable and non-biodegradable waste to be provide.

9.6.4.2. Proposal for connecting Shankarnarayana to Molahalli:

The Haladi or Varahi River separates Shankarnarayana from Molahalli, which is located towards the west across the river. Molahalli is known for its Tile factory, Cashew industry and Oil pressing industry. Children from Molahalli commute to Shankarnarayana for education and people from Shankarnarayana travel to Molahalli for occupation.

The current distance from Shankarnarayana to Molahalli through the existing Haladi Bridge is 15 Km. whereas, construction of a motor able bridge at the end of Sowda road, can reduce distance to



Figure 9-23 Map showing proposal for connecting Shankarnarayana and Molahalli with a bridge at the end of Sowda Road.

Source: (Earth)

Molahalli by 7.5 Km. The construction of the bridge will reduce the travel distance and time for daily commuters from either place can be greatly reduced.

9.6.5. Proposal for Smart Bus Shelters with ICTs

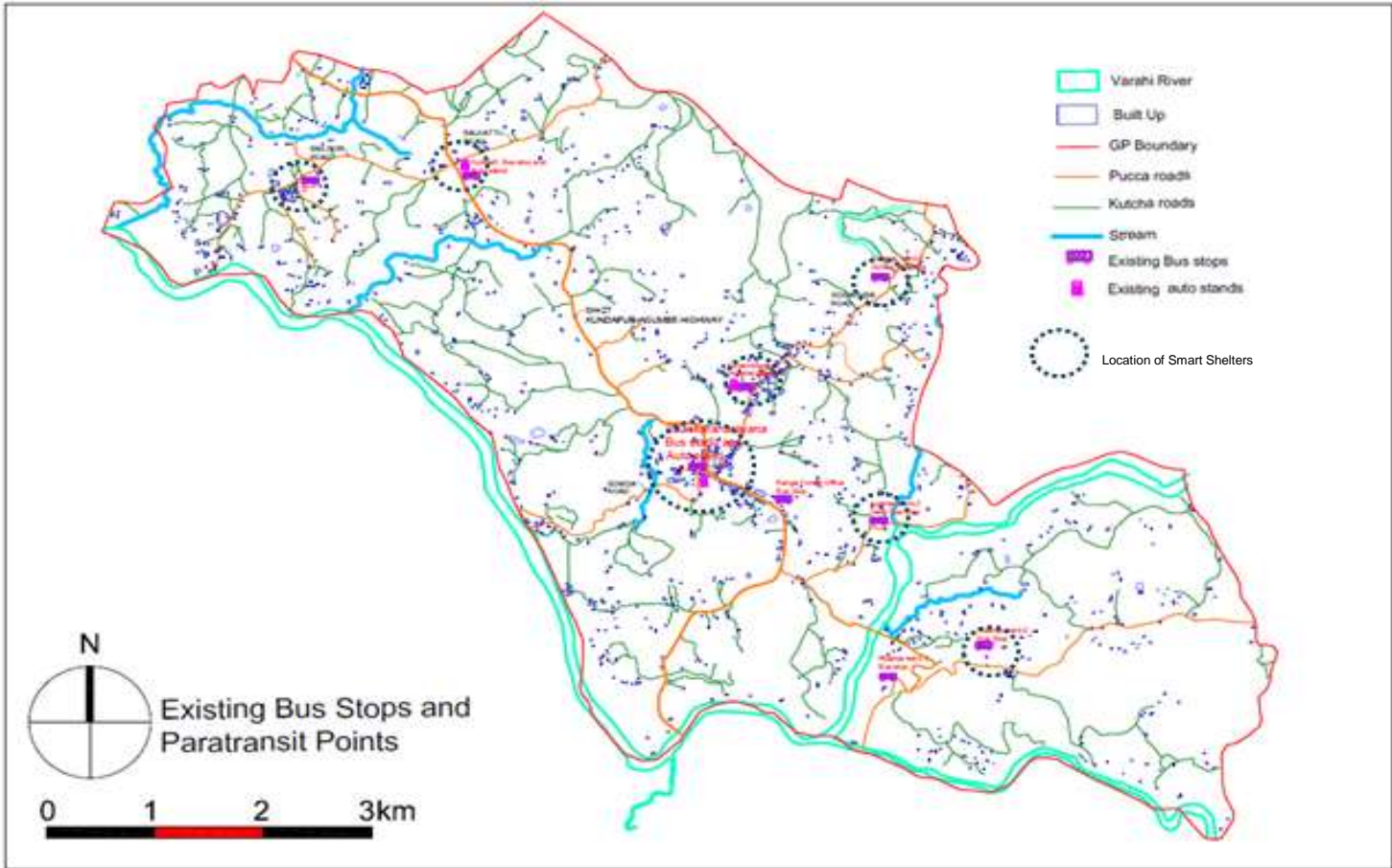


Figure 9-24 Map showing location of proposed Smart Shelters.

Source: Author

As the village does not have good network coverage, it is so proposed to develop shelters that are equipped with Wi-Fi connectivity which

- Provides real time transit data like route numbers, arriving buses with their estimated arrival time.
- Provide interactive data to the users such as bus route maps and guides.
- It should be user friendly for elderly, children and physically challenged including tactile and braille boards for visually impaired.
- Provide safety by means of increasing visibility for waiting commuters
- Provide ICT facilities like WiFi Hotspots and mobile charging point.
- Provide space for advertisements.

These Shelter will be majorly used by the youths in the community for accessing internet. These smart shelters can be located at major landmark locations like education institutions to cater to a larger crowd.

There is a total of 7 smart shelters proposed. The location and the wards it will be catering is as follows:

Ward no. 1- Bailoor cross Bus Stop. It will cater to ward no. 1,2 and 6

Ward no.3- Bus Stop near to Forest Office. It will cater to ward no. 3,4,5

Ward no. 3- Bus stop near PHC and Government PU and Degree College. This will mainly cater to the college going students

Ward no. 4- Near to the Shankarnarayana Bus Stand. It will majorly cater to the daily commuters, who visit the bus stand.

Ward no. 6- Bailoor and Haleagrahara are residential zones. It has a higher primary school, so school going children can access the facility.



Figure 9-25 A model of a smart shelter.

Source: Author



Kulanje- ward-1, Kulanje ward-2 (2no.s) - will cater to the remote locations for school students to access the facility.

9.6.6. Proposal for smart utility pole

Broad design of smart utility pole:

1. Shankaranarayana gram panchayat requires a smart street pole Solution which is best in class with innovation for

network densification in an outdoor rural environment. The smart pole should be able to meet the village aesthetic requirement and it should be visually appealing. It should easily blend into the gram panchayat light pole master plan. The general concept is to integrate a telecom solution with streetlight poles in a Smart way. This solution should fully be encapsulated for outdoor site deployments. The Telecom units should be inside the



Figure 9-26 Smart utility pole.

Source: Invalid source specified.

Smart pole that is camouflaged while other equipment such as power, battery, and cooling, etc. are placed underground in the cabinet. It shall be possible to uplift the entire underground Column above Ground level. Underground equipment box should be maintenance-friendly, Provision of the lifting of equipment from a maintenance perspective is available. To have trouble-free operation Lifting column can support 200Kg or more of the equipment load.

2. Apart from the LED Lights and Telecom Equipment, the pole should have capabilities to accommodate Surveillance Camera, Environment Sensors, and Wi-Fi. It should have the capability to incorporate backhaul for connectivity such as Optical Fiber Network and Microwave as per requirement. The signage may be fitted at an appropriate height measuring 4 feet by 3 feet. All the cablings are to be done inside the pole and the whole design should be aesthetic and attractive.

3. The features of the Smart pole solution.

- i. Easy to place and build. Best mobile coverage on streets and hot spots.
- ii. Getting the ideal location for seamless mobile broadband coverage in rural areas for various technologies 2G/3G/4G & Wi-Fi.
- iii. Multi-use of rural infra – blends easily into Shankaranarayana aesthetics without any visual pollution.
- iv. The Smart Pole should withstand partial flooding on the ground level.
- v. Smart Street Solution should be designed to suit all climate zones.
- vi. Lighting protection and grounding are to be included in the pole structure.
- vii. DC Power Backup: It should be possible to house a minimum of 3-4 telecom technologies
- viii. (GSM, WCDMA, LTE, Wi-Fi, BLE4.0, etc.) Simultaneously with a minimum of 2-3 sectors.
- ix. It should also be possible to support future technologies such as 5G.
- x. It should be possible to support LED luminaries as per the primary requirement of the Light Pole
- xi. The height of the smart pole should be in line with the requirement of the street light varying from 9 to 15 meters depending on the type of the road and the lighting required.
- xii. It should be possible to support 1 light arm/2 light arm as per requirement.
- xiii. The smart pole should be possible to support other societal/smart rural applications such as surveillance cameras, weather monitoring, flood monitoring, billboard, etc.
- xiv. The camera should be integrated with the light arm and should have a feature of night Vision.

Selection of the site:

The site for the proposal of a smart utility pole is selected at the junction of Sidhapura road and Sowda road. The site is located in a prime location of Shankaranarayana gram panchayat which has many commercial outlets, Shri krodagiri

temple, Shankaranarayana gram panchayat office, Banks, ATMs, Police station, BSNL CSC Shankaranarayana office, MESCOM office, Shankaranarayana agriculture Service cooperative bank, Kshirasagara milk society, medical shops, textiles, Jewelers, etc in the surrounding if the junction. This leads to the active movement of the people in this area. It also has State highway 27 passing through which increases the requirement of such interventions.

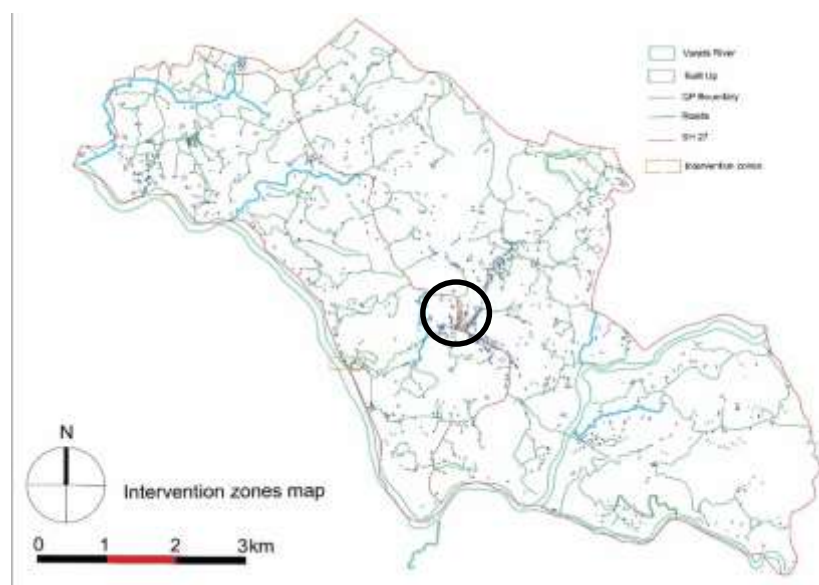


Figure 9-27 Intervention zone - Junction of Siddapura road and Sowda road.

Source: Author

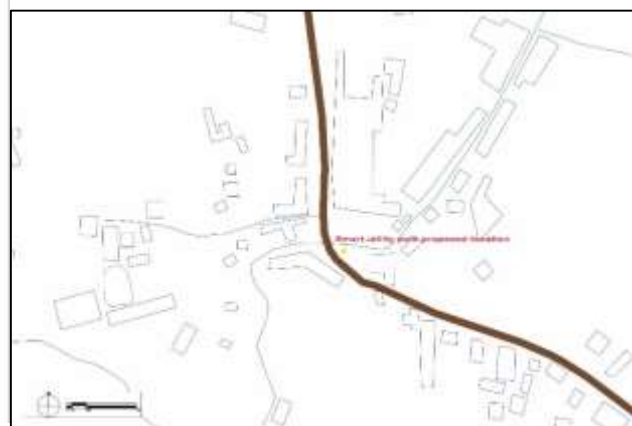


Figure 9-28 Map showing the zoomed-in site for the proposal junction.

Source: Author

Benefits of the proposal:

As Shankaranarayana is a developing and prosperous village with various agro-based industries coming up along with the provision of the agricultural development of such smart utility pole are to be provided to enhance the development. The smart pole system has various advantages over conventional street lights such as reduced maintenance costs, real-time reports and controllability, less environmental impact, and expendable infrastructure and scalability. This pole covers around 2-5 km of radius. It provides the daily weather conditions, crop recommendations based on various seasons, etc.

Public safety

360° Video Surveillance. The panic button automatically alerts local law enforcement (police station and panchayat) and activates siren with signal light.

Environmental factors

Air Pollution Sensors allow for easy monitoring of air quality and breathability in the village. Smart pole sensors monitor several environmental factors and display the information to help citizens limit their exposure to air pollution. This also enables city planners and urban designers to make effective decisions by using the gathered data.

Community access

LED Displays for parking information, Advertising, safety alerts, etc. Optional WiFi hub capabilities for resident and tourist convenience. Optional Charging Integration for electric vehicles and smart devices.

Infrastructure benefits

High Efficiency "Smart" LED Lighting for reduced energy consumption. Track of public servants allows access to pole features for authorized users. Customizable Sensor Mount System allows for further expansion as new technologies emerge in the Panchayat boundary.

9.7. Neighborhood Planning

9.7.1. Design Guidelines for Built forms:



Based on the topography, (Figure-8.7) the regions marked in green (variant) are more feasible for settlements as it provides lesser level differences/discrepancies. It also represents feasibility for the direction of future development of the village and can be considered as future spots for developing infrastructure, housing, services etc. (except for forest areas).

The Current center of gram panchayat is also in line with the understanding of the physical attributes of the village, therefore, the development should be focused more towards the north and north eastern and in some parts of the south eastern parts across the river system. The maximum value observed is 535 ft. (red).

The minimum value is 13 ft. (blue).

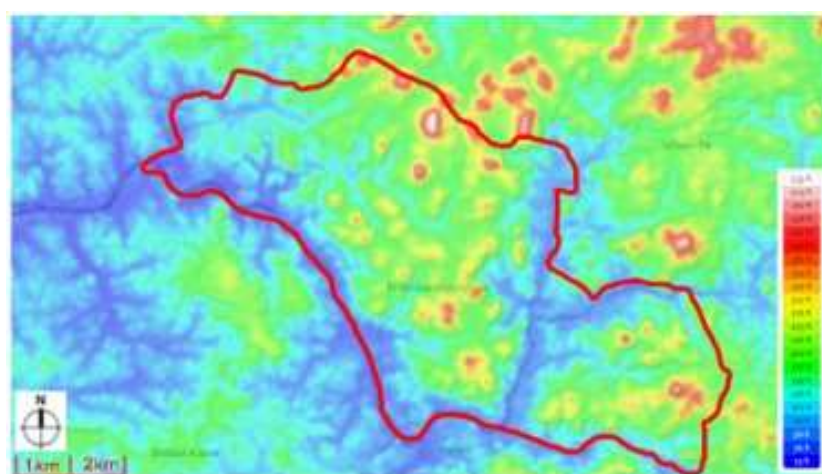
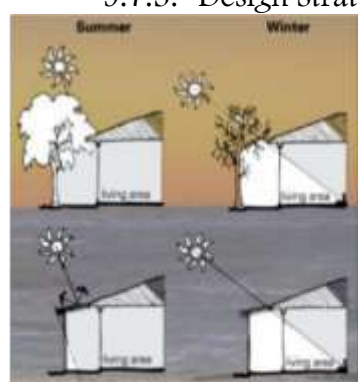


Figure 9-29 Level gradient map.

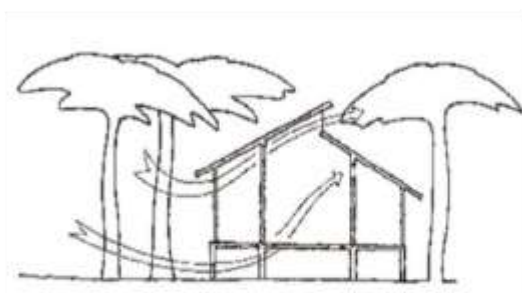
9.7.2. Building Layouts:

As per the traditional housing layouts, courtyards and verandas formed the basis of any planning. Courtyards serve as multi-functional spaces and for the purpose of ventilation. A pitched roof to be used to protect the walls and interiors from rain. Deep overhangs to be provided along the verandas to prevent the indoor temperature from increasing. The front veranda is a semi-public area where community activities can be held, the central house is for family activities, and a backyard for services or agrarian activities. Vegetation, like banyan, Jack around the site allows gentle breezes and should be placed away from the building foundation. Trees like coconut, areca nut, etc. are to be planted to protect from monsoon winds and the glare of the sun.

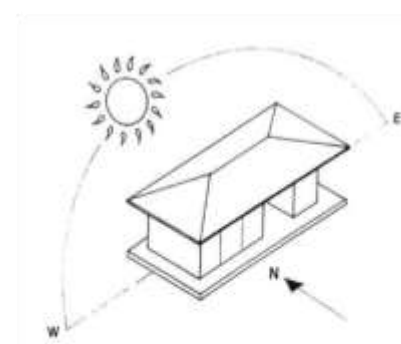
9.7.3. Design Strategies



Verandah is used for ventilation and protection from sun radiation and rains. Semi open spaces like these can be used for day time activities.



Ventilation can be increased by use of vegetation around the house. Cross ventilation with large openings for unobstructed air path.



House with hipped roof, elongated in E-W direction provides best shading

Figure 9-30 Traditional Housing Techniques. Source: (Shetty, Architecture of Bunt Community)

- The residences should be facing north or east direction to allow morning sunlight to enter the house and also oriented concerning wind patterns.
- Minimizing the area which receives the sun radiation reduces the indoor temperature.
- The facade, roofing, ceiling, and other external surfaces should be painted with light colors to reduce the absorption of heat by the surfaces.
- Roof overhangs should be at least 0.7m to 1m to protect from sun radiation and rains.

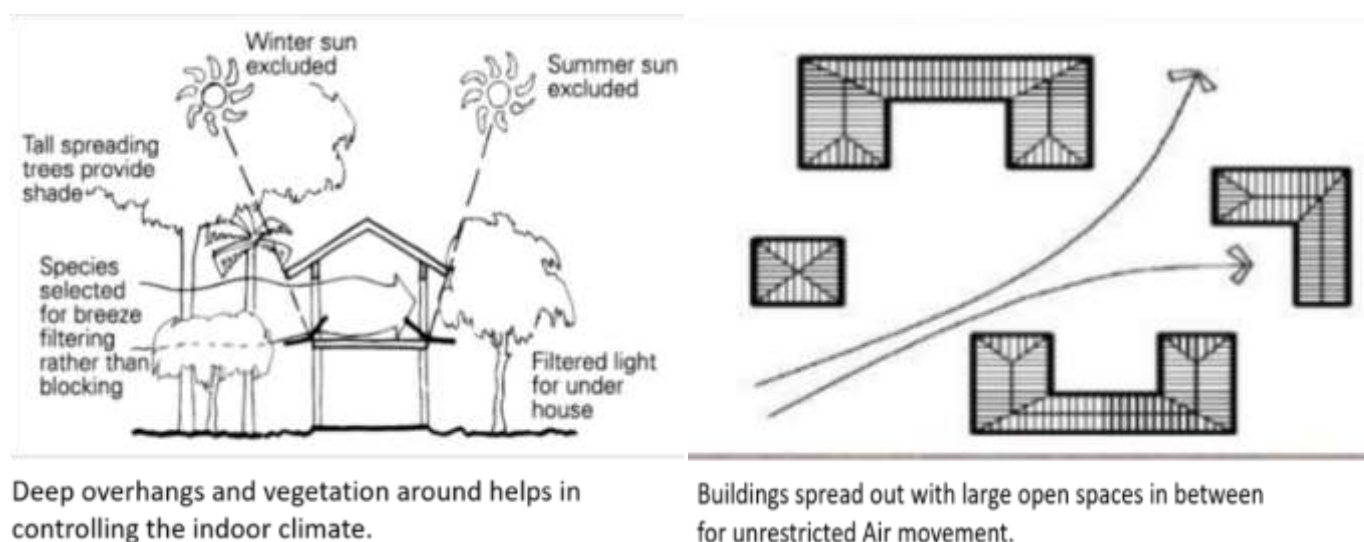


Figure 9-31 Orientation and Site setting for ideal micro climate.

Source: (Koenigsberger, 1975)

- A large opening in outer walls and multiple openings on both sides to be provided to facilitate cross ventilation. Buildings should be oriented towards the windward side.
- Surrounding plants can be used to protect the walls and windows from solar radiation. Trees with high canopies can reduce the solar heat gain with a small blockage of the wind.
- Constructed boundary walls should be avoided and trees or other native vegetation should be used for demarcation boundaries, which facilitates ventilation and cool breeze.

9.7.4. Construction Material & Techniques.

Following local materials are identified that can be used for construction in Shankaranarayana GP:

i. Masonry Bricks and Clay tiles:

- Solid or perforated bricks of all shapes and sizes for standard masonry constructions, including foundations, floors, and load-bearing walls.
- Roof tiles of various shapes and sizes for roof slopes ranging between 1: 3 (18°30') and 1: 1 (45°).
- Weather-resistant
- Pleasant indoor environment



Figure 9-32 Typical Section for future house construction.

Source: (Timmeriah)

ii. Laterite bricks:

- Easily available
- The cost of procuring is low.
- No specialized skilled labor required
- Favors climatic performance due to high thermal capacity and porosity.
- Used in foundations too.
- Extra reinforcement for earthquake resistance.

iii. Mud:

- Extraction can be made from the plot itself
- A more solid material is needed for the foundation.
- Climate responsive
- Adobe, Compressed earth blocks, Rammed earth are different ways of mud walls.
- Construction limited to G or G+1 structures only.
- Protecting the wall from either rain or sun is to have a good big overhang to the roof.
- Provide trenches around the house to receive dripping water and drain it away.
- Should be reinforced with another material like bamboo to make it earthquake resistant



iv. Foundation types:

It is observed that the GP has two soil types – clayey and loamy.

- For clayey soil: 900-1200mm subject to movement due to expansion and shrinkage because of moisture. Foundation should be below this zone. Strip foundation and stepped foundation (sloping site) are suitable for this soil. Damp-proof coating for footing should be done.
- For Loamy soil: Ideal soil for construction with a combination of silt, sand, and clay. Zone with the higher organic matter should be avoided and a deeper foundation should be considered. Isolated pad footing is suitable for this soil.

v. Water proofing of the structures:

Damp proof course in plinth:

Foundation is always in contact with the sub soil, which sometimes contain water and enters the building. Due to capillary action the water rises into the walls of the building and indicates dampness. So DPC is provided to prevent this capillary action.

The rich cement concrete, generally of M20 grade with water proofing compound added to it can be used as DPC. Sometimes Tar is also applied below DPC to prevent entry of water. Above DPC, regular structure is done.

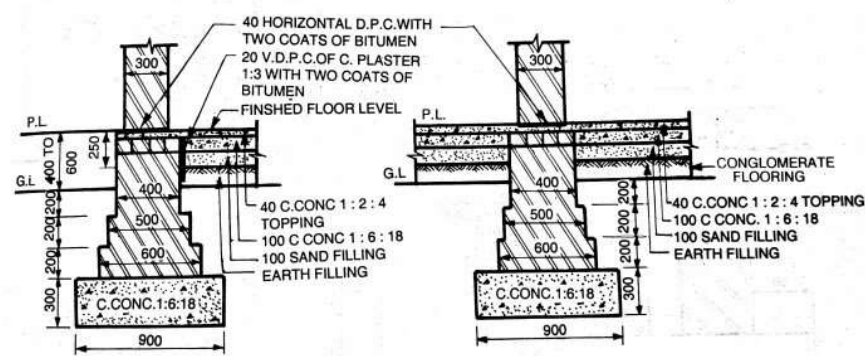


Figure 9-33 Damp proof Course at plinth.

Source: (Kumar, 2020)

9.7.5. Design considerations for Disaster Management:

- Buildings with convex and simple plan geometries are preferred, because they demonstrate superior seismic performance than those with concave and complex plan geometries.
- Simple rectangular shapes (see Fig- 9.10) behave better in an earthquake than shapes with many projections.
- It is desirable to restrict the length of a block to three times its width. If longer lengths are required two separate blocks with sufficient separation in between should be provided.
- Seismic bands in brick walls should be provided through all external and internal walls at the plinth level, window, and doors lintel level, at the ceiling level of roofs consisting of tiles or prefabricated planks, and at eave gable level in sloping roofs with tiles.

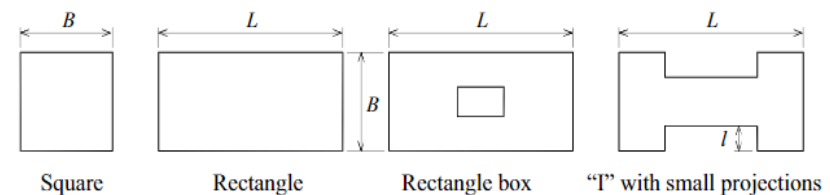


Figure 9-34 Symmetrical desirable plans.

Source: (Murthy)

- The bars for the seismic bands should have a minimum cover of 25 mm below and above them.
- For achieving full strength of brickwork, all vertical joints between the bricks must be filled with mortar, that is, the longitudinal joint between two bricks should be filled with mortar.

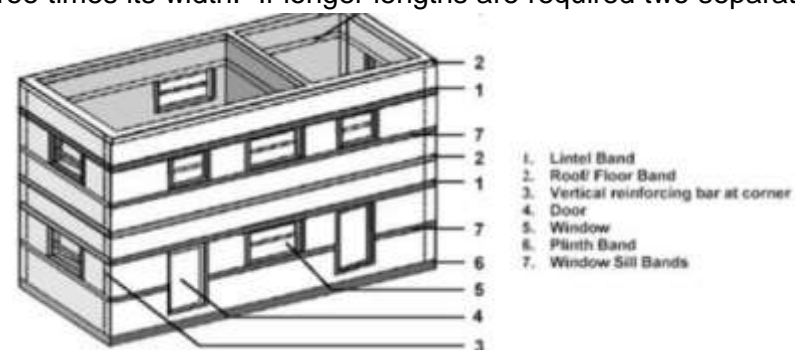


Figure 9-35 Seismic bands at different levels.

Source: (Programme)

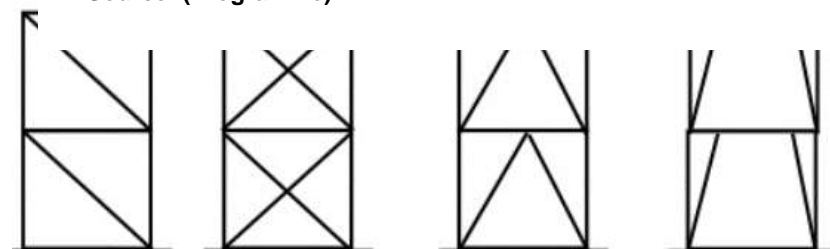


Figure 9-36 Different types of cross bracing.

Source: (Murthy)

- Door and window openings shall be at least 45 cm from the wall corners. The distance between the two openings shall be not less than 60 cm.
- The cover to any bar (main or distribution) should be kept 15mm minimum and 20 mm maximum in concrete slabs used as floor or roof.
- The cover in beams to the main bars should not be less than 25 mm and to the stirrups not less than 15 mm.
- Shear walls and cross braces can be used to transfer the load to the foundation.
- Bracing can be provided in between columns.
- Large openings should be reinforced with a mesh of gauge 13 with wires at 25mm in a width of 250mm around the opening.
- Foundations of dilapidated structures to be retrofitted by strengthening the existing foundation.
- To prevent short column failure, the special confining stirrups should be provided throughout the height of the column at short spacing as required near the ends of the columns.
- Buildings with convex and simple plan geometries are preferred, because they demonstrate superior seismic performance than those with concave and complex plan geometries

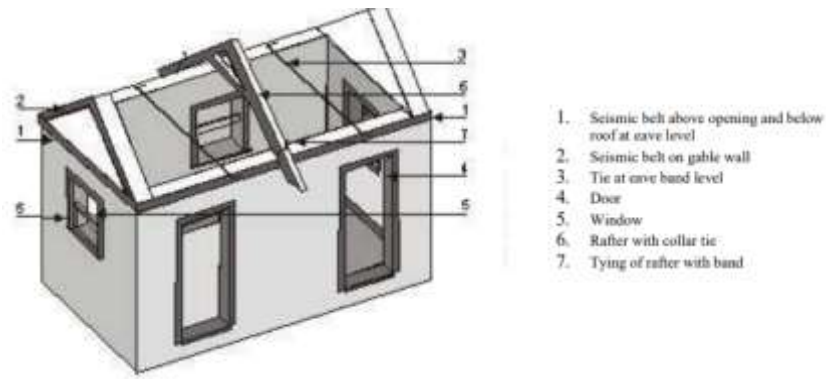


Figure 9-37 Arrangement of Reinforcing Masonry Building Having Pitched Roof.

Source: (STANDARDS)

9.7.6. Design Considerations using alternate material for construction- BAMBOO:

- Alternate material that can be used in Shankaranarayana GP is Bamboo. It is fastest growing plant that can be cultivated in SN and is quickly replaced after harvesting.
- Climate and soil of the GP is suitable for cultivation and growth of plants. Cultivation in the village saves transportation and fuel costs and also provides local employment at the plantation, treatments, and processing centers.
- It can be used for foundations, building frame, beams, and roofs. Composite Bamboo-concrete foundations are provided.
- Withstands earthquakes.
- Reconstruction is possible in a short time if damaged.

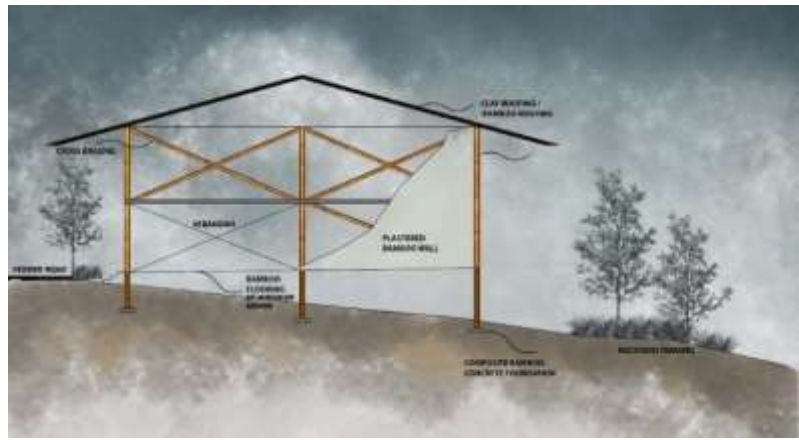


Figure 9-38 Typical Section of house construction with Bamboo.

Source: (Timmeriaiah)

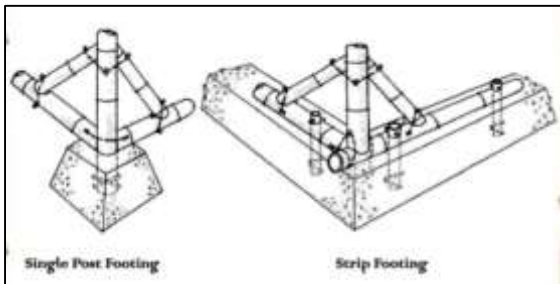


Figure 9-39 Bamboo Footing.

Source: (htt8)

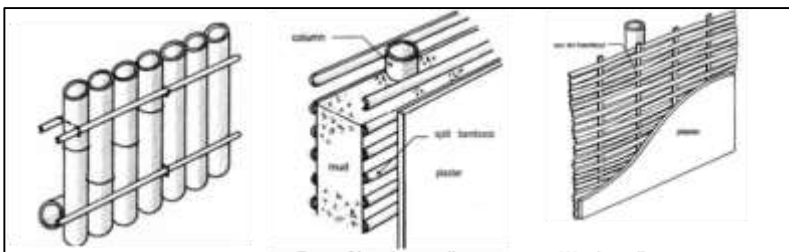


Figure 9-40 Types of Bamboo well.

Source: (htt8)

Guidelines for safety provision of bamboo structures:



- Use of only a mature variety of bamboo for structural posts and main beams. All structural bamboo should be treated chemically to conform to Indian Standards.
- The distance between the two posts shall be not more than 1.2 m centre to centre. The unsupported height of the post shall be not more than 3.0 m. If the height of the post is longer, a horizontal tie of the bamboo shall be provided.
- A 30 cm deep and 100 mm dia. hole shall be made in the plinth beam and the foundation pile/pier below to embed and fix the bamboo post. The post shall be erected in this hole and clean sand shall be filled and compacted around the post in the hole.
- Diagonal bracing between the posts in each wall at the corners from plinth level end to attic level end shall be provided.

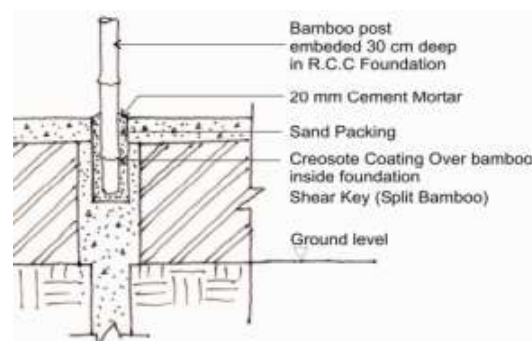


Figure 9-41 Foundation detail - Bamboo Construction.

Source: (NID)

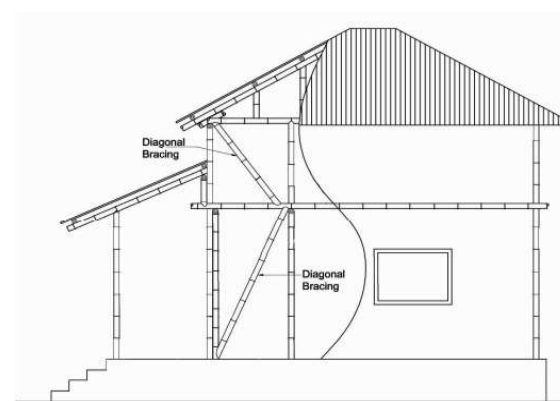


Figure 9-42 Diagonal Bracing.

Source: (NID)

9.8. Waste Management

9.8.1. Solid waste management guidelines

Management of solid waste is a major requirement in the Gram Panchayat. The Swachh Bharat Mission not only aims at making villages Open Defecation Free (ODF), but also stresses on scientifically suitable methods for garbage disposal. The waste generated from individual households should not lead to unpleasant streets and unhealthy environments.

“Street Cleaning and Sanitation” are one of the essential responsibilities of every Gram Panchayat (GP). In order to achieve healthy rural environment and quality living in the GP's, they need to make required provisions for the collection and disposal of waste generated at the village level in socially acceptable manner.

The Swachh Bharat Mission (Gramin) encourages Gram Panchayat for effective functioning of the waste management. The GP's are also encouraged by the State Government to outline various plans for the management of waste in most practical and scientifically suitable methods. The Government of India through the Ministry of Drinking Water and Sanitation has also facilitated various initiatives under the process. (RAJ, 2016)

9.8.2. System for Management of waste at GP

- The Panchayat should formulate a system for solid waste management. The sanitation workers should be trained for waste collection based on the different category of users groups.
- The terms and charges should be fixed based on the waste generated at different categories of user groups such as households, tea stalls, hotels, restaurants, marriage halls, Vegetable markets, Mutton and chicken stalls / Fish markets, Schools and offices, temples etc.
- The charges can be revised on a yearly basis to reflect changes in the cost incurred in solid waste management services
- The revenue generated from the service should be used for the purpose of operation and maintenance of future services such as the workers' salary, employed additionally for this purpose. **Invalid source specified.**

9.8.3. System for Management of waste at Household Level.

- Each household should be held responsible for primary segregation of waste into wet waste (kitchen waste) and dry waste (other waste) and place in separate bins provided for each purpose. The households who fail to practice the process of segregation of waste should be levied heavy fines.
- The leftover food items such as fish bones, mutton and chicken bones may be fed to the cats / dogs, if available at the households. This is best way to deal particularly with leftover food at household level. In other case, it can be wrapped in a newspaper and handed to the sanitation workers (preferably with a green X [cross mark] on it). It helps easy identification of what is inside.
- Vegetables peels, fruit peels, egg shells, used tea leaves, leftover cooked vegetables on the plate may be put in wet waste bin without knotting it.
- It is always preferred to wash inside of a milk packet with water. Washed milk cover makes it easy for the sanitation workers to deal with it, as it does not smell, In case of littering of packets should not cause harm to animals.
- Waste such as sanitary pads, kids' nappies, and condoms shall be wrapped in newspapers, or some papers available (put a red X [cross mark]) before it is handed to the sanitation workers, who shall take them to bury in landfill. Marking helps easy identification so that the sanitation worker shall not open it.
- Use of plastic bags for knotting sanitary pads should be avoided. They should always be wrapped in newspapers or some paper available.
- The sanitation workers (in uniform & cap) shall visit every household with a cart / tri-cycle, and blow a whistle to let the households / shops in that area to get to know that the waste collection vehicle has arrived. It is the responsibility of each household to give the two baskets to the sanitation workers, who shall empty each basket in separate containers they bring in partitioned vehicles.



9.8.4. Solid Waste Management Plan

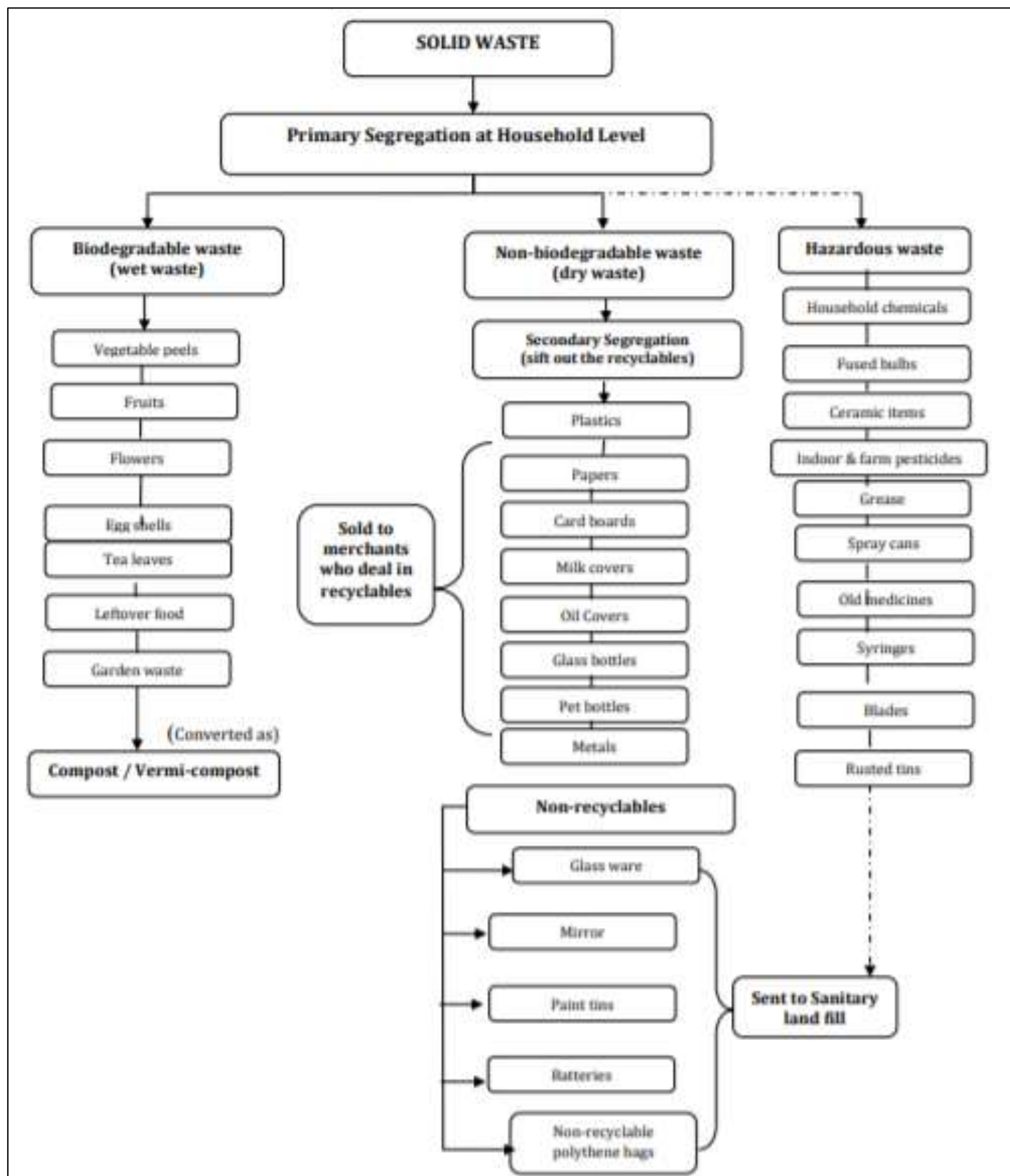


Figure 9-43 Flowchart of Solid Waste Management

9.8.5. Management of biodegradable waste

The biodegradable wet waste at the household level can be put into a compost pit or a community compost pit which can be used for gardens or agriculture land. The following method shall be adopted to construct compost pit.

Site Selection and Preparation of Tank

- This method of composting requires a permanent built structure made of mud or clay bricks, or cement blocks. It is best suitable to construct the tanks after the monsoons.
- The site should be prepared by excavating the pit, and should be located near to an available water source.
- The excavated areas should be marked with ring of stones or a small fence to prevent people and animals fall accidentally.

Construction of Tank

- Construction of rectangular brick tank with space maintained between the bricks for aeration. The recommended size of the tank is 10' (length) x 5' (breadth) x 3' (height).

- All the four walls of NADEP tank are provided with 6 inch vents by removing every alternate brick after the height of 1ft. from bottom for aeration. The tank can be constructed in mud mortar or cement mortar.
- The tank shall also be plastered by dilute cattle slurry so that bacterial activity is enabled along the walls. The tank shall be filled in definite layers followed by sub layers.
- The floor of the tank is made of bricks or blocks laid on the ground and covered with a layer of cement.

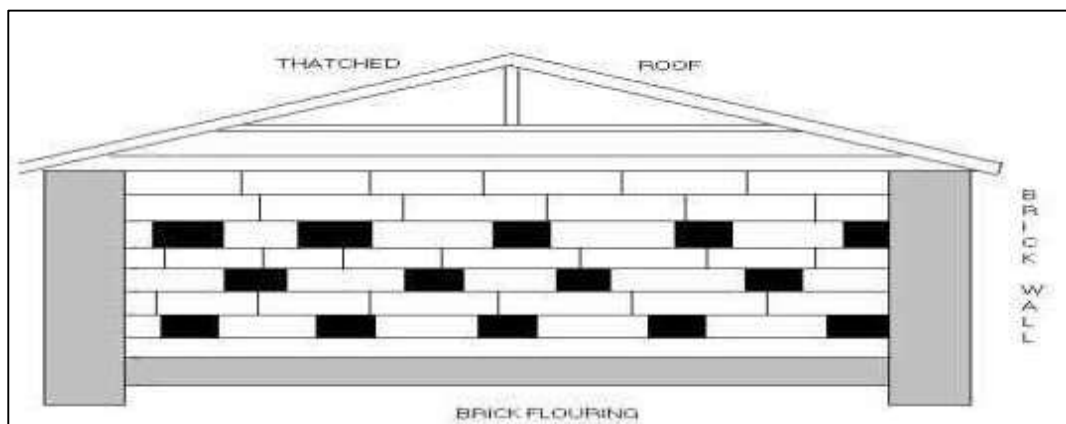


Figure 9-44 Schematic Section of the Compost Tank.

Filling the tank

- Raw materials such as agricultural waste (Dry & green) – 100-150 kgs. Cattle dung or biogas slurry – 98 – 100 kgs, Fine sieved soil – 1675 kgs. Water – 1350-1400 liters is used for filling the tank.
- The amount of water varies with the season and the proportion of dry to green plant materials available. It is provided equivalent to the plant materials is needed.
- If urine from cattle and/or people is available, it should be diluted in the proportion of 1-part urine for 10 parts water (1 jug of urine put into 10 jugs of water in a bucket).
- During this technique it is important to fill the tank at one time within 24-48 hours, as this can affect the quality of compost formation.
- The three layers used to fill the tank are as follows: First layer dry or mixed dry and green plant materials to make a layer 15–25 cm thick at the sides, and slightly thicker in the middle. Second layer: mix of cow dung or fresh biogas slurry sprinkle or scatter it over the plant materials so they get completely moistened. Third layer: cover the wet plant waste and cow dung or slurry layer with clean, sieved top soil.

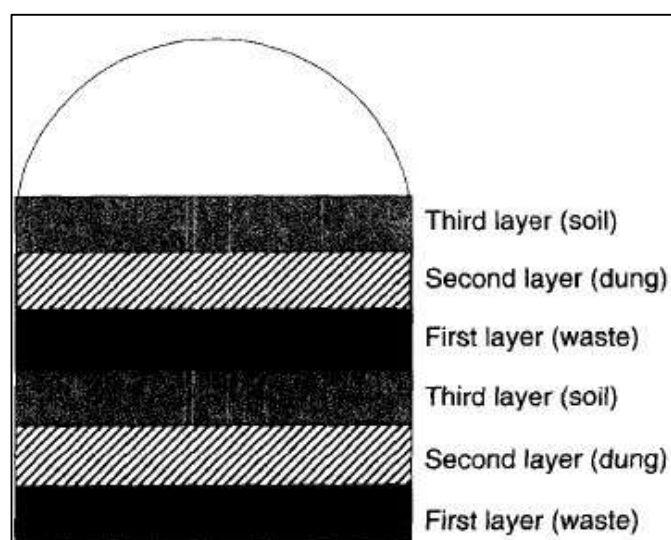


Figure 9-45 Composting layers process

Composting Process

- It is essential to keep the contents of the tank moist, with a moisture content of 15–20%. The mud plaster has to be checked regularly for seal on the top of the tank and fill any cracks that appear with cow dung plaster.
- The weeds grown have to be removed from the surface, as their root systems can damage the cover and reduce water content in the compost.
- Regular water should be sprayed through the gaps in the walls of the tank during the dry seasons. It takes three to four months' time for the process of decomposition. The mature compost is dark brown, moist, and with a pleasant earthy smell.
- This mature compost should be well moistened, or it will lose its nitrogen content. It is important to sieve the compost before mixing to the soil.
- The sieved compost is used in making the soil for the nursery beds, and the remainder is kept and added to a new compost-making process.

9.8.6. Management of biodegradable waste: (Toilet Waste)



- The toilet waste generated from the GP in the present scenario lacks appropriate system of network. Bio-digesters are efficient way to digest the human waste by means of inoculum bacteria. In bio digestive system, toilet is connected to the inlet of the bio-digesters so that the human waste falls in the chamber 1 where the inoculum bacteria are present. This bacterium digests the human waste and sludge is formed which settles at the bottom of the chamber. Water that is at excess overflows at the chamber 2, the water that is over flown into the chamber is with lesser with harmful matter, when compared to the water that was drained from the inlet pipe to the chamber 1.

- According to the capacity of the bio-digester the chambers can be increased or decreased, also, the size can vary. These waste as and when is digested, the biogas is formed which can be utilized for other purposes, also, there is the outlet pipeline through which the water that contains nutrition after all the harmful material is digested by the inoculum bacteria in the chamber.

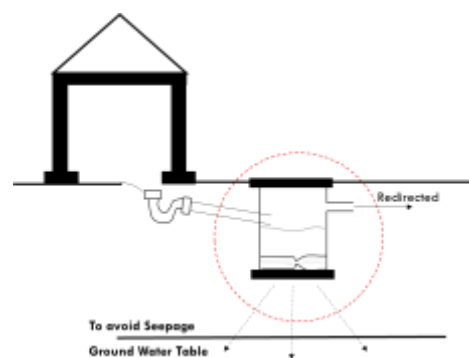


Figure 9-48 Schematic representation – toilets connected to the inlet of the bio-digester.

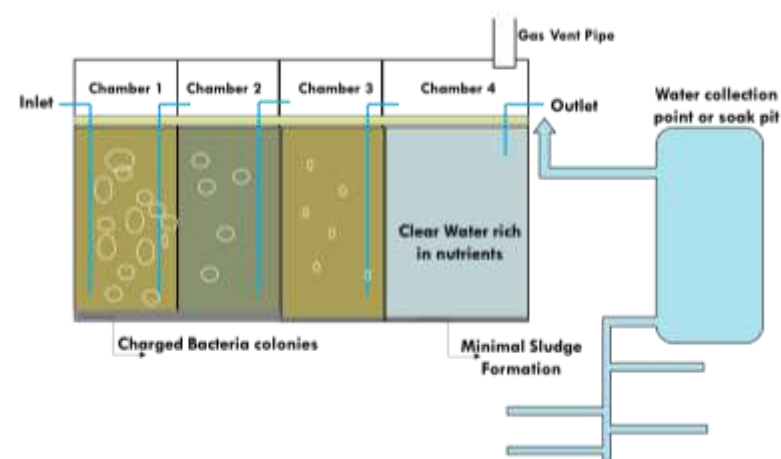


Figure 9-46 Process of the bio-digestive system.

Source: Author

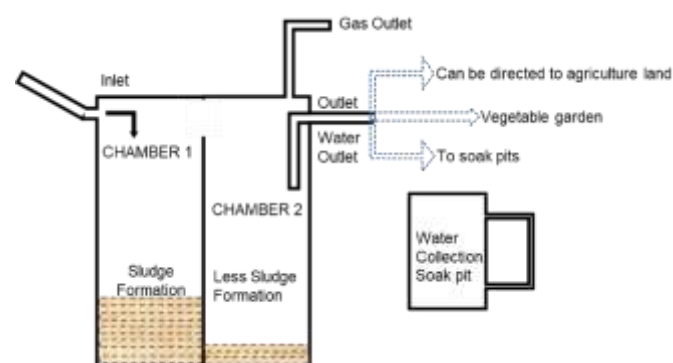


Figure 9-47 Bio-digesters with respect to the capacity and the outlet that is linked with the garden. Source: (Author)

The calculation for the size of the bio digester is dependent on the number of users. The table represents the size of the septic tank and bio digester.

Table 9-1 Size of the Bio- Digester

Source- Invalid source specified.

| Sl. No | No. of Users | Volume of Septic Tank (m ³) | Volume of Bio digester (m ³) |
|--------|--------------|---|--|
| 1 | 5 | 1.12 | 0.7 |
| 2 | 10 | 1.8 | 1.2 |
| 3 | 15 | 2.34 | 1.7 |
| 4 | 20 | 3.28 | 2.3 |
| 5 | 50 | 10 | 6 |
| 6 | 100 | 19.87 | 9 |
| 7 | 150 | 30 | 12 |
| 8 | 200 | 39.6 | 14 |
| 9 | 300 | 60 | 17 |

9.8.7. Recycling of Grey Water

At the individual households, a simple plumbing system can be incorporated with the help of Canna Lilly plants, which have the ability to purify waste water. As the grey water seeps through, it gets purified by the Canna roots and the natural microbes present in the soil, the treated water enters the ground water table. This system is considered completely safe and simple. Canna indica (Kalvazhai), hedygium (sugandhi) and heliconium are some of the plants that supply oxygen to the soil. With the help of the oxygen liberated, the soil bacteria break down organic compounds in grey water and purify the water clean,”

Grey water is composed of small proportions of soaps and detergents, washing sod etc. The bacteria present digest the organic components like Linear Alkyl Benzene Sulphonate. The inorganic compound Sodium

Tri Poly Phosphate present in the detergent serves as a nutrient for the plants.

The treated water thus can be used to recharge the groundwater, or can be collected in dug wells/sumps and used for flushing toilets. The kitchen waste contains matter that may lead to foul smell and hence requires larger soil space. A garden space with an area of 2.5 sq.ft. can captivate up to 50-60 liters of greywater.



Figure 9-49 Preparation of Soil Bed.

Source: (htt7)

9.9. Heritage Zone Development

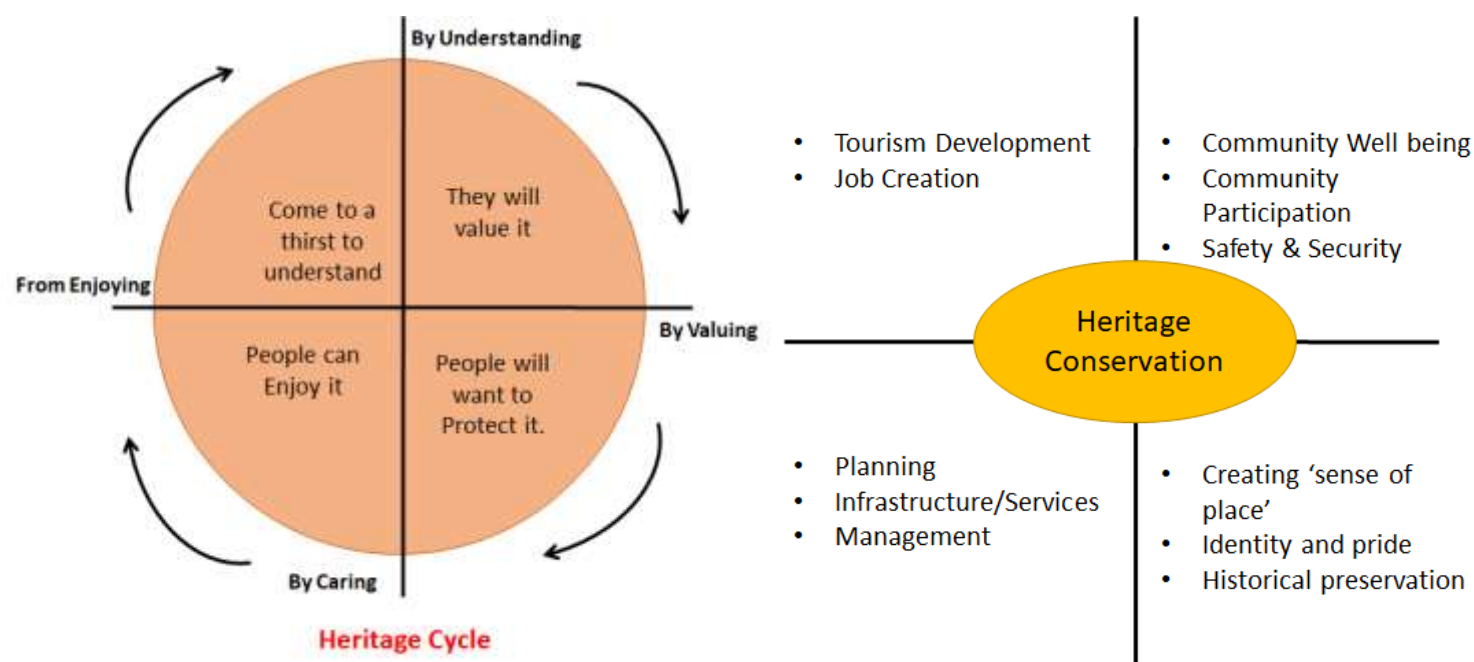


Figure 9-50 Heritage Cycle & Heritage Conservation.

Source: (htt9)

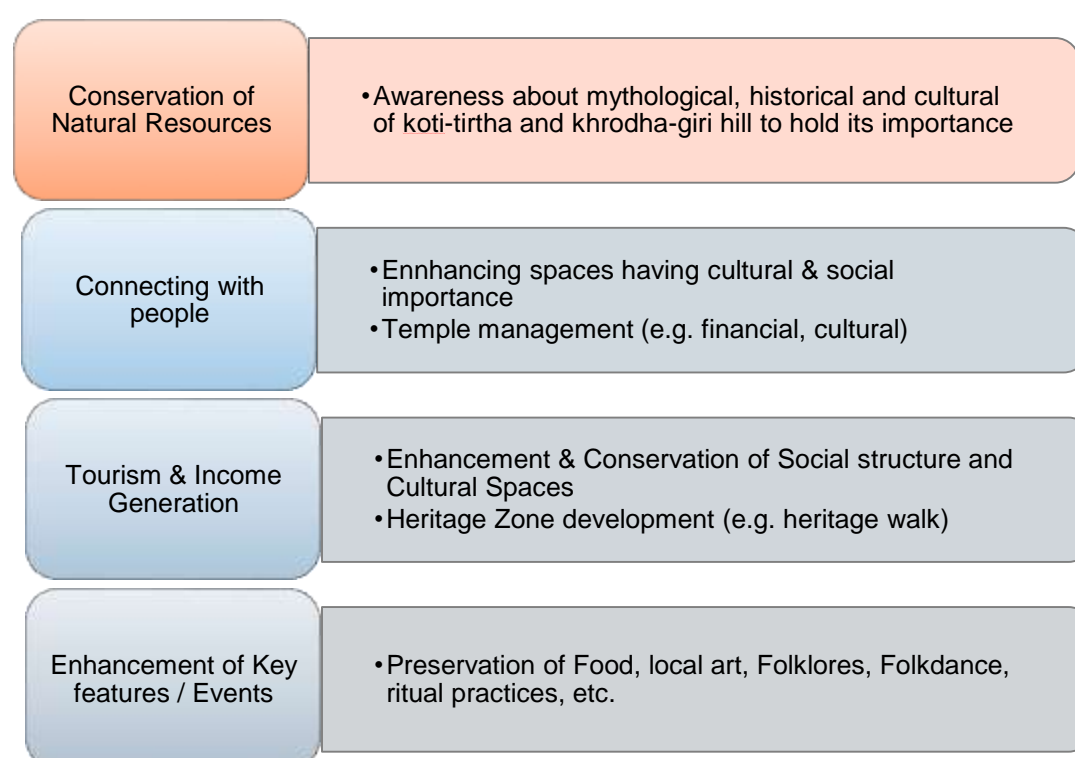


Figure 9-51 Key goals of Heritage Development.

Source: Author

9.9.1. Guidelines proposed for development of the heritage zone

(Model Heritage Regulations, 2011):

- 1) **Protection of Visual landscape & surroundings** - Buildings within heritage precincts or in the vicinity of heritage sites shall strive to maintain the skyline in the precinct and follow the architectural style (without any high-rise or multistoried development) as may be existing in the surrounding area, so as not to diminish or destroy the aesthetic value or view of, from the said heritage sites. The development within the precinct or in the vicinity of heritage sites shall be in accordance with the Urban Design Guidelines framed by the Commissioner/CEO, Municipal Corporation / Municipal Council / Nagar Panchayat or Vice- Chairman, Development Authority or District Collector on the advice of the Heritage Conservation Committee or separate Regulations if any, prescribed for respective zones by the Municipal Corporation / Municipal Council / Panchayat / Development Authority / District Collector.
 - 2) **Religious and Cultural Monuments**- Built area in the vicinity should be restricted to G+1 structure, use of locally available material (e.g. Mangalore tile roofing) to be encouraged, no hoardings to be allowed in heritage zone.
- Heritage as a tool for development and employment generation**- Maximum visitors come to the temple during

Jaatre, so a zone can be defined where temporal structures can be proposed for vending activity and during regular days it can be an open space for gathering.

- 3) **Signs and Outdoor Display Structures / Including Street Furniture on Heritage Sites** - The display or advertising signs and outdoor display structures on buildings and land shall be in accordance with Part X – Signs and Outdoor Display Structures of the National Building Code of India, 2005. Signage and Information Board for directions to heritage zones should be proposed. Material that can be used is stone, tile or wooden board.
- 4) Mythological stories could be depicted on walls of temple area or near the ceremonial route by wall murals or painting. This would also uplift image of the village.
- 5) Adaptive re-use of the residence of Brahmin family and sub-registrar office. This is an effective strategy to conserve architectural heritage, particularly by retaining these built structures as museum or interpretation centers to enhance the village Identity.
- 6) **Development Permission for Heritage Precincts / Natural Feature Areas** - In case of notified streets, precincts, areas and natural feature areas, development permissions shall be granted in accordance with Urban Design Guidelines prescribed for respective streets, precincts / natural feature areas which shall be framed by the Commissioner/CEO, Municipal Corporation / Municipal Council / Nagar Panchayat or Vice- Chairman, Development Authority or District Collector on the advice of the Heritage Conservation Committee.
- 7) **Heritage Fund** - With a view to give monetary help for repairs of Heritage buildings a separate fund may be created, which would be kept at the disposal of the Municipal Commissioner/CEO, Municipal Corporation, Municipal Council/Nagar Panchayat or Vice- Chairman, Development Authority or District Collector, who shall make disbursement from the funds on the advice of the Heritage Conservation Committee. The fund shall be used mainly to support the cost of listing of heritage buildings/ sites and expert guidance and fees for architects, engineers and other experts while the actual conservation works shall be supported by the owners or from sources other than the Heritage Fund.

There are 2 government schemes identified for implementation of these strategies:

- 1) **Seva Bhoj Yojna:** For distribution of free food within Daiva Sthana in Shankaranarayana.
- 2) **Scheme for Financial Assistance for Seminars, Festivals and Exhibitions on Cultural Subjects by Not-for-Profit Organization's or the Cultural Functions Grant Scheme (CFGs):** Ministry of Culture has announced this Scheme, which provides financial support for seminars/symposia and research etc. It will now be open to assist the hosting of festivals and exhibitions as well. All Not-for-Profit organizations, including the University Department/Centers are eligible to apply for this grant.

9.9.2. Heritage Zone Development Plan

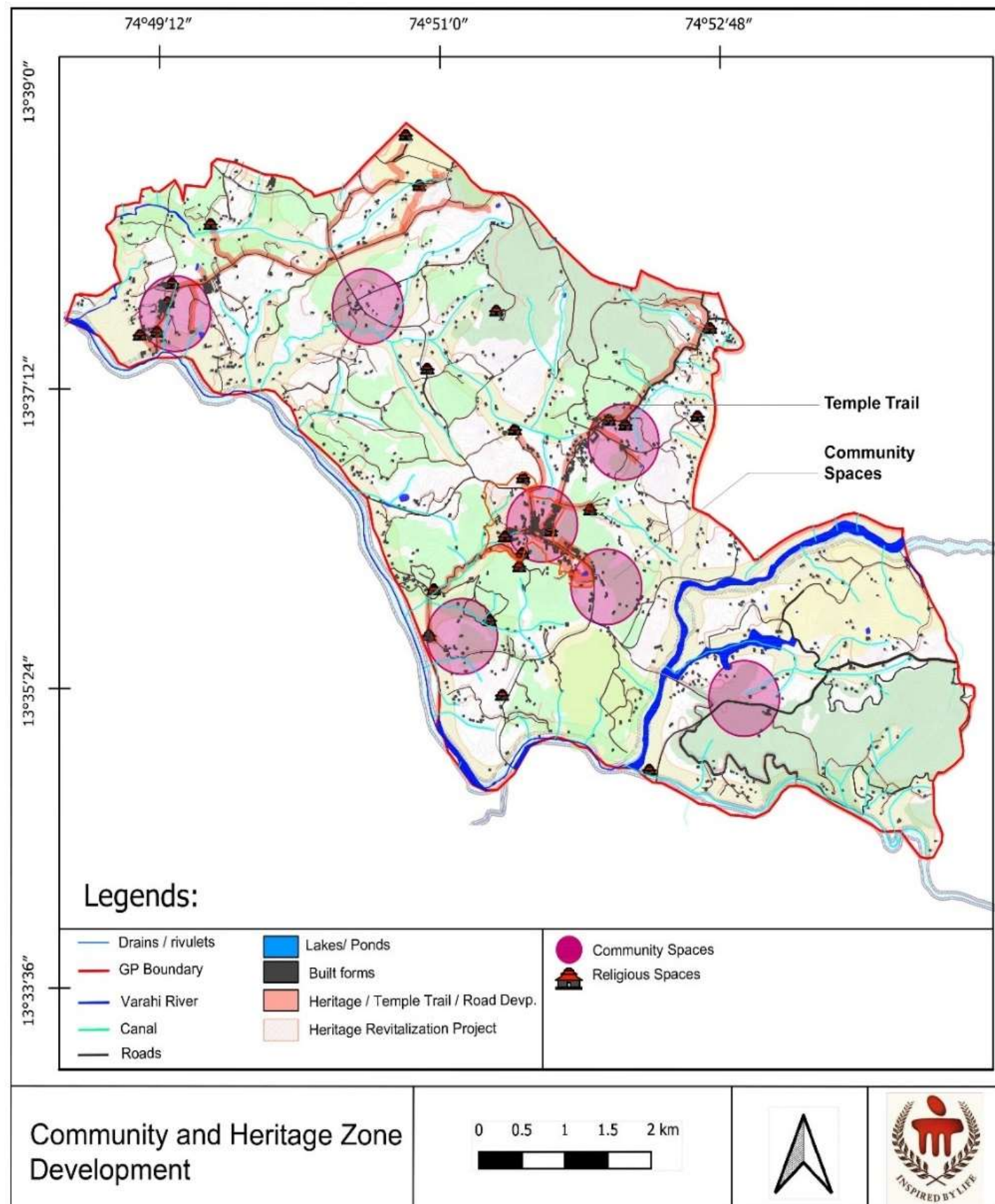


Figure 9-52 Heritage and Community Zone Development

Issues addressed:

- Preservation of history
- Creating job opportunities through tourism
- Giving identity to the Gram Panchayat
- Cultural Heritage Management
- Community Participation

Site selection criteria's:

- For heritage zone, site selected is at the main Shankaranarayana Temple located at the foothills of Krodhagiri.
- This zone will be 65.62 hectares in which the existing religious structures, temple tank, Ashwath katte, sub-registrar office, hale Agrahara, old brahmin family house, procession route are located

Project Description:

There are 4 main parts to this project:

9.9.4. Heritage Zone projects:

This intervention looks into the historical preservation of temples, old existing structures, conservation and protection of Hills, temple tanks, madagas and the mangroves.

- Adaptive re-use of Brahmin family house and Sub registrar office
- Preservation of Temple tank
- Conserving Ashwath katte – Informal community space (Tree associations)
- Preservation of the structures located in Hale Agrahara area

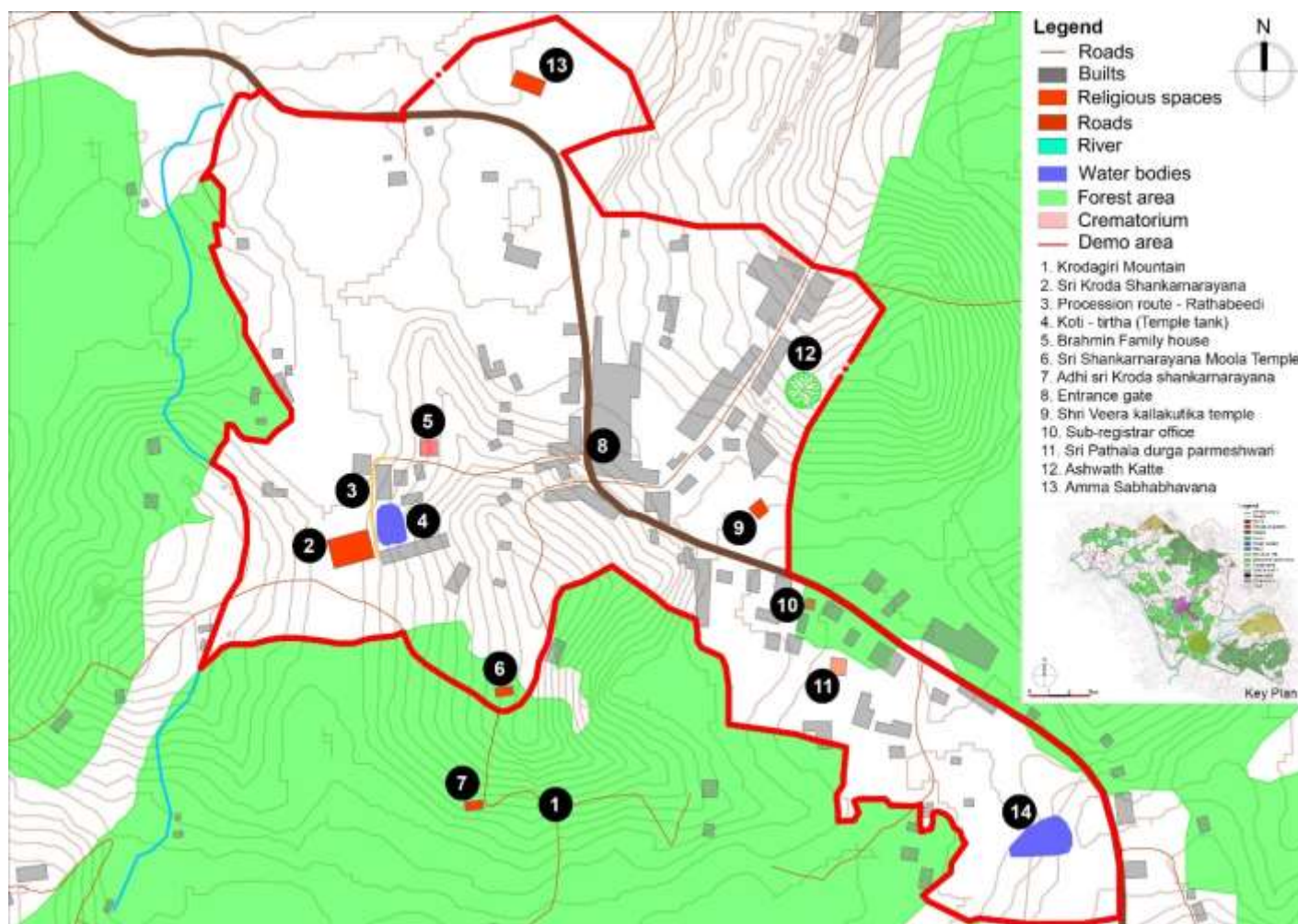


Figure 9-53 Heritage Zone in SN Village.

The map shows the Proposal of Heritage zone development within the Shankaranarayana Gram panchayat. The heritage zone's location will be in the center of the Grama, where the Krodagiri mountain and Sri Kroda Shankaranarayana temple is located. The area will comprise the natural sites, religious spaces, built – heritage structures, and natural and manmade water bodies. Along with those places, it will also include the tree culture-related informal space and few social networks. This zone's total area will be 65.62 Hectares, highlighted in a red marker on the above map. Main state highway – Kundapura Agumbe highway is passing through this zone. Zone also includes the main village bus-stand area, auto



stand, bank, gram panchayat office, police station, post office, and forest office as this area is surrounded by the forest areas. By developing this zone, we can give the village identity and enhance the infrastructure under rural area development. This Heritage zone will be part of the proposed heritage trails. We have divided the important landmarks into 5 categories to further develop the heritage zone: temples, religious spaces, Social spaces, environmentally sensitive areas, and built – heritage. The tourists visit for one day during the Shankaranarayana Jaatre as it is a part of the Sapta-kshetra. During the Kola festival people visit the gram panchayat for three days and reside at the Amma Sabhabhavana or with their families within the village. Thus separate accommodation is currently not proposed for the people.

Classification of natural and built areas. Source: Author

| Temples | Allied spaces (Temple precinct) | Community spaces | Environmentally sensitive areas | Built heritage |
|--|---|--|---|--|
| <ul style="list-style-type: none"> Shankaranarayana Temple Durgaparmeshwari Temple Krodha bailor Temple Kattemakki temple Naga Temple Ganpathi temple, etc | <ul style="list-style-type: none"> Agraharas Temple tank Wells | <ul style="list-style-type: none"> Ranga Mandira Sabhamandira Marriage halls Katte | <ul style="list-style-type: none"> Krodhagiri hill Madaghas Forest area River Residual hll | <ul style="list-style-type: none"> Sub Registrar Office Brahmin family house |

Figure 9-54 Classification of natural and built areas.

Table 9-2 Festival Calendar.

Source: Author

| Festivals & Days | English Months | Days | Number of Visitors | Description |
|---------------------------|--------------------|--|--------------------|-------------------------------------|
| Shankarnarayana jaatre | January | 7 days | 10,000 | Rathostava Fest |
| Kalkuthka Devasthana | March / April | 3 Days | 20,000 | Free food and Folk dance activities |
| Karthik masa Mondays | October / November | 1 Day | 100 – 150 | Lakshya Patra Puja |
| Ananth Chaturdashi | September | 14 th day of Bhadrapada month – 1 day | --- | Visarjan Pooja |
| Navaratri, Vijaya Dashami | October | 10 Days | --- | Ayudha Pooja, Dussehra |
| Shiva yoga day | October / November | 13 th day of Karthik masa – 1 Day | --- | Panch Shankarnarayana Yatra |

9.9.5. Rural Tourism:

Any form of tourism that portray the rural life, art, culture, and heritage at rural locations so that it will be benefiting the local community economically and socially as well as provide the relation between the tourists and the local people for a more augment tourism experience can be termed as rural tourism. (Raut, 2019)

- Sustainable Rural/spiritual circuit
- Tourism growth can be harness as a method for rural development.
- Economic & Social Development of Local Community.
- Rural Tourism helps to develop the infrastructure

9.9.6. Heritage and Nature Trails

This trail will combine historical, natural, and socio-cultural spaces, including Forest area, Hills, Waterbodies, monuments, temples, Agraharas, rang Mandira, built – heritage, etc. This trail also creates a job related to the tourism sector, and it will also look into cultural heritage management.

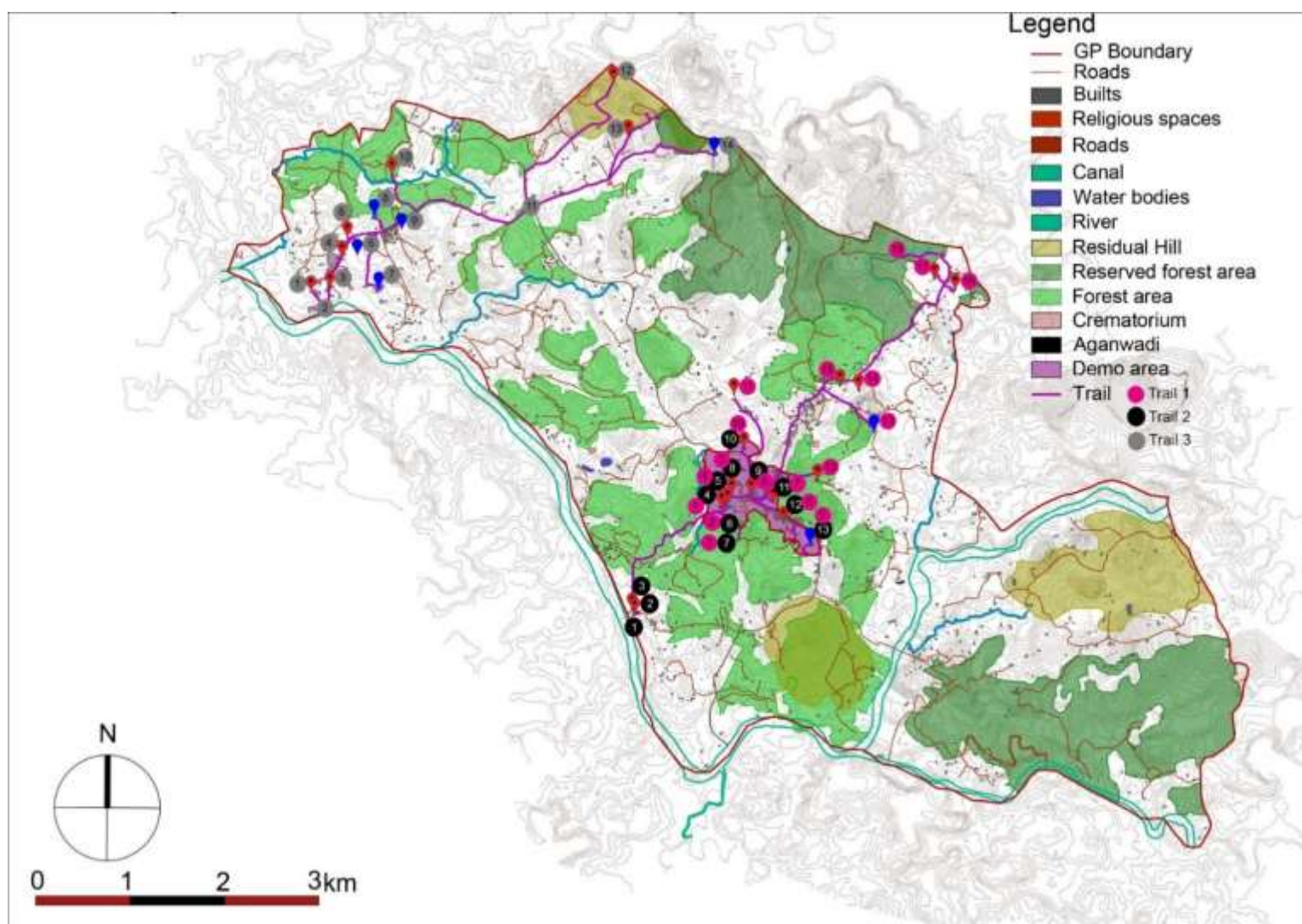


Figure 9-55 Map showing the 3 different trails within the GP area.

Source: Author

Trail 1: (Marked in Pink color numbers tag)

- 1) Shri Kroda Shankaranarayana temple
- 2) Sri Shankaranarayana Moola temple
- 3) Adhi sri Shankranarayana temple
- 4) Koti – Tirtha (Temple tank)
- 5) Brahmin family house
- 6) Entrance gate along the SH highway
- 7) Shri Veera kallakuttika temple
- 8) Sub - registrar office
- 9) Shri Pithala Durga parmashwari temple & Madagha
- 10) Amma Sabhabhavana
- 11) Sri Mahavishnu temple
- 12) Abhyadi sri Mahishmardhini temple
- 13) Madagha
- 14) Gopalakrishna temple
- 15) Sri siddhivinayaka temple
- 16) Sri Kalyani Durgaparmeshwari temple
- 17) Naga temple
- 18) Reserved forest area along the waterbody

Trail 2: (Marked in Black color numbers tag)

- 1) Varahi Riverbank
- 2) Sri Venkatramana temple



- 3) Sri Sambasadashiva temple
- 4) Shri Kroda Shankaranarayana temple
- 5) Koti – Tirtha (Temple tank)
- 6) Sri Shankaranarayana Moola temple
- 7) Adhi sri Shankranarayana temple
- 8) Brahmin family house
- 9) Entrance gate along the SH highway
- 10) Amma Sabhabhavana
- 11) Shri Veera kallakuttika temple
- 12) Sub - registrar office
- 13) Shri Pithala Durga parmeshwari temple & Madagha

Trail 3: (Marked in Grey color numbers tag)

- 1) Swami naga temple
- 2) Varahi riverbank
- 3) Shri Mahishmardini temple, Kroda bailooru
- 4) Bhajana Mandira
- 5) Madagha
- 6) Ravu temple
- 7) Madagha
- 8) Madagha
- 9) Madagha
- 10) Haiguli temple
- 11) State highway crossroad
- 12) Shri Siddhivinayaka Devasthan
- 13) Shri Mahalingeshwara Devasthan
- 14) Lake & forest area

Each of the above trails would be conducted on separate three days. First and second trail span along 7 kms each; and third trail is spanned up to 5 kms. The tourists would have a choice to select either or all three trails as per their convenience.

9.9.7. Farm - Home Stay:

- i. In the Gram Panchayat, communities like farmers and small entrepreneurs can offer tourists, real home-stay experiences.
- ii. The guest would be offered to stay with the family and experience the everyday life with facilities to enjoy the local food, heritage and culture.
- iii. Traditional knowledge sharing can take place between the farmer community and the guests, by engaging them with first hand experiences in their agricultural lands.



Figure 9-56 Farm Home – Stay.

Source: NewsIndiaExpress

9.9.8. Management Centre:

This centre will cater to the management of finances of all temples located within the Gram Panchayat. Main objective of this system is to connect Shankaranarayana village with other taluk and district level tourism hotspots.

- i. Computerized operations of the temple,
- ii. Providing assistance with Temple puja's, seva's as well as Devotees,
- iii. Keeping track of the payment transactions,
- iv. Maintaining the temple annual revenue

This way we can provide annual funds to the temples which are located within the Gram Panchayat but are not a part of the sapta-kshetra.



9.10. Rural Community Development

To enable holistic development of villages and its people, the projects focus on improving livelihood, health, early childhood development, youth related activities, education, welfare and strengthening grassroots institutions.

Community development is always a continuous process in which members come together to take collective actions to generate solution of the common problems.

- Child development - 0 to 4 age (ability of parent and supports)
- Adolescence development - teenager's skill for future life
- Youth development- productive age group
- Women development to nourish care promote development of women including their reproductive health.
- Welfare of senior citizen age 60 and more (protection and social security caring and caring and acceptance)
- Agriculture and allied activities (maintaining the essential vegetables and suggesting agricultural production)
- Spillover spaces (open and semi-open spaces) for institutes or development centers
- Informal market area for a cluster of community

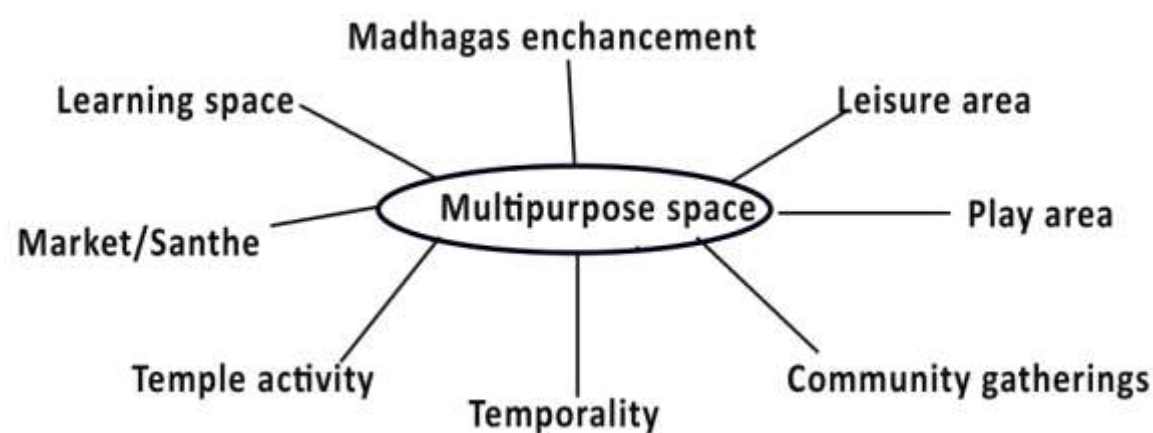


Figure 9-57 Framework for Quality of Space for Community.

Source: Author

9.10.1. Design Guidelines for development of rural community spaces

(Design Guidelines, BUILDING NEIGHBOURHOODS TO THRIVE IN, 2018) :

- Entrances and exits should be easy to locate for a first time user, and especially for a caregiver with young children.
- Pathways should be connected with destinations, and well sign-posted.
- No solid walls, planting edges along main routes that obstruct sightlines.
- Keeping fence permeable, with frequent openings every 50-80 metres.
- Considering the fence as an attractive object. It can add value to a space, by doubling up as a trellis plants, having benches incorporated in the fence, or having an attractive pattern.
- Planting and green elements with a range of colour, texture, shape and use.
- Provide shaded spots where people need to wait and have good sightlines.
- Concrete and steel benches absorb heat and can be uncomfortable to sit on in the summer. Wood stays cooler.
- Group benches together, so that people can socialise.
- Mobile food stalls can be designed to precisely fit the dimensions of a parking space, including the area needed for customers to stand.

9.10.1.1. Intent of the project:

- To create an environment that fosters community engagement and strengthen community ties.
- To create spaces and experience that inspire action and creativity and has led to self-growth at an individual level.
- To act as social hub for community over which the members feel sense of ownership to strike a balance between the aspiration of community and the environment that they are familiar with to create a new environment that is suited to their needs.
- To create a multipurpose space that can look after multiple activity of a community engaging multiple user groups.
- This is to uplift the socio-cultural aspects of the community.

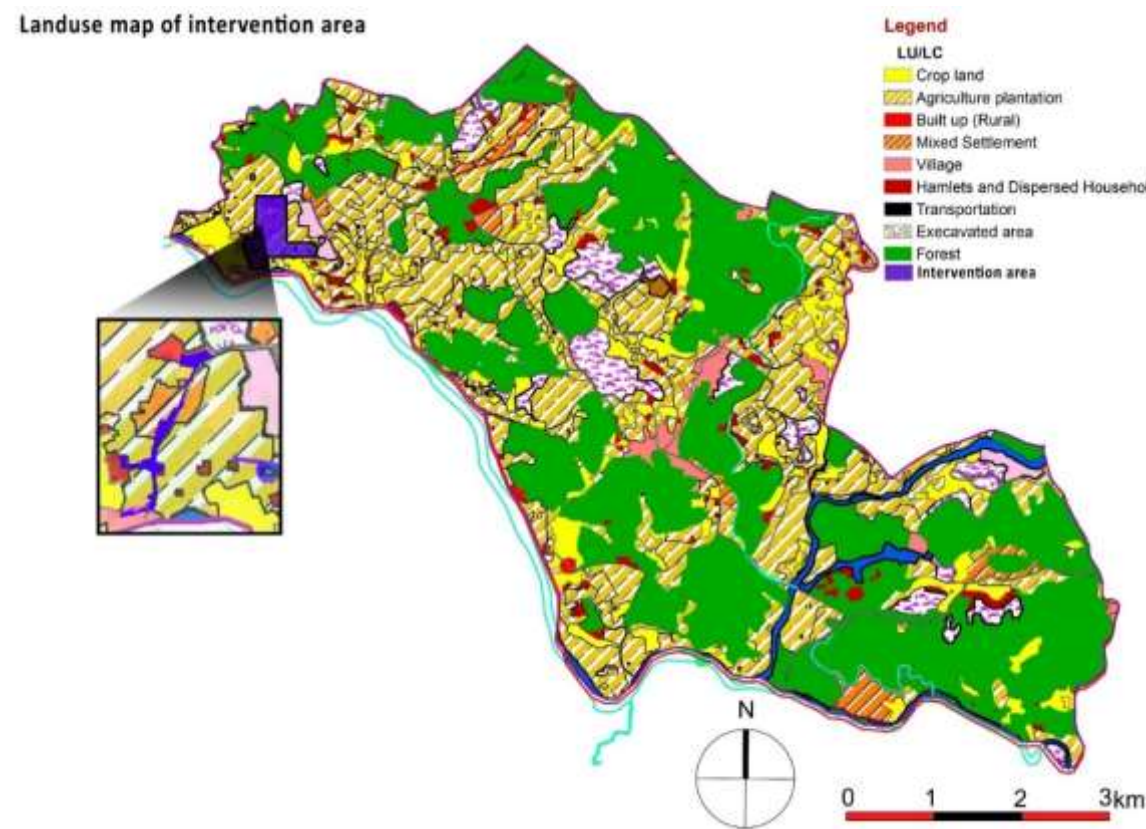


Figure 9-58 Land use map of Intervention Area.

Source: Author

On the proposed site the predominant land use is of agriculture plantation; while in the vicinity we have excavated area, dispersed household

9.10.1.2. Spaces for engagement:

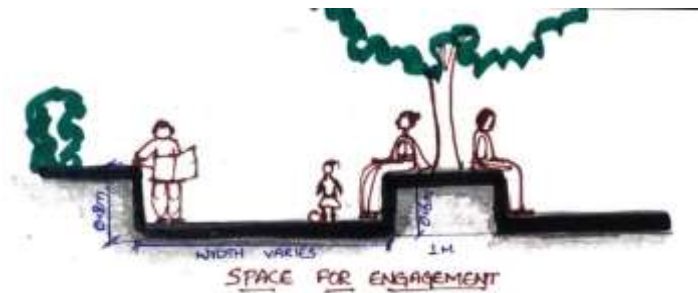


Figure 9-59 Schematic representation of Community space for Engagement. Source: Author

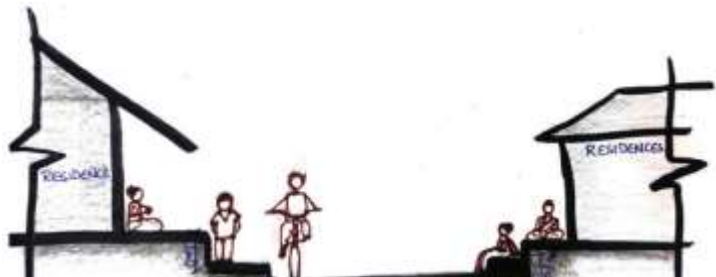


Figure 9-60 Schematic representation of Community space for Permeability.

Source: Author



Figure 9-61 Schematic representation of Community space for Sociability.

Source: Author



The center for rural community development is an intervention for the public that specifically aims to create engagement. It is believed that if people get a chance to interact with each other the community spirit will be fostered. Three aspects that could bring the quality of space in community are: Occupiable, Permeability and Sociability

9.10.2. Project Description



Figure 9-63 Sketch (plan) shows the Demo area conceptual level intervention.

Source: Author

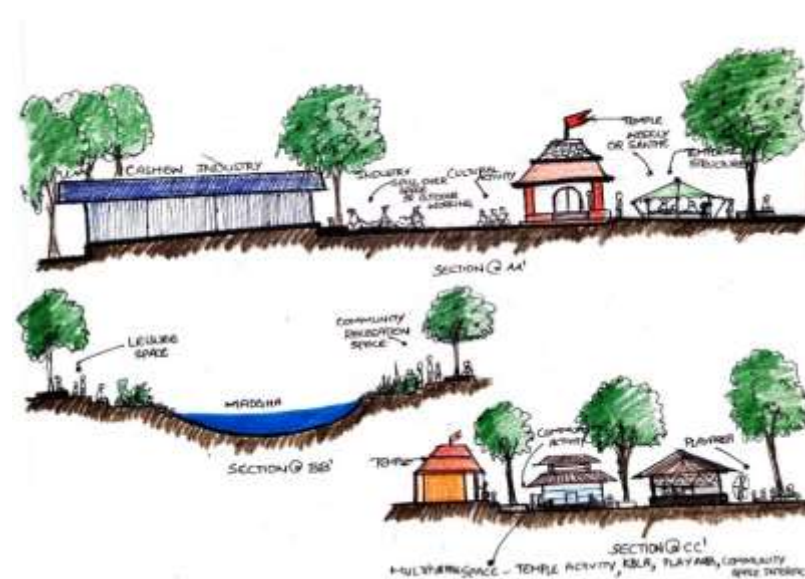


Figure 9-62 Sketch shows the Demo area conceptual level sections of multipurpose use for community.

Source: Author

9.10.2.1. Design Intervention:

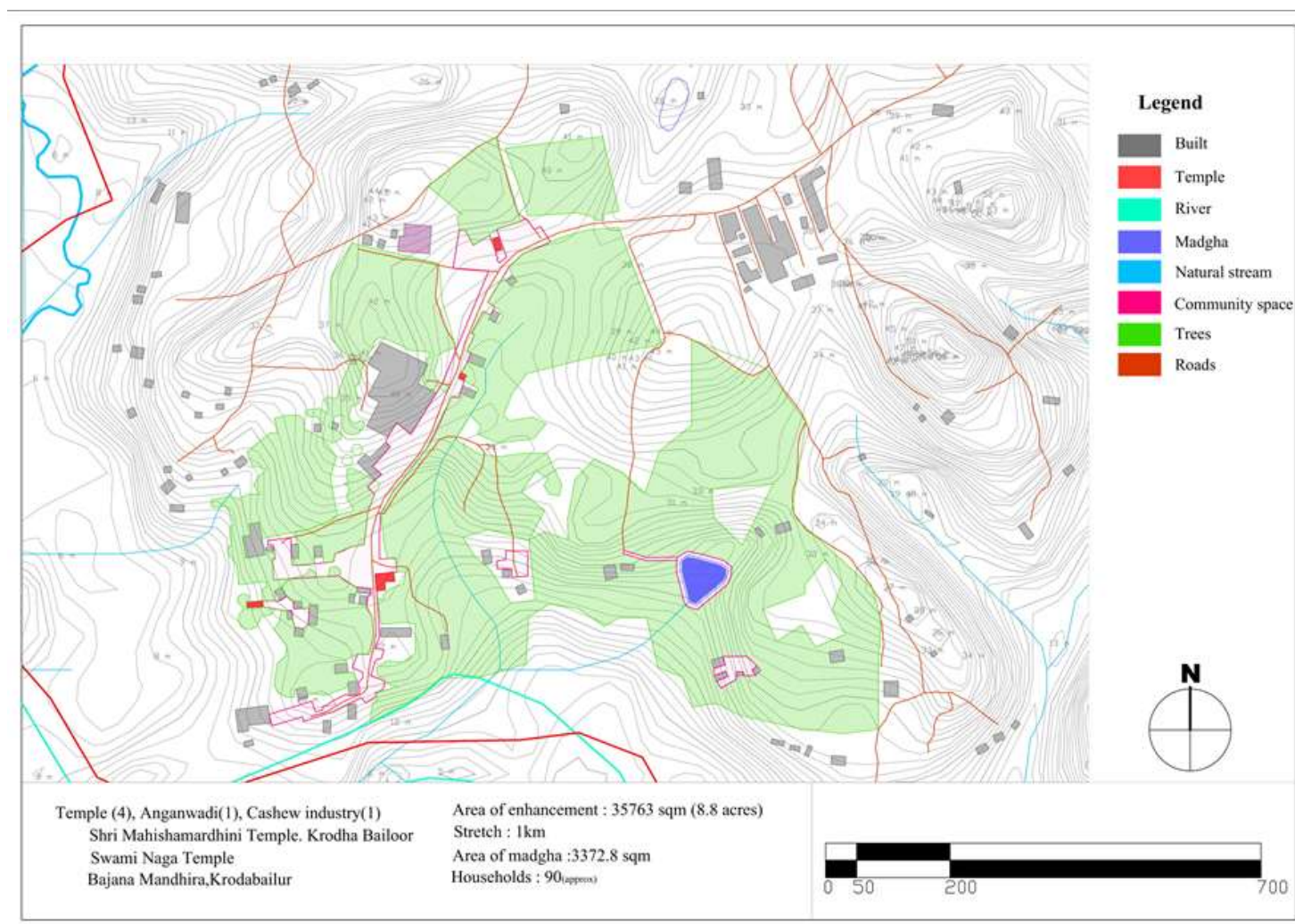


Figure 9-64 Demo area near Krodha Bailoor Temple.

Source: Author



Figure 9-65 Multiple scenario – informal market, seating area for community gathering, play area for kids.

Source: Author

The north-west zone of the Gram Panchayat has concentration of existing temples, anganwadi's and madagas. This zone has the potential of being converted into a community space which would also act as a spill over to the resources in the vicinity. For instance, the area near the anganwadi's and the temples could be enhanced for multipurpose use. The space has the potential to transform from santhe (market) in the morning, outdoor learning space for the anganwadi activities in the afternoon and activities associated with the temples in the evenings. This temporality of space could be developed by enhancing the edge conditions. The spaces near the madagas can be developed for leisure activities retaining the importance of the resource, which would provide for a community space to the residents of the village and also uplift the identity of the gram panchayat.

9.10.3. Skill Development Centre

The Proposed Vocational/skill development centre consists of two prototypes

I) Centralized model and II) Decentralized model

- The Pradhan Mantri Kaushal Vikas Yojana(PMKVY) & Jan Shikshan Sansthan (JSS) are the two schemes targeted for both centralized and decentralized Vocational/skill development centre
- The Centralized model has an integration of E-Governance, E-Commerce, Tele-medicine, ICT (Information and communication technology), Vocational courses, and economic symbiosis model.
- The decentralized model falls under category 3 as per the PMKVY mandate centre category, where the area requirement given is a minimum of 3000 Square feet, courses pertaining to one sector with two trades and which can annually train 500 candidates.
- The centralized Vocational/skill development centre is located in Kulanje ward-01 which has high involvement of formal graduates wherein the nearby Shankarnarayana ward-04 has more involvement in informal sectors, the integration of all the sectors will suffice the need of both wards. Due to its centrality of location, along the SH27 and its size, this centre can cater to a minimum of 1500 candidates annually.
- The decentralized Skill development and Village support Centre is located in Shankaranarayana ward 1, integrated along with the existing Anganwadi/ Lower primary school at Kondali with the proximity of SH27 (800m from Bailoor cross). This centre can cater to a minimum of 500 candidates annually.
- E-Governance is provided to take care of Shankarnarayana and Kulanje village, at present people need to travel to Siddapura, Kundapura, and Baindoor for any Government related work. E-governance service is provided in this centre to avoid traveling to other villages.
- E-Commerce is provided to sell and invest in the local products of the Gram Panchayat. In Shankarnarayana & Kulanje there is no such a platform for selling to the consumers outside the village since they lack knowledge of technology.
- Tele-medicine is provided to support existing healthcare centres, hospitals, and other healthcare providers. The Gram Panchayat lacks diagnostic facilities to identify their degree of disease and refer medical support.
- In Shankarnarayana & Kulanje the primary sector (agriculture) plays a major role, hence first preference is given to primary sector courses to generate more local employment opportunities followed by other technical and non-technical sector courses



- The proposed vocational center will facilitate both Students who have completed secondary or higher secondary education (Youth 16- 35 years) and interested candidates to acquire skills in the technical or non-technical sectors. It is also open to all category of people in the GP in need of employment opportunities.
- The Infrastructure provided should implement training programs which is barrier-free for people with disabilities based on prescribed standards.

9.10.3.1. Resource Symbiosis Model for Sustainable livelihood generation through Bricolage

A model proposed by Ramit Debnath, Ronita Bardhan (Ramit Debnath)

Bricolage is defined as making-do by applying combinations of resources already at hand' (Baker and Nelson, 2011). It focuses on addressing opportunities and problems with the limited available resources which are free or cheap.

RSM is an extension of social entrepreneurship, where the producers and consumers have feedback loops in the form of mutual benefits, which integrates into a sustainable market-based resource consumption model.

The conceptual framework of facilitating village development through resource mobilization through bricolage is given below:

PHASE 1 – High level of resource mobilization and significant bricolage will be required to push village development; i.e. more resources must be mobilized to create a balance between self-sufficiency and wealth creation from market-based businesses. This phase essentially assimilates the social and natural resource elements of the village to create this balance. Once this balance is established, the process of symbiosis begins

PHASE 2 – The virtue of the symbiosis drives the development. This stage can act as a dock for the implementation of Ministry of Rural Development Schemes.

PHASE 3 – Advanced phase where resource utilization will directly co-benefit the advanced growth of the village, i.e. at this stage resource mobilization in the village to impact the quality of life directly.

Thus, the village development will imitate city like growth curve. At this stage, it becomes highly probable that the village can be promoted to an Urban Local Body

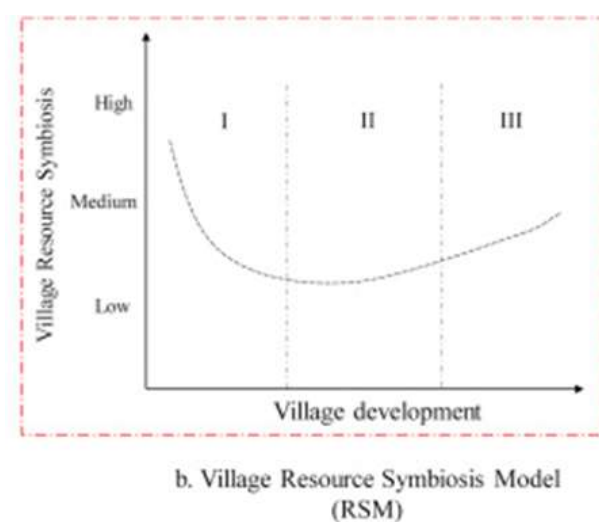


Figure 9-66 Village resource symbiosis model

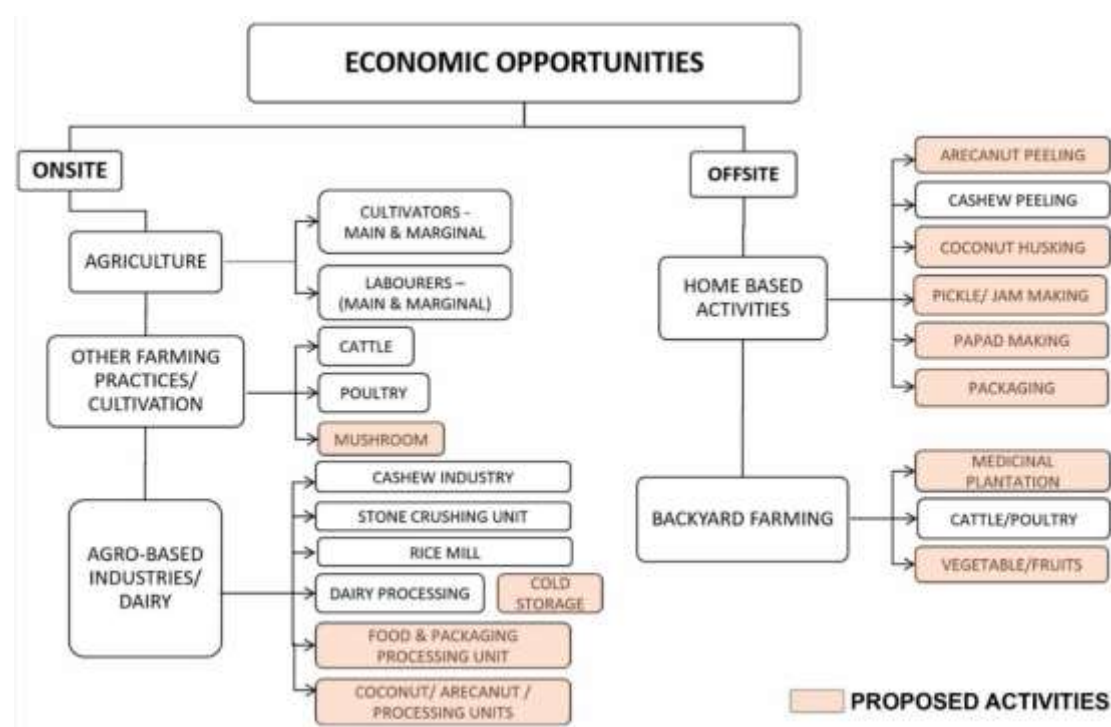


Figure 9-67 Showing Proposed Economic Model for the GP.

Source: Author

The total percentage of main working population in the GP is 49.3%, the total percentage of marginal working population is 11.62% and the total percentage of non-working population is 39.08%. As the percentage of non-working population accounts to almost half the population of the GP, it is necessary to promote other economic generating activities in the GP. Agriculture is the primary occupation in the GP, hence an economic model is proposed by making the best use of the existing resources. Figure 1 shows the proposed economic model for the GP, Onsite model that which requires land/ processing unit/ storage facilities (small-scale industries) and Offsite model are those economic activities at household level (Household industries). These additional economic generating activities are proposed by making the best use of the existing resources that are; Coconut, Arecanut, Paddy, Pineapple and Banana. The process flow for each of the resources are illustrated below;

9.10.4. Coconut Processing Business

The above flow chart (Figure 2) represents the process flow of possible Coconut processing businesses in the GP. Coconut being a major crop of the village, the possible products that can be obtained are charted, also ensuring a circular economy in the village by promoting the use of Biogas plants/ digesters to treat the waste and thereby provide heat and electricity to the processing unit.

Example:

Small Scale Coir Industry (Onsite Model)

- Converting Coconut husk, a waste into wealth
- Provides full time employment to unskilled workers and part time employment to agricultural laborers

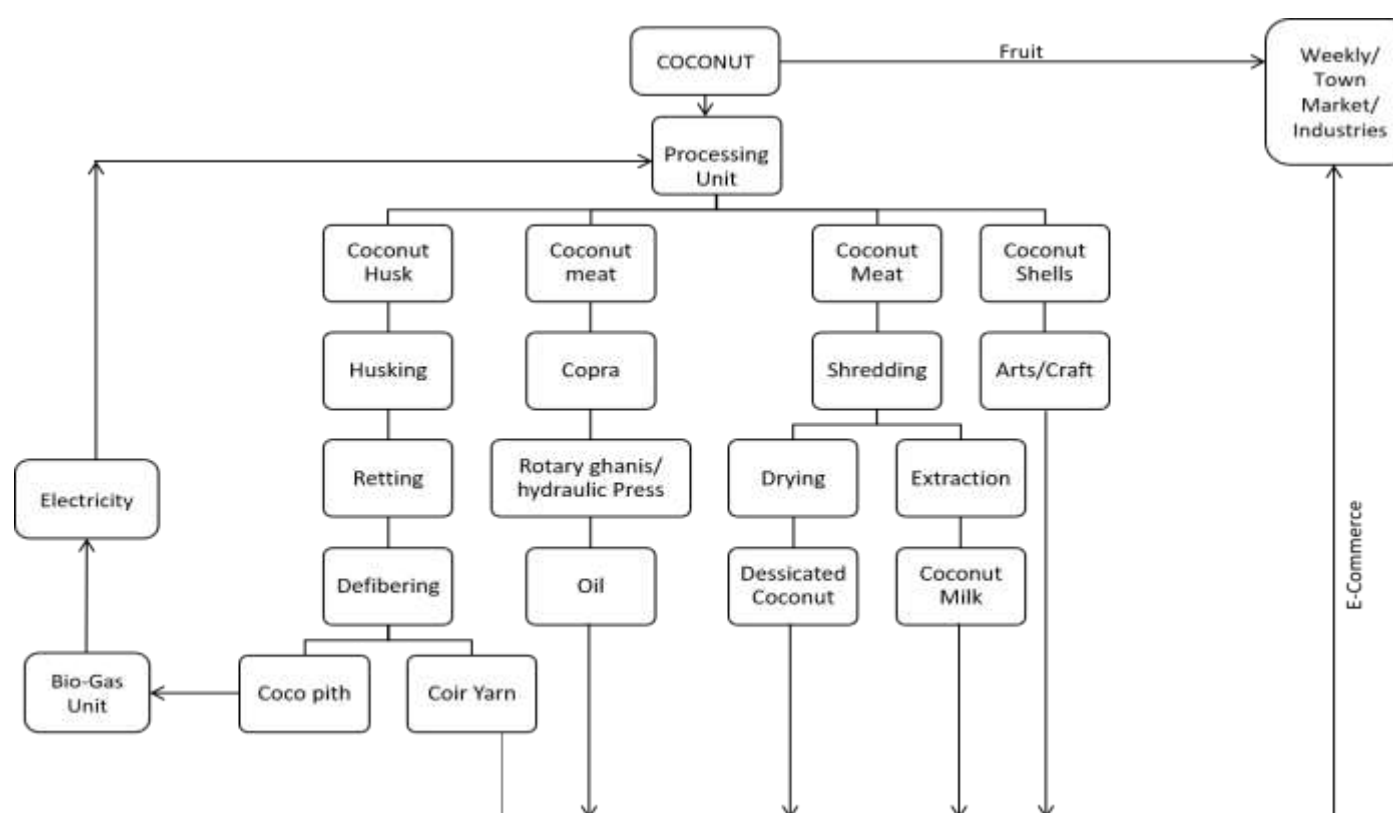


Figure 9-68 Process Flow Chart of Coconut Processing Business in the GP. Source: Author

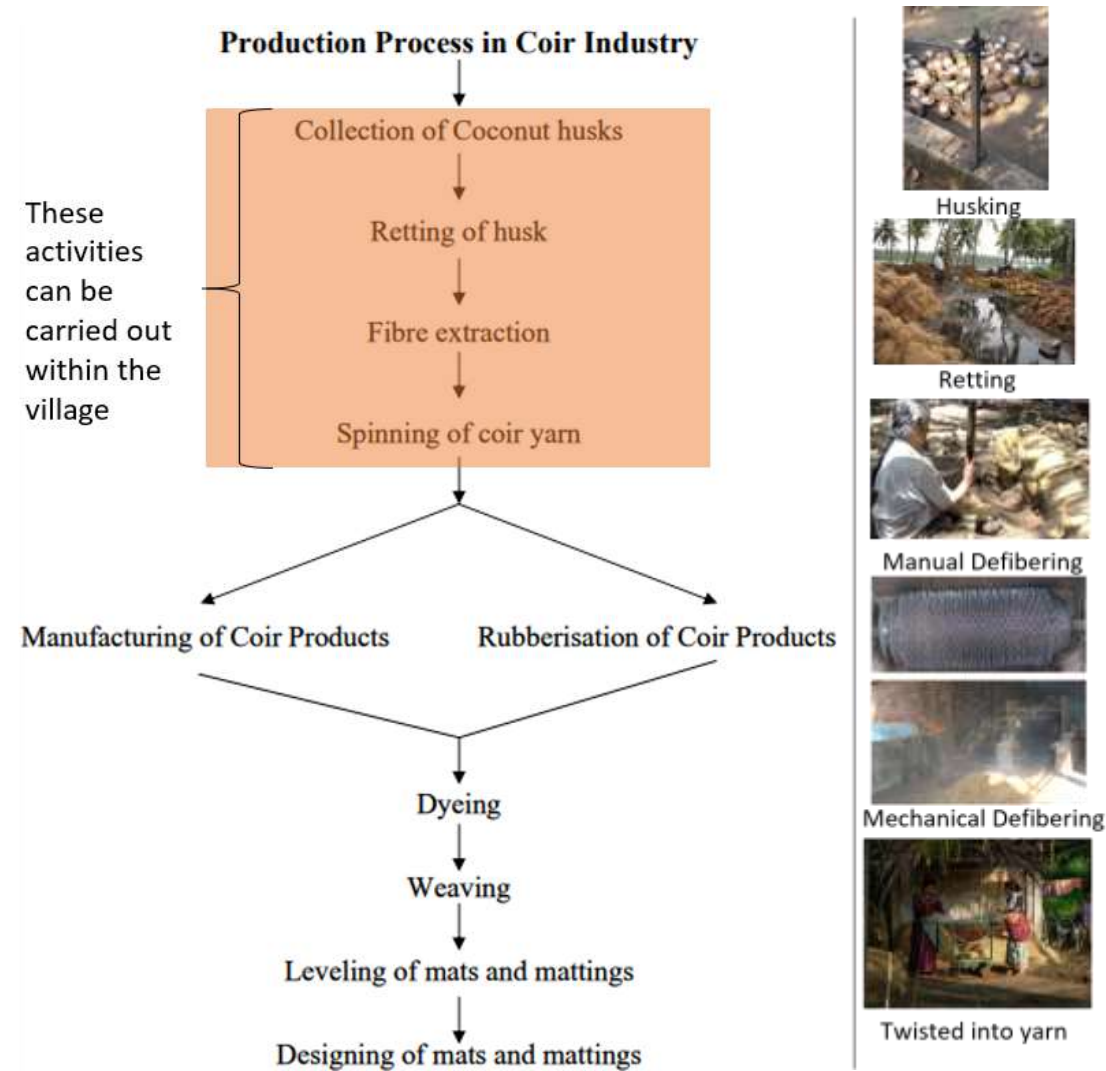


Figure 9-69 Production process in Coir Industry. Source: Author

HARVESTING – 45-60 day cycle with each tree yielding 50-100 coconuts per year. Coconuts that have fallen will simply be picked up off the ground or harvested by human climbers – can harvest fruits from 25 trees in a day or if the climber uses a bamboo pole with a knife attached to the end to reach through the tree top vegetation, he can harvest 250 trees per day.

HUSKING – Ripe coconuts are husked immediately, To remove the fruit from the husk, the coconut is impaled on a steel tipped spike to split the husk. A skilled husker can manually split and peel about 2000 coconuts per day.

RETTING – Traditional retting process involves husks being buried in pits dug along riverbanks, immersed in water-filled concrete tanks, or suspended by nets in a river and weighted to keep them submerged. The husks typically soak at least six months

Whereas, Mechanical retting involves ripe husks being processed in crushing machines after being retted for only seven to 10 days. Immature husks can be dry milled without any retting.

DEFIBERING -Traditionally, workers beat the retted pulp with wooden mallets to separate the fibers from the pith and the outer skin. In recent years, motorized machines have been developed with flat beater arms operating inside steel drums. Separation of the bristle fibers is accomplished by hand or in a machine consisting of a rotating drum fitted with steel spikes.

Separation of the mattress fibers from the pith is completed by washing the residue from the defibering process and combing through it by hand or tumbling it in a perforated drum or sieve

The clean fibers are spread loosely on the ground to dry in the sun.

FINISHING - Bristle fibers that will not immediately be further processed are rolled and tied into loose bundles for storage or shipment. More mechanized producers may use a hydraulic press to create compact bales. However, if more processing is desired, the fibers are combed with mechanical or manual carding tools, then loosely twisted into a thick yarn (wick), and wound into bundles.

9.10.5. Arecanut Processing Business

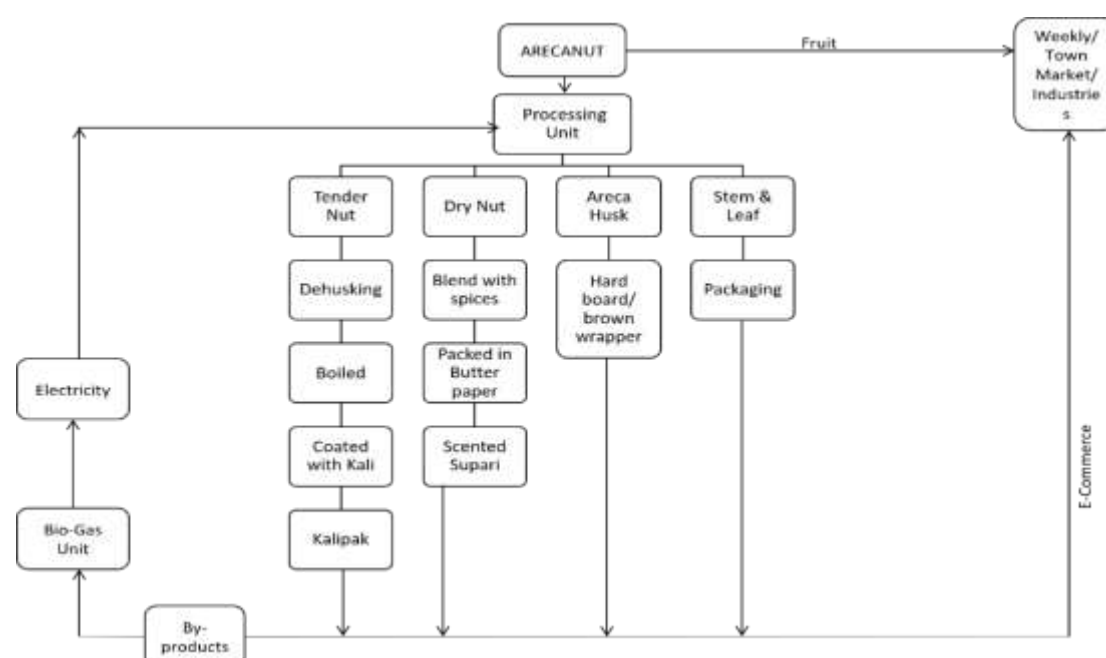


Figure 9-70 Process Flow chart of Arecanut Processing Business in the GP. Source: Author

The above flow chart represents the process flow of possible Arecanut processing businesses in the GP. Arecanut being another major crop of the village, the possible products that can be obtained are charted, also ensuring a circular economy in the village by promoting the use of Biogas plants/ digesters to treat the waste and thereby provide heat and electricity to the processing unit.

Example:

9.10.5.1. Arecanut Processing (Onsite Model)

HARVESTING- Minimum two people with required skills are necessary to accomplish this. One professional tree climber with experience of plucking the fruits and another person who uses gunny bag to catch it when the fruits are falling down.

STORING & TRANSPORTATION -Once the harvesting is completed it has to be transported safely to the home. During one full day of harvesting in a typical farm of about 1 acre, you can get the yield of 14-15 gunny bags. The capacity of each gunny bag is 60 kgs. So, depending on the quality of the yield, you may expect around 800-900 kgs of raw areca nut fruits per acre. The normal process in these villages is to use the bullock cart to transport. If the quantity is more in the range of 30-40 gunny bags, then the truck would be used to transport.

PEELING TO GET THE KERNEL- The raw fruit has to be peeled in order to get its kernel. This has to be done within a day or two after harvesting. Otherwise, the cutting will not be easy at all. Since it is a heavy and intensive manual work, you need a minimum of 7-8 people working for an entire day to peel the arecanut raw fruits of 14-15 gunny bags (800-900 kgs). The labourers enjoy working together like a family with full dedication of 12 hours every day and earn daily wages of RS 150-200.

BOILING THE KERNEL - Immediately after the kernel is taken out, it has to be boiled with high temperature for minimum of 12 hrs. For efficiency purposes, two huge metallic vessels of capacity of 600 litres are being used as seen in the below picture.

SUN DRYING THE KERNEL - This drying process has to be done for minimum of 7-10 days. This is the last step of areca nut processing. Once the drying process is over, it can be packed in and kept for any number of days before selling it in the retail market. For every 100 Kgs of raw areca nut fruits, you can expect the final dried areca nut in the range of 13-15 kgs.

MECHANICAL DRYING – During monsoon, the kernels can be mechanically dried using Solar cum biomass dryer

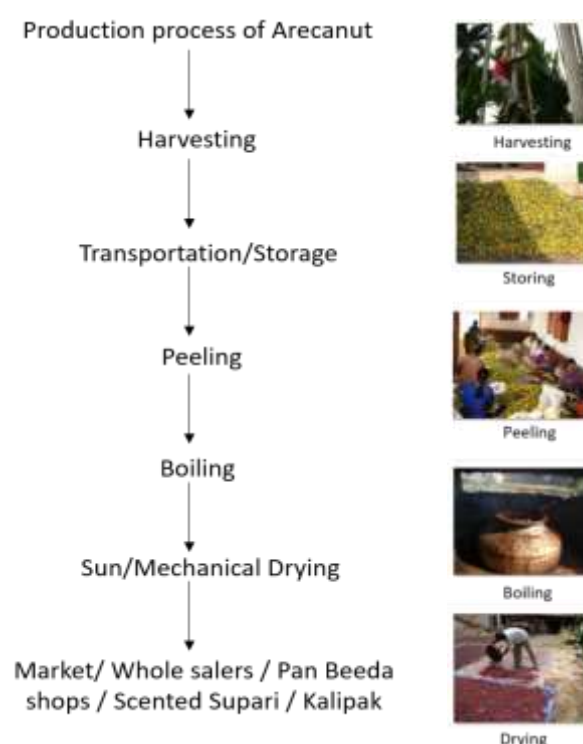


Figure 9-71 Production Process of Arecanut



9.10.6. Mushroom Cultivation (Onsite Model)

a) Button Mushroom Cultivation

- **COMPOSTING** - The growing cycle of mushrooms starts with compost. A square metre of compost (which is equal to 90 kilos) yields a maximum of 35 kilos of mushrooms. The leftover compost can still be used as a soil conditioner in other agricultural companies.
- **SPAWNING** - The process of sowing the mushroom mycelium into the beds is called spawning. The spawns are obtained from certified national laboratories at nominal cost. Spawning can be done in two ways- either scattering the compost on the bed surface in the tray or mix the grain spawn with compost before filling the trays. After spawning the trays are covered with old newspaper sheets. The sheet surface is then sprinkled with water to maintain moisture and humidity
- **CASING** - The spawn run is complete when there is white cottony growth. The surface of the compost is then covered with casing soil upto 3cm thickness. Casing soil is prepared by mixing finely crushed and sieved, rotten cow dung with the garden soil. Once prepared, the casing soil must be sterilized to kill the pests, nematodes, insects and other molds. Sterilization is done by treating it with formalin solution or by steaming. Once the casing soil is spread on the compost the temperature is maintained at 25°C for 72 hours and then lowered to 18°C. Casing stage needs a lot of fresh air.
- **CROPPING** - 15 to 20 days after casing, pinheads start becoming visible. White colored, small-sized buttons develop within 5-6 days of this stage. Mushrooms are ready for harvest when the caps are sitting tight on the short stem. If they are allowed to stay longer on the stem then the cap may open like an umbrella. Opened button mushrooms are considered to be inferior in quality.
- **HARVESTING** - While harvesting, the cap must be twisted off gently. The average production of button mushroom is 3-4 Kg per tray. In favorable conditions the yield can go upto 6 Kgs as well



Figure 9-72 Production Process of Button Mushroom cultivation

9.10.7. Paddy Straw Mushroom

- **SPAWNING** – The mushrooms are spawned on chopped, soaked paddy straws. Sometimes they are spawned on cereal grains or millets. When they are spawned on paddy straw, they are called straw spawn and when spawned on cereal grains, they are called grain spawn. They are available at certified and government centers at a nominal cost. One bottle of spawn is usually sufficient for one bed.
- **STRAW PREPARATION** - In India, the mushroom of this variety is grown on paddy straw. Well dried, long straws are tied together in bundles of 8-10 cm in diameter. They are then cut to uniform length of 70-80 cm and soaked in water for 12-16 hours.
- **BED PREPARATION** - Since the mushrooms must be cultivated on raised platforms, foundations made of bricks and soil must be raised. Its size must be slightly larger than the bedding and must be strong enough to hold the weight of the bed.
- **MUSHROOMING** - Generally, mushrooms begin to grow within 10-15 days of spawning. They continue to grow for the next ten days. Once the volva erupts and the mushroom inside is exposed the crop is ready for harvest. These mushrooms being very delicate have a very short shelf life. They must be consumed fresh. If refrigerated, they can be stored only for a maximum of 3 days. The yield of this mushroom variety is about 2.5 Kg per bed.



Figure 9-73 Production Process of Paddy Straw mushroom cultivation

9.10.8. Skill Development Centre

Centralized Vocational and Skill Development Centre

I. Demo Area-1 (Centralized model)

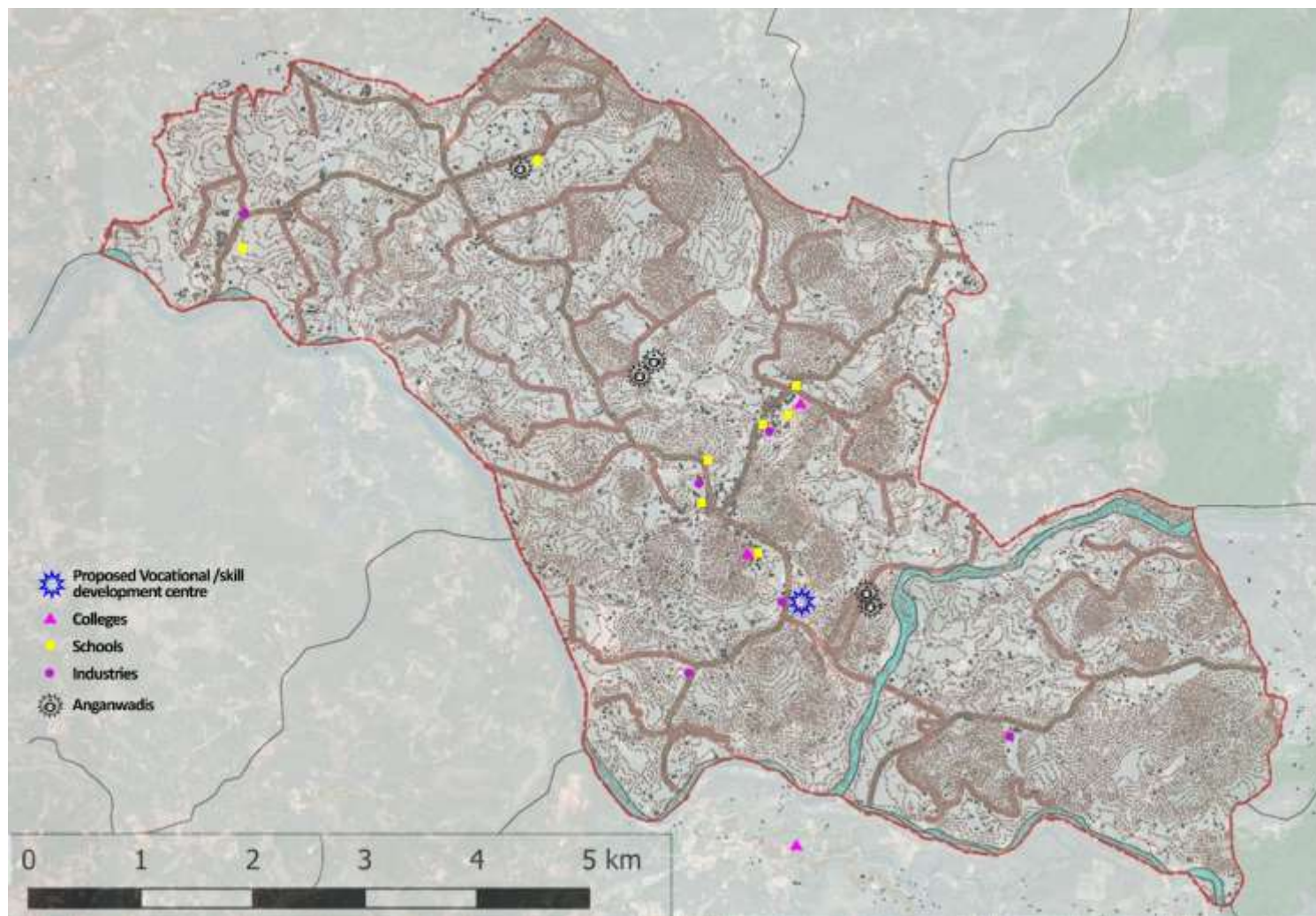


Figure 9-74 Map Showing Proposed Areas for Intervention.

Why

- Present youth (approx. 40%) are moving out to cities for work and employment.
- Less opportunity to retain people with higher qualification
- Lack of employment opportunities for women, more than 50% women are unemployed including some widows and unmarried women

What

- Vocational training for employment
- Digital Learning centre

How

- ICT integration for education and work
- E- Learning platform to continue higher education & promote digital literacy

Location

The demo area is located in Kulanje ward-01 along with the SH 27 and to the proximity of Shankaranarayana bus stand- 1km approx.



I. Demo Area Location- 1 (Centralized model)



Figure 9-75 Map Showing Demo Area along with Site Section. Source: Author

II. Vocational and Skill Development Centre Details:

Primary Sector Courses

In Shankaranarayana & Kulanje the primary sector activity plays a key role for village economic development, at the same time there is very few sustainable practices found in the Gram Panchayat except for few, farmers rarely get enough income from what they have invested because of various factor like lack of knowledge, skills and market awareness among the farmers. Due to these drawbacks the middlemen get benefitted. So, there is a need for a proper learning center to manage all farming activities which include sustainable practices, handling of modern equipment, etc. The different courses that can be made available within the GP are;

- I) Agro-processing II) Dairying III) Food Production IV) Fruit & Vegetable processing

Information Communication Technologies, Digital & Non-technical courses

Kulanje and Shankaranarayana have people with higher qualifications but there is no opportunity to continue higher education within the gram panchayat. There is very less opportunity to retain people with higher qualifications. In Shankaranarayana there is a lack of employment opportunities for women, more than 50% of women are unemployed including some widows and unmarried women to support them Digital learning and processing courses are provided.

- I) ITC & E-Distance Learning II) Sewing Technology III) Spa Therapy

Informal Sector Courses

In Shankaranarayana and Kulanje there is more engagement in the informal sector around 40% of youth migrate to find job opportunities in the informal sectors like construction sector and technical sectors, hence there is a need provide for the youth to upgrade their skills. A multi-purpose classroom and lathe/workshop can be used for different informal sector courses during various schedules provided. The technical appliance courses can be done through multi-purpose classrooms, the technical courses include,

- I) Mechanical II) Welding III) Carpentry IV) Home appliances V) Mobile & Electrical devices repairing VI) Electrical rewinding

I. Site Plan Showing Vocational and Skill Development Centre:

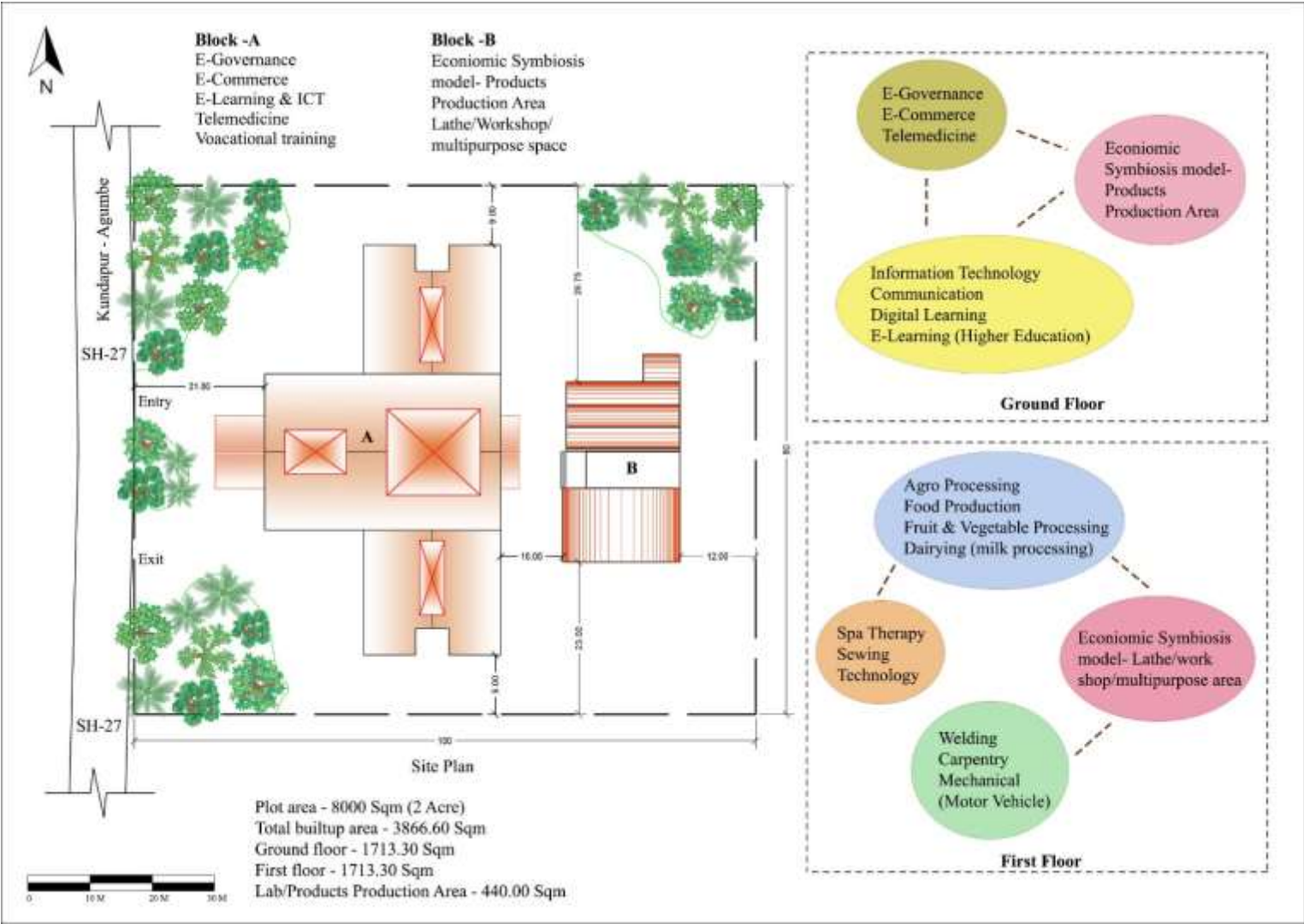


Figure 9-76 site plan of Vocational and Skill Development Centre. Source: Author

II. Detailed Plan, of Block A:

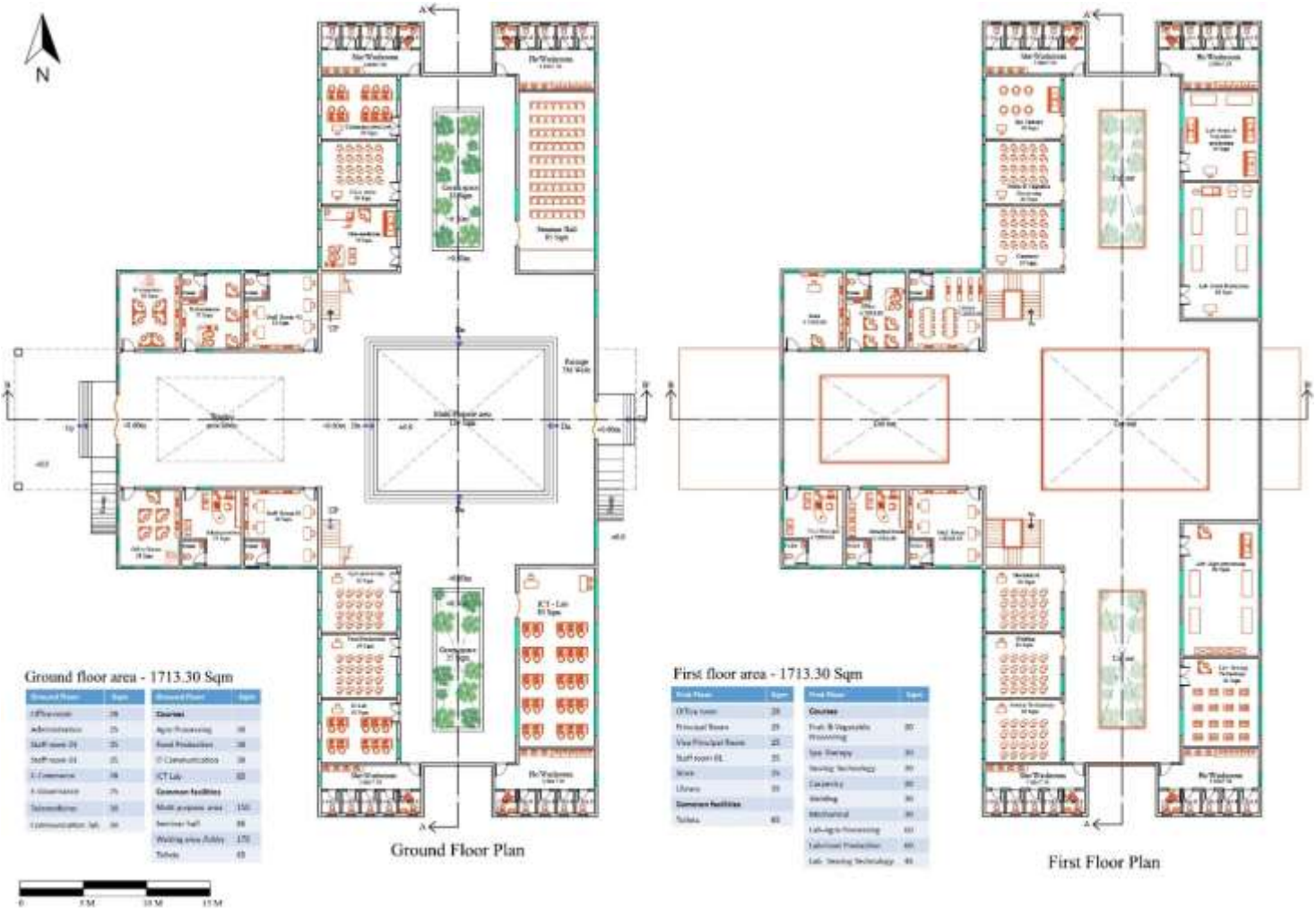


Figure 9-77 Floor plans of Vocational and Skill Development Centre (Block –A). Source: Author

I. Area statement:



Ground floor – E-Governance, E-commerce, Tele-medicine, ICT, Multi-purpose area

Table 9-3 Showing Ground floor and first floor carpet area of Vocational and Skill Development Centre (Block –A)

| S.No. | Requirement | Area Sq.mt | Total Sq.mt | Number of people (Per Class Room) |
|---------------------------------|---|--------------------|-------------|-----------------------------------|
| West Wing | | | | |
| 1. | Office Room | 28 | 28 | |
| 2. | Administration | 25 | 25 | |
| 3. | Staff Room (2 Nos) | 30 | 60 | |
| 4. | E-Commerce | 28 | 28 | |
| 5. | E-Governance | 25 | 25 | |
| South Wing | | | | |
| 1. | ICT Lab | 85 | 85 | 25 |
| 2. | Smart IT Lab | 30 | 30 | 10 |
| 3. | Food Production class | 30 | 30 | 20 |
| 4. | Agro-Processing class | 30 | 30 | 20 |
| 5. | Toilet (Male & Female) | 30 | 60 | |
| North Wing | | | | |
| 1. | Telemedicine | 30 | 30 | |
| 2. | Language class | 30 | 30 | 20 |
| 3. | Communication Lab | 30 | 30 | 10 |
| 4. | Seminar Hall | 85 | 85 | 65 |
| 5. | Toilet (Male & Female) | 30 | 60 | |
| Other areas | | | | |
| 1. | Multipurpose area | 150 | 150 | |
| 2. | Green area | 35 | 70 | |
| 3. | Ground floor Common area, Circulation + waiting lobby | 30+ 170+ 500 | 700 | |
| Ground Floor Carpet Area | | | 1556 | |

First floor – Vocational courses, Administration, Labs

| S.No. | Requirement | Area Sq.mt | Total Sq.mt | Number of people (Per Class Room) |
|--------------------|--------------------------------------|------------|-------------|-----------------------------------|
| West Wing | | | | |
| 1. | Principal | 28 | 28 | |
| 2. | Vice Principal | 25 | 25 | |
| 3. | Staff Room | 30 | 30 | |
| 4. | Store | 25 | 25 | |
| 5. | office | 28 | 28 | |
| 6. | Library | 30 | 30 | |
| South Wing | | | | |
| 1. | Mechanical | 30 | 30 | 20 |
| 2. | Welding | 30 | 30 | 20 |
| 3. | Sewing Technology | 30 | 30 | 20 |
| 4. | Lab Sewing Technology | 45 | 45 | 20 |
| 5. | Lab Agro-processing | 60 | 60 | 20 |
| 6. | Toilet (Male & Female) | 30 | 60 | |
| North Wing | | | | |
| 1. | Spa therapy | 30 | 30 | 20 |
| 2. | Carpentry | 30 | 30 | 20 |
| 3. | Fruits and vegetable processing | 30 | 30 | 20 |
| 4. | Lab- Fruits and vegetable processing | 45 | 45 | 20 |
| 5. | Lab- Food Production | 60 | 60 | 20 |
| 6. | Toilet (Male & Female) | 30 | 60 | |
| Other areas | | | | |

| | | | | |
|--------------------------------|-------------|-----|-------------|--|
| 1. | Circulation | 600 | 600 | |
| First Floor Carpet Area | | | 1276 | |

I. Schedule for Class room & Lab area/Multipurpose.

Table 9-4 Showing Training time of Vocational and Skill Development Centre (Block –A)

Vocational Training Timing - Class Room & Lab area/ Multipurpose

| Target User | Timing | Course Offered | Duration |
|---|--|--|----------------|
| Youth (15 – 25) Male & Female | 9 – 12 Am (Morning Session) | Primary sector courses | 3 to 12 months |
| Adults (25+) Male & Female | 2 – 5 Pm (Afternoon Session) | Primary sector courses | - |
| Open to all age groups (Male & Female) | 9 – 12 Am Weekend (Morning Session) | Primary sector awareness & Training programs | - |
| Youth (15 – 25) Male & Female | 8 – 11 Am (Morning Session) | ICT & Distance education | 12+ months |
| Primary and high school students Male & Female | 1 – 4 Pm weekend (Afternoon Session) | E-learning computer programming | 3 to 6 months |
| Adults (25+) Male & Female | 2 – 5 Pm week days (Afternoon Session) | Basic digital learning | 1 to 3 months |
| Youth (15 – 25) Male & Female | 9 – 12 Am (Morning Session) | Sewing Technology & Spa Therapy | 3 to 12 months |
| Adults (25+) Male & Female | 2 – 5 Pm (Afternoon Session) | Sewing Technology & Spa Therapy | - |
| Youth (15 – 25) Male & Female | 9 – 12 Am (Morning Session) | Technical sector | 3 to 12 Months |
| Adults (25+) Male & Female | 2 – 5 Pm (Afternoon Session) | Technical sector | - |
| Youth (15 – 25) Male & Female | 9 – 12 Am (Morning Session) | Non-Technical Sector & Construction Sector | 3 to 12 Months |
| Adults (25+) Male & Female | 2 – 6 Pm (Afternoon Session) | Non-Technical Sector & Construction Sector | - |

II. Detailed Elevation and Section of Block A:

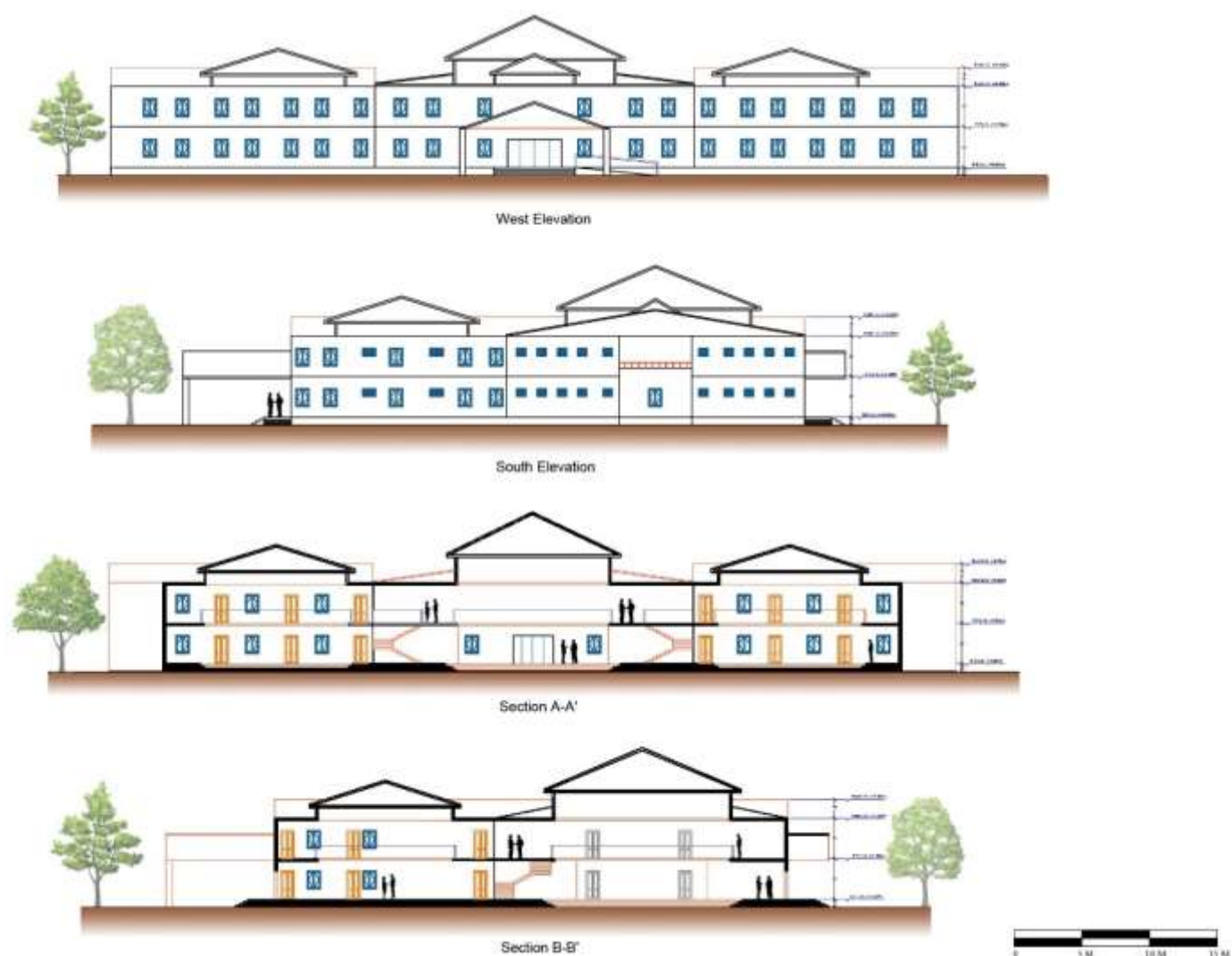


Figure 9-78 Elevations & sections of Vocational and Skill Development Centre (Block –A)

II. Detail Plan, Elevation and Section of Block B (Economic Development):



Figure 9-79 Floor plans& details of Vocational and Skill Development Centre (Block –B) Source: Author

Area Statement of Block B (Economic Development):

Ground floor – Food Processing Area & Eco Products Processing Area Storage/Warehouse/

Table 9-5 Showing Floor carpet area of Vocational/Skill Development Centre (Block –B)

| S.No. | Requirement | Area Sq.mt | Total Sq.mt |
|---|----------------------------|------------|-------------|
| North Wing – Food Processing Area | | | |
| 1. | Cooking/Boiling | 20 | 20 |
| 2. | Washing/ Weighing | 20 | 20 |
| 3. | Filtering/ Pressing | 30 | 30 |
| 4. | Sterilization | 15 | 15 |
| 5. | Labelling/Packaging | 10 | 10 |
| 6. | Storage | 25 | 25 |
| 7. | Cold Storage | 15 | 15 |
| 8. | Circulation | 20 | 20 |
| 9. | Administration | 15 | 15 |
| 10. | Toilet (Male Female) | 35 | 35 |
| South Wing – Eco Products Production/Storage | | | |
| 1. | Equipment area | 70 | 70 |
| 2. | Product processing/Storage | 125 | 125 |
| | Total | | 400 |

9.10.9.Decentralized Skill Development/ Village Support Centre

I) Demo Area -02 (Decentralized Model)

Figure 9-80 Map Showing Location of Proposed Skill development/ Village support centre. Source: Author

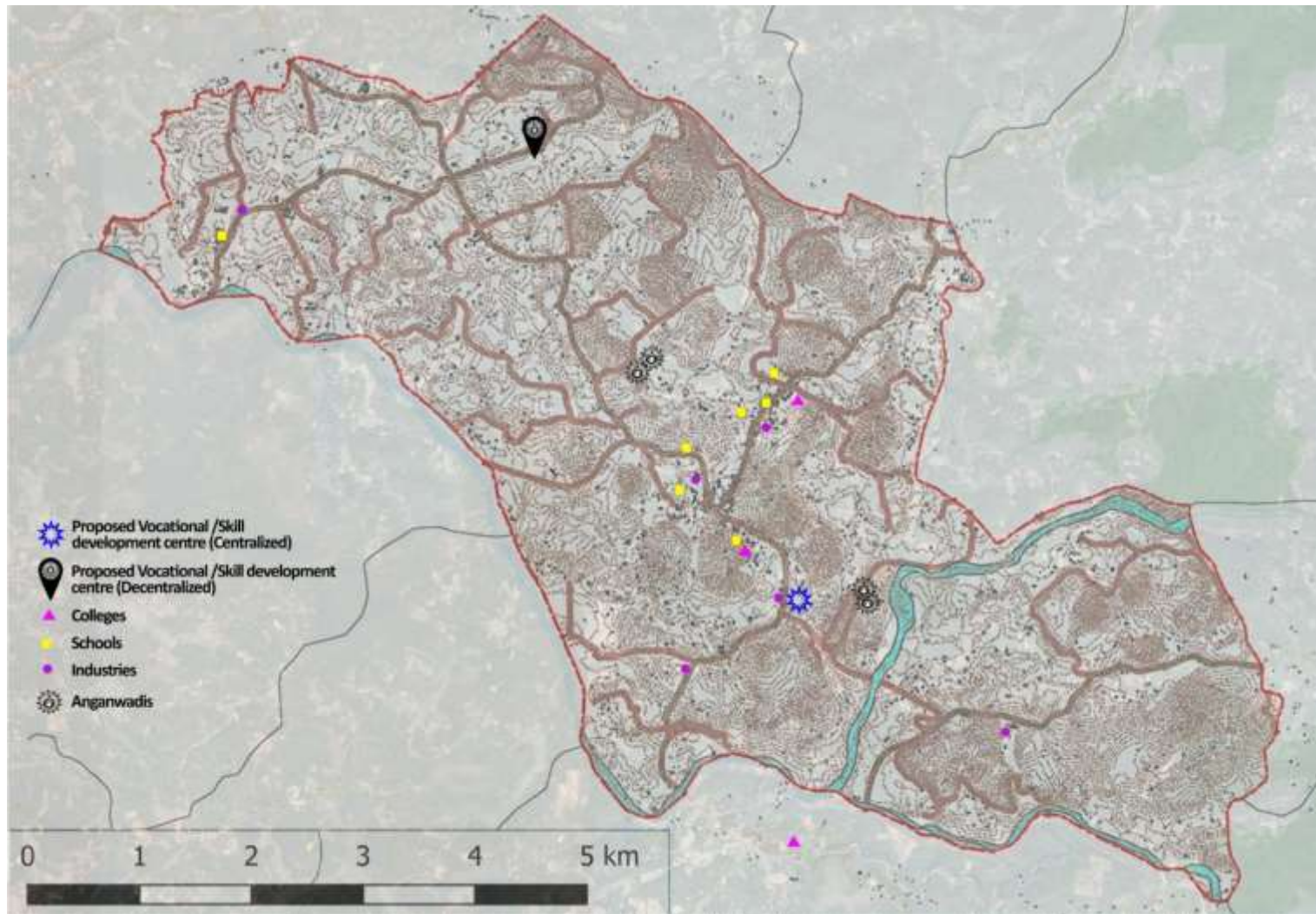


Figure 9-81 Location of Proposed Skill development/ Village support centre. Source: Author

II) Site Plan of Proposed Skill development /Village Support Centre

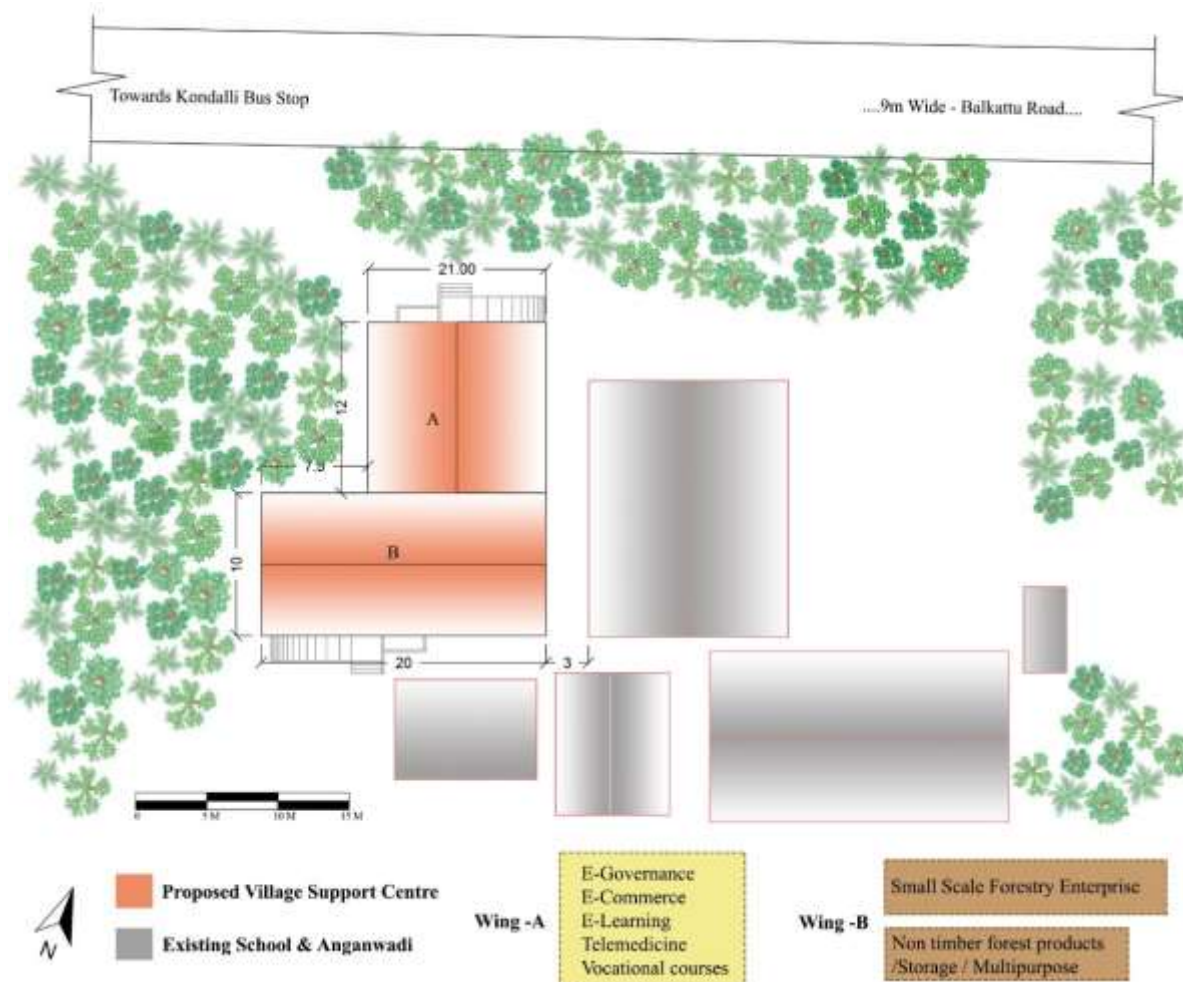


Figure 9-82 Site Plan of Proposed Village Support Centre. Source: Author



Figure 9-83 Detailed Plan, Elevation and Sections of Village Support Centre. Source: Author

III) Area statement

Table 9-6 Showing Carpet area of Skill development /Village Support Centre

| S.No. | Requirement | Area Sq.mt | Total Sq.mt | Number of people (Per Class Room) |
|---------------------------------|---|---------------|----------------|--------------------------------------|
| Wing A | | | | |
| 1. | Waiting lobby/ Information service | 28 | 28 | |
| 2. | E-Governance/ E-Commerce | 28 | 28 | |
| 3. | Telemedicine | 30 | 30 | |
| 4. | Computer learning /Class/Multipurpose space | 30 | 30 | 20 |
| 5. | E-Governance | 25 | 25 | |
| Wing B | | | | |
| 1. | Small scale forest enterprises /Class/Multipurpose space | 30 | 30 | 20 |
| 2. | Non timber forest products/ Storage/ Multipurpose hall | 60 | 60 | |
| 3. | Cold storage | 10 | 10 | |
| 4. | Toilet (1 for He & 1 for She) | 20 | 40 | |
| Ground Floor Carpet Area | | | 281 | |

IV) 3d views of Proposed Village Support Centre



Figure 9-84 3D Views Village Support Centre



Recycling Organic Waste by Integrating Circular Economic Model

9.10.10. Mushroom Cultivation

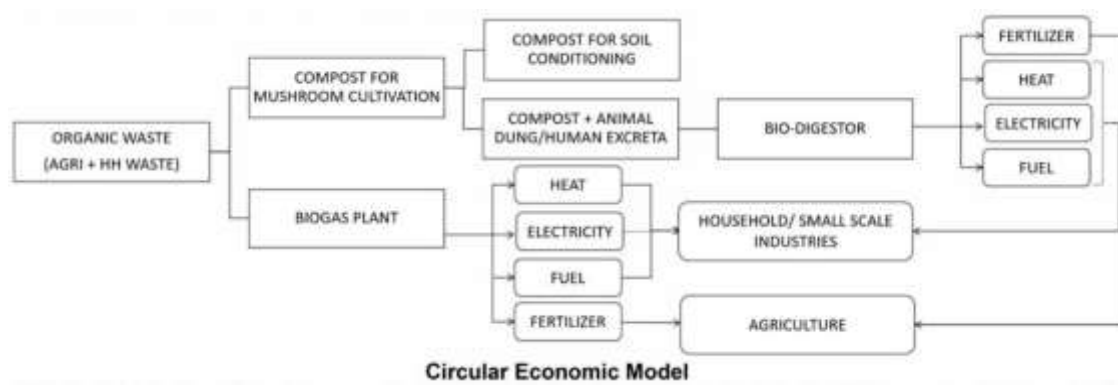


Figure 9-85 Promoting Circular Economic Model through Mushroom Cultivation

With the introduction of mushroom cultivation and bio-digestors/ biogas plants in the GP, we can achieve a circular economic model where in the organic waste that is produced in households and agricultural unit can be converted to produce heat, electricity, fuel and fertilizer, thereby creating a zero emission or total productivity concept.

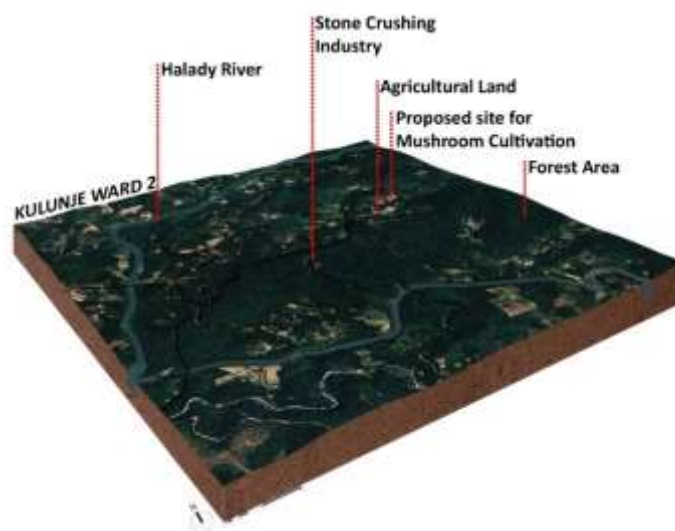


Figure 9-86 88 Possible Location for Mushroom Cultivation in Kulunje Ward

9.10.11. Insect Based Bioconversion

When insects are mass produced under controlled conditions, they can break down significant quantities of food waste. Further, as the insects consume this waste, they produce multiple valuable commodities, such as insect biomass (proteins, lipids), pharmaceuticals, biofuels, lubricants, and fertilizer from their excrement. This process is called bioconversion

The chemical and physical properties of insect frass used as a fertilizer are compatible to other commercial products. For animal feeds, the most well studied and commonly used species are black soldier fly larvae, house fly, mealworms, and crickets. Black soldier fly larvae are an especially lucrative feed source, rich in protein and fat, with faster development than other species used for bioconversion.

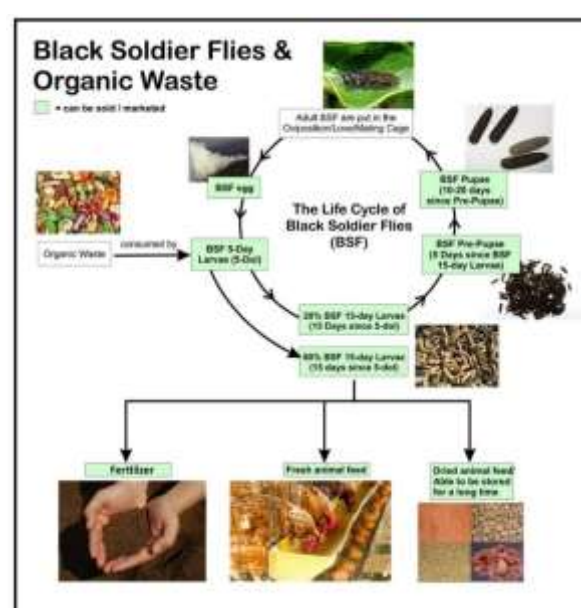
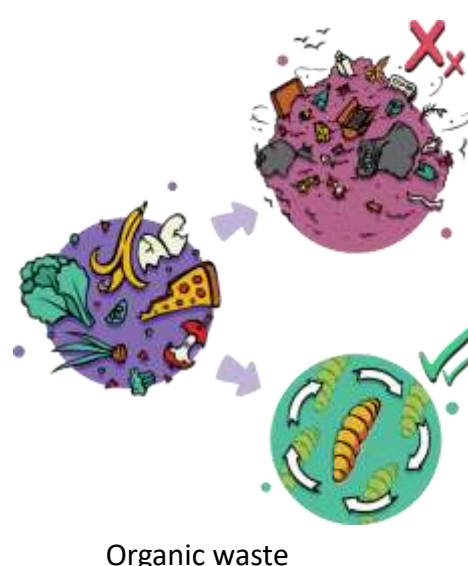


Figure 9-87 circular flow of Organic Waste using Insect Bioconversion



Organic waste

9.10.12. Woman Empowerment Centre

Guidelines for Setting up a Women Empowerment Centre

- The centre should be located in such a place that the transportation facility will be available or it should be within 500 meters of bus stop & auto stop.
- The centre will be within 1 km of post office location, which will help strengthen the e-commerce system.
- Small medical aid unit for the centre which would provide guidance for all kinds of physical & mental health awareness for woman.
- This centre can cater all women age of 18-65 years without any class bias.
- Working woman can be facilitated with child care unit, children are ageing 2 to 7 years old can get this facility.
- This centre will cater to production as well as selling of the homemade products supported with e-commerce facility.
- The centre can be arrangement of required rooms with courtyard which can provide openness and also act as a gathering space for any training or awareness programme. Rooms should have RCC roof and minimum height of 3m.
- This centre can guide Rastriya Mahila Kosh policy for the rural woman to achieve business related funding assistance.
- Providing facility of Mahila E-haat which is an online marketing platform for women provides an opportunity for women entrepreneurs to leverage technology for showcasing and selling products made by them.



9.10.13. Women Empowerment Centre (Mahila Mandal)

Social Structure of Women in the GP

Empowerment of women and achieving equality between men and women is beneficial for economic development and enhance social life also. In rural areas women are dominated and economic opportunity also not encouraged for them. Shankaranarayana village has more women population than men.

Social Structure of Women in Shankaranarayana Village

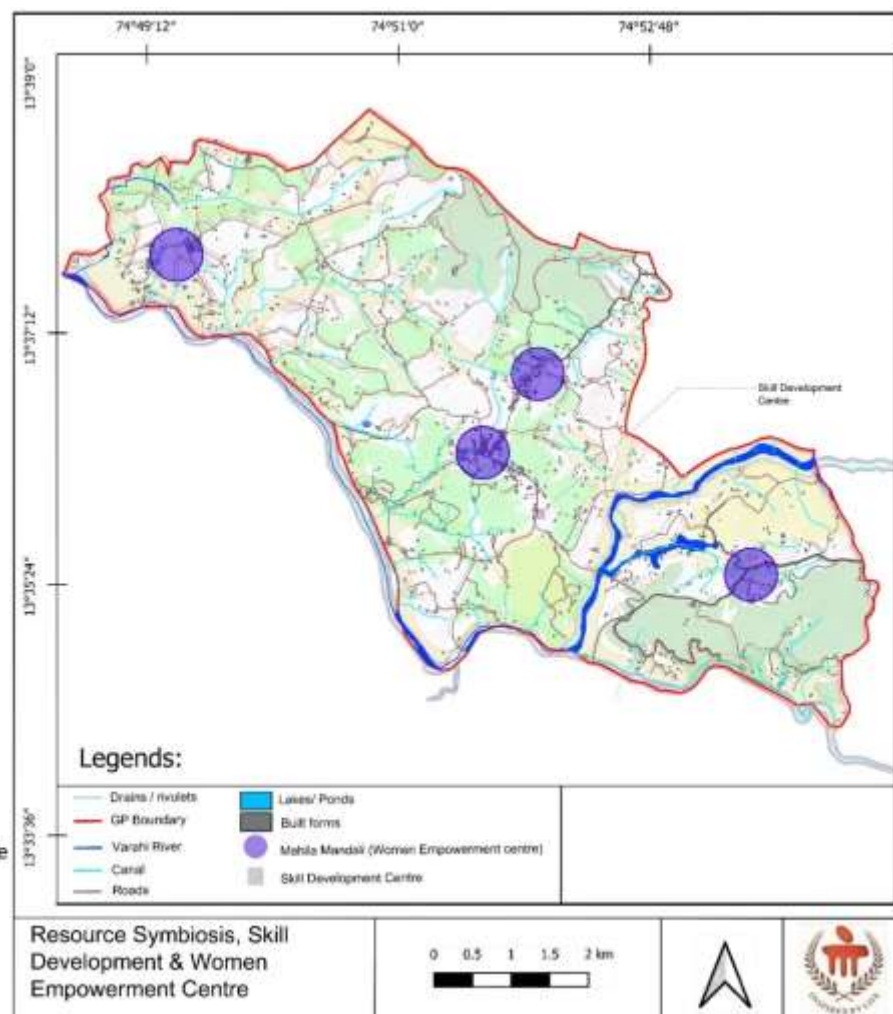
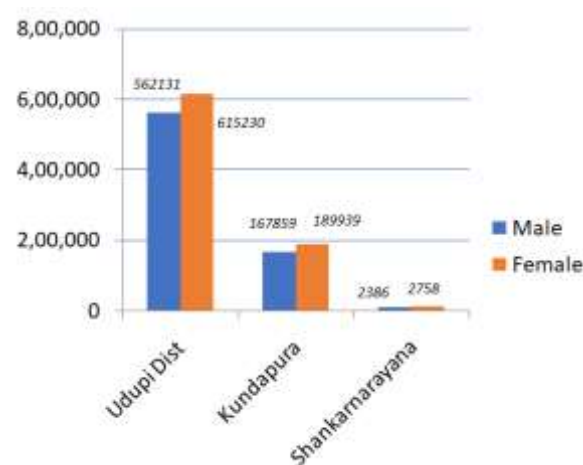


Figure 9-89 Social Infrastructure Development: Resource Symbiosis Model, Skill Development Centre, Women Empowerment Centre

Figure 9-88 Comparative analysis of male female ratio.

Source: GPDP Report

As per figure 9-92 Shankaranarayana Village female population is more than male population. As per statistics Shankaranarayana Village women are more literate rather than male ratio, whereas we can see more female are illiterate in comparison of male. May be small scale business or training can help those female communities.

As per data Shankaranarayana Village women are mostly nonworking comparison to male because of less Opportunity. So, it is clearly visible that female is associate with in house related work so some SHG (Self-help group) can create more small-scale home-based items production as a job opportunity. Shankaranarayana Village has lack of woman empowering facilities like woman training center, Self-help group participation, and woman cooperative centering based small industry. The women of this village can be encouraged by empowering them based of their home-based skill which generally they inherit. The literacy rate also high in women population which they can use for their development. Changing of economical status of the women also help them to develop their social life and create better future for their child.

Shankaranarayana Village non availability of woman facilities-

- Woman training center
- SGH- Self-help group
- Woman cooperative center.
- NGO based small industry

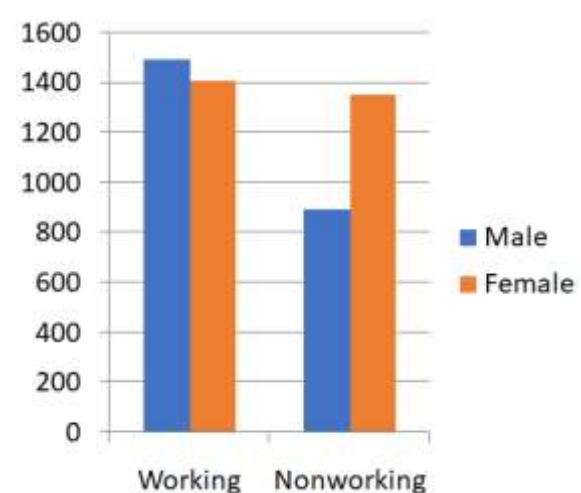


Figure 9-90 Shankaranarayana Village comparative data of working & nonworking for male and female.

Source: GPDP Report

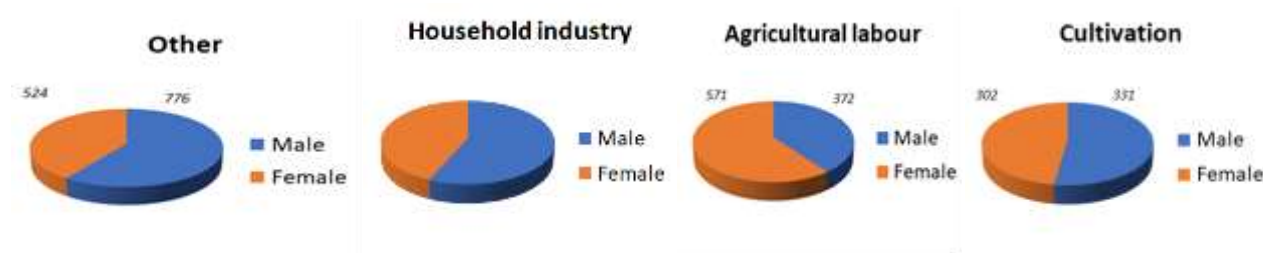


Figure 9-91 Shankaranarayana Village Female working comparative data of different industry. Source: GDP Report

Shankaranarayana Village ownership is in hand of man whereas most of the same amount of cultivation is doing by woman almost same. Shankaranarayana Village women are mostly involved in agricultural work profile rather than other industry. 70% of the man are going outside for work opportunity so woman is taking care of home and children so home-based product training can be income opportunity for them.

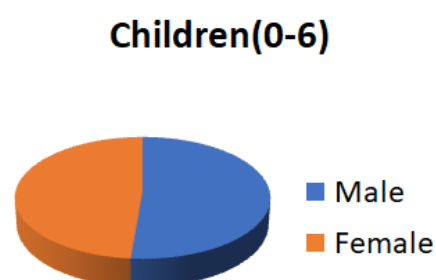


Figure 9-92 Shankaranarayana Village comparative data of male and female children. Source: GDP Report

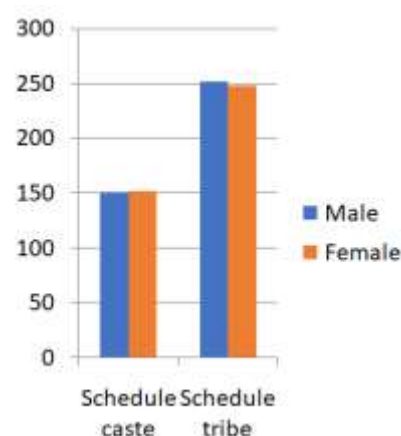


Figure 9-93 Shankaranarayana Village comparative data of schedule cast & schedule tribe population for male and female. Source: GDP Report

Shankaranarayana Village Schedule tribe population is more than schedule caste population. There is different improvement policy is there but due to their bad lifestyle their children are mostly sent to other state for job.



Figure 9-94 Map showing involvement of occupation in different area

Most of the woman are participate in cultivation work or agricultural labor job where male is earning five hundred rupees per day and women are getting three fifty rupees per day. In seasonal based forest-based income generation also man and woman are equally participating but it mainly provides benefit for male community.

Social Structure of Women in Kulunje Village



Kulunje village female population is more than male population as shown in above chart. Streetlight for safety is not available which is not ensure the woman safety. Less women are involving in some job. Job opportunity is less for woman. Primary Health care center is 5km away Community health care center more than 10 km away. Streetlight for safety is not available which is not ensure the woman safety. Primary Health care center is 5km away. Community health care center more than 10 km away.

Inferences

- Woman job opportunity should be more as female literacy rate is higher than male.
- Small scale job opportunity is needed as most of the women are unemployed.
- Nearest primary health care center is more than 5km away so for woman and children health care should be provide.
- 0-6 year's female children is less number.
- Nearest school 5km away from village.so child safety also is a questionable here. Village majority of population is female but special care of woman empowerment is not available here.
- Most of the woman population involve in agricultural labour and cultivation.
- Illiteracy rate of woman is higher than the man illiteracy.
- Some of the ward is difficult to access to bus stop in the evening as woman safety is also a issue for them.
- Unavailability of street light is most serious issue as its create more difficulty for woman to access road.
- Primary health care infrastructure is not very good so women are
- Mainly dependent on private dispensaries.
- Community health care center is more than 10 km away so accessibility is also a major question for woman.
- Woman training center for woman small scale empowerment is not available.
- No fund infrastructure for woman skill development and small scale business
- Non-working of woman population is more as opportunity for woman empowerment is less.

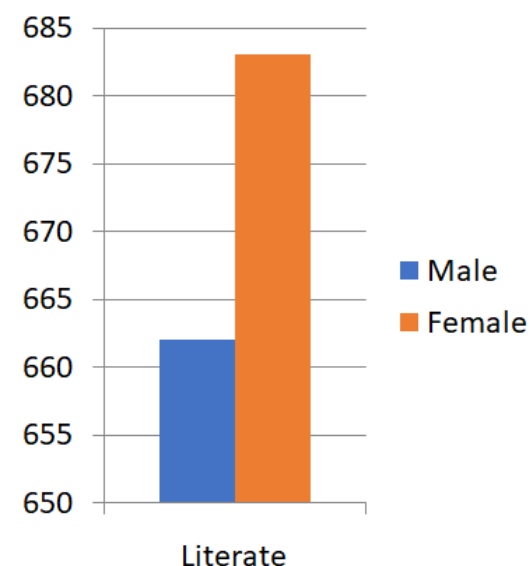


Figure 9-95 comparative data of literate & illiterate for male and female in Kulunje village.
Source: GPDP Report



Figure 9-96 Map Showing Ward wise occupation for women

9.10.14. Economic Opportunities for Women in the village currently

Most of wards most of the people involved in cultivation and partially involve in animal husbandry. In ward-4 commercial facility is more. Ward-5 tailoring shop and welding shops are there. So woman's are mostly work as agricultural labour. Here as most of the women are taking care of children and home related work as they don't have any opportunity in their village so some women are working in other places which is far away so more time consume for travel. Most of the woman are interested in small scale homemade production base job opportunity. So they can create some agro base food production from Rice, Banana, Cashew nut and Coconut etc. Also some forest base job opportunity can create like Honey production, herbal beauty production etc. Also some hand craft or tailoring skill can be used as the job creation.

Benchmark and Important Factors to be considered

- Create woman empowerment training centre.
- Involvement of NGO /SHG to create opening for woman economical independency.
- Woman corporative for more small scale job opportunity creation.
- Create a fund infrastructure for woman to introduce a small scale business.
- Ensure woman safety in terms of infrastructure like road, hospital, school, emergency services etc.
- Awareness programme for child labour and woman empowerment should be enhance
- Small scale job creation through homemade product so all woman can participate.
- Woman safety should be taken care.
- Accessibility is an important factor should be taken care of.
- Cultural places or commercial place will be nearby as it act as a safety eye.
- Post office location can be accessible so it easy to send the parcel.

Strategy

To create a homemade small scale industry like pickle, papad, coconut oil, Agarbatti , Beauty product from Herbal trees, stitching, Handcraft etc. .Where all the woman age from 18 to 60 years can join. Mainly all literate and illiterate women can join and become economically independent.

Incorporating the woman empowerment related policy information centre which can be guide the woman community about how to apply those policy and their validation. Creating a woman corporative which will help them to economically stable and unitize. NGO participation is also important to improvise their production and creating an opportunity for trading. With the activity area can be proposed for guidance and teaching which can be used as yoga centre in the morning. Also ecommerce centre will be incorporated as all the women are not aware of e-commerce so it will be help to showcase their product and sell it. Child care facility also should provide for working mother which can enhance their participation.

Intervention for Women Empowerment Centre (Mahila Mandali)

Creating home-based Industry for different opportunities for enhancing woman's economic condition. Providing training for different scope of job opportunities and the own village product like cashew, coconut, herbal trees can be resource of raw material. Different NGO participation can enhance the different types of guidance can be arrange like how to make herbal beauty products, Herbal oil etc. Recreational space for woman which can work as a community space as well as interaction place. Here the indoor and outdoor space both can be used for different function base work. Also, for working mother childcare facility available. So that they can also participate in income generation. Information center should be incorporate so for creating awareness and knowledge about woman empowerment policies. Different NGO and Self-help group participation for encouraging woman to use their different skill for generating money and secure their future. Important basic infrastructure like toilet, canteen, and computer room should be incorporated.

Issue Identified for Proposal

More no of woman are unemployed. They have very less exposure for job opportunity. Most of wards most of the woman involved in cultivation and partially involve in cashew industry. So, women are mostly work as agricultural labor. Here, as most of the women are taking care of children and home related work as they don't have any opportunity in their village so some women are working in other places which is far away so more time consume for travel. Most of the woman are interested in small scale homemade production base job opportunity. So, they can create some agro-based food production from Rice, Banana, Cashew nut and Coconut etc. Also, some forest base job opportunity can create like Honey production, herbal beauty production etc. Some hand craft or tailoring skill can be used as the job creation.

Project Outcome



Create alternative/different type job opportunity for the woman. Production and opportunities for value addition and non-farm employment, which is considered essential to improve the economic condition for all women with the age of 18-60 years

Woman opportunity for work – small industries. Production space for home-based products and other small-scale industry product for easier trade and transport with the help of E-commerce. Co-operative also can be formulated by rural women for easy loan sanctioned. Economic opportunity for all women. Child-care can be helpful for all working mothers to participate in work.

Exhibition will help to showcase their skill and product. Also, people can purchase homemade product directly from them. NGO participation or SHG group can help them to train them or help them for trading.

9.10.15. Mahila Mandali

| | |
|----------------|--|
| Mapping | Small homemade production enterprises within the Panchayat area. |
| | Economic opportunity for the village woman |
| | Opportunities for all women. |
| Identification | Potential of village based agro production |
| | Skill and interest of the woman |
| Facility | Job opportunity |
| | Facilitate policy for new start up and trading |
| | Provide opportunity for trading through E-commerce |
| | Support for working mother by providing child care. |
| | Multiple uses of spaces in different spaces. |
| | Encourage good and healthy life style for women yoga center. |
| | Providing shop give an opportunity to display their production. |
| Maintain | Categorization of employee based on skills. |
| | Improving quality of product. |
| | Expansion of business through e-commerce. |

Demo Site Selection

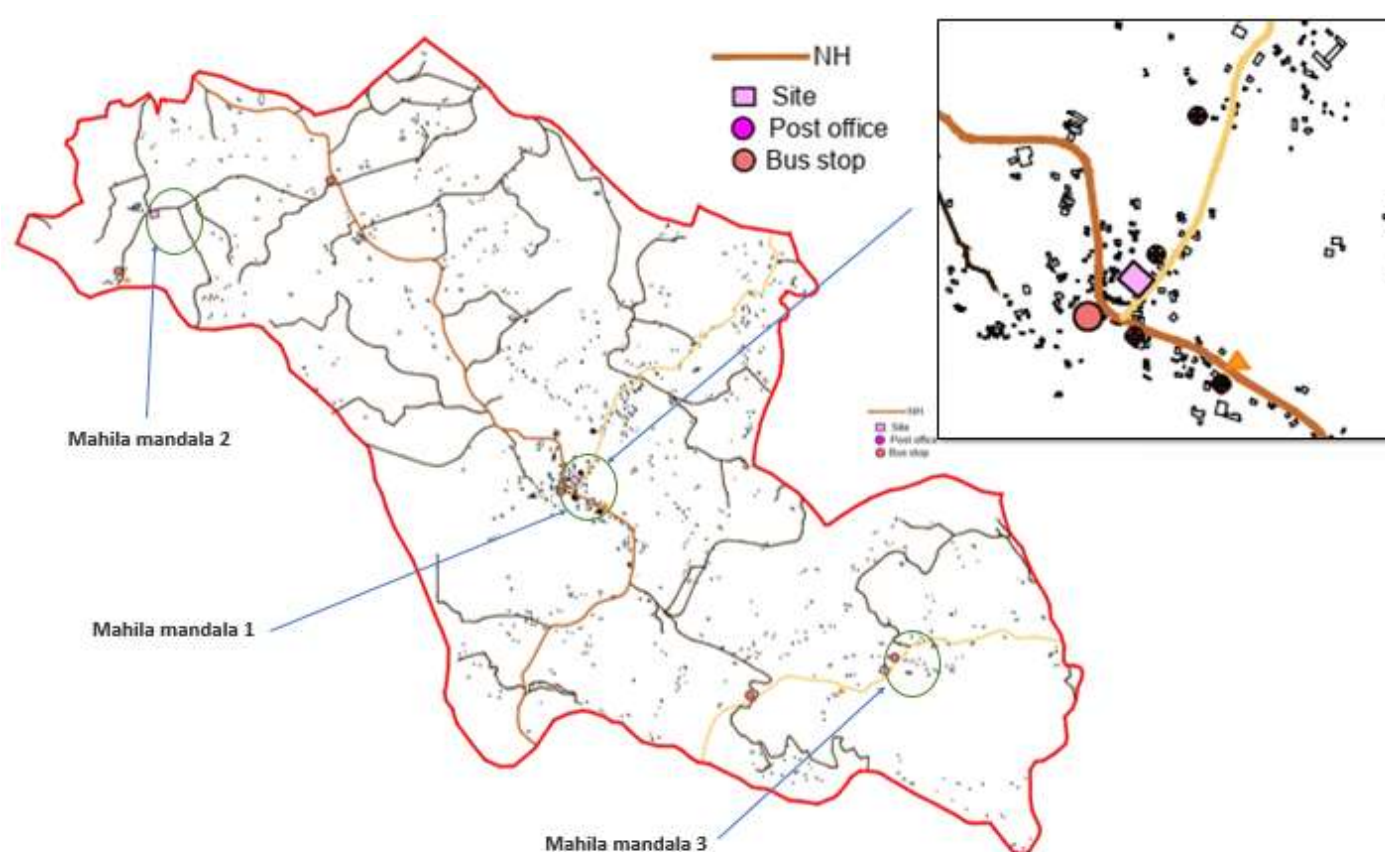


Figure 9-97 Map Showing Demo Site Area

Site Selection Criteria

Site has been chosen depending of some factors which will be a backup for woman empowerment. First is accessibility is an important for woman safety, so the site has chosen near bus stop which is within walkable distance of 500m so they can easily access their workplace. Also, main site is situated near junction of the village and national highway. The site is surrounding by commercial area, so it is working as eye of safety. Also, it is situated within 500 meter of the important public infrastructure like police station and hospital so which is easy to access in emergency. The chosen site is situated near important religious place or community place so it will be easy to practice their rituals and correspondingly involve in their workplace also. As target is to provide job opportunity at least 75% of the total unemployed woman. One center can cater 300 women at a time so other two demo site can cater more 600 women.

Proposed Site Area Required for Mahila Manadala

The total requirement for the site is 2500 sq. m. The center has basic three areas for serving the purpose. The first is public, second semipublic and third is private.

Public Area: This spaces includes information, Display center, E commerce and Administrative area this places can accessible for all the people.

Semipublic Area: This space includes Amenities, Storage, Business center, Activity area, Child care etc. This spaces are restricted by some of the people.

Private Area: This Spaces can be consisting of Home based industry, processing units, packaging units. This spaces are restricted only by women.

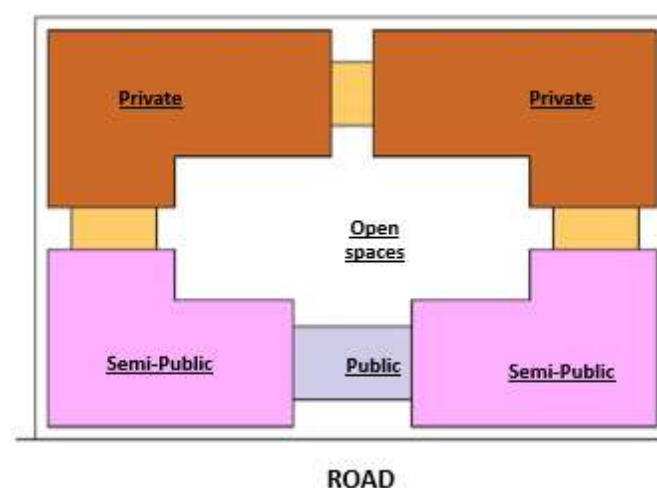


Figure 9-98 Zoning of Site

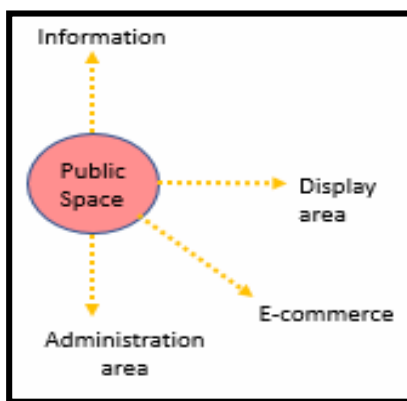


Figure 9-101 Division of Public Spaces

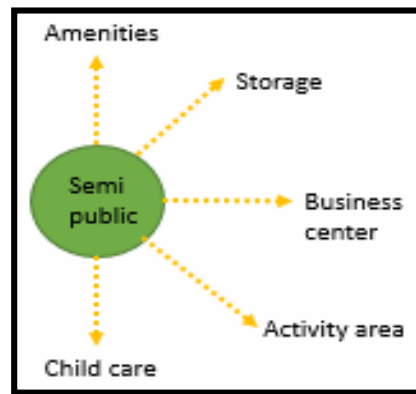


Figure 9-100 Division of Semi-Public Spaces, Source: Author

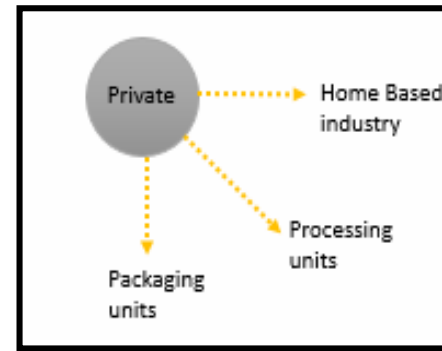


Figure 9-99 Division of Private Spaces
Source: Author

Concept

The concept is to create interaction between the working woman and community people.

All spaces should be interlinked.

Open spaces will work as an interaction come working zone

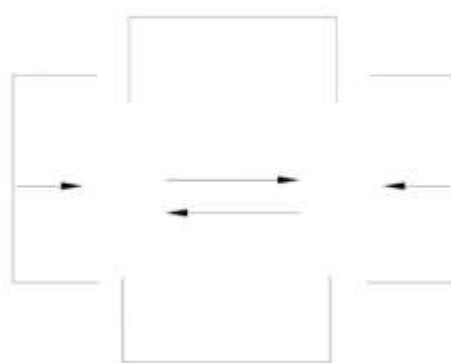


Figure 9-103 Concept of site



Figure 9-102 View of Mahila Mandali

Types of Small-Scale Industry – For Women

1. Papad Industry

Papad is one of the traditional food in India and also has a demand in foreign countries. As pulses is local product so making of Papad can create a good market and also generates employment opportunities for rural people. Total requirement of area is 150 sq. m which will have drying area for papad, storage area for pulses item, processing and packaging area.

2. Pickle Industry

Home made products contribute to revenue economy with locally available items can be resource like jackfruits and vegetable etc. Like vegetable pickle fish pickle also has a demand. Authentic homemade pickle can easily attract market demand. For this industry 100 sq.m. area is required. It also helps to generate employment of 25 numbers of women.

3. Agarbatti Production

Agarbatti production is very popular industry as it doesn't require of huge invest and manpower. Local bamboo can be used as ingredients of agarbatti production. It required 100 sq.m. area with consist of storage, processing unit and packaging unit.

4. Coconut oil industry

Coconut trees is very common trees in this place. Many products can be manufactured from coconut trees and coconut like rope, green coconut, coconut oil, dry coconut, coconut milk powder, leaf can be used in making of broom stick, ecofriendly straw etc. For coconut based product like oil and broom stick production total area requirement is 200smt.

5. Banana chips industry

Banana is very common fruits which is produce here. Food products can be manufactured from banana. For banana based product like banana chips is very attractive food. This industry includes storage area, cleaning, processing and packaging area.

6. Masala Industry

India is the world's largest consumer, producer and exporter of spices. Every commercial food industry like hotels, restaurants, catering business and many more are using powder spices on a daily basis. Spice powder makes it an easy

and profitable business to start. Masala industry also can be useful resource of employment generation. It required less space with storage, cleaning, processing and packaging space.

7. Handcraft Industry

Woman is one of them especially the skilled in hand craft industry. The industry will empower women and they will contribute in economic development rather playing a passive role.

8. Stitching Industry

Stitching industry is very famous small-scale revenue generating woman dominated industry. Different kinds of dresses and cushion cover, bed cover, embroidery works those items has a great market value as well as demand. It also consists of storage, working area and packaging area.

9. Herbal Product making industry

This village has different kind of herbal tree which can be resource of different herbal product. Herbal product has a great demand in all over the world.

10. Shop

Shop trade area where all the manufactured product can be sale. The home base product like Papad, Agarbatti which village woman can produce can be sell their product in this shop. Total requirement of area is 250smt.

11. Other Amenities

Other amenities like toilet, drinking water, canteen area, child-care area can be included. Total area required 500smt.

Area requirement

| Description | Area Requirement |
|-------------------------|------------------|
| Papad Industry | 128 sq.m. |
| Pickle Industry | 130 sq.m. |
| Masala Industry | 122 sq.m. |
| Fried food Industry | 128 sq.m. |
| Coconut oil Industry | 191 sq.m. |
| Handcraft Industry | 191 sq.m. |
| Tailoring | 122 sq.m. |
| Herbal product industry | 130 sq.m. |
| Agarbatti industry | 67 sq.m. |
| Broom stick Industry | 50 sq.m. |
| Administrative | 130 sq.m. |
| Child care center | 67 sq.m. |
| Shop | 40 sq.m. |
| Other Amenities | 500 sq.m. |



10. References

- (Globally, 1992; GOI, 2014; Indira & Anupama, 2016; Jovovic et al., 2017; Khajehzadeh et al., 2016; Mills, 2006; Moles et al., 2006; Moresová et al., 2020; Onwuanyi & Oyetunji, 2016; Papers, 2005; Patra, 2016; S.Sharma, n.d.; Setijanti et al., 2015; Shaji & Kini, 2016; Sholihah & Heath, 2016; Study et al., 2020; Thadani, 2011; United Nations - Department of Economic and Social Affairs, 2013; عمالوي, n.d.)Globally, R. (1992). *Why resilience in cities?*
- GOI. (2014). Press Information Bureau Government Of India. *Goi2014, April, 23389338*. <https://pib.gov.in/newsite/mbereel.aspx?relid=159082>
- Indira, C. G., & Anupama, V. (2016). The Smart Villages : The Real Future Of Emerging India. *International Journal of Innovative Research in Advanced Engineering (IJIRAE)*, 3(12), 29–31.
- Jovovic, R., Draskovic, M., Delibasic, M., & Jovovic, M. (2017). The concept of sustainable regional development – institutional aspects, policies and prospects. *Journal of International Studies*, 10(1), 255–266. <https://doi.org/10.14254/2071-8330.2017/10-1/18>
- Khajehzadeh, I., Vale, B., & Yavari, F. (2016). A comparison of the traditional use of court houses in two cities. *International Journal of Sustainable Built Environment*, 5(2), 470–483. <https://doi.org/10.1016/j.ijbe.2016.05.010>
- Mills, G. (2006). Progress toward sustainable settlements: A role for urban climatology. *Theoretical and Applied Climatology*, 84(1–3), 69–76. <https://doi.org/10.1007/s00704-005-0145-0>
- Moles, R., Kelly, R., O'Regan, B., Ravetz, J., & McEvoy, D. (2006). *Methodologies for the estimation of sustainable settlement size*.
- Moresová, M., Sedliačiková, M., Schmidtová, J., & Hajdúchová, I. (2020). Green development in the construction of family houses in urban and rural settlements in Slovakia. *Sustainability (Switzerland)*, 12(11), 1–17. <https://doi.org/10.3390/su12114432>
- Onwuanyi, N., & Oyetunji, A. K. (2016). Revitalizing Nigeria's built heritage using Facility Management service delivery: The Lagos National Arts Theatre Complex. *International Journal of Sustainable Built Environment*, 5(2), 579–586. <https://doi.org/10.1016/j.ijbe.2016.05.001>
- Papers, U. D. (2005). Promoting Sustainable Human Settlements and Eco-City Planning Approach: Southeastern Anatolia Region and Southeastern Anatolia Project (Gap) in Turkey As a Case Study. *Promoting Sustainable Human Settlements and Eco-City Planning Approach: Southeastern Anatolia Region and Southeastern Anatolia Project (Gap) in Turkey As a Case Study*, 7, 1–19. https://doi.org/10.5209/rev_UNIS.2005.n7.29360
- Patra, R. T. (2016). *Town Planning in Ancient India : In Moral Perspective THE INTERNATIONAL JOURNAL OF HUMANITIES & SOCIAL STUDIES Town Planning in Ancient India : In Moral Perspective. September.*
- S.Sharma. (n.d.). *City Region in India: Meaning, Distance, Nature and other details*.
- Setijanti, P., Defiana, I., Setyawan, W., Silas, J., Firmaningtyas, S., & Ernawati, R. (2015). Traditional Settlement Livability in Creating Sustainable Living. *Procedia - Social and Behavioral Sciences*, 179, 204–211. <https://doi.org/10.1016/j.sbspro.2015.02.423>
- Shaji, L. S., & Kini, M. K. (2016). Contextual Form Based Coding as a Tool in Urban Design Process-chalai, Thiruvananthapuram as a Case. *Procedia Technology*, 24, 1714–1725. <https://doi.org/10.1016/j.protcy.2016.05.204>
- Sholihah, A. B., & Heath, T. (2016). Assessing the Quality of Traditional Street in Indonesia: A case study of Pasar Baru Street. *Procedia - Social and Behavioral Sciences*, 234, 244–254. <https://doi.org/10.1016/j.sbspro.2016.10.240>
- Study, N., Panchayat, B., Literature, S., Resources, E., Week, N., & Perpetration, G. I. S. L. (2020). *Environmental Resources. 1*.
- Thadani, D. (2011). *"The future of India lies in its villages."* <https://www.planetizen.com/node/50694>
- United Nations - Department of Economic and Social Affairs. (2013). Chapter III: Towards sustainable cities. *World Economic and Social Survey 2013*, 53–84.
- Biodiversity of Karnataka at a glance, Government of Karnataka, Karnataka Biodiversity Board, 2010
- BIS (Bureau of Indian Standards) 10500, Indian standard drinking water specification, First revision, 2012, pp 1-8.

- D'Cunha, P., & Nair, V. M. G. (2013). Diversity and distribution of ant fauna in Hejamadi Kodi Sandspit, Udupi District, Karnataka, India. *Halteres*, 4, 33-47.
- District census handbook, Udupi; directorate of census operations, Karnataka, 2011
- District National Resource Data Management System (NRDMS) center, Udupi.
- Draft River Regulation Zone report, 2012
- Forest department of Karnataka report, 2018-2019
- Ghate Ketaki, & Karandikar Manasi (2014). *Grow Natives*
- Goulding, K. W. T. (2016). Soil acidification and the importance of liming agricultural soils with particular reference to the United Kingdom. *Soil use and management*, 32(3), 390-399.
- Gowda, P. V. (2013). Diversity of mangroves in Udupi district of Karnataka State, India. *International Research Journal of Biological Sciences*, 2(11), 11-17.
- Ground water information booklet Udupi district, Karnataka, 2008. Government of India Ministry of Water Resources, Central Ground Water Board. http://cgwb.gov.in/District_Profile/karnataka/UDUPI_BROCHURE.pdf
- Ground water information booklet, Udupi, Karnataka; Central ground water board, 2012
- <http://en-gb.topographic-map.com/maps/a58g/Shankaranarayana/>, accessed on 10 September 2020
- <https://pmksy.gov.in/mis/Uploads/2016/20161220120721037-1.pdf>
- https://shodhganga.inflibnet.ac.in/bitstream/10603/132387/9/09_chapter%202.pdf
- <https://villageinfo.in/karnataka/udupi/kundapura/shankaranarayana.html>, accessed on 10 September 2020.
- <https://www.worldweatheronline.com/kundapur-weather-averages/karnataka/in.aspx>, accessed on 2 September 2020
- Indian Foundation for butterflies, Butterflies of India – <http://bioatlasindia.org/>
- Ingahalikar Shrikant, & Barve Sharvari (2010). *Trees of Pune*
- ISRO geoportal: BHUVAN, accessed from 10 August onwards. https://bhuvan-app1.nrsc.gov.in/ka_forest/
- ISRO geoportal: BHUVAN, accessed from 10 August onwards. <https://bhuvan-app3.nrsc.gov.in/data/download/index.php>
- IUCN Red data list- India, 2019
- J A, N. (2019, September 27). Shankarapura Mallige: Falling price, a thorny problem. Retrieved September 2, 2020, from <https://www.deccanherald.com/state/mangaluru/shankarapura-mallige-falling-price-a-thorny-problem-763101.html>
- Janakiram, T & Sanikommu, Vijay Rakesh Reddy. (2016). Hill horticulture-status, problems and strategies. *Journal of Hill Agriculture*. 7. 1. 10.5958/2230-7338.2016.00003.3.
- Karnataka State Natural Disaster Monitoring Centre
- Milsom, C., & Rigby, S. (2010). *Fossils at a glance*. Hoboken, NJ: Wiley.
- Mookambika Wildlife Sanctuary- Gazette of India e-portal, accessed on 18 August 2020. [http://www.egazette.nic.in/\(S\(4pkg2uvuksbrjpw1n41ptgo\)\)/default.aspx?AcceptsCookies=yes](http://www.egazette.nic.in/(S(4pkg2uvuksbrjpw1n41ptgo))/default.aspx?AcceptsCookies=yes)
- Mudappa, D., & Raman, T. S. (2018). *Pillars of Life: Magnificent trees of the WESTERN GHATS*. Nature Conservation Foundation.
- Narasimhaiah, N., Hegde, S., & Tenjing, S. Y. (2016). Fish fauna of the Seeta River in Udupi district, Karnataka, Western Ghats, India. *International Research Journal of Environmental Sciences*, 5(9), 67-71.
- Naveenchandran, B., Lokesh, K. N., U., & Bhat, H. G. (2010). Use of remote sensing, geophysical data set and web GIS techniques for development of ground water information system of Udupi District. *International Journal of Earth Sciences and Engineering*.
- NRSC-GIS Data: National remote sensing center, Hyderabad
- Prajapati, R. C. (2010). *Biodiversity of Karnataka, at a glance*. Forest. Environment & Ecology Department, Government of Karnataka, Bangalore, 25.
- Ramachandra T.V, Bhat Harish, & Kulkarni Gouri (2014). Tree species for planting at the sides and median of the roads in Bengaluru
- Rao Abhishek G. K., & Suvarna S. Usharani. (2016). Vegetation of Bairampally village of udupi district. Conference on Conservation and Sustainable Management of Ecologically Sensitive Regions in Western Ghats.
- Ravikumar, P., & Somashekar, R. K. (2011). A geochemical assessment of coastal groundwater quality in the Varahi river basin, Udupi District, Karnataka State, India. *Arabian Journal of Geosciences*, 6(6), 1855-1870.



- Ravikumar, P., & Somashekar, R. K. (2013). A geochemical assessment of coastal groundwater quality in the Varahi river basin, Udupi District, Karnataka State, India. *Arabian Journal of Geosciences*, 6(6), 1855-1870.
- Regulation and of human activities along rivers and lakes by National institute of ecology, December 2002
- Report on the Landslides at Karwar, October 2009: Causes and Remedial Measures, Western Ghats Task Force, Center for Ecological Science, IISC Bangalore, November 2009
- Technical report on rainwater harvesting in sector 26, Chandigarh, (2012). Water Programme Unit, Centre for Science and Environment.
- The Editors of Encyclopaedia Britannica (Ed.). (2012, March 02). Inceptisol. Retrieved September 15, 2020, from <https://www.britannica.com/science/Inceptisol>
- Runoff, I. S., Infiltration, I. R., & Erosion, M. (n.d.). 47 *Hillside Drainage*, <https://www.water.gov.my/jps/resources/auto%20download%20images/58464efcc60cf.pdf>
- Water Programme Unit. (n.d.). Technical Report on Rainwater harvesting for sector 26, Chandigarh. *Matrix*, 1–10.
- <http://shankaranarayana.org/>
- <https://www.pilgrimage.com/temples/shankaranarayana-temple>
- <http://www.karnatakaholidays.com/shankaranarayana.php>
- <https://www.census2011.co.in/data/village/608716-shankaranarayana-karnataka.html>
- <http://udupidarshan.com/attraction/varahi-river.php>
- <https://web.archive.org/web/20061103061257/http://www.shankaranarayana.org/history.html>
- Dreiser, T. (2015). Chapter li. Sister Carrie. [tps://doi.org/10.9783/9780812291575.12](https://doi.org/10.9783/9780812291575.12)
- Shetty, B. D. (2012). COMPREHENSIVE PLAN OF COASTAL REGULATION ZONE IN.
- Swami Shridhar. Shree Shankaranarayana Kshetra Mahatma
- NRSC-GIS Data: National remote sensing center, Hyderabad
- Karnataka State Natural Disaster Monitoring Centre
- IUCN Red data list- India, 2019
- Forest department of Karnataka report, 2018-2019
- Draft River Regulation Zone report, 2012
- Ground water information booklet, Udupi, Karnataka; Central ground water board, 2012
- District census handbook, Udupi; directorate of census operations, Karnataka, 2011
- District National Resource Data Management System (NRDMS) center, Udupi
- Report on the Landslides at Karwar, October 2009: Causes and Remedial Measures, Western Ghats Task Force, Center for Ecological Science, IISC Bangalore, November 2009
- Regulation and of human activities along rivers and lakes by National institute of ecology, December 2002
- Biodiversity of Karnataka at a glance, Government of Karnataka, Karnataka Biodiversity Board, 2010
- Milsom, C., & Rigby, S. (2010). *Fossils at a glance*. Hoboken, NJ: Wiley.
- Janakiram, T & Sanikommu, Vijay Rakesh Reddy. (2016). Hill horticulture-status, problems and strategies. *Journal of Hill Agriculture*. 7. 1. 10.5958/2230-7338.2016.00003.3.
- Goulding, K. W. T. (2016). Soil acidification and the importance of liming agricultural soils with particular reference to the United Kingdom. *Soil use and management*, 32(3), 390-399.
- Mudappa, D., & Raman, T. S. (2018). Pillars of Life: Magnificent trees of the WESTERN GHATS. Nature Conservation Foundation.
- Naveenchandran, B., Lokesh, K. N., U., & Bhat, H. G. (2010). Use of remote sensing, geophysical data set and web GIS techniques for development of ground water information system of Udupi District. *International Journal of Earth Sciences and Engineering*.
- Ravikumar, P., & Somashekar, R. K. (2011). A geochemical assessment of coastal groundwater quality in the Varahi river basin, Udupi District, Karnataka State, India. *Arabian Journal of Geosciences*, 6(6), 1855-1870.
- The Editors of Encyclopaedia Britannica (Ed.). (2012, March 02). Inceptisol. Retrieved September 15, 2020, from <https://www.britannica.com/science/Inceptisol>

- J A, N. (2019, September 27). Shankrapura Mallige: Falling price, a thorny problem. Retrieved September 2, 2020, from <https://www.deccanherald.com/state/mangaluru/shankrapura-mallige-falling-price-a-thorny-problem-763101.html>
- ISRO geoportal: BHUVAN, accessed from 10 August onwards. https://bhuvan-app1.nrsc.gov.in/ka_forest/
- ISRO geoportal: BHUVAN, accessed from 10 August onwards. <https://bhuvan-app3.nrsc.gov.in/data/download/index.php>
- Indian Foundation for butterflies, Butterflies of India – <http://bioatlasindia.org/>
- Mookambika Wildlife Sanctuary- Gazette of India e-portal, accessed on 18 August 2020. [http://www.egazette.nic.in/\(S\(4pkg2uvuksbrjpw1n41ptgo\)\)/default.aspx?AcceptsCookies=yes](http://www.egazette.nic.in/(S(4pkg2uvuksbrjpw1n41ptgo))/default.aspx?AcceptsCookies=yes)
- <https://www.worldweatheronline.com/kundapur-weather-averages/karnataka/in.aspx>, accessed on 2 September 2020
- <http://en-gb.topographic-map.com/maps/a58g/Shankaranarayana/>, accessed on 10 September 2020
- <https://villageinfo.in/karnataka/udupi/kundapura/shankaranarayana.html>, accessed on 10 September 2020
- <https://web.archive.org/web/20061105103452/http://www.shankaranarayana.org/index.html>
- Shenoy Narayana, K. (1999). Hydrogeological studies in Udupi Taluk of Coastal Karnataka India (Unpublished master's thesis). Mangalore University. doi:<http://hdl.handle.net/10603/132387>
- Prajapati, R. C. (2010). Biodiversity of Karnataka, at a glance. Forest. Environment & Ecology Department, Government of Karnataka, Bangalore, 25.
- D'Cunha, P., & Nair, V. M. G. (2013). Diversity and distribution of ant fauna in Hejamadi Kodi Sandspit, Udupi District, Karnataka, India. Halteres, 4, 33-47.
- https://shodhganga.inflibnet.ac.in/bitstream/10603/132387/9/09_chapter%202.pdf
- http://mospi.nic.in/sites/default/files/publication_reports/nad10_2008_karnataka_final.pdf
- Technical Report on Rainwater Harvesting in Sector 26, Chandigarh, (2012). Water Programme Unit, Centre for Science and Environment.
- <http://shankaranarayana.org/>
- <https://www.pilgrimage.com/temples/shankaranarayana-temple>
- <http://www.karnatakaholidays.com/shankaranarayana.php>
- <https://www.census2011.co.in/data/village/608716-shankaranarayana-karnataka.html>
- <http://udupidarshan.com/attraction/varahi-river.php>
- <https://web.archive.org/web/20061103061257/http://www.shankaranarayana.org/history.html>
- Dreiser, T. (2015). Chapter li. Sister Carrie. [tps://doi.org/10.9783/9780812291575.12](https://doi.org/10.9783/9780812291575.12)
- Book – Shree Shankarnarayana Kshetra Mahatma by Shridhar swami
- Shetty, B. D. (2012). COMPREHENSIVE PLAN OF COASTAL REGULATION ZONE IN.

(n.d.). Retrieved from <https://www.thebetterindia.com/238262/bengaluru-rainwater-harvesting-cheap-method-how-to-save-water-indian-army-colonel-recommendation-india-gop94/>

(n.d.). Retrieved from www.irc.nic.in/publications.aspx

(n.d.). Retrieved from <https://theconstructor.org/building/bamboo-as-a-building-material-uses-advantages/14838/>

(n.d.). Retrieved from <https://www.cultivatingculture.com/2014/03/06/tbt-importance-cultural-heritage/heritage-cycle-graphic/>

(n.d.). Retrieved from <https://www.thebetterindia.com/240601/how-to-build-a-rainwater-harvesting-system-at-home-cheap-bore-water-bills-low-cost-diy-bengaluru-ros174/>

(n.d.). Retrieved from <https://www.thebetterindia.com/93834/greywater-recycling-reuse/>

Bartholomew, H. (1955). *Landuse in American Cities*. Cambridge: Harvard University Press.

Bhat, G. (1969). *Antiquities of South Kanara*. Udupi: Prabhakar Press.

Design Guidelines, BUILDING NEIGHBOURHOODS TO THRIVE IN. (2018). Bernard van Leer Foundation.



- Dickinson, R. (1948). The scope and Status of Urban Geography. *Land Economics*, XXIV, 221-38.
- (2011). *District Census Handbook, Udupi*. Census of india.
- Earth, G. (n.d.).
- (2011). *Ecological sanitation practitioner's handbook*. UNICEF.
- Frey, H. (1999). *Designing the city towards a more sustainable urban form*. New York, london: E & FN Spon, an imprint of Routledge.
- Gol. (n.d.). <https://groww.in/p/savings-schemes/pradhan-mantri-gramin-awaas-yojana/>. Retrieved from Groww.
- Haryana, D. a. (2018). *Guidelines for the preparation of Gram Panchayat Development Plan*.
- <https://www.pmgys.nic.in/>. (n.d.).
- (2005). *Indian Standard EARTHQUAKE RESISTANT DESIGN AND CONSTRUCTION OF BUILDINGS—CODE OF PRACTICE*. BUREAU OF INDIAN STANDARDS.
- IT professional show india how to turn waste plastic bags into fashionable handbags* . (2018, february). Retrieved from Swachhindia: <https://swachhindia.ndtv.com/professionals-show-india-turn-waste-plastic-bags-fashionable-handbags-8961/>
- Karthik rajendran, S. a. (2012). ahousehold biogas digesters - A review. *Energies*.
- KJA. (2019). Karnataka state water policy.
- Koenigsberger, O. H. (1975). *Manual Of Tropical Housing & Building*.
- Kumar, A. (2020). Damp Proof Course (DPC) - Designing Building.
- Manual on Artificial Recharge of ground water, M. o. (n.d.).
- Ministry of Water Resources, G. (n.d.). NATIONAL WATER POLICY (2012) .
- Model Heritage Regulations*. (2011). Ministry of Urban Development Government of India.
- MSAP, A. . (2020). Uppunda GP.
- MULTI-VILLAGE DRINKING WATER SUPPLY SCHEME – GADAG DISTRICT, K. I. (n.d.). *MULTI-VILLAGE DRINKING WATER SUPPLY SCHEME – GADAG DISTRICT, KARNATAKA, INDIA*. Retrieved from <https://www.tahal.com/project/multi-village-drinking-water-supply-scheme-gadag-district-karnataka-india/>
- Murthy, C. V. (n.d.). *Learning Earthquake Design and Construction*.
- Nevis, S. K. (2001). *An Assessment of Beach Erosion Hazards in St. Kitts and Nevis*.
- NRSC. (n.d.).
- O'Sullivan, A., & Sheffrin, S. M. (2003). *Economic: Principles in Action*.
- Panchayat-Uppunda, G. (2020, August). (MSAP, Interviewer)
- Poirier, L. M. (n.d.). *Maslow Interpreted for the Residential Environment*.
- Programme, U. D. (n.d.). *Model guidelines for development & building construction including safety provisions for National Hazards in Rural Areas*. Gol.
- Raj, M. o. (2018). *Design & Construction of Housing for flood-prone rural areas of Bangladesh*. Gol - adpc.
- Raj, M. o. (2018). *Guidelines for Preparation of Gram Panchayat Development Plan*. GOI.

RAJ, N. I. (2016). *Solid Waste Management in Rural Areas*.

Ramit Debnath, R. B. (n.d.). Resource Symbiosis Model through bricolage: A livelihood generation assessment of an Indian village. *Journal of Rural Studies*.

Ricker, M. (2020). *What are alluvial soils?* Retrieved from Soils Matter: <https://soilsmatter.wordpress.com/2020/02/15/what-are-alluvial-soils/#:~:text=Alluvial%20soils%20provide%20many%20functions,water%20quality%20for%20downstream%20communities!>

Sharma, A. A. (2017). *Need for Development of Coastal Architecture*. Research Trend.

Shetty, D. (13th- 14th April 2015). Sustainable Integrated Development of Urban Infrastructure for Udupi District. In M. S. Anderson (Ed.), *3rd Annual International Conference 'ACE2015 : Architecture and Civil Engineering*. 2, pp. 616-624. Singapore: GSTF GLObal Science and Technology Forum. doi:10.5176/2301-394X_ACE15.159

Shetty, D. (2010). Bunt Architecture of the mansions. In B. S. Rao, *Bunts in History and Culture* (pp. 85-92). Udupi: Rashtra Kavi Govind Pai Samshodhana Kendra, Udupi and World Bunts Foundation Trust (R).

Shetty, D. (2013). *Comprehensive plan of Coastal Regulation Zone in Udupi District for CRZ-III zone 100-200m in consultation with traditional coastal community in accordance with the provisions of CRZ notification 2011*. Ministry of Environment and Forestry of Karnataka, Karnataka State Coastal Zone Management Authority. Bangalore: Karnataka State Coastal Zone Management Authority , State Government of Karnataka. Retrieved from <http://www.ksczma.kar.nic.in/docs/COMPREHENSIVE%20PLAN%20REPORT%20OF%20UDUPI%20DIST.pdf>

Shetty, D. (Dec 2013). Integrated Udupi Urban Development'. *Unpublished proceedings of Udupi 360 degree the way forward-sustainability, renewability prosperity*. Manipal: Udupi district Administration.

(2016). *Solid Waste Management in Rural Areas A Step-by-Step Guide for Gram Panchayats*. Center for rural infrastructure, National institute of Rural development and Panchyatiraj.

STANDARDS, B. O. (n.d.). *Indian Standard EARTHQUAKE RESISTANT DESIGN AND CONSTRUCTION OF BUILDINGS—CODE OF PRACTICE*.

(n.d.). *The ground water yearbook of Karnataka*.

Timmaiah, T. (n.d.).

(2019). *Trashbot by Nivedha - The waste segregator is currently available in four capacities—500 kg, two tonnes, five tonnes and ten tonnes*. By: ARANHA, JOVITA. Bangalore: The better home.

Water harvesting structures planning, design and construction. (n.d.). In P. H. Department.

Zwarts, A. a. (n.d.). The meaning of residential environment features: a case study comparing urban and suburban apartment dwellers. *Astrid Zwarts and Henny Coolen*, 81.



11. Annexure I - On-site Observation Check List:

Socio-Economic Aspects:

1. Regional Level

- Climate
- Soils
- Water
 - Source and the courses of the water body
- Transportation & approaches
- Energy
- Economy
- Architectural character
- Landscape character
 - Conserved forest / agricultural / production land or precinct
 - Cultural/holy protected area
 - Regional topography (slope and landform)
- Cultural amenities- Temples, community festival spaces, etc.
- Recreational Amenities - parks
- Employment opportunities
- Healthcare facilities
- Major detractor
- Exceptional features

2. Community Level

- Travel – time distance (for necessary activities)
- Travel experience
- Community ambiance
- Schools
- Shopping
- Religious
- Cultural amenities
 - Cultural association to water bodies and precinct
 - Tree species with social or cultural values
- Public services
- Safety and security
- Medical facilities
- Governance
- Taxes and revenue
- Influence zone
- Major detractor
- Exceptional features (scale)
- Commercial trees or crops
- Communal spaces – katte or paars, waterfront sit outs, etc.
- Funeral spaces
- Markets

3. Property/Site Level

- Size and shape
- Approaches
- Entrances and exits
- Nodes
- On-site 'feel'
- Water (River / Stream / Lakes / Aquifers / Tanks)
 - Utilitarian / Religious
 - Natural / Artificial
- Permanent landscape features
 - Old & Mature Trees / Medicinal trees
 - Grazing / Pastures
- Need for clearing
- Ground form and gradients
- Soils
- Site drainage
- Immediate neighbors
- Adjacent structures
- Relationship to circulation patterns
- Sights
- Views to and from site
- Observation points
- Orientation to sun, wind, and rain
- Privacy
- Cultural/societal influence over Daily routine
- Signages

- Housing –Kacha, Pucca, Materials, size, typology.
- Assets – Movable, immovable, Livestock
- Saving pattern, spending capacity
- Occupations – Primary, Secondary, etc.
- Migrant & Immigrant

Infrastructural Aspects:

1. Transport and Communication Network

- Condition of road, potholes, etc. (if any), provision of the pedestrian walkway
- Road site vehicular parking and other related issues.
- Signage, traffic control, religious significance (if any)
- Existing Traffic conditions
- Road characteristics (Length, width)
- Services along the road, Paving materials, etc.
- Length, width, function (motorable or pedestrian), Construction material of bridges/ flyovers, etc.

2. Irrigation and Water Supply

- Condition of water sources like hand pumps, OHTs, etc.
- Municipal Supply lines- if present or not
- Wells (lined/un-lined)- in case of individual households
- Storage Tanks (portable or fixed)
- Condition of water canals, lakes, ponds, and any other water source.

3. Electricity and Fuel Supply

- Condition of electric poles/ sub- stations/ transformers.
- Present lighting conditions on streets (solar streetlights, if any)
- Issues related to Overhead Lines Telephone lines- safety features, etc.

4. Housing and Basic Amenities

- The present condition of the Building, plinth height, foundation, construction materials for building components.
- Other facilities and amenities in the vicinity and their present conditions (Present conditions like Construction type).
- Condition of abandoned areas and its present usage.
- Condition of open spaces and any issues related to it.

5. Waste Disposal, Drainage, and Sanitation

- Condition at Household level- Soak pits, Septic tanks
- Panchayat level- public sewerage system- present or not.
- Solid waste- collection system/ availability of garbage collection pits/ dustbins etc.
- Drain characteristics- conditions of Stormwater drains
- Condition of public sewerage system etc.

6. Food Supply and Nutrition Services

- Conditions like Daily Market or vegetable market, Grocery shop and its proximity to households/ communities, etc.
- Condition of stockyards/ godowns, its maintenance.

7. Health Delivery System

- Present condition, Construction type, No. of Beds, Patient numbers
- Need for improving infrastructure

8. Schooling and Education

- Present condition
- Construction type

9. Employment and Self-Employment

- Engagement in farm activities.
- Other private non- farm activities (Stores & Stationery, Electronic shops, Barber shop, Betel or pan shop, Meat, fish market or shop)

10. Farm sector Development

- Conditions of agricultural lands
- Any other related issues like irrigation methods, water supply, etc.

11. Industry and Trade



- Present Condition
- Challenges in Quantity of produce/ Supply and distribution of goods
- Construction type

12. Annexure II - Survey Form

English

| HOUSEHOLD SURVEY | | | | | | | | | | | | | | | | | |
|---|-------------------------|----------------------|-----------------|-----------------------------|--------------------------------|-----------------------------------|-----------------------------------|--|----------------------|-------------------------------------|----------------------------|--------------------------------|-----------------------|------------------|--|---|--|
| Name of Respondent: | | | | | | Time Period of Residence: | | | | Location: | | | | | | | |
| Religion: | | | Caste: | | | Ownership: | | | | Rent: | | BPL Card: | | Ration Card: | | | |
| BASIC INFORMATION | | | | | | | | | | | | | | | | | |
| Member | Age | Sex | Marital Status | Qualification | Location of Education Facility | Occupation | Location of Job | Vehicle Owned | | | | | Place of Migration | Digital Literacy | | | |
| | | | | | | | | 2W | 3W | 4W | Cycle | None | | | | | |
| | | | | | | | | | | | | | | | | | |
| Change in Occupation if any: _____ Since When and Reason: _____ | | | | | | | | | | | | | | | | | |
| MOBILE USAGE/NETWORK | | | | | | | | | | | | | | | | | |
| Member | Connectivity | | Use of Internet | | WiFi/Broadband | | Purpose of Use | | | | | | | | | | |
| | Good | Poor | Yes | No | Yes | No | Family Connect | Work | Study | Online Shopping | Emergency Use | | | | | | |
| | | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | |
| OCCUPATION | | | | | | | | | | | | | | | | | |
| IF AGRICULTURE | | | | IF SKILLED/UNSKILLED LABOUR | | | | IF BUSINESS | | | | | | | | | |
| No. of members involved: | | | | 1 | | | | 2 | | | | 3 | | 1 | | 2 | |
| Area | | Soil Type | | Type | | | | | | | | Type | | | | | |
| Crop Type | | | | Location | | | | | | | | Location | | | | | |
| Frequency | | | | Mode of Travel | | | | | | | | Mode of Travel | | | | | |
| Source of Irrigation | | | | Travel Distance | | | | | | | | Travel Distance | | | | | |
| if yes, scheme/private | | | | Marginal/Full Year | | | | | | | | Marginal/Full Year | | | | | |
| Seeds Availability (From where) | | | | Wages | | | | | | | | Annual Income | | | | | |
| is there any change in cropping pattern | | | | IF INDUSTRIAL LABOUR | | | | | | | | | | | | | |
| Store Location | | | | Type | | | | | | | | Travel Distance | | | | | |
| Where do you sell | | | | Location | | | | | | | | Shifts | | | | | |
| Produce p.a. | | | | Mode of Travel | | | | | | | | Salary | | | | | |
| IF SERVICE JOB | | | | | | | | | | | | | | | | | |
| Type | | | | Travel Distance | | | | | | | | | | | | | |
| Location | | | | Shifts | | | | | | | | | | | | | |
| Mode of Travel | | | | Salary | | | | | | | | | | | | | |
| LAND HOLDING | | | | | | | | | | | | | | | | | |
| TOILETS | | | | | | | | | | | | | | | | | |
| Availability (Y/N) | If Yes, Under Use (Y/N) | Public | Private | Community | Open defecation | Under Scheme/Own Construction | If under scheme; Amount received: | Availability of water Connection (Y/N) | Image to be attached | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| MONTHLY EXPENDITURE | | | | | | | | | | | | | | | | | |
| Criteria | Food | | Health | | Education/Training | | Transportation | | Rent | | Leisure | | | | | | |
| Ranking | | | | | | | | | | | | | | | | | |
| Lump-sum Monthly Expenditure: | | | | | | If paying Interest then how much: | | | | Time period of Interest: | | | | | | | |
| HEALTH | | | | | | | | | | | | | | | | | |
| Member | Health Card/ Insurance | Habits | | | | Location of Primary Health Care | Location of Critical Care | Mode of travel | Travel Distance | No. of visit to Hospital in a month | Fees paid for 1 time visit | Health Issues for past 2 years | Cause of Death If any | | | | |
| | | Alcohol | Smoking | Tobacco | Others | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | |
| Vaccination if any: Yes/No | | | | | | | | | | | | | | | | | |
| Awareness about the various Government health schemes: Yes/No | | | | | | | | | | | | | | | | | |
| ASSETS | | | | | | | | | | | | | | | | | |
| Livestock | | Number | | Problem/Disease | | Commercial (Y/N) | | Other Assets | | | | Yes/No | | | | | |
| Cow/Buffalo | | | | | | | | Television | | | | | | | | | |
| Ox | | | | | | | | Smartphone | | | | | | | | | |
| Goats | | | | | | | | Refrigerator | | | | | | | | | |
| Chickens | | | | | | | | Solar Appliances | | | | | | | | | |
| Horses | | | | | | | | Stove Type | | | | | | | | | |
| Donkeys | | | | | | | | Computer/Laptop | | | | | | | | | |
| Others | | | | | | | | | | | | | | | | | |
| SUGGESTIONS FOR IMPROVEMENT OF VILLAGE INFRASTRUCTURE | | | | | | | | | | | | | | | | | |
| Social Facilities | | Education Facilities | | HealthCare Facilities | | Business Facilities | | Employment Facilities | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |



Survey form - Kannada

| ಹೌಸ್‌ಹೋಲ್ಡ್ ಸರ್ವೆ | | | | | | | | | | | | | |
|----------------------|--------|------|----------------|-----------------|---------------------|--------|--------------|-----------------|--|---------------|--|------------|------------------|
| ಪ್ರತಿವಾದಿಯ ಹೆಸರು: | | | | ನಿವಾಸದ ಅವಧಿ: | | | | ಸ್ಥಳ: | | | | | |
| ಧರ್ಮ: | | ಜಾತಿ | | ಮಾಲೀಕತ್ವ: | | | | ಬಿಪಿಎಲ್ ಕಾರ್ಡ್: | | ಪರಿಶರಣೆ ಚೀಟಿ: | | | |
| ಮೂಲ ಮಾಹಿತಿ | | | | | | | | | | | | | |
| ಸದಸ್ಯ | ವಯಸ್ಸು | ಲಿಂಗ | ವೈವಾಹಿಕ ಸ್ಥಿತಿ | ಶೈಕ್ಷಣಿಕ ಅರ್ಹತೆ | ಶಿಕ್ಷಣ ಸೌಲಭ್ಯದ ಸ್ಥಳ | ಉದ್ಯೋಗ | ಉದ್ಯೋಗದ ಸ್ಥಳ | ವಾಹನ ಮಾಲೀಕತ್ವ | | | | ವಲಸೆಯ ಸ್ಥಳ | ಡಿಜಿಟಲ್ ಸಾಕ್ಷರತೆ |
| 2W | 3W | 4W | ಸ್ಕೆಕಲ್ | ಇಲ್ಲ | | | | | | | | | |
| ಉದ್ಯೋಗದಲ್ಲಿ ಬದಲಾವಣೆ: | | | | | | | | | | | | | |
| ಯಾವಾಗ ಮತ್ತು ಕಾರಣ: | | | | | | | | | | | | | |

| ಮೊಬೈಲ್ ಬಳಕೆ / ನೆಟ್‌ವರ್ಕ್ | | | | | | | | | | | | |
|--------------------------|----------|------|----------------|------|------------------|------|---------------|------|--------|------------------|-------------|--|
| ಸದಸ್ಯ | ಸಂಪರ್ಕ | | ಇಂಟರ್ನೆಟ್ ಬಳಕೆ | | WIFI/ಬ್ರೂಬ್ರಾಂಡ್ | | ಬಳಕೆಯ ಉದ್ದೇಶ | | | | | |
| | ಒಳ್ಳೆಯದು | ಕಳಪೆ | ಹೌದು | ಇಲ್ಲ | ಹೌದು | ಇಲ್ಲ | ಕುಟುಂಬ ಸಂಪರ್ಕ | ಕೆಲಸ | ಅಧ್ಯಯನ | ಆನ್‌ಲೈನ್ ಶಾಪಿಂಗ್ | ತುರ್ತು ಬಳಕೆ | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

| ಜೀವನೋಪಾಯ | | | | | | | | | | | |
|---------------------------|--|--|--|---|--|--|--|-----------------------------|--|--|--|
| ಕೃಷಿ / ತೋಟಗಾರಿಕೆ | | | | ಕೌಶಲ್ಯ / ಕೌಶಲ್ಯರಹಿತ ಲೇಬರ್ / ಮೀನುಗಾರಿಕೆ / ಜೈಗಾರಿಕೆ | | | | ವ್ಯಾಪಾರವಾಗಿದ್ದರೆ | | | |
| ಒಳಗೊಂಡಿರುವ ಸದಸ್ಯರ ಸಂಖ್ಯೆ: | | | | 1 | | | | 2 | | | |
| ವಿಸ್ತೀರ್ಣ | ಮಣ್ಣಿನ ಪ್ರಕಾರ | | | ವಿಧ | | | | ವಿಧ | | | |
| ಬೆಳೆ ಪ್ರಕಾರ | | | | ಸ್ಥಳ | | | | ಸ್ಥಳ | | | |
| ಆವರ್ತನ | | | | ಪ್ರಯಾಣದ ವಿಧಾನಗಳು | | | | ಪ್ರಯಾಣದ ವಿಧಾನಗಳು | | | |
| ನೀರಾವರಿ ಮೂಲ | | | | ಪ್ರಯಾಣದ ದೂರ | | | | ಪ್ರಯಾಣದ ದೂರ | | | |
| ಹೌದು, ಸ್ಕೀಮ್ / ಪಾಸಗಿ | | | | ಕನಿಷ್ಠ / ಪೂರ್ಣ ವರ್ಷ | | | | ಕನಿಷ್ಠ / ಪೂರ್ಣ ವರ್ಷ | | | |
| ಬೀಜಗಳ ಲಭ್ಯತೆ(ಎಲ್ಲಿಂದ) | | | | ವೇತನ | | | | ವಾರ್ಷಿಕ ಆದಾಯ | | | |
| ಬೆಳೆ ವಿಧಾನದಲ್ಲಿ ಯಾವುದೇ | ಗುಣಮಟ್ಟ ಮತ್ತು ಬೆಂಬಲ ಸ್ಥಿತಿ ವಿವರಣೆ ಮತ್ತು ಸಮಸ್ಯೆಗಳು ಯಾವುದಾದರೂ ಇದ್ದರೆ | | | | | | | | | | |
| ಅಂಗಡಿ ಸ್ಥಳ | | | | ಉದ್ಯೋಗ ಸೌಲಭ್ಯ | | | | ಆರ್ಥಿಕ ಭದ್ರತೆ / ಭವಿಷ್ಯ ನಿಧಿ | | | |
| ಮಾರಾಟ ಮಾಡುವ ಸ್ಥಳ | | | | ನೈರ್ಮಲ್ಯ ಸೌಲಭ್ಯ | | | | ಕೆಲಸದ ಸಮಯ/ವರ್ಗಾವಣೆಗಳು | | | |
| Produce p.a. | | | | ಮೈದ್ಯಕೀಯ ಬೆಂಬಲ | | | | ಯಾವುದೇ ಇತರ ಟೀಕೆಗಳು | | | |
| ಸೇವಾ ಕೆಲಸವಿದ್ದರೆ | | | | | | | | | | | |

| | |
|-------------------------------|---------------------------------------|
| ಹೆಚ್ಚಿನ ಅಧ್ಯಯನ ಅಥವಾ | ಪ್ರಯಾಣದ ದೂರದಲ್ಲಿ ಬದಲಾವಣೆಗಾಗಿ ಅಭಿಪ್ರಾಯ |
| ನವೀಕರಿಸಲು ವ್ಯಾಪ್ತಿ ಮತ್ತು | ಸಮಯ ಮತ್ತು ವರ್ಗಾವಣೆಗಳ ತೊಂದರೆಗಳು |
| ನೀವು ಯಾವುದೇ ಬೆಂಬಲ ಸೌಲಭ್ಯವನ್ನು | ಯಾವುದೇ ಇತರ ಟೀಕೆಗಳು |

| ಲ್ಯಾಂಡ್ ಹೋಲ್ಡಿಂಗ್ | | |
|-----------------------|-----------|------------------|
| Khasra No. | ವಿಸ್ತೀರ್ಣ | ಭೂ ಹಿಡುವಳಿ ಅವಧಿ: |
| ಕೃಷಿ ಮಾಡಬಹುದಾದ: | ಪಾಳುಭೂಮಿ | |
| ಹೆಚ್ಚುವರಿ ಭೂ ಹಿಡುವಳಿ: | ವಿಸ್ತೀರ್ಣ | ಉದ್ದೇಶ: |

| ಮನೆ (ವಿವರವನ್ನು ನಿರ್ಮಿಸಲಾಗಿದೆ) | | | | |
|-------------------------------|-------------------------|---------------|-----------------------|-----------------------|
| ರಚನೆಯ ಪ್ರಕಾರ | ಕಚ್ಚಾ | ಪಕ್ಕಾ | ಅರೆ ಪಕ್ಕಾ | |
| ಮಸ್ತು(ಮಾಳಿಗೆ) | ಕುಲ್ಕು / ಕಚ್ಚಿ / ಬಿದಿರು | ಮಣ್ಣು | ಸುಟ್ಟುಹೋಗದ ಇಟ್ಟಿಗೆಗಳು | ಮಾರ್ಬನ್‌ಹೋಗದ ಕಲ್ಲು |
| ಮಸ್ತು (ಗೋಡೆ) | ಕುಲ್ಕು / ಕಚ್ಚಿ / ಬಿದಿರು | ಮಣ್ಣು | ಸುಟ್ಟುಹೋಗದ ಇಟ್ಟಿಗೆಗಳು | ಮಾರ್ಬನ್‌ಹೋಗದ ಕಲ್ಲು |
| ಕಟ್ಟಡದ ಎತ್ತರ | G | G+1 | G+2 | G+3 |
| ಯೋಜನೆ (ಹೌದು / ಇಲ್ಲ) | | | | |
| ರಚನೆಯ ವಯಸ್ಸು | 10 ವರ್ಷಕ್ಕಿಂತ ಕಡಿಮೆ | 10-20 ವರ್ಷಗಳು | 20-50 ವರ್ಷಗಳು | 50 ವರ್ಷಗಳಿಗಿಂತ ಹೆಚ್ಚು |
| ಸ್ಥಿತಿ | ಒಳ್ಳೆಯದು | ಮಾಧ್ಯಮ | ಕೆಳಮಟ್ಟದ | ತಿಥಿಲಿಗೊಂದಿದೆ |

| ಸೇವೆಗಳು | | | | | | |
|--|-----------------------------|--------------|-------------|---|------------------|--------|
| ಸೇವೆಗಳು | ಲಭ್ಯತೆ | ಅವಕಾಶ | ಪ್ರಯಾಣದ ದೂರ | ಸೌಲಭ್ಯಗಳು | ಕಾಲೋಚಿತ ಅಡಚಣೆಗಳು | |
| | ವ್ಯವಸ್ಥೆಯನ್ನು ಅನುಸರಿಸಲಾಯಿತು | ಮತ್ತು ಪ್ರಮಾಣ | | | ಬೇಸಿಗೆ | ಮಳೆಗಾಲ |
| ನೀರು ಸರಬರಾಜು ಮತ್ತು ಸಂಗ್ರಹಣೆ (ಲಗತ್ತಿಸಬೇಕಾದ ಚಿತ್ರ) | | | | ಬಾವಿ / ಕೈ ಪಂಪ್ / ಬೋರ್ ಬಾವಿ / ನೀರಿನ ಟ್ಯಾಂಕ್ | | |
| ಘನತ್ಯಾಜ್ಯ ಸಂಗ್ರಹ (ಲಗತ್ತಿಸಬೇಕಾದ ಚಿತ್ರ) | | | | ಓಪನ್ ಡಂಪಿಂಗ್ / ಕಾಂಪೋಸ್ಟ್ / ಕಲೆಕ್ಷನ್ ಕಾರ್ಟರ್ | | |
| ವಿದ್ಯುತ್ | | | | ಹೌಸ್ ಹೋಲ್ಡ್ / ನೀರಾವರಿ | | |
| ಸಾರಿಗೆ | | | | ಬಸ್ / ಟೆಂಪೋ / ಟ್ಯಾಕ್ಸಿ / ಬುಲೆಟ್ ಕಾರ್ಟರ್ / 2 ವೀಲರ್ / 4 ವೀಲರ್ / ಸ್ಕೆಕಲ್ | | |
| ದೂರವಾಣಿ | | | | | | |
| ಅಡುಗೆ ಇಂಧನ (ಲಗತ್ತಿಸಬೇಕಾದ ಚಿತ್ರ) | | | | ಎಲಿಜಿ / ಸೀಮೆಎಣ್ಣೆ / ಮರ / ಪ್ಲಾಸ್ಟಿಕ್ ಅನಿಲ / ಸಗಣೆ ಕೇಕ್ ಇಂಧನ | | |

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| | | | | | | |
|---|--|--|--|--|--|--|
| ಅತ್ಯುತ್ತಮ ಅಭ್ಯಾಸಗಳು (ಲಗತ್ತಿಸಬೇಕಾದ ಚಿತ್ರ) | | | | ಮಳೆ ನೀರು ಕೊಯ್ಲು / ಮಿಶ್ರಗೊಬ್ಬರ / ಕಿಚನ್ ಗಾರ್ಡನ್ / ಸೌರ ವಸ್ತುಗಳು | | |
|---|--|--|--|--|--|--|

| ಶೌಚಾಲಯಗಳು | | | | | | | | | |
|-----------------------|------------------------------------|-----------|-------|--------|-----------------|-----------------------|--|---------------------------------|--------------------|
| ಲಭ್ಯತೆ (ಹೌದು/ಅಲ್ಲ) | ಹೌದು, ಬಳಕೆಯಲ್ಲಿದೆ (ಹೌದು / ಇಲ್ಲ) | ಸಾರ್ವಜನಿಕ | ಖಾಸಗಿ | ಸಮುದಾಯ | ಮುಕ್ತ ಮಲವಿಸರ್ಜನ | ಸ್ವಂತ ನಿರ್ಮಾಣದಡಿಯಲ್ಲಿ | ಯೋಜನೆಯ ಅಡಿಯಲ್ಲಿದ್ದರೆ; ಸ್ಥಳೀಕರಿಸಿದ ಮೊತ್ತ: | ನೀರಿನ ಲಭ್ಯತೆ ಸಂಪರ್ಕ (ಹೌದು ಅಲ್ಲ) | ಲಗತ್ತಿಸಬೇಕಾದ ಚಿತ್ರ |
| | | | | | | | | | |

| ತಂಗಳ ಖರ್ಚು | | | | | | |
|---------------------------|------|--------|-------------------------|--------|------------------------|-------|
| ಮಾನದಂಡ | ಆಹಾರ | ಆರೋಗ್ಯ | ಶಿಕ್ಷಣ / ತರಬೇತಿ | ಸಾರಿಗೆ | ಬಾಡಿಗೆ | ವಿರಾಮ |
| ಶ್ರೇಯಾಂಕ | | | | | | |
| ಒಟ್ಟು ಮೊತ್ತದ ಮಾಸಿಕ ಖರ್ಚು: | | | ಬಡ್ಡಿ ಪಾವತಿಸಿದರೆ ಎಷ್ಟು: | | ಸಾಲದ ಮೇಲಿನ ಬಡ್ಡಿ ಅವಧಿ: | |

| ಆರೋಗ್ಯ | | | | | | | | | | | | | |
|--------|----------------------|---------|--------|--------|-------|------------------------------|-------------------------|--------------|-------------|--|-----------------------|-------------------------|------------------------------|
| Member | ಆರೋಗ್ಯ ಕಾರ್ಡ್ / ವಿಮೆ | ಅಭ್ಯಾಸ | | | | ಪ್ರಾಥಮಿಕ ಆರೋಗ್ಯ ಕೇಂದ್ರದ ಸ್ಥಳ | ವಿಮರ್ಶಾತ್ಮಕ ಆರೈಕೆಯ ಸ್ಥಳ | ಪ್ರಯಾಣದ ಸಾಧನ | ಪ್ರಯಾಣದ ದೂರ | ಒಂದು ತಂಗಳಲ್ಲಿ ಆಸ್ಪತ್ರೆಗೆ ಭೇಟಿ ನೀಡಿದ ಸಂಖ್ಯೆ | ಬಾರಿ ಭೇಟಿಗಾಗಿ ಪಾವತಿಸಿ | ಕಳೆದ 2 ವರ್ಷಗಳಿಂದ ಆರೋಗ್ಯ | ಯಾವುದಾದರೂ ಇದ್ದರೆ, ಸಾವಿನ ಕಾರಣ |
| | | ಮದ್ಯಪಾನ | ಧೂಮಪಾನ | ತಂಬಾಕು | ಇತರರು | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
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ಯಾವುದಾದರೂ ಇದ್ದರೆ ಲಿಪಿ: ಹೌದು ಇಲ್ಲ
 ಸರ್ಕಾರದ ವಿವಿಧ ಆರೋಗ್ಯ ಯೋಜನೆಗಳ ಬಗ್ಗೆ ಜಾಗೃತಿ: ಹೌದು / ಇಲ್ಲ

| ಆಸ್ತಿ | | | |
|-----------|--------|--------------|-----------------------|
| ಜಾನುವಾರು | ಸಂಖ್ಯೆ | ಸಮಸ್ಯೆ / ರೋಗ | ವಾಣಿಜ್ಯ (ಹೌದು / ಇಲ್ಲ) |
| ಎಮ್ಮೆ/ಹಸು | | | |
| ಎತ್ತ | | | |
| ಆಡುಗಳು | | | |
| ಕೋಳಿಗಳು | | | |
| ಕುದುರೆಗಳು | | | |
| ಕತ್ತಿಗಳು | | | |
| ಇತರರು | | | |

| ಇತರ ಸ್ವತ್ತುಗಳು | | ಹೌದು/ ಅಲ್ಲ |
|----------------------------|--|------------|
| ದೂರದರ್ಶನ (TV) | | |
| ಮೊಬೈಲ್ ಫೋನ್ (mobile phone) | | |
| ಕ್ಯಾಬ್ | | |
| ಸೌರ ವಸ್ತುಗಳು (Solar) | | |
| ಸೆಲ್ಫ್ ವಾಕ್ ಪ್ರಕಾರ | | |
| ಕಂಪ್ಯೂಟರ್ / ಲ್ಯಾಪ್ಟಾಪ್ | | |

| ಗ್ರಾಮ ಇನ್ಫ್ರಾಸ್ಟ್ರಕ್ಚರ್ ಸುಧಾರಣೆಗೆ ಸಲಹೆಗಳು | | | | |
|---|------------------|-----------------------|-------------------|------------------|
| ಸಾಮಾಜಿಕ ಸೌಲಭ್ಯಗಳು | ಶಿಕ್ಷಣ ಸೌಲಭ್ಯಗಳು | ಹೆಲ್ಪ್‌ಲೈನ್ ಸೌಲಭ್ಯಗಳು | ವ್ಯಾಪಾರ ಸೌಲಭ್ಯಗಳು | ಉದ್ಯೋಗ ಸೌಲಭ್ಯಗಳು |
| | | | | |



13. Annexure III – Flora and Fauna in Udupi

Table 13-1 Flora and Fauna in Udupi, Karnataka

| Flora | | | |
|---------|---|------------------|----------------------------------|
| Sl. No. | Scientific Name of Species | Family | Common name |
| 1 | <i>Alstonia Scholaris</i> | Apocynaceae | Haale mara |
| 2 | <i>Aporosa lindleyana</i> | Euphorbiaceae | Saroli mara |
| 3 | <i>Artocarpus hirsutus</i> | Moraceae | Hebbalasu |
| 4 | <i>Bambusa bamboa</i> | Poaceae | Bidiru |
| 5 | <i>Bryophyllum pinnatum</i> | Rosaceae | Kaadubasale |
| 6 | <i>Calophyllum inophyllum</i> | Clusiaceae | Honne mara |
| 7 | <i>Calycopteris floribunda</i> | Combretaceae | Enjir soppu |
| 8 | <i>Canthium dicoccum</i> | Combretaceae | Ammehannu |
| 9 | <i>Careya arborea</i> | Melastomataceae | Daddaala |
| 10 | <i>Carissa congesta</i> | Apocynaceae | Karande |
| 11 | <i>Cassia tora</i> | Fabaceae | Thagathe |
| 12 | <i>Caryota urens</i> | Araceae | Baini mara |
| 13 | <i>Cinnamomum verum</i> | Lauraceae | Daalcheeni |
| 14 | <i>Clerodendrum viscosum</i> | Verbenaceae | Thaggi gida |
| 15 | <i>Cuminum cyminum L.</i> | Apiaceae | Jeerige, Jeerdari |
| 16 | <i>Ervatamia heyneana (Wall.) Cooke</i> | Apocynaceae | Maddarasa, Kokke kayi |
| 17 | <i>Rauvolfia serpentina (L.) Benth.</i> | Apocynaceae | Sarpagandha Patalagaruda |
| 18 | <i>Tabernaemontana divaricata (L.) R. Br.</i> | Apocynaceae | Nandibattalu, Nanjatte |
| 19 | <i>Caryota urens L.</i> | Arecaceae | Baine, Indu |
| 20 | <i>Aristolochia indica L.</i> | Aristolochiaceae | Ishwara беру |
| 21 | <i>Calotropis gigantea (L.) R. Br.</i> | Asclepiadaceae | Akka, Akkamale |
| 22 | <i>Hemidesmus indicus (L.) Schult.</i> | Asclepiadaceae | Namada беру, Nannari, ookurma |
| 23 | <i>Elephantopus scaber L.</i> | Asteraceae | Nela mucchir |
| 24 | <i>Barringtonia racemosa (L.) Spreng.</i> | Barringtoniaceae | Samudra pala |
| 25 | <i>Caesalpinia bonduc (L.) Roxb.</i> | Caesalpiniaceae | Gajjuga, Kaat kalenji kayi |
| 26 | <i>Tamarindus indica L.</i> | Caesalpiniaceae | Hunase, Puli |
| 27 | <i>Celastrus paniculatus Willd.</i> | Celastraceae | Gangamma balli |
| 28 | <i>Cuminum cyminum L.</i> | Apiaceae | Jeerige, Jeerdari |
| 29 | <i>Colocasia esculenta</i> | Araceae | Kesu |
| 30 | <i>Costus speciosus</i> | Zingiberaceae | Narikabbu |
| 31 | <i>Cyclea peltata</i> | Menispermaceae | Haade balli |
| 32 | <i>Cynodon dactylon</i> | Poaceae | Garike |
| 33 | <i>Elephantopus scaber</i> | Asteraceae | Nelamuchhilu |
| 34 | <i>Ficus benghalensis</i> | Moraceae | Aalada mara |
| 35 | <i>Ficus benghalensis</i> | Moraceae | Atti mara |
| 36 | <i>Flacourtia indica</i> | Flacourtiaceae | Jeide |
| 37 | <i>Garcinia indica</i> | Clusiaceae | Punerpuli |
| 38 | <i>Garcinia morella</i> | Guttiferae | Jaarige |
| 39 | <i>Garcinia gummigutta</i> | Guttiferae | Vaate Huli |
| 40 | <i>Gloriosa superba</i> | Liliaceae | Gowri hoo |

| | | | |
|--------------|---------------------------------|-----------------------|--------------------------------------|
| 41 | <i>Hemidesmus indicus</i> | Periplocaceae | Naanadaberu |
| 42 | <i>Holarrhena pubescens</i> | Apocynaceae | Kodasiga |
| 43 | <i>Holigarna arnottiana</i> | Anacardiaceae | Chera |
| 44 | <i>Hopea parviflora</i> | Dipterocarpaceae | Bogi |
| 45 | <i>Hopea ponga</i> | Dipterocarpaceae | Karimara |
| 46 | <i>Jasminum malabaricum</i> | Oleaceae | Kaddu mallige |
| 47 | <i>Madhuca nerifolia</i> | Sapotaceae | Uppaligana mara |
| 48 | <i>Mangnifera indica</i> | Anacardiaceae | Maavu |
| 49 | <i>Memecylon amplexicaule</i> | Melastomataceae | Ollekodi |
| 50 | <i>Melastoma malabathricum</i> | Melastomataceae | Nekkarika |
| 51 | <i>Musa paradisiaca</i> | Musaceae | Banana |
| 52 | <i>Memecylon amplexicaule</i> | Melastomataceae | Ollekodi |
| 53 | <i>Myristica frgrans</i> | Myristaceae | Jayikaayi |
| 54 | <i>Myristica malabarica</i> | Myristaceae | Ramapatre |
| 55 | <i>Pandanus fascicularis</i> | Pandanaceae | Kedage |
| 56 | <i>Phyllanthus emblica</i> | Euphorbiaceae | Nellii mara |
| 57 | <i>Pongamia pinnata</i> | Fabaceae | Honge mara |
| 58 | <i>Smilax zeylanica</i> | Pontederiaceae | Chenne booru |
| 59 | <i>Strychnos nuxvomica</i> | Gentianaceae | Kaasarkana mara |
| 60 | <i>Syzygium caryophyllatum</i> | Myrtaceae | Kuntangila |
| 61 | <i>Tabernaemontana heyneana</i> | Apocyanaceae | Maddarasa |
| 62 | <i>Terminalia paniculata</i> | Myrtaceae | Mathi |
| 63 | <i>Vateria indica</i> | Dipterocarpaceae | Dhoopa |
| 64 | <i>Vitex negundo</i> | Lamiaceae | Lakki gida |
| 65 | <i>Ziziphus oenoplia</i> | Rhamnaceae | Choori mullu |
| 66 | <i>Acanthus ilicifolius</i> | Acanthaceae | Mangrove plant |
| 67 | <i>Acrostichum aureum</i> | Pteridaceae | Mangrove plant |
| 68 | <i>Aegiceras corniculatum</i> | Myrsinaceae | Mangrove plant |
| 69 | <i>Avicennia alba</i> | Avicenniaceae | Mangrove plant |
| 70 | <i>Avicennia officinalis</i> | Avicenniaceae | Mangrove plant |
| 71 | <i>Bruguiera gymnorhiza</i> | <i>Rhizophoraceae</i> | Mangrove plant |
| 72 | <i>Excoecaria agallocha</i> | <i>Euphorbiaceae</i> | Mangrove plant |
| 73 | <i>Kandelia candel</i> | <i>Rhizophoraceae</i> | Mangrove plant |
| Fauna | | | |
| 1 | <i>Puntius filamentosus</i> | Cyprinidae | Filament barb/Threadfin silver biddy |
| 2 | <i>Puntius chola</i> | Cyprinidae | Swamp barb/chola barb |
| 3 | <i>Puntius dorsalis</i> | Cyprinidae | Long shouted barb |
| 4 | <i>Cirrhinus mrigala</i> | Cyprinidae | Red tailed carp |
| 5 | <i>Tor khudree</i> | Cyprinidae | Yellow masheer |
| 6 | <i>Barilies bendelisis</i> | Cyprinidae | Hamitons barila |
| 7 | <i>Amblypharyngodon mola</i> | Cyprinidae | Mola carpet |
| 8 | <i>Garra mullya</i> | Cyprinidae | Mullya garra |
| 9 | <i>Labeo chrysophekadion</i> | Cyprinidae | Black shark |
| 10 | <i>Mystus monatanus</i> | Bagridae | Striped dwarf catfish |
| 11 | <i>Horabagrus nigricollaris</i> | Bagridae | Black collared catfish |
| 12 | <i>Ompok malabaricus</i> | Siluridae | Catfish |
| 13 | <i>Clarias dossumeri</i> | Claridae | Walking catfish |
| 14 | <i>Xenentodon cancila</i> | Belonidae | Freshwater garfish |



| | | | |
|----|--------------------------------|------------------|------------------------------|
| 15 | <i>Ambassis commersoni</i> | Ambassidae | Commerson's glassy perchlet |
| 16 | <i>Lobotes surinamensis</i> | Lobotidae | Triple tail |
| 17 | <i>Pomadasys olivaceum</i> | Haemulidae | Grunt |
| 18 | <i>Etroplus suratensis</i> | Cichlidae | Pearl-spot |
| 19 | <i>Channa punctatus</i> | Channidae | Spotted snake wad |
| 20 | <i>Mastacembelus armatus</i> | Mastacembelidae | Spiny eel |
| 21 | <i>Anoplolepis gracilipes</i> | Formicinae | Yellow crazy ant |
| 22 | <i>Camponotus compressus</i> | Formicinae | Godzilla ant |
| 23 | <i>Camponotus oblongus</i> | Formicinae | C. oblongus |
| 24 | <i>Oecophylla smaragdina</i> | Formicinae | Red ant |
| 25 | <i>Cardiocondyla nuda</i> | Myrmicinae | C. nuda |
| 26 | <i>Crematogaster subnuda</i> | Myrmicinae | C. subnuda |
| 27 | <i>Meranoplus bicolor</i> | Myrmicinae | M. bicolor |
| 28 | <i>Monomorium pharaonis</i> | Myrmicinae | Pharaoh ant |
| 29 | <i>Anochetus ghilianii</i> | Ponerinae | A. ghilianii |
| 30 | <i>Ponera rugosa</i> | Ponerinae | P. rugosa |
| 31 | <i>Tapinoma melanocephalum</i> | Dolichoderinae | Ghost ant |
| 32 | <i>Tetraponera nigra</i> | Pseudomyrmecinae | T. nigra |
| 33 | <i>Panthera tigris tigris</i> | Felidae | Bengal tiger |
| 34 | <i>Panthera pardus</i> | Felidae | Common leopard |
| 35 | <i>Troides minos</i> | Papilionidae | Southern birdwing |
| 36 | <i>Papilio paris</i> | Papilionidae | Paris peacock |
| 37 | <i>Papilio buddha</i> | Papilionidae | Malabar banded peacock |
| 38 | <i>Euploea core</i> | Nymphalidae | Common Indian crow |
| 39 | <i>Strix huhula</i> | Strigidae | Black-banded owl |
| 40 | <i>Felis chaus</i> | Felidae | Jungle cat |
| 41 | <i>Sus scrofa cristatus</i> | Suidae | Indian boar |
| 42 | <i>Buceros bicornis</i> | Bucerotidae | Great hornbill |
| 43 | <i>Harpactes fasciatus</i> | Trogonidae | Malabar trogon |
| 44 | <i>Tor tambroides</i> | Cyprinidae | Mahseer |
| 45 | <i>Moschiola indica</i> | Tragulidae | Indian spotted chevrotain |
| 46 | <i>Lepus nigricollis</i> | Leporidae | Indian hare |
| 47 | <i>Petaurista philippensis</i> | Sciuridae | Indian giant flying squirrel |
| 48 | <i>Ophiophagus hannah</i> | Elapidae | King cobra |
| 49 | <i>Canis aureus</i> | Canidae | Golden jackal |
| 50 | <i>Rusa unicolor</i> | Cervidae | Sambar deer |




14. Annexure IV - Infrastructure at Shankarnarayana Gram Panchayat

| CATEGORY | NAME | PHOTO | LOCATION (GPS) | | WARD NO. | OBSERVATION/ COMMENTS |
|-------------------------|-----------------------------------|---|------------------|-----------------|-----------------|--|
| | | | Latitude (N) | Longitude (E) | | |
| PHYSICAL INFRASTRUCTURE | | | | | | |
| Roads | SH-27 Kundapur-Agumbe Highway |  | 13 35'38.54823" | 74 51'42.15384" | | Bitumen Road. Road is in good condition. Road/carriage way width (of tar portion)- 6.0 m |
| | Kondalli Road |  | 13 38'1.42152" | 74 50'29.28552" | Ward-1 | |
| | Shankaranarayana Temple Cart Road |  | 13 36'21.96" | 74 51'27.58" | Ward-4 | 15.0 m wide road, Religious Sinificance, during festivals |
| | |  | 13 35'16.44828" | 74 51'24.70104" | Ward-5 | Mud road leading to concrete block making factory |
| | |  | 13 35'17.87604" | 74 53'8.71404" | Kulanje- Ward 2 | The mud road is proposed for concreting. |
| | |  | 13 35'37.58568" | 74 52'7.69836" | | Mud road road |
| | Kroda Bailoor Road |  | 13 37'56.05" | 74 50'18.63" | | Pot holes on bitumen road |
| | Haleagrahara road |  | 13 37'35.16132" | 74 49'36.0408" | Ward 6 | WBM Exposed. Bitumen road not in good condition, no shoulder along the road, road 3.0 m wide |
| | Haleagrahara road |  | 13 37'47.57844" | 74 49'29.8344" | Ward 6 | 3.0 m narrow concrete road, with no shoulder, not suitable for two way traffic |
| | Bailoor Cashewnut factory road |  | 13 37'46.575224" | 74 49'17.92092" | Ward 1 | Mud Road to Cashew nut factory |
| | Siddapura Road |  | 13 36'32.21892" | 74 51'47.1276" | | 6.0 m wide Bitumen road, Road is in good condition |
| | |  | 13 34'52.5522" | 74 51'23.16756" | Kulanje- Ward 2 | |
| Bridges | Helady River Bridge |  | 13 34'59.5506" | 74 51'26.0874" | Ward-5 | Edge of Ward 5 |
| | |  | 13 37'00.13" | 74 52'09.85" | Kulanje- Ward 1 | Bridge over Varahi Irrigation canal.Siddapurra Road. Width 8.0 m Length 35.0 m |



| SOCIAL INFRASTRUCTURE | | | | | | |
|-----------------------------------|--|---|------------------|-----------------|-----------------|---|
| Panchayat Office | Shankaranarayana GP Office |  | 13 36' 20.88" | 74 51'34.00" | Ward-4 | |
| Panchayat Office (Old) | Old Gram Panchayat Office |  | 13 36'19.74" | 74 51'39.26" | Ward-3 | |
| Post Office | Shankaranarayana Sub Post Office Pincode-576227 |  | 13 36' 16.05" | 74 51'50.36" | Ward-3 | |
| | Kulanje Branch Post Office(Letter Box). Pincode: 576227 |  | 13 35' 18.01104" | 74 53'7.72872" | Kulanje- Ward 2 | |
| | Krodabailoor Branch Post Office |  | 13 37' 18.01104" | 74 53'7.72872" | Ward-6 | |
| Police Station | Shankaranarayana Police Station |  | 13 36' 17.02944" | 74 51'45.23724" | Ward-4 | |
| Gazette Sub Treasury Office | |  | 13 36' 19.6218" | 74 51'35.01036" | Ward-4 | |
| Range Forest Office | |  | 13 36' 13.2516" | 74 51'52.83648" | Ward-3 | |
| Sub-Registrar's & Marriage Office | |  | 13 36'16.90" | 74 51'46.51" | Ward-4 | |
| Electricity Department | MESCOM Office |  | 13 36'18.54792" | 74 51'40.80024" | Ward-4 | |
| Telephone Exchange | BSNL CSC Office |  | 13 36'23.24" | 74 51'32.80" | Ward-3 | |
| Health care Facilities | Govt. Primary Healthcare Centre (PHC) |  | 13 36'44.99" | 74 51'51.66" | Ward-3 | |
| | Veterinary Hospital |  | 13 36'16.48" | 74 51'44.36" | Ward-4 | |
| | Vaidya Clinic; Dr. Sachidananda Vaidya |  | 13 36'23.24" | 74 51'36.49" | Ward-4 | Vaidya Commercial Complex |
| | Dr. Anand Prakash Rao's Private Clinic |  | 13 36'18.62" | 74 51'13.15" | Ward-4 | |
| Anganwadi | Kroda Bailoor, Anganwadi |  | 13 37'36.12288" | 74 49'12.39852" | Ward-6 | |
| Bank | Karnataka Bank |  | 13 36'18.54792" | 74 51'40.80024" | Ward-4 | |
| | Syndicate Bank |  | 13 36'28.08792" | 74 51'45.17208" | Ward-3 | |
| | Amma Sabha Bhawana |  | 13 36'37.77" | 74 51'34.84" | Ward-3 | Used for Marriage Functions and social gatherings |
| | G S Acharya Ranga Mandira |  | 13 36'20.14" | 74 51'39.21" | Ward-3 | Used for drama & cultural performances |

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| | | | | | | |
|--------------|--|---|------------------|------------------|-----------------|---|
| College | Govt. Junior College, Shankarnarayana |  | 13 36'54.59" | 74 52'00.09" | Ward-3 | PU College |
| | Govt. First Grade College and Post Graduate Centre |  | 13 36'46.03" | 74 51'58.64" | Ward-3 | There is no, science course. Only M.com is offered as PG Course |
| | Mother Teresa PU College |  | 13 36'10.63" | 74 51'46.50" | Ward-4 | Science and Commerce |
| School | Mother Teresa Memorial School |  | 13 36'10.88" | 74 51'49.99" | Ward-4 | English medium (LKG to 10th) |
| | Ambedkar Memorial Residential School |  | 13 36'37.00" | 74 51'33.50" | Ward-2 | |
| | Govt. Higher Primary School, Kulanje |  | 13 37' 07.77" | 74 52' 19.13" | Kulanje- Ward 1 | Class 1 to 8 |
| | Shankaranarayana Primary School Vidhya complex |  | 13 36' 24.70" | 74 51' 33.26832" | Ward-3 | |
| | Govt. Higher Primary School, Kroda Bailoor |  | 13 37' 37.53" | 74 49'11.71" | Ward-1 | |
| | Mavina Kodlu Govt. Higher Primary School |  | 13 35' 17.01" | 74 53'8.13" | Kulanje- Ward 2 | |
| | Govt. Lower Primary School Kondalli + Anganwadi |  | 13 38' 7.33884" | 74 50'47.23188" | Ward-1 | |
| | Govt. Lower Primary School Kumbaramakki |  | 13 36' 17.80" | 74 52'54.44" | Kulanje- Ward 2 | |
| | Shankaranarayana Temple |  | 13 36' 17.70" | 74 51'27.46" | Ward-4 | The name of the Village was derived from this temple. |
| Temple | Brahmalingeswara Temple, Kattamakki |  | 13 35' 24.78912" | 74 51'27.24912" | Ward-5 | |
| | Sri Veera Kallukutikka Temple |  | 13 36' 19.64" | 74 51'43.93" | Ward-3 | |
| | Sri Siddhi Vinayaka Temple |  | 13 36'58.50" | 74 52'06.57" | Kulanje-Ward 1 | |
| | Sri Durgaparameshwari Temple, Munkodu |  | 13 34'55.47" | 74 52'21.00" | Kulanje-Ward 2 | |
| | |  | | | Ward-3 | |
| Fuel Station | Indian Oil |  | 13 36' 43.70" | 74 51'50.70" | Ward-3 | |
| | Bharat Petrol Bunk |  | 13 36' 10.27" | 74 51'56.28" | Ward-4 | |
| | ESSAR Petrol Bunk |  | 13 36' 05.55" | 74 51'58.20" | Ward-4 | |
| Dairy | Shankaranarayana Dairy |  | 13 36' 22.13" | 74 51'35.15" | Ward-3 | |
| | Kulanje Dairy |  | 13 36' 21.07" | 74 52'55.12" | Kulanje- Ward 2 | |
| Poultry Farm | Poultry Farm |  | | | Ward-4 | |



| INDUSTRIES | | | | | | |
|---|--|---|------------------|-----------------|-----------------|---|
| Food and Agricultural Industries | Hem's Food Factory |  | 13 36' 47.78748" | 74 51'52.49592" | Ward-3 | Cashew Industry (Gajanana Group) |
| | Rice Mill |  | 13 36' 30.85" | 74 51'33.37" | Ward-3 | Cashewnut Factory |
| | Shankaranarayana Cashews |  | 13 37' 48.28" | 74 49'14.64" | Ward-1 | Cashewnut Factory |
| Manufacturing (Type-Building or construction) | |  | 13 35' 18.70" | 74 53'8.12" | Kulanje- Ward 2 | Stone Crushing Industry |
| | MCK Paver Industries |  | 13 35' 36.28" | 74 51'30.52" | Ward-5 | Concrete Paver block industry |
| TRANSPORT INFRASTRUCTURE | | | | | | |
| Bus Stand | Shankaranarayana Bus Stand and auto stand. |  | 13 36' 21.65" | 74 51'35.85" | Ward-4 | There is no specific bay or area dedicated for the auto stand |
| Auto Stand | Kondalli Bus Stop Auto Stand |  | 13 37' 57.83" | 74 50'21.00" | Ward-1 | |
| Bus Stop | Kondalli Bus Stop |  | 13 37' 57.50" | 74 50'21.52" | Ward-1 | |
| | Bailoor Bus Stop |  | 13 37' 52.4532" | 74 49'35.19156" | Ward-6 | |
| | Kulanje Bus Stop |  | 13 35' 26.07936" | 74 53'25.64772" | Kulanje- Ward 2 | |
| | Kulanje Dairy Bus Stop |  | 13 36' 20.07828" | 74 52'54.1938" | Kulanje- Ward 2 | |
| | Govt Hospital Bus stop |  | 13 36' 45.10" | 74 51'49.54" | Ward-3 | |
| | Range Forest Office Bus Stop |  | 13 36' 12.72" | 74 51'52.17" | Ward-4 | |
| | |  | 13 35' 10.65" | 74 52'32.39" | Kulanje-Ward 2 | |

| WATER BODY | | | | | | |
|------------|------------------------------|---|--------------|--------------|--------|---|
| Tank | Shankaranarayana Temple Tank |  | 13 36'18.93" | 74 51'27.71" | Ward-4 | Temple Tank/Pond dimension Length 40.0 m Width 20.0 m |



| | | | | | | |
|-----------------------|----------------------------|---|------------------|-----------------|-----------------|--|
| Natural Pond | Madaga-1 |  | 13 35'25.37196" | 74 51'27.25416" | Ward-5 | Identified panchayat water body (named as Madaga-1*), measuring 10x15m is a natural pond, Not in good condition, |
| | Madaga-2 |  | 13 37'38.42" | 74 49'16.45" | Ward-6 | size: 12x 12 m approx |
| | Madaga-3 |  | 13 37'31.00" | 74 49'28.54" | Ward-6 | Located at Haleagrahara. Triangular shaped around area 1313 sqm, having one side measuring 50m |
| | Madaga-4 |  | 13 37'37.90" | 74 49'32.87" | Ward-6 | size- 60' * 40' * 15' deep |
| | Madaga-5 |  | 13 37'55.35" | 74 49'26.96" | Ward-1 | Measuring 99.0 m * 45.0 m approx |
| | Madaga-6 |  | 13 37'52.79" | 74 49'38.17" | Ward-6 | Madaga no.6 on kumki land. 60' * 50' * 20' deep. Can be proposed for widening and deepening. |
| | Madaga-7 |  | 13 36' 58.89" | 74 52'07.05" | Kulanje- Ward1 | |
| River | Halady/Varahi River |  | 13 34' 58.15416" | 74 51'28.14732" | Ward-5 | |
| Canal | Varahi Irrigation Canal |  | 13 37'00.13" | 74 52'09.85" | Kulanje ward-1 | On-going project. Width of canal is 8.0 m approx |
| RESERVE FOREST | | | | | | |
| Forest | Kondalli Reserve Forest |  | 13 38' 2.92236" | 74 50'33.74988" | Ward-1 | |
| | Bakudi Hole Reserve Forest |  | 13 35' 20.52" | 74 52'54.99" | Kulanje- Ward 2 | |

15. Annexure V - Guidelines for Setting up a skill development centre under Pradhan Mantri Kaushal Kendra

| S.no | Attribute | Parameter | Conditionality | Remarks |
|------|---|--|----------------|--|
| 1 | Size of Centre | Category A – Minimum. 8000 Sq.ft Category B – Minimum. 5000 Sq.ft Category C – Minimum. 3000 Sq.ft | Mandatory | |
| 2 | Ownership | Yes/No | Desired | |
| 3 | Lease/Rental/Maintenance Agreement Terms | Registered Rent Agreement for 3 years OR Lease agreement for a period of 11 months along with an undertaking to renew the lease at the end of every 11 months, during the period of three years. | Mandatory | Applicable to all leased or rented centres |
| 4 | Open Area (Area other than built area within boundary wall) | Category A – Minimum. 800 Sq.ft Category B – Minimum. 500 Sq.ft Category C – Minimum. 300 Sq.ft | Desired | |
| 5 | Parking | 10 two-wheelers, Cycle stand | Desired | |
| 6 | Approach | Located near (at walking distance) from a major approach road (highway/main market road) Conveniently close to public transport facility (Bus stand/Railway station/Metro station) Having adequate road lights and public movement | Desired | |
| 7 | Approach Road | The approach road should preferably be a pucca main road with a minimum width of 12 ft, If the centre is on an arterial road then the distance should not be more than 500 meters from main road and that arterial road should be at least 8 ft wide | | |
| 8 | Distance to nearest Public Transport | Distance to nearest public transport: Access to nearest public transport facility, which could be a bus stand, auto stand or railway station should not be more than 5 km away from the centre location | Mandatory | |
| 9 | Number of Classrooms | Category A – Minimum 5 Category B – Minimum 3 Category C – Minimum 2 | Mandatory | |
| 10 | Class Room Area | 10 Sq.ft per trainee | Mandatory | Classroom size for a particular job area to be as per defined SSC specifications |



| | | | | |
|----|---|--|-----------|---|
| 11 | Number of Training Labs | Category A – Minimum 2 Category B – Minimum 2 Category C – Minimum 1 | Mandatory | Labs as per machinery setup & SSC/MES standards |
| 12 | Lab Area | As per SSC Guidelines | Mandatory | Actual area will be a factor of sector, type of machinery and no. of trainees to be trained (would be updated/modified/changed given the scope of the scheme implemented in PMKK) |
| 13 | Computer Lab | 20- 30 computers | Mandatory | |
| 14 | Number of Washrooms/Urinals | Category A – Minimum 3 For Males and 3 for Females Category B – Minimum 3 For Males and 3 for Females Category C – Minimum 2 For Males and 2 for Females | Mandatory | |
| 15 | Number of Washbasins | One per Urinal/Toilet + 3 common basins at eating area | Desired | |
| 16 | Eating Area/Canteen | 200 Sq.ft | Desired | |
| 17 | Reception Area | 200 Sq.ft | Mandatory | |
| 18 | Counselling Room | 75 Sq.ft | Mandatory | |
| 19 | Common Area (Area except lab area and classrooms) | Category A – Minimum. 1600 Sq.ft Category B – Minimum. 1000 Sq.ft Category C – Minimum. 600 Sq.ft | Desired | |
| 20 | Flooring | Preferred Flooring Specifications - Glazed Vitrified Tiles; Colour Grey/White; Size 60cm x 60cm | Desired | Flooring should be consistent and bring out uniformity throughout the centre. The flooring specifications for the labs shall be as per SSC guidelines |
| 21 | Power Connection | 3 Phase Connection | Mandatory | |
| 22 | Power Backup | Adequate Power back-up should be available | Mandatory | Desired Specifications: Either 7.5 KW online UPS and 10*150 (Ah), (ampere hour) SMF (Self Maintenance Free)battery or Genset to back up lab utilization, minimum 10KW |
| 23 | Water Proofing of building | As per building standards | Desired | |
| 24 | Electrical Wiring | Fully covered, secured and taped | Desired | |
| 25 | Switch Boards and Panel Boards | Fully covered, secured and taped | Mandatory | |
| 26 | Seating – Waiting Area | Seating minimum for 10 people | Mandatory | |
| 27 | Fire Safety Norms | Instructions to be displayed at key areas along with fire extinguishers | Desired | As per Government prescribed norms |

| | | | | |
|----|---|--|-----------|--|
| 28 | White Board | | Mandatory | |
| 29 | Classroom projector with adequate AV facilities | | Mandatory | |
| 30 | Smart Classroom | Having technology-enabled audio-visual and web-enabled access capability | Mandatory | At least one such classroom in the centre |
| 31 | CCTV with Recording Facility | In every classroom/lab | Mandatory | |
| 32 | Internet Connection | Minimum speed of 256 kbps | Mandatory | |
| 33 | Classroom Chairs | All Chairs to have attached writing desk | Mandatory | Colour of the chairs to be as per branding guidelines |
| 34 | Classroom/Labs Walls | Concrete, brick or prefabricated sheets of minimum width of 3 inch for sound absorption | Desired | |
| 35 | Student History File | Individual file for each individual having the following: i. Trainee Registration form. ii. Parent Consent form iii. Address Proof. iv. Aadhar Copy v. Proof of last academic qualification vi. Assessment Results vii. Placement Proof | Desired | |
| 36 | General Safety Instructions Board | Will be as per the trade requirements | Mandatory | All Relevant safety instructions, Do's & Don'ts to be listed |



16. Annexure VI - Guidelines for Road Side Plantations

Tree species for planting at the sides and median of the roads - T.V. Ramachandra, Harish R.Bhat, Gouri Kulkarni

(Source - <http://wgbis.ces.iisc.ernet.in/energy/water/paper/ETR79/trees.html>)

| Sl. No | Species | Common Name | Flowering & Fruiting | Root | Benefits to ecosystem/urban and rural area | Growth rate and requirements | Method of propagation | Trees/km |
|--|---------------------------------|------------------------------------|---------------------------------------|---|--|--|---|-------------|
| Description of the trees suggested for planting at sides of the roads in Shankaranarayana GP | | | | | | | | |
| 1 | <i>Pongamia pinnata</i> | Indian Beech, Pongam, Honge, Ponge | Flower: March-April. Fruit: Summer | It has a good superficial thick long taproot and condensed network of lateral roots resist drought. | It is semi-deciduous, medium sized tree, nitrogen fixing leguminous tree. It is used as beautification, shade and tolerant to environmental stress. Helps in controlling soil erosion and binding sand due to its compressed network of rooting system. | Height: 9 to 12 m, Spread: 9 to 12 m Growth rate: fast., Highest growth rates are observed on well drained soils with assured moisture. It can grow in any type of soil. | It is propagated by seeds and stem cuttings. The seeds can be sown in a pit directly. The seedlings are also raised in nursery bed and then transplanted to the field after one year. The fresh seeds are used for sowing in the month of May-June. One-year old seedling are planted in months of June-July. Young plants need water at an | 83 trees/km |
| 2 | <i>Artocarpus heterophyllus</i> | Jack fruit; Katahal | Summer | The taproot is tuberous long further it tapers abruptly. | It offers many environmental services. It grows moderately rapid in early years and as it reaches maturity growth slowdown. It is highly wind tolerant. The tree canopy provides perennial cover to the soil and absorbing the impact of rain on the soil. It also increases the soil fertility and provides the shade | Height: 8–25 m, Diameter: 3.5–6.7 m at 5 years of age. Growth rate: fast It grows best in well drained, deep soils of moderate fertility but tolerates a wide range of soils types. It is cold tolerate and prefers sunlight for best growth. | The tree does not tolerate waterlogging or poor drainage. Seeds are sown at a depth of 2 cm and can be laid flat or planted with the hilum pointing down. When plants are not growing properly, about 10-15 kg of farmyard manure per plant should be applied. One-year-old bare seedlings can be planted in the field during | 82 trees/km |
| 3 | <i>Mangifera indica</i> | Mango, Aam | Winter to Summer | The mango has a long taproot that of ten branches just below ground level. | It is called "king of fruits" "It encourages Water Infiltration which will help to reduce flooding. Provides the shade. | Height: 9 to 14 m Spread: 9 to 12 m. Plant at the beginning of the rainy season. Watering is necessary till the first year of the plant. Tree grows in full sun. Particular attention should be paid to weeding and uprooting of competing shrubs where grafted Mango has been planted. The ideal soil has a fairly loose, brittle, crumbly structure. | It is propagated by seeds and by vegetative. The seedling is sowed in the nursery bed first then can be transplanted into the fields after 12 months. Planting is done during monsoon at a distance of 8-9 m in dry areas and 10-12 m in humid areas. Weeding should be done regularly to facilitate proper germination. | 83 trees/km |

| | | | | | | | | |
|---|---------------------------|---|--|--|--|---|--|--|
| 4 | <i>Syzygium cumini</i> | Java plum, jamun, black plum, Indian blackberry | Winter to summer | The taproot is strong, woody, and prominent. | The tree provides good wind breaks. It also provides shelter. | Growth rate: Rapid Height: 10-30 m Diameter: 11-12 m. The tree favours moist, damp or marshy situations, where it tends to form gregarious crops. Initially it needs shade. It tolerates prolonged flooding, and once established, it can tolerate drought. | It is generally propagated by seeds, where the soil is worked beforehand in lines about 30cm wide and 15 cm deep. The fresh seeds are sown because they lose their viability soon. Another method: The seedlings can be transplanted into the field when they reach height of 1 m or after 12 months. The spacing should be 20 m. the pit should contain red soil. The soil around the roots should be loosened during the first five years of growth. Planting is done in the beginning of rains. | 50 trees/km |
| 5 | <i>Azadirachta indica</i> | Neem, Bevu | February – May. Fruit: winter to summer. | It has strong root system with an extensive deep root system and lateral roots. It is a drought Resistant with a well developed root system. | The hardy Neem can grow luxuriantly even in marginal and leached soils. Neem is a useful species for improving soil fertility due to the quality of its leaf litter. It is a good source of carbon sink. It is an effective shade tree widely planted as an avenue tree. Improve the quality of air. Reduced the noise pollution | Height: 12 to 15 m Diameter: 15 to 20m. A neem should be planted with a distance between tree rows of 25m, a width of the rows of 0.5 m and distance between trees of 4.5m. Young plants cannot tolerate intensive shade, frost or excessive cold. The tree needs little water and plenty of sunlight. | The seeds can be sown directly at depth of 1 cm. It grows on saline and alkaline soils having pH up to 9.8. Planting should be done during July-August. If the seedlings are taken from nursery then one year old seedling can be transplanted into the field during monsoon season. | 50 trees/km |
| Description of the saplings suggested for planting at median of the roads in Shankaranarayana GP | | | | | | | | |
| 1 | <i>Muntingia calabura</i> | Gasgase hannu, Singapor cherry | Summer months. Fruit: throughout the year | Summer months. Fruit: throughout the year | It is drought resistant but not salt tolerant. Fast growing tree that makes for a favourable shade tree. Height: 3-12 | It is drought resistant but not salt tolerant. Fast growing tree that makes for a favourable shade tree. Height: 3-12 m Width: 20 cm Growth rate: very fast The seed requires light to germinate. Seed requires high temperature and light conditions for germination. The seedlings do not tolerate shade. Water is provided in spring winter. | The plant is propagated by cutting. The saplings should be planted 6-8 m apart, in a pit prepared with mixture of soil and decomposed | Crown is spreading and has drooping branches. The crown size is 5-10 m. About 100 trees can be grown along the 1 km. |



| | | | | | | | | |
|---|------------------------|---|--|--|---|---|--|--|
| 2 | <i>Gmelina arborea</i> | gambar, khumbhari, kumbuda, kumulu, shivani | April – May. Fruit: May – June. | The roots are strong which are situated within 3 m below soil surface. | Helps to conserve soil. It is resistant to drought, fire, wind damage, and high intense heat. The fruit of is edible, attract birds, bats and other mammals. | Height: 35m Diameter: more than 3 m Growth rate: Fast It grows well in wild sands on deep clay loams. Requires regular watering. It takes 2-3 months to raise Gmelina seedling in nursery. It does not grow in sandy soils. | It is propagated by seeds. The fresh seeds are sown directly in the permanent place. | The crown size is 5m. 200 trees/km |
| 3 | <i>Saraca asoca</i> | Sita Ashok, Achenge | March – August. Fruit: August-September | It has well branched taproot system. | It is evergreen perennial tree. Air pollution tolerant species. Tree produces large bunch of sweet smelling flowers throughout the year which attracts butterflies and birds. Bats disperse the fruits. | Height: 8.5m - 15.2m Growth Rate: Slow Soil pH: Acidic, Neutral Soil Drainage: Well Drained Soil type: Loam, Sand Water requirements: Average Water. The tree grows well in partial sunlight. It requires organic rich fertile, moist soil with an acid pH. Potassium fertilizer is required. Limited | The seedlings can be Transplanted into the fields after they are one-year-old, during the monsoon season. It should be planted in 60 cubic meter size pits. The spacing should be 10 m apart. The sapling cannot withstand direct sunlight and require a humid atmosphere in initial six months of growth. | The crown size is 5-8 m. Along the 1 km road 125 trees can be grown. |
| 4 | <i>Pavetta indica</i> | Indian Pavetta, Indian Pellet Shrub, Pavati | April - June | It has much branched taproot system. | It is evergreen shrub. Improve the fertility of soil. It is used as ornamental plant. The flowers are white, sweetly scented flowers attract many pollinators such as birds, bees, wasps, beetles, ants and butterflies. These in turn attract birds and other predators. Birds love the fruits and these are obviously distributed by birds. | Height: 2-5 m | <i>Pavetta</i> is propagated by seed, and vegetatively by cuttings. Seeds of <i>Pavetta indica</i> are sown in a fibrous, loam-based medium, with added sharp sand and charcoal. | The crown size is 5-8 m. 125 trees/km |
| 5 | <i>Ixora brachiata</i> | Gorbale (Marathi), Gurani, Kurati (Konkani) | December-February | It has strong taproot system | A medium sized evergreen tree. It is endemic to Western Ghats. It is used for ornamental purpose. Flowers are white, scented and fruit is edible which attracts birds and butterflies. | Height: 10 m It requires regular watering. | | The crown size is 5m. 200 trees/km |