STUDY ON IDENTIFICATION OF PERENNIAL HILL STREAMS (SPRINGS) WITH IRRIGATION POTENTIAL IN 5 TSP DISTRICTS OF ODISHA AS A POTENTIAL SOURCE OF LIVELIHOOD ENHANCEMENT

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(SCSTRTI)

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Acronyms

ACWADAM	Advanced Centre for Water Resources Development and Management
AOI	Area of Interest
BRLF	Bharat Rural Livelihood Fund
CHIRAG	Central Himalayan Action Research Group
CD	Community Development
DDA	Didayi Development Agency
DEM	Digital Elevation Model
DKDA	Dongria Kondha Development Agency
EC	Electrical Conductivity
FGD	Focus Group Discussion
GFWSS	Gravity Fed Water Supply System
GoI	Government of India
GP	Gram Panchayat
HSS	Himalaya Seva Sangh
ICTs	Information and Communications Technologies
IFAD	International Fund for Agriculture Development
IHR	Indian Himalayan Region
ISRO	Indian Space Research Organization
ITDA	Integrated Tribal Development Agency
LIP	Lift Irrigation Points
LULC	Land Use and Land Cover
LRD	Land Resources Development
MIP	Minor Irrigation Projects
MoTA	Ministry of Tribal Affairs
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MSL	Mean Sea Level
MSTs	Mobile Survey Tools
NEIDA	North East Initiative Development Agency
NGOs	Non-Governmental Organizations
NICWYD	National Institute for Children, Women and Youth Development
NITI	National Institution for Transforming India
NRDWP	National Rural Drinking Water Supply Programme
NRSC	National Remote Sensing Centre
OPELIP	Odisha PVTG Empowerment Livelihoods Improvement Programme
pH	Potential of Hydrogen
PHED	Public health and Engineering Department
PGWM	Participatory Groundwater Management
PMKSY	Pradhan Mantri Krishi Sinchayee Yojana
PSI	Peoples Science Institute

PVTGs	Particular Vulnerable Tribal Groups
PWSS	Piped Water Supply System
RD	Rural Development
RM&DD	Rural Management & Development Department
RWSS	Rural Water Supply and Sanitation
SDGs	Sustainable Development Goals
SCs	Scheduled Castes
STs	Scheduled Tribes
SCSTRTI	Scheduled Castes and Scheduled Tribes Research and Training Institute
TSP	Tribal Sub Plan
TDS	Total Dissolved Solids
UNDP	United Nations Development Programme
VJNNS	Vishaka Jila Nav Nirman Samiti
WASH	Water, Sanitation and Hygiene

Executive Summary

Springs are the lifeline for the people living in the hills and mountainous region. Springs directly support the partial or complete water needs of more than 15% of India's population. Besides, springs form the sources of many small and large rivers in India. Almost all non-Himalayan rivers and many Himalayan rivers originate from springs in the catchment areas. Many of these springs and their catchments have been revered through history either in the form of a symbolic temple orthrough the tribal legacy of 'sacred groves'.

The drying of springs has led to acute water shortages and great distress for populations in mountainous regions along with their livestock. The need to identify, conserve and protect the recharge areas of springs becomes important not just for local sustainability but also for the sustenance of our river systems.

Integrating the understanding of the groundwater resources with improved recharge, efficient supply and equitable distribution is the key for protecting and conserving springs. In recent years, there has been an upsurge of studies and initiatives to address spring management in India given the seriousness of the emerging crises around springs. These have been mostly community-centric initiatives that have looked at distribution rather than regeneration, although they have helped in mitigating the rural water crises to some extent. The concept of springshed management – that is management of the area of recharge of springs, down to the area of discharge, is now getting increasingly well-ingrained in the form of pilots of varying scales across the Himalayan States, and more recently in Bhutan and Nepal.

The Goal – 6 of the Sustainable Development Goals (SDGs) recognizes the importance of access to clean water. Many tribal communities, especially, the Particularly Vulnerable Tribal Groups live in hilly, thickly forested and hard-to-reach areas. Due to the difficult terrain and complex hydro- geological limitations, the ground water development potential through conventional means (dug wells/tube wells/bore holes, etc.) becomes difficult. They are naturally endowed with springs - a natural source of groundwater in the hilly areas which meet their basic requirements, though with certain difficulties at some places due to lack of collection and distribution network. However, for enhancing their livelihoods they come across various multi-dimensional vulnerabilities associated with the lack of water security in tribal areas.

With this backdrop the '1000 Springs Initiatives' by the Ministry of Tribal Affairs and United Nations Development Programme has come as ray of hope which has demonstrated a localized innovative solution by harnessing the potential of perennial springs to meet the water needs of the remote tribal communities. Under this initiative, the present study made an attempt to map the perennial springs in the five Tribal Sub-Plan districts namely Koraput, Malkangiri, Mayurbhanj, Rayagada and Sundargarh.

Objectives

- To identify and map out the perennial springs in catchments area considerations and assesstheir potential to increase the irrigation coverage and other uses like drinking water and sanitation.
- To document the folklore, history and other cultural attributes of the tribes in relation to the specific streams across the spatial and temporal scale.
- To understand the traditional management systems, conflict resolution mechanisms and collective choice arrangements in relation to conservation of the streams, including the externalities responsible for affecting the efficacy of the streams.
- To generate a GIS based database with approximate calculation of the command area the streams could generate.

Methodology

For undertaking the survey i.e., for mapping of the springs a dedicated App in the name of mWater developed by MoTA and UNDP was used in the mobile for data collection. The identified perennial springs are GIS tagged along with the data on their local names; the villages they serve or have potentiality to serve, their current status in terms of their discharge volume, quality of water and potentiality for irrigation etc., were collected through the mWater app. Besides, details on socio-cultural importance of the springs, their conservation by the community, governance in the distribution of spring water, dispute settlement mechanism were collected through conducting focus group discussions with the help of semi-structured questionnaire and guide points.

Within the scope of time and resources of the study 688 perennial springs were studied and data were collected from the five districts with an average of around 135 springs per district covering three to four blocks within a period of 10 months. There are still thousands of live springs in each district which needs to be mapped and comprehensive database of each district as well as the state can be built. The data collection process was delayed due to COVID-19 restrictions to some extent.

Findings and observations

- Springs have immense potentiality to change the landscape of natural ecosystem, economy, and quality of life of the tribal communities living in difficult terrain and geographic complexities. Due to ecological degradation and increased anthropogenic pressure, many of the perennial springs are dying down. It needs urgent intervention for their conservation, rejuvenation and efficient use of water resources for irrigation and drinking water purposes. This can be done in convergence with programmes like MGNREGA and active participation of local community through their institutions such as Pani Panchayat.
- Irrespective of measurable discharge volume (as prescribed in mWater portal) all the springs mapped offer different potentials for tapping drinking water, utilizing spring water for sanitation and irrigation. Specific

recommendations have been made to undertake appropriate biophysical interventions considering criticality and conditionality of the spring and the spring shed. The springs where measuring water has been a challenge does not mean that their discharge volume is low. Therefore, all the springs require site specific intervention in respect of their conservation, restoration and optimal efficient use of water for irrigation, drinking water and sanitation. However, what is more important is the fact that along with ecological restorations to enhance the discharge of water in springs, appropriate governance mechanisms to maintain water equity and crop-water budgeting should be brought in place to ensure sustainability of the spring flow.

The study has brought out some critical reflections and suggestive remarks for future course of actions as stated below.

- With declining discharge of water invariably from all the springs, urgent attention must be given for their conservation, rejuvenation and efficient use of water resources for the purpose of irrigation and drinking water. All flagship programmes relating to irrigation, drinking and natural resource management should be undertaken towards the conservation and rejuvenation of springs in hilly terrain of all the districts of Odisha.
- While reviewing the district irrigation plan (Pradhan Mantri Krishi Sinchayi Yojana - PMKSY) of the five districts that was prepared in the year 2016, it was found that springs have not received any specific attention while discussing about the current irrigation status as well as potential for further expansion. Needless to mention that perennial springs play a very critical role for meeting the need of the tribal community in respect of their drinking water and water for irrigation. It is pertinent to mention that many tribal communities have started practicing settled agriculture since quite for some time. It is suggested PMKSY may incorporate spring-based intervention in the revised plan.
- Springs can be taken up as micro level irrigation plan thus serving as a hub for drinking water and other domestic usage, horticulture, and agriculture at village or in a cluster of villages.
- Springs with relatively higher discharge volume of water with steep elevation has got potentiality to be developed as a micro hydro power generation unit to serve the villages in the proximity. There are a few examples in Koraput district where micro-hydro- power units which run in an entrepreneurship mode. They not only provide power to the villages, but also run the processing unit such as rice huller, mini flour mill etc.
- In line with the Pani Panchyat, the springs in one area can be clubbed and community level institution can be promoted for its conservation and laying down the benefit sharing mechanism.
- In the downstream villages of the springs, multi cropping agricultural

techniques should be encouraged instead of focusing on single and water intensive cropping pattern.

- Piped Water Supply System (PWSS) and Rural Water Supply and Sanitation (RWSS) should systematically focus on conserving the springs and tapping the water for the optimal use by the community. Ironical coexistence of the perennial springs and scarcity of drinking water in the nearby villages can be altered easily.
- The water discharge in almost all the springs is in declining trend, so some intervention for their conservation as well as rejuvenation should be taken up on high priority basis. This plan can be incorporated in the Gramsabha of the Panchayat and theneedful can be done.
- The officials of the government line department at Block and District level should be thoroughly educated about the spring eco-system and how different prorgammes andschemes can be integrated for its conservation and benefit sharing.
- Most of India's water policies are designed around large structures such as dams, canal, lake/pond or in the form of tube wells. However, there is no national level policy on springs and their management. Having the same is the need of the hour.
- A digital atlas of springs should be developed at state as well as national level as to monitor their status and intervention.
- Community has already rich knowledge system on springs, which can further be strengthened with scientific inputs by organizing Gram Panchayat level workshops. Thiswill further sensitize them for better conservation of springs.
- An adaptive strategy can be developed based on hydrogeological investigation and demand-supply model for vulnerable springs.
- Intervention strategy can be drawn for reviving the recently dried up springs with activeparticipation of the community.
- Springs and springshed development can contribute to improving water security in mountainous areas by providing safe water thus contributing toward meeting commitments under the Sustainable Development Goals (SDGs) especially SDG 6. Thus, linkage with SDGs could facilitate multi-stakeholder collaborations required for effective implementation of springshed management.
- Mainstreaming and convergence of springshed management with large scale public investments like MGNREGA and 'Har Ghar Nal Se Jal (pipe water in every house)'
- Encouraging creation of water recharge structures such as contour trenches, deep pits and percolation pits during monsoon help in collection and storage of rainwater that further percolates into aquifer and prevent run-off. This process helps to protect the local vegetation, preserving soil moisture profile and rejuvenate the springs.

Chapter 1
Context, Rationale and Importance of Perennial Springs

1.1 Concept of springs

Natural springs are points on the surface of the earth through which groundwater emerges and flows. The spring points refer to the mark where the water from the aquifer seeps out upon the surface of the earth. Gravity springs are a result of the aquifer water moving through permeable soil onto the surface, or when the aquifer waterbed is intercepted by the surface level. This water is commonly used as a main source of irrigation, drinking and domestic purposes in many areas, especially in mountainous and hilly regions. Because of its importance, springs are also studied by scientists in great detail using digitally advanced tools like remote sensing, geophysical investigation and isotope techniques, but mainly from an academic point of view. The utility of such research for the welfare of the communities and managing this resource itself has been ignored to a great extent.

Water being the source of life, traditionally springs used to be considered as sacred places and they form a major cultural pivot on which the entire community livelihood is based upon. In spite of their ecological and anthropological importance, springs lack their much- deserved recognition as a ‘common’ property resource. Land use changes, construction and deforestation works in the guise of development and pollution have led to the rampant abuse of this ‘common’ resource which is severely affecting it in both a quantitative and a qualitative manner. The abode of this important resource i.e., the underlying rocks or aquifers also are a ‘common’ unit; which is an ignored fact all over India.

To understand spring better the most important concept is to understand groundwater and its behavior such as ‘aquifers’. It is these aquifers where groundwater is stored, replenished and is then made available for use under differing geological conditions. Without the proper understanding of aquifers, the study of groundwater remains incomplete and thus springs can be understood only superficially and not in their totality. ‘Aquifers’ are defined as a saturated geological formation which can yield sufficient quantities of water to wells and springs. In simple words aquifer are rock layers which allow storage and movement of groundwater within them. They are the units for understanding groundwater. As is clear from the definition of aquifers, groundwater is stored and transmitted through openings in rocks. These openings may be in form of pore spaces or fractures. Thus, the study of rocks forms the basis for study of groundwater.

Understanding on geohydrology and its spatial and temporal variation determines the quantity of spring discharge and quality of water, which helps in classifying the springs. Precisely, the capacity of the aquifer to store and transmit groundwater directly reflects in the nature of spring discharge. Hydrogeological mapping of the springs often reveals that the recharge and protection areas of the springs are very site specific. The extent and location of these areas can be indirectly correlated to the spring type and nature of discharge. The extent and location of these areas are governed by the local geology and structure present and not by the administrative boundaries or type of land such as private, common, agricultural, forest etc.

1.2 Types of springs1

Springs are an important part of the hydrological cycle and interestingly can be classified into popularly five different types. The word spring comes from German word 'springer,' which means 'to leap from the ground'. The ground water discharges through spring's occuring in areas where the upper surface of the zone of saturation intersects the ground surface. In simple terms natural springs are points on the earth surface through which ground water emerges and flows. Springs are classified based on their morphological characteristics.

Depression springs: Depression springs are formed in unconfined aquifers when the topography intersects the water table, usually due to the surface stream incision. As these springs are formed because of earth's gravitational pull they are named depression or gravity springs. These are usually found along hillside and cliffs. They are most common in the Himalayas (Uttarakhand) and sub-Himalayas region (North East) and also at elevation more than 950 meters. So, few are seen in the Koraput areas also because of its altitude.

Contact Springs: The contact plane between a permeable and impermeable rock intersects the ground surface in such a way that the ground water is deflected to the surface making it a contact spring.

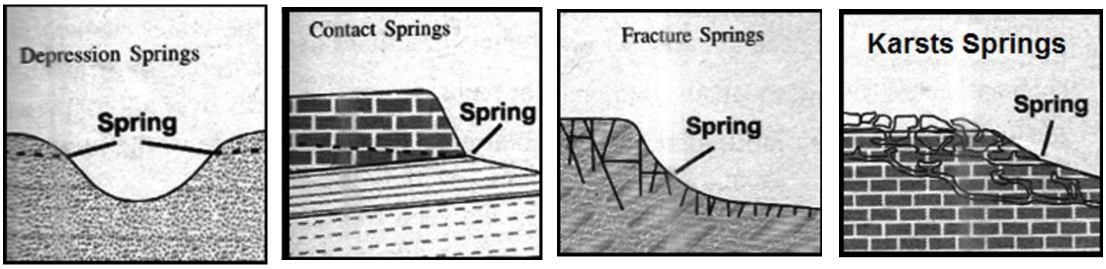


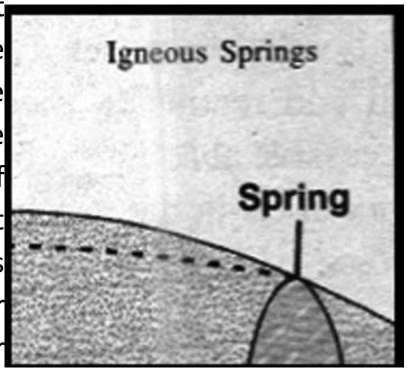
Figure 1:- Different type of spring

Fracture Springs: Fracture spring has waters flowing from joints or other fractures in contrast to the numerous small openings from which a filtration spring flows. Fracture spring occurs when a system of interconnected minor faults leads the groundwater to the surface.

Karsts Springs: The term 'karst' is derived from a Slavic word thatmeans barren, stony ground. It is also the name of a region in Slovenia near the border with Italy that is well known for its sinkholes and springs. Geologists have adopted karst as the term for all such terrain. Karst spring represents a natural exit for ground water to the surface through the hydrologically active fissures of karst mass. The spring in karst

[1] https://geographyandyou.com/five-types-natural-springs-found-india/natural-springs/ accessed on 2nd July, 2021

landscape appears more frequently in the places of contact between the carbonate masses and the impermeable layers.



Igneous springs: Igneous spring, also called hot spring, is a natural spring with water at a temperature substantially higher than the air temperature of the nearby region. Most igneous springs discharge groundwater that is heated by thin intrusions of magma. Some igneous springs, however, are not related to volcanic activity. In such cases, the water is heated by convective circulation – groundwater percolates downward reaching depths of a kilometer or more where the temperature of rocks is high because of the normal temperature gradient of the earth's crust. Taptapani hot spring of Ganjam district and Atri hot spring of Khurda district are Igneous Springs.

1.3 Cultural history of springs

The utilization and tapping of spring water has been an ancient art throughout human civilization. Historically, it has been found that to have easy access to water, towns and cities were often situated near large springs (water source), while those cities without a reliable water supply were destroyed or abandoned because they could not survive the sieges. (Kresic. N and Stevanovic. Z, 2010). These evidences are seen across the world, be it the excavated wells from the Harappan civilization found in Dholavira, Gujarat or citations in various ancient literatures.

In early times there used to be less pressure on the extraction of groundwater as the population and consumption was less. Later on, with increase in the number of dependents the use of groundwater also increased. Besides, in recent times use of groundwater or spring water was restricted to drinking purpose, but due to population growth, urbanization, increasing demand of water for agriculture, and electricity generation (especially from spring water) the pressure on ground water and spring water substantially increased. The adverse effects on groundwater started increasing when it was optimally exploited by the industry and for irrigation. This led to the formulation of a number of conventional watershed practices in order to harvest water and recharge the ground water so as to augment the supply of this resource. However, the practices followed in order to augment groundwater recharge were completely based upon geomorphic (surface) features while neglecting the sub surface geology.

In a natural process, the groundwater is stored and transmitted through aquifers. Thus, an aquifer should be considered as the very basic unit for any study on groundwater or any watershed development or a recharge augmentation programme. In the mountainous and hilly areas high relief and the complex geological structure play a vital role in formation of 'mountain aquifers. These mountain aquifers store groundwater which discharges out on to the surface in the form of springs. Every spring is different from the other in terms of its type, catchment area, recharge and discharge. This is governed by the local slope and the geological structure present underneath. Every spring has its unique characteristic recharge area and the margins irrespective of the land type.

1.4 Importance of springs in the hilly terrains

Figure 2:-Fractured Spring, Koraput District, Odisha

Springs are the main source of water for millions of people, especially the tribal, living in the hilly terrains of the country. Both rural and urban (especially in the Indian Himalayan Region-IHR) communities depend on springs for their drinking, domestic and agricultural water needs. Most water supply schemes, especially in IHR, that have been laid in the areas have their origins in a spring. In other hilly areas of central India region where mostly tribal communities inhabit, springs and streams have been the major source of water for drinking and agriculture activities.

There is increasing evidence that springs are drying up or their discharge volume has been reducing over the years throughout the hilly terrains. The ecosystem of hilly terrains is quite fragile and susceptible to several changes caused due to both natural dynamism and anthropogenic interventions. Erratic rainfall, seismic activity and ecological degradation associated with land use change for infrastructural development are impacting mountain aquifer systems. It is reported that half of the perennial springs have already dried up or have become seasonal resulting in acute water shortages across the country. If this crisis persists it will affect lives and livelihoods of millions of people in the mountains and hilly region. This implies that with changing climatic conditions and rainfall pattern, a large number of villages, hamlets and settlements are and will be facing potential water shortages[2].

Needless to mention, any significant depletion in such spring flows at river origins will surely impact the flow of rivers. A large share of the groundwater flux ends up in springs and consequently in rivers. Therefore, river rejuvenation will be incomplete without a clear focus on keeping spring perennial, as the rivers are kept alive throughout the year, particularly in a monsoonal climate, primarily due to discharge from groundwater as springs and seeps along their river channels.

Since springs play a vital role in our river system, we tend to pay a lot of attention to the tribal culture and religious rituals around the springs. The culture attributes a high value to springs and many cultural activities are still prevalent around spring water.

[2] NITI Aayog (2018): Report of Working Group -I on Inventory and Revival of Springs in the Himalayas for Water Security

Depletion in spring discharge is not just a one-dimensional problem. In recent years, there has been increasing concern about the quality and volume of spring water, though there is very little documentation available on these issues. Both contamination and deterioration of spring water originate from major two sources like geogenic and anthropogenic. Microbial content, sulphates and nitrates are primarily because of anthropogenic reasons, while fluoride, arsenic and iron contamination is mainly derived from geogenic sources.

The Working Group Report of NITI Aayog in 2018 on Inventory and Revival of springs in the Himalayas for Water Security describes the importance of springs in the following manner:

- Springs form the sources of many small and large rivers in India. Almost all non- Himalayan rivers and many Himalayan rivers originate from springs in the catchment areas. Many of these springs and their catchments have been revered through history either in the form of a symbolic temple or through the tribal legacy of ‘sacred groves’.
- Springs directly support the partial or complete water needs of more than 15% of India’s population.
- The drying of springs has led to acute water shortages and great distress for mountain populations along with their livestock, both rural and urban.
- The need to identify, conserve and protect the recharge areas of springs becomes important not just for local sustainability but also for the sustenance of our river systems.
- Integrating the understanding of the resource (mostly groundwater) with improved recharge, efficient supply and equitable distribution is the key to protect and conserve springs.

1.5 Springs as lifeline for tribal community in Odisha

Natural Springs and hill streams are lifeline of tribal communities living in mountain and forest regions of Odisha and elsewhere. The tribal culture and livelihoods are intricately linked with the natural springs/hill streams, most of them being perennial in nature. The springs find descriptions in tribal folklore, myths and legends. Springs are deified and related to the well-being of people and hence revered. Choice for settlements also depends on the proximity to streams and their water discharge capacities. The perennial springs have vast potential to sustain the tribal agriculture and other land-based livelihood pursuits and hence are valued highly from economic and ecological perspectives.

Odisha occupies a unique position among the Indian States and Union Territories for having a rich, colorful and diversified tribal communities with 62 Scheduled Tribes groups out of which 13 communities have been designated as Particularly Vulnerable Tribal Groups (PVTGs). According to 2011 Census, the tribal population of the State constitutes 22.85% of the total population of the State and 9.66% of the total tribal population of the country. Odisha has the third largest concentration of tribal population in the country. About 44.70% of the State's geographical area which is known as Scheduled Area (under fifth schedule of the Constitution), extends over 119 Blocks in 13 districts.

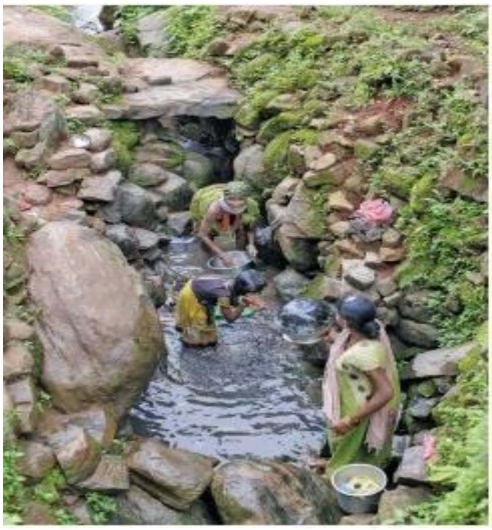


Figure 3: Spring Water used by community people

Agriculture is the mainstay of the tribal livelihood system. The communities depend largely on agriculture, forest and shifting cultivation for their livelihood. There are tribal communities who have larger dependency on forests and live as hunter gatherers; there are certain groups who are better known for their art of shifting cultivation or slash and burn agriculture. There are also tribal communities who have integrated different forms of livelihood trends such as agriculture, horticulture, shifting cultivation and such other land-based livelihood activities. Invariably, almost all tribal communities living in forested and mountainous regions of the state depend on slope agriculture in one form or the other because of paucity of levelled lands to take up settled agriculture. The perennial hill streams provide them the basis of agriculture on hill slopes and valleys. There are some best practices based on traditional wisdom in Odisha where particular tribal groups like Lanjia Saora and Bonda who have converted the hill slopes into terraces for paddy cultivation and making a choice of different paddy varieties in the upstream and down streams. The Dongaria Kondh in Niyamgiri hills are well known for the water management by efficiently diverting the courses of the streams for sustaining their agriculture round the year.

1.6 Scope for leveraging and conserving the springs

Tribal agriculture is by and large rainfed and hence Kharif is the main agriculture season. Excepting some patches of lands being cultivated with the help from the perennial springs, all other lands are cultivated once in a year due to non-availability of water for irrigation. To cater to the food requirements of a growing population with increasing number of households it is required that the available lands are optimally brought under productive use. In other words, the situation demands the cultivation of the available lands in all seasons such as the Kharif, Rabi and summer, which is feasible. The irrigation plays a critical role in this context. Adequate intervention by the government for developing irrigation infrastructure has not yet been done, though it received attention for quite some time.

Drying springs, contamination of water, reduced water discharge has been a matter of concern and therefore negatively impacting food security, livelihood choices and health status of tribal communities. In this context, the Sustainable Development

Goals (SDGs) 1- No Poverty, 2- Zero Hunger, 6- Clean Water and Sanitation recognizes the importance of access to water for food and livelihood security, drinking and sanitation etc.

Many tribal communities live in hilly, thickly forested and hard-to-reach areas. Due to the difficult terrain and complex hydro-geological limitations, the ground water development potential through conventional means (dug wells/tube wells/bore holes, etc.) is limited. However, springs - a natural source of groundwater in the hilly areas could address the various multi-dimensional vulnerabilities associated with the lack of water security in tribal areas.

1.7 Mapping of perennial springs

Figure 4: Channelization of spring

Springs - a natural source of groundwater in the hilly areas have huge potentiality that could address the various multi-dimensional vulnerabilities associated with the lack of water security in tribal areas. There is no comprehensive documentation of perennial springs in tribal areas that hinders planning for enhancing irrigation coverage and domestic water supply. Interventions on perennial springs have remained largely a domain of watershed and special projects although there are several other government schemes that could be tapped for their restoration, conservation and utilization. In this context the '1000 Springs Initiative' by the Ministry of Tribal Affairs and United Nations Development Programme demonstrated a localized innovative solution by harnessing the potential of perennial springs to meet the water needs of the remote tribal communities. More than 400 springs in four tribal dominated districts of Odisha have been mapped to create an online Spring Atlas[3]. This GIS online inventory will help in locating springs, analyzing their health status, quality of water, discharge capacity and other physical, chemical and biological properties. It will fill the crucial information gap to develop a national map of springs and build capacities of communities and other stakeholders in protection, preservation and management of the springs for sustainability of the resource[4].

Needless to mention, springs have been traditionally dealt through watershed interventions. Springshed management has come out as new technical

[3] https://thespringsportal.org/

[4] https://tribal.nic.in/1000-springs-initiative.aspx , accessed on 20th July, 2021

trends/concepts for restoring and rejuvenating perennial springs. It is a matter of fact that many perennial springs have not been intervened so far, and thus their potential for irrigation and drinking water supply to households not tapped adequately. Identifying such springs, intervening for their conservation and eco-restoration, creating potential for irrigation would immensely benefit the tribal people living in the vicinity. Conservation of perennial springs can contribute to enhancement in soil moisture profile that would significantly support the primary production. Stream based tribal knowledge system like terracing, channelizing, and management like water equity and water budgeting may provide new insights into this initiative.

Chapter 2
Experiences from the spring-based initiatives across the Country

Emphasis on springs has been a very recent phenomenon in our country though access to water has been highlighted as a critical factor for growth and development at policy and programme level discourses. It has been an experience since last few decades that bore-wells, tube wells have been set up for drinking water in tribal areas even where potentiality of channelizing spring water was very much present. Off late, the focus is gradually shifting to springs for their productive usage –drinking and irrigation. Efforts are being made to preserve and save springs from drying up; consequently, efforts to recharge them are also gaining momentum. A number of initiatives have been taken by some State governments, Civil Society Organizations / NGOs who are actively contributing towards promoting awareness about the importance of conservation and productive usage of spring resources so as to build capacities to protect, develop and manage 'springsheds' across the country.

2.1 Initiative of spring rejuvenation in Sikkim

The first systematic 'springshed' initiative was undertaken through the Dhara Vikas Programme by the Rural Management & Development Department (RM&DD), Government of Sikkim. This initiative was geographically targeted in south and west districts of Sikkim where low rainfall and drought situation became imminent over a few years. Having a planned convergence with MGNREGS, a spring revival initiative (Dhara Vikas) was launched in the State. This is an initiative built on the foundations of building capacity, implementing the concept of recharge and conservation through a scientific process with active community participation model. The intervention resulted in recharging 1035 million litres of groundwater annually covering 637 ha of catchment area and revival of 60 springs and four lakes in 20 drought-hit Gram Panchayats.

2.2 Participatory springshed management

Springs and Participatory Groundwater Management (PGWM) initiative in Himachal Pradesh was started in 2012 by the People's Science Institute (PSI) in the Sirmour District. As a result of anthropogenic factors when the discharge volume of springs was reducing and the water was getting contaminated due to pathogens, PSI with support from the community, intervened for rejuvenating five critical springs located in three villages of Thanakasoga Panchayat using the principles of Participatory Groundwater Management (PGWM) with technical inputs from ACWADAM and financial support from Arghyam. The intervention was based on local hydrogeological studies, groundwater quality monitoring and strong community mobilization which resulted in formulation of protocols for protecting the recharge area, maintenance of *baoris*[5], and equitable use of water. The initiatives not only resulted in enhanced spring discharge within a few months but also resulted in control of spring water contamination. Additional water was available for minor irrigation as well[6].

2.3 Springs revival through para-hydrologists

Central Himalayan Action Research Group (CHIRAG), an NGO, developed a team of para- hydrogeologists who mapped springsheds, monitored spring discharge and quality and identified a spring typology for the region. This work led to piloting of recharge and demand management measures that helped impact more than 100 springs in three districts of Kumaon region. CHIRAG collaborated with ACWADAM to develop capacity of their spring team and facilitate the team of para-hydrogeologists in mapping springs, catchments and aquifers to develop a systematic approach to spring-water management in the Kumaon region[7].

2.4 Mission spring revival

HIMMOTTHAN an initiative of Tata Trusts launched 'Mission Spring Revival' with a concept of spring shed management largely in Uttarakhand and later in Nagaland. HIMMOTTHAN implemented springshed management in the region of Uttarakhand through their Himmotthan Pariyojana programme. It identified the sources of springs, studied their history and diagnosed the issues impacting their discharge. By adopting comprehensive scientific methods such as hydrogeology and quality assessment of water, the initiative has been successful in implementing spring-fed, gravity flow WASH programmes in the region, benefitting more than 40,000 people. With the active participation of local communities, more than 300 villages in the Pithoragarh district have been included under the springshed management project. The construction of loose boulder check dams has helped minimize water and soil run-off and landslides. Improved water security through systematic springshed management measures and distribution of spring water under the concept of WASH has been established as anexample[8].

2.5 Campaign for springs

Though the Himalayan region receives high rainfall, the local communities struggle for access to potable water during the non-monsoon times of the year. This meant that the women, who were primarily responsible for fetching water, travelled long distances braving the odds of high gradient due to the mountainous terrain for

[5] an architectural design basically steepwell constructed in semi-arid areas

[6] http://peoplesscienceinstitute.org/PDF's/EQMG/Briefing%20Paper%20on%20Thanakasoga-revised.pdf , accessedon 20 Sept, 2021

[7] http://nhp.mowr.gov.in/HIS/docs/Manual/Spring_Rejuvenation.pdf , accessed on 18 Sept,2021

[8] https://www.tatatrusts.org/our-work/water-sanitation-and-hygiene/water-resource-management/springshed- management-programme-uttarakhand , accessed on 21 Sept, 2021

fetching water for household purposes and livestock. Arghyam supported Himalaya Seva Sangh (HSS) to institutionalize community-based water supply systemsto ensure perennial water availability from the springs. The initiative was otherwise called Campaign for Springs[9]. This was done by tapping the existing water harvesting structure. The key components of the intervention include:

- Ensured adequate water supply system around the year on sustainable basis.
- Ensured safe drinking water to the people of that area.
- Building capability of the community to manage their drinking water system.
- Awareness was imparted on hygiene practices leading to better health and hygiene among the households round water recharge, spring rejuvenation and soil erosion control.
- Created a network of partners who were facilitated to work in their respective regions to ensure water security and improving hygiene practices.

2.6 Spring Revival in Meghalaya

The dependency of large proportion of the population in Meghalaya on spring water suggests that with varying climatic conditions and rainfall pattern, a large number of villages are facing potential drinking water shortage. The ignorance of the role being played by the springs in the larger context of rivers, watersheds and aquifers is also a reason for great concern as such unawareness has led to gaps in practice and policy in developing any strategic national response to spring water management. There is a crucial need to address these issues in a holistic and scientific manner given that spring water is important for people living in the mountains. Government of Meghalaya, in 2016, initiated the work to map 60,000 springs and created a first-cut plan for spring water management on 5,000 springs in 11 districts over the next four years. This initiative is also supported through capacity building and hand-holding under the Springs Initiative, involving Arghyam, PSI and ACWADAM[10].

2.7 Springshed management in Hill Districts of West Bengal (Jharnadhara)

Bharat Rural Livelihood Fund (BRLF) in collaboration with West Bengal MGNREGA Cell, Ministry of Rural Development, Govt of West Bengal initiated (in 2017) spring rejuvenation program in four northern districts of North Bengal viz., Darjeeling, Alipurduar, Kalimpong and Jalpaiguri of West Bengal for treating about 600 springs through the implementing partners – PRASARI and ACWADAM. The initiative is called 'Jharnadhara[11]' (Springshed Rejuvenation and Management).

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[10] http://nhp.mowr.gov.in/docs/NHP/WebEvent/Spring%20Rejuv_Double-Page-FINAL-02.pdf , accessed on 20th Sept, 2021

[11] https://www.brlf.in/west-bengal/ accessed on 23rd Sept, 2021

The major components of the initiative include science-based aquifer mapping, aided with various field surveys and scientific analysis, facilitating and building community decision-making processes for sustainable usage and utilization of springs. The key components of the project include:

- Developing 616 springsheds across four districts – Darjeeling, Alipurduar, Kalimgpong and Jalpaigur. Majority of the springsheds are in Darjeeling district.
- Construction of physical structures and treatment of upper ridge that would be done through leveraging financial resources through MGNREGA programme.
- This project would not be a stand-alone activity since all the line departments would be involved and their respective schemes would be dovetailed as per this project.

2.8 Gravity Fed Water Supply System (GFWSS)12

With support from Infosys Foundation the Vishaka Jila Nav Nirman Samiti (VJNNS- an NGO) initiated the work in 2018 on Gravity Fed Water Supply Systems (GFWSS) in the Eastern Ghats for providing water security to tribal population in these regions as the existing water sources had water contamination issues leading to poor health. VJNNS also created filter tanks at natural spring sources and channeled the water to tribal villages using pipelines.

The endowment of Rs 5.92 crore will be used to provide safe drinking water to 100 tribal villages of the districts Visakhapatnam and Srikakulam through pipelines and promote good sanitation practices and create efficient water management systems in all the villages.

2.9 Grampari – Spring box model for water security13

Villages around Panchgani, a quaint hill station in Satara district of Maharashtra (Western Ghats of Maharashtra), had been facing a severe water crisis for a decade. One of these villages, Akhegani, however, found a way to overcome the crisis-it tapped underground spring water.

Recently, it had to depend on tankers for drinking water. These supplied barely 1,000 litres of water every day for the village population of about 600 people, mostly farmers, according to records available with the municipal body, Panchgani Nagar

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[12] https://www.infosys.com/newsroom/features/2017/water-management-systems-tribal-vjnns.html , accessed on23rd Sept, 2021

[13] https://www.downtoearth.org.in/coverage/spring-in-a-box-49240, accessed on 23rd Sept, 2021

Palika. This translates to 1.6 litres perperson. In comparison, the hill station receives 133 litres of water per person from the nearby Dhom dam. A few farmers in Akhegani own wells and borewells, the water from which is used mainly for irrigation. Things changed in 2012 when the people in Akhegani joined hands with Grampari, an NGO at Panchgani, to build spring boxes that tap underground spring water. The community effort has turned Akhegani's fate from being a water-starved village to a self-sufficient one. The spring-based water security approach ensured protection through spring boxes, rejuvenation based on springs hydrogeology, and resource - aquifers based governance through community participation. This approach in 19 springs provided water security to equal number of villages, while larger outreach has been to 60 villages through the springshed management work. It also helped to address the issues of quantity, quality, conflicts and enabled coordination and governance at local scales.

2.10 Spring conservation for water supply in the Nilgiris14

It is fact that there is a lack of data relating to the number and locations of springs in the country as a whole and the Nilgiris is no exception to this. While local inhabitants can possibly reel off names of springs close to them, no one person/institution has data on the locations of all the springsin the region. Mapping the springs is just a first step to understanding them and conserving them as they are the lifelines of people, flora and fauna of Nilgiris!

Keystone Foundation initiated an eco-hydrological model with interdependent and interconnected components of springs, forest, groundwater, wetlands and biodiversity in the Nilgiri's. Initially around 20 springs were taken up at different locations which provided immediate water security to 20 villages, while restoring forest, wetlands and groundwater systems which supports larger bio-diverse habitats and downstream communities.

Besides, they have developed a good repository, which they call as Spring Atlas. The atlas can be used by anyone who wants to know more about springs in the Nilgiris and/or work towards their conservation. The atlas can help anyone who appreciates the richness of water resources that exist in the Nilgiris and that require care to sustain in the future.

2.11 Springshed Management in Nagaland15

In the year 2018 a consortium of agencies such as Rural Development Department (RD), Land Resources Development Department (LRD) of Govt of Nagaland with Tata

[14] https://nilgiriswaterportal.in/a-spring-atlas-of-the-nilgiri-biosphere-reserve/ accessed on 24th Sept, 2021

[15] https://easternmirrornagaland.com/rejuvenating-springs-to-beat-water-shortage-in-nagaland/ accessed on 22nd Sept, 2021

Trust and the North East Initiative Development Agency (NEIDA) with technical support from Peoples Science Institute (PSI), Dehradun and ACWADAM, Pune took up springshed management project on pilot basis in the state of Nagaland, especially focusing on rejuvenating the springs for supply of drinking water to 100 villages in the rural Nagaland. The overall goal of the project was to developa state-wide springshed development programme to achieve sustainable water security and enhance resilience of mountain communities who are increasingly becoming vulnerable due to climate change impact.

The project was largely undertaken in a convergence mode where labour component was pooled from MGNREGA. The community has been capacitated to carry on the springshed development work and distribution of water resources so that that conservation and consumption go hand in hand. So far (till June, 2021) 105 springs have been rejuvenated where 11857 households of 95 villages covering 23 blocks of 11 districts of Nagaland have become all-weather water sufficient.

2.12 Springshed initiative of Mizoram16

Once upon a time the state of Mizoram used to be referred as the land of rolling hills, lakes and rivers in the north-eastern region, however, has been facing the impacts of climate change and anthropogenic pressure on its green coverage as well as spring eco-system making it inherently vulnerable, which is similar to other Himalayan states in India. Among the main challenges, the upland villages in the state face acute water scarcity in the lean season. Increased temperature andrainfall variations due to climate change have worsened the degradation of water catchments because of accelerated soil erosion and surface water run-offs. Combined with mismanagement of water resources, water bodies are increasingly drying up or becoming seasonal, leading to acute shortage, particularly from November to March.

For rural households, springs serve as the primary source of water in the hilly terrain of the state. Therefore, proper springshed management would thwart slow-onset climate impacts such as soil erosion and water scarcity, while strengthening the adaptive capacities of rural communities. One pilot in springshed management was undertaken in Sumsuih village, some 50 kilometers from the state capital Aizawl, which successfully demonstrated that community driven conservation efforts could ensure water security around the year. Residents of 240 households (Lalrenpuii Pachchau community) were primarily dependent on water from the springs. The Public Health and Engineering Department (PHED) built three small reservoirs to store the spring water to meet theneeds of villagers.

[16] https://www.preventionweb.net/news/india-revive-springs-water-security-mizoram, accessed on 24th Sept,2021

To implement recharging of aquifers in Sumsuih village, a detailed hydro-geological mapping wasconducted to identify specific recharge zones and interventions based on the properties of aquifers. Conservation structures such as pits, trenches and a weir were constructed after identifying the recharge points and zones, serving as more effective interventions for recharging aquifers. For this, a specialized group of state officials were trained in aspects of hydro-geology and the development of water security plans. The work also facilitated monitoring of base flow of spring water to quantify the impacts primarily due to interventions of springshed activities. The project was supported by GIZ with technical support from PSI and ACWADAM. Now the initiative is being scaled up to 100 springs with Forest Department as the nodal agency.

2.13 Reviving springs and ensuring water security to Baigas of Madhya Pradesh17

Baigas, a vulnerable tribal group inhabit in states like Madhya Pardesh, Chhattisgarh and Odisha. They follow a simple lifestyle, and a self-provisioning, self-determining and nearly self-sufficient community live in the resource rich highland forest regions in small hamlets. The dense forest, itsflora and fauna and water are the main sources of sustenance for this community. Rice and millets mostly form their staple diet and they supplement it with seeds, grains, roots, leaves and fruits of numerous wild plants, which flourish in the forest.

The elders in the villages recall the time when stream flowing in the forests were full of water for most part of the year and the water availability used to be sufficient enough to meet therequirements for drinking and agriculture. However, during past few decades things have changed significantly. They are now grappling to meet the basic requirement of water. Factors like anthropogenic pressures, loss of forest cover and changes in the micro-climate of the region have adversely impacted the availability of water. Declining water tables and degradation of the catchment have made people more vulnerable. The impact of water scarcity has enhanced the drudgery for the girls and women, who need to spend hours for fetching drinking water, often walking miles to reach the source.

Though hand pumps are installed by the Public Health Engineering Department for drinking water, the Baigas prefer water from the springs as their preferred source of drinking water, because they feel it tastes better as compared to water from the hand pumps (which draw water from deep aquifers). The fact that springs could be a potential source of drinking water, hence their conservation was never given its due importance by the government.

In an attempt to revive the springs WaterAid India began working in 52 villages of Dindori district in Madhya Pradesh, for ensuring availability of drinking water for the

[17] https://www.indiawaterportal.org/articles/bringing-springs-life-ensuring-water-security-baigas-madhya-pradesh , accessed on 30th Sept, 2021

Baigas throughout the year. It was realised that the conservation of springs through protection of catchment areas and springshed management by the community could ensure perennial nature and better flow of water from the springs. Community participation along with concurrence from the *Gram Sabhas*, and association of an NGO called National Institute of Women, Child and Youth Development (NICWYD), and the district administration, a programme was devised to repair and renovate the springs and build institutions to manage them.

A spring chamber - square-shaped mini pond like structure at the source of the spring was constructed at each spring to ensure its protection. A pipeline was used to supply water from this chamber to the filter tank (with sand filtration techniques) through gravity flow. The filtered water is then supplied to individual stand posts placed in front of every household in the village. When this successful model was demonstrated in Kapoti village of Dindori, it was gradually being replicated to other 51 villages in a phased manner.

Natural Springs are a neglected resource in India's water management system

In spite of the springs being a source of water for many settlements and hosting unique biodiversity, the management of springs has been a major blind spot in India's water management sector.

As societies, lifestyles, and worldviews changed, so did our association with springs. The influence of British education and scientific training in India introduced Western concepts and classification systems of springs, which are followed for their benefits even today. However, the scientific rationale evolved in the geographical and socio-cultural context of the European world do not match up to the historical, geographical, and culturalrealities of spring management in India.

Historically, springs acted as catalysts in the growth of villages: communities settled around them. Hunter-gatherers and nomads have extensively depended on perennial and seasonal springs since the prehistoric period (9,000 BCE to 7,000 BCE).

Natural springs are an integral part of the ecological cycle—their waters are rich in nutrients and dissolved gases, and are ecosystems themselves in that they sustain a wide range of flora and fauna. Because of steady discharge rates, perennial springs provide water to numerous other streams, as well as lakes, wetlands, and rivers, ultimately contributing to the freshwater capacity of major rivers and coastal ecosystems. Almost all major rivers in India—such as the Ganga, Krishna, Godavari, Narmada, and manyothers—have their origin sources as springs… Radhika Mulay - Environmental Researcher & Activist

Chapter 3
Objective, Methodology, Design and Study Area

The study was undertaken in selected five districts of Odisha that come under Tribal Sub-Plan (TSP), namely Koraput, Malkanagiri, Mayurbhanj, Rayagada and Sundargarh. While selecting the area of survey, springs existing in and around the PVTGs habitats were given relative priority so that some development plan could be made for them in future. Besides, concentration of tribal population and lower %age of irrigated areas of the Block was also a deciding factor.

The major objectives of the spring mapping exercise are:

- To identify and map out the perennial springs in catchments area considerations and assess their potential to increase the irrigation coverage and other uses like drinking water and sanitation.
- To document the folklore, history and other cultural attributes of the tribes in relation to the specific streams across the spatial and temporal scale.
- To understand the traditional management systems, conflict resolution mechanisms and collective choice arrangements in relation to conservation of the streams, including the externalities responsible for affecting the efficacy of the streams.
- To generate a GIS based database with approximate calculation of the command area the streams could generate.

3.1 Study design

The study has been a combination of exploratory and explanatory methods integrating the anthropological (Ethnographic) and GIS methods. Attempts have been made to focus more on pragmatic and solution driven outcomes rather than testing hypothesis.

The study gives a description of important spring water parameters like average quantity of water discharge from the source, water quality such as, TDS, electro conductivity (EC), pH and temperature using various measuring instruments. There are 688 spring locations which were identified and geo tagged using GIS technology and uploaded in the mWater portal application site.

Data was collected using primary and secondary sources. For the primary data collection various research methods such as FGD manual or guide, observation, mWater Inventory questionnaire, field instruments were used. The questionnaire used for FGD was both structured and semi- structured type. The data was collected using GIS application by using mWater[18] inventory questionnaire following the mWater portal guidelines. The mWater portal application is a mobile application consisting of questions based on springs on five broad topics along with 45 subset questions which the field staff (Research Assistants and Community Mobilisers) needed to collect,fill and submit in consultation with the community people. The app is designed in such a manner that it works in remote locations irrespective of availability of internet connectivity. While fillingthe mWater application questions, the field staffs were provided with a set of instruments like measuring beaker (2000ML) capacity, EC and TDS meter, pH meter to collect the samples and measure. The data analysis was done using MX-EXCEL.

Secondary data was collected from published sources like census report 2011, district annual report, District Irrigation report, Government Gazette, journals, various newspapers, articles, books and magazines.

3.2 Training and Pilot Study

Before the field work started, the field staff and other members of the study team were given intensive orientation for two days by ACWADAM (Pune) & Gram Vikas facilitated by SCSTRTIregarding the utility and usage of mWater portal. Post training session, the study team went to Thuamul Rampur (Kalahandi) for 3 days for hands on training in the field which was facilitated by GramVikas.

3.3 Limitations of the study

- Though the project was of ten months duration (Apr 2021-Feb2022), it was adverselyaffected by the restrictions and disruptions due to COVID-19. The study could not cover
- mWater helps governments, utilities and service providers, and organizations use data to increase access to safewater and sanitation around the world.
- The entire district due to paucity of time, thus any generalization of conclusions to the entiredistrict may not be appropriate.
- There were many springs where the water volume measurement was not possible as collecting water at a single convergence point was feasible. Water from any spring normally discharges in a spread over area. In the springs where some intervention by the community, NGO or government line department to collect or channelize water at a singlepoint, the discharge volume could be measured.
- The data collection was done using purposive and snow ball sampling to reach a targeted number of springs with support from the local community and key informants like field level officials from watershed and soil conservation department. Topo-sheet was not usedin identifying the data.
- Data on some springs could not be collected due to their location at a higher altitude andmaking it difficult to access by the field staff.

- Water discharge volume was measured post monsoon purposefully. This was done to avoiderror in calculating the water discharge when spring water got mixed up with run off rain water.
- The command area for potential irrigation of springs were calculated on an approximate estimate by categorizing the springs as high, medium and low discharge. The officials fromwatershed and soil conservation department at Block and District level were consulted in making such cursory assessment. Thus, it did not involve any scientific method ofcalculation.
- There were certain areas which were excluded during field survey like reservedforests, mining areas etc.

3.4 Team Composition

The study has been initiated in the 5 TSP districts of the Odisha i.e. Sundargarh, Mayurbhanj, Koraput, Malkangiri and Rayagada. The work was carried out by a research team comprising of Consultant, Research Associate, GIS expert, Research Assistants and few community mobilizers from 5 different districts. The detail of research team is given below.

Table 1:- List of research team involved in the field study

Sl. No	Name of the Team members	Designation	Sl.no	Name of the Team members	Designation
1	Dr. Braja Sundar Mishra	Consultant	9	Mr Purusottam Nayak	Community mobiliser
2	Ms. Biji Patra	Research Associate	10	Mr Narahari Nayak	Community mobiliser
3	Mr. Shankar Shan Patro	GIS Expert	11	Mr Subhas Kirsani	Community mobiliser
4	Mr. Alok Ranjan Khatua	Research Assistant	12	Mr Surjya Narayan Padhi	Community mobiliser
5	Mr. Pabitra Kumar Rout	Research Assistant	13	Mr Rabi Nayak	Community mobiliser
6	Mr. Manoj Kumar Jena	Research Assistant	14	Mr Ashok Kousalya	Community mobiliser
7	Mr. Manmohan Mishra	Research Assistant	15	Mr Dambaru Badnayak	Community mobiliser
8	Mr. Dutikrishna Nayak	Research Assistant	16	Mr Ajit Kumar Pradhan	Data Entry Operator

Chapter 4
District Profile

Table 2: District wise classification of cultivated land

Classification of cultivated land of five districts (000, Ha)				
District	**Highland**	**Medium land**	**Low land**	**Total**
Mayurbhanj	186 (43 %)	125	126	437
Sundargarh	163 (52%)	95	55	313
Koraput	187 (61 %)	79	38	304
Rayagada	129 (67%)	42	22	193
Malkangiri	87 (61%)	31	24	142

Source: Computed from Agricultural statistics, 2013-14, Govt of Odisha

The above table implies that except Mayurbhanj more than half of the cultivated areas are in the upland, where the perennial springs play a very critical role for agriculture and allied activities.

4.1 Mayurbhanj

Figure 5: District map of Mayurbhanj District

Prior to independence, Mayurbhanj was a princely state, ruled by the Mayurs and Bhanjas since the ninth century A.D. The dynasty ruled continuously for more than 1000 years. The state became a part of the Indian Union on November 9, 1948 after the Instrument of Merger was signed. It was the last feudal state to be annexed with Orissa on January 1949 and become a district. It is the largest among thirty districts of the state in terms of area. It lies between 85° 40'E and 87° 11' E longitude and 21° and 23° N latitude. It is bounded on the north by the state of Jharkhand and West Bengal,on the south by Kendujhar and Baleswar districts of Orissa, on the east by West Bengal state and Baleswar district and on the west by Kendujhar district and Jharkhand state.

Three distinct topographical formations are found in the district. At the centre, there are hills and lesser elevations running from north to south. These hills divide the plains into two parts: eastern and western. The eastern part slopes gradually towards the sea. A number of hill streams pass through this region. On the western side, there are many rocky mounds and hills, for which the landscape is marked by a number of rises and falls. The soils on the northern part of this plain is fertile. Bamanghaty subdivision is located in the north and Panchapir sub-division in the south.

For administrative convenience, the district has been organised into 4 subdivisions, namely, Panchpir, Bamanghaty, Baripada and Kaptipada. The district is divided into 26 Community Development Blocks, which comprise 382 Gram Panchayats and 3,950 villages (of which 202 are uninhabited). The district is richly endowed with mineral resources, but there is no large scale industry. Industrial sector mainly comprises handloom, handicraft, village and cottage industries. The district is rich in mineral resources such as iron ore, china clay, quartzite, vanadium bearing titanium, ferrous magnetic iron ore, soapstone, kainite, fire clay, copper ore and asbestos. Iron ore deposits of Gorumahisani, Badampahar and Suleipat have been exploited for quite a long time byseveral industries. Other mineral deposits also are being mined for use. Mining activities in the mines located in the forest areas are generally restricted since environmental clearance is requiredfor the purpose.

4.1.1 People and their culture

Mayurbhanj presents a unique and varied culture. Various religious groups constitute the district population. The Hindus are in the majority with a population of more than 18.5 lakhs (83.64 % of the district population). The presence of other religious communities like Muslims, Christians and Sikhs is insignificant, at 1.19 %, 0.41 % and 0.02 %. There are a number of tribal communities in the district with their distinct customs and social practices. The cultural environment is a fusion of the unique demography and traditions of these communities which live with their own cultural domain, speak diverse languages and dialects and practise different economic avocations and rituals. Tribal communities preserve their identity; but they live together in harmony and share common property resources. The rural life in Mayurbhanj has been hardly marred by communal disturbances. Out of 62 Tribals tribal communities of Odisha 18 live in Mayurbhanj. The major tribes in the district are Santhal (45.32 %), Kolha (17.55 %), Bhumijas (12.29 %), Bethudi (8.59%) and Bhuyan (4.60 %). The tribal communities like Gonds, Sauntis and Mundas, Kharia and Ho are very less in number. The communities are organised in characteristic social groups and their life- style, beliefs and values differ across groups. Some of these tribes like Santhal and Saora have developed their own scripts. Each community has its unique settlement pattern and house type, varying from scattered settlements to arranged patterns. The food and drinking habits of the tribal communities are almost alike, but their methods of food preparation vary. Santhals are known for their sense of sanitation and hygiene. Santhal women keep their houses neat and clean, and paint walls with different colours. Kolhas are lovers of art. Walls of their houses are decorated with artistic drawings.

4.1.2 Climate

The district comes under the North Central Plateau agro-climatic zone, characterised by hot, moist and sub-humid climate. Summers are generally hot and humid. May is the hottest month of the year with a mean daily maximum temperature of 41°C. During the rainy season, i.e. from July to September, the district gets more than half its total annual rainfall. The normal average annual rainfall is 1,648.2 mm spread over 85 rainy days. December usually is the coolest month of the year with an average temperature of 14°C to 16°C. The minimum temperature occasionally falls to 4°C at a few places. During peak winter, the high reaches of Similipal get frost. The climate of the district is generally humid throughout the year with maximum humidity rising to 87 %.

4.1.3 Soil and land slopes

The soil type and land slopes of the district are classified as under:

Table 3:- Soil type and slope distribution

Major Soil Classes	Area (ha)	0-3"_SLOPE	567721.4
Matured, Red & lateritic Soil (Alfisols)	115947.58	3- 8% _SLOPE	144508.55
Mixed Grey soil (Inceptisols)	841283.15	8- 25"_SLOPE	236126.42
Unaltered soils with Coarse Parent Materials (Entisols)	104.07	>25% _SLOPE	8978.42
Settlement	65976.47	Settlement	65976.47
Water body	18488.72	Water body	18488.72
Total	**1041800**	**Total**	**1041800**

Source: District Irrigation Plan, 2016

Table 4:- Table showing irrigation status of the district

Dist./Surveyed Block	Net irrigated area(Ha)	Partially irrigated area (Ha)	Unirrigated area/ Rainfed(Ha)	% of irrigated area (net &partially)
Mayurbhanj	121046	11369	291953	31
Jashipur	2933	452	15613	18
Karanjia	2964	237	16899	16
Thakurmunda	1427	187	13026	11

Source: Computed from the data provided in District Irrigation Plan, 2016

4.1.4 Livelihood system

For sustaining livelihoods people mostly depend on agriculture, horticulture, livestock, and non-timber forest produces. Major part of the agriculture is rain fed. Upland areas are low productivedue to lack or irrigation, improper crop /plantation planning.

4.2 Sundargarh

Sundergarh district was constituted on 1st January, 1948 after merger of two ex-states, Gangpur and Bonei, in Odisha. It is the second largest district of the state with geographical area of 9,712 sq. km., which is 6.23 % of the state area. It has forest cover of 4,957 sq. km., which is more thanhalf of its geographical area. It is bounded on the north by Jharkhand State, on the south by Jharsuguda, Sambalpur and Deogarh districts of Odisha and Singhbum district of Jharkhand on the west and on the north-west by Raigarh district of Chhattishgarh. It is located between 21035' N and 22032' N latitudes and 83032' E and 85022' E longitudes

Figure 6: District map of Sundargarh

Looking at the evidences of stonetools which have been found nearwater sources, it can be said that the district has been a place of human habitation since pre-historic era. The hand tools of early Stone Age have been found at Bishalbury, Jangra and Satkuta which are proof of early human habitations in the district. Thestone tools like flakes of middle Stone Age have also been found at Bishalbury, Bhanjgarh, Bisra, Bhaludungri, Bonaigarh, Jagannathposh, and Jhirpani. Polished stones of Neolithic era have been found at many places of the district. Traditionally, the territory, which is now called Sundergarh district, formed a part of Daksina Kosala. Kosala was an important Mahajanpada of northern Indiaand it continued as single unit till the rise of Mauryas. In the later stage, a new kingdom, called Kosala, grew in the Vindhya region. Eventually, it was designated as Dakshina Kosala in order to distinguish it from Uttar Kosala (North Kosala). In general, Dakshina Kosala comprised of the modern district of Raipur and Bilaspur regions of the present Chhattisgarh and districts of Sambalpur, Sundergarh, Bolangir and Kalahandi in Odisha.

The total cultivable land of the district is 3.35 lakh hectares (ha) and the area used for non- agriculture activity is 0.7 lakh ha. The barren and pasture land is 0.6 lakh ha and 0.3 lakh ha respectively. It is a fairly open country interspersed with tree-clad isolated peaks, vast forests tracts, extensive river valleys and mountainous terrain. It is an undulating tableland of different elevations broken up by rugged hill ranges and cut-off by torrential hill streams and Brahmani river. Because of this undulating, hilly and sloping nature of landscape, the area is subject to rapidrunoff leading to soil erosion. Administratively, the district is divided into three sub-divisions, namely, Bonai, Panposh and Sundergarh, 18 Tehsils and 17 Community Development (CD) Blocks. The district also has four municipalities namely, Biramitrapur, Rajgangpur, Rourkela and Sundergarh.

The population of the district was reported 20.93 lakh in 2011 with 50.7 % male and 49.3 % female population. The density of population is 216 persons per sq. km., lower than the State average of 270 persons per sq. km. It is the sixth most populous district of Odisha having 4.99 % population of the State. About 64.7 % people reside in rural areas. Sex ratio in the district was 973 in 2011, marginally lower than the state average of 979. Sundergarh is a tribal dominated district with 50.7% tribal population, which is the second highest tribal population among all districts of Odisha. Munda, Kharia, Oram, Kisan, Bhuyan and Gonda are its main tribal communities.

4.2.1 People and their culture

Sundergarh has sizeable Scheduled Tribes (ST) population (about 51% of total population) and main tribal communities are Munda, Kharia, Kisan, Bhuyan, Oram and Gond. The Kisan tribe dominates in the district. They speak several languages including kisan, sadri, sambalpuri, odiya, and Hindi. In addition, Mundari, Ho, Santali, Kurukh and Kharia languages are also spoken. They are farmers and gatherers of forest products. Of the total ST population, male population comprises 49.6 % and female population is 50.4 %. Out of 17 Blocks, five blocks have more than 70 % of Scheduled Tribe population in the district.

4.2.2 Climate

Topographically, the district exhibits widely diversified tracts of mountains, forests and extensive river valleys with variegated flora and fauna and a rich bio-diversity. The climate of the district is generally extremely hot in summer and cold in winter. The normal rainfall in the district is 1422 mm. The district is richly endowed with mineral resources. The hot season begins in March and touches high temperatures in May and ranging between 39^{o} to 47^{o} Celsius. Sometimes, different parts of the district receive pre-monsoon rains which regulate the rising temperature. The temperature begins to fall with the arrival of monsoon by mid-June. The district receives maximum rainfall between June and September through south-west monsoon. Though the normal rainfall is 1,422.4 mm, rainfall has mostly been erratic and during the last decade, there is a wider deviation from normal rainfall ranging from -318.8 mm to - 656.80 mm. The month of July gets the heaviest rainfall of the year, though rainfall is not very regular throughout the season. The relative humidity varies from 30 % to 86 %. The relative humidity remains high during monsoon. During winter, the air remains fairly dry. The driest part of the year is the early summer season when the relative humidity remains low of the order of 25 %. The district faces occasional flash floods, because of the terrain. This cause heavy damage to roads and crops. Occurrence of droughts of different degree (less than 50 % crop loss, 50 to 75 % crop loss and more than 75 % crop loss) is frequent due to various reasons such as uneven and erratic rainfall, inadequate irrigation infrastructure and inadequate soil moisture to retain the crop etc. The total forest area is 4,96,000 ha which is about 51 % of the total geographical area of the district. The total permanent pasture land comprises 26,000 ha. Barren and un-cultivable land comprises 66,000 ha. Cultivable land of the district can be classified into four categories. Aatt lands are mainly unbounded uplands which are less fertile and rain-fed. Berna lands are medium or mid-low lands with average fertility. Bahal lands are low lands, which are generally plain fertile lands suitable for paddy cultivation. Dangar lands are located on hill slopes and are occasionally utilized for shifting cultivation while Bari lands are used generally for kitchen gardens and cultivation of fruits and vegetables. The area, along the banks of major rivers namely Brahmani, Sankha and Koel are generally alluvial sandy and sandyloam spills.

4.2.3 Water and irrigation

Though there is considerable increase in irrigation potential in 2008-09 as compared to 1998-99, irrigation potential varies widely across different blocks. Lephripada block (55.26 %) and Lathikata block (46.48 %) reported highest irrigation areas and Kuarmunda block (15.89 %) and Kutra block (17.86 %) had lowest irrigated areas in 2008-09 in the district. Lack of availability ofirrigation facilities in the district is a major constraint to developing agriculture. Further, ground water exploitation for irrigation remains only at 13.5 % which is very low. Minor irrigation sourceshave been one of the major sources of irrigation in the district. The district has 75 Minor Irrigation Projects (MIP) and another 10 MIP are at different stages of construction. Around 10 Lift Irrigation Points (LIP) is also operational in the district. The net irrigated area of the district is about 33%, whereas the surveyed blocks have much lower net irrigated areas.

4.3 Koraput

Koraput as a district was formed in the province of Odisha on the 1st April 1936. Koraput district was the largest among the rest of the districts of the State till 1992. It was divided into districts of Rayagada, Nawarangpur, Malkangiri, and Koraput. Presently, the district of Koraput comprises of two sub divisions, 14 tahasils, 14 blocks. It isone of the remote districts of Odisha. Koraput district derives its name from its headquarters town. In ancient times when the Nalas were ruling this tract, Pushkari was the capital city located near modern Umarkot. In the medieval period Silavamsi kings developed Nandapur as the capital and sometimes they were under the kings of the *Suryavansh* dynasty. Vikram Dev of the *Suryavansh* dynasty shifted his headquarters to Jeypore in 17thcentury. For better health prospect, the then British Administrator choose Koraput town for its headquarters on 1870. The origin of the name of Koraput is obscure. As far as history goes Koraput is a misnomer of the word ‘Karaka Pentho’, Karaka literally means ‘hailstone’. It is also believed that one ‘Khora Naiko’ laid foundation of the village during the time of Nandapur dynasty. For his faithful and meritorious services, he had permitted to establish this village which was named after him as Khora Putu, and the name has been converted to ‘Koraput’.

The district has total geographical area of 8807 sq. kms. Koraput District is located between the parallels of 18º 13´ to 19º 10´ North Latitude and Medians of 82º 5´ to 83º 23´ east Longitude. The district is situated in the south eastern region of Odisha surrounded by Rayagada district and Srikakulam of Andhra Pradesh in the east, Nabarangpur district in the North, Malkangiri district in the West and Visakhapatnam of Andhra Pradesh in the South. Physiologically the district is contiguous to the mainland of Eastern Ghat. The different areas in this zone are situated at an altitude of 1501000 meters above the Mean Sea Level (MSL). The district has famous Deomali hill and small hill range which exists extends from East to West. Apart from this Kolab and Machhkund and other smaller tributaries pass through the district. The District boundaries are extended in the north to Nawarangpur, in the east to Kalahandi and Rayagada districts, in the south to Andhra Pradesh, in the west to Malkangiri district and Bastar district of Chhattisgarh. The present district has 2 subdivisions, 14 Tahasils (as recently each Block has been declared as a Tahasil), 14 Community Development Blocks and 226 Gram Panchayats. The entire district comesunder the Scheduled area. Total numbers of villages are 2028 out of which 106 are uninhabited villages.

Figure 7: District map of Koraput

The total population of the district is 13, 79,647 and total households 3, 37,677 (. The total male population of the district is 6, 78,809 whereas the total female population is 7, 00,838. The total rural population is 11, 51,528 and the total rural male population is 5, 63,422 whereas the rural female population is 5, 88,106. Total Urban Population of the district as per 2011 census is 2, 25,406, out of which the male are 1, 14,442 and the female are 1,10,964. The density of populationhas increased from 134 in 2001 census to 156 per sq. Km in 2011. The ST and SC population to the total population of the district constitute 50.60% and 14.2% respectively (Census 2011).

4.3.1 People and their culture

The tribals who constitute the bulk of population of the district speaking either the Austric or Dravidian language. The Marias, Gadabas and Bondas are the widely prevalent tribes in Koraput. They still practise the primitive axe and hoe cultivation, pottery and basket making, spinning and weaving and erecting funerary, religious menhirs from the past. The Godabas are clearly divided into three classes – Bonda

Paraja, Bonda Gadaba and the Perenga Godaba. The cultural heritage of Gadabas and Bondas are similar and one can hardly doubt that they are both representative of ancient Austro-Asiatic culture. The Bondas are found to be linguistic and having cultural affinitieswith the neighbouring communities like the Gadaba, the Perenga and the Didayi. The Bondas known among themselves a 'Remo' (men) are a small tribe of the type now often called Austro- Asiatic. Their country is the wild and mountainous region called Bonda Hills, North-West of the Machhkund river and here they have preserved themselves comparatively unaffected by the march of civilization. The Bondas are regarded as one of the most savage and primitive tribes of Odisha, with the scanty and strange body dress-in general and the clear shaved head as well as heavy masses of colorful necklaces in case of females. They stand in sharp contrast to their neighboringtribes. They speak an Austro-Asiatic language belonging to Mundari group.

4.3.2 Climate

The district enjoys tropical climate characterized by hot summer, cold winters and rainy seasons. The winter season generally commences from late November and continues up to the end of February. The summer season commences from March and continues till middle of June. The summer is quiet pleasant here with the mean daily maximum temperature around 40°C while the mean daily minimum temperature is around 14°C. It is observed that about 80% of the total annualrainfall takes place due to south-west monsoon between the middle of June and mid-October. Thenorth east monsoon gives erratic and insufficient rainfall. The average annual rainfall varies between 1320-1520mm. The district is drought prone because of the erratic and uneven pattern ofrainfall.

4.3.3 Irrigation

The district is highly deficient in irrigation facilities. Even though it receives an average rainfall of 1567.2 mm in about 84 days, the rainfall is erratic and unevenly distributed. In spite of all efforts, only two blocks out of 14 in the district have more than 35% of irrigation facilities. The benefits of major irrigation project Upper Kolab are enjoyed only by four blocks in Jeypore Sub- division. During the Eleventh Five Year Plan, investment has been proposed under Jalanidhi Yojana to attain 35% irrigation potential in all the blocks of the district. In addition to numerous streams and presence of many perennial rivers like Kolab, Machkund, Indravabi, Jhanjabati, the scope for creation of irrigation potential in the district is very high. The district has one major irrigation projects namely Upper Kolab Project, 69 MIPs of which 45 Nos. are functional.

4.4 Malkangiri

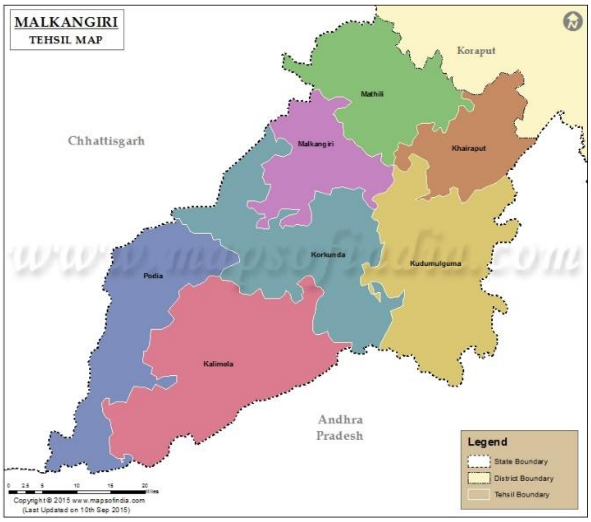


Figure 8: District map of Malkangiri

Malkangiri district is one of the Southern located districts in Odisha. It lies between 81°22′ to 82°25′ Longitude east and between 17°40′ to 18°43′ latitude North. It is bounded by the Chhattisgarh State in North, Andhra Pradesh in South, Chhattisgarh in the East and Koraput district in the west. The district has an area of 5791sq. km and 6.13 lakhs of population as per 2011 census. The district accounts for 3.72 % of the state territory and shares 1.46 % of the state population. The density of population of the district is 106 per sq. km as against 270 persons per sq.km of the state. It has 1055 villages (including 60 uninhabited villages) covering 7 blocks 7 Tehsils and 1 Sub-division. As per 2011 census the schedule caste population is 138295 (22.6%) and schedule tribe population 354614 (57.42%). The literacy percentage of the district covers 48.5% against 72.9 % of the state.

Malkangiri district is named after its headquarter town, Malkangiri. During formation of Odisha province in 1936, Malkangiri was a Taluk of Nabarangpur sub-division of Koraput province in Odisha. The present Malkangiri got its identity as an independent district due to reorganization of districts of Odisha with effect from 2nd October 1992. The district is sparsely populated with not much of a difference between males and females. Almost the entire district district is a vast dense jungle with few populations residing in urban areas. The district is divided into two distinct parts the eastern part is covered with steep ghats, plateaus and valleys, inhabited by primitive tribes, notable among them are Bonda, Koyas, Paraja and Didayi.

Figure 1:- Map of Malkangiri District

Malkangiri is one the border districts of Odisha. It touches the border of Andhra Pradesh and Chhattisgarh. It is believed that the place derived its name from the word 'Malyaratnagiri' in Valmiki 'Ramayana'. It is here that Rishi Valmiki was enlightened with the view to script the epic "Ramayana". May it be the river 'Tamasa', the Shiva Linga or the Pandavas' sword being worshipped by the Koyas tribe, the district seems to be well connected to its roots.

The district consists of only one sub-division namely Malkangiri and the district is divided into 7 Tehsils namely Malkangiri, Chitrokonda, Motu, Mathili, Khairiput, Kudumulguma and Kalimelaalong with 7 Community Development Blocks.

4.4.1 Climate

The climate in the district is generally cold during winter and hot in summer with temperature ranging from 13^{o} to 47^{o} Celsius. The average annual rainfall is about 1700mm. Relative humidityis generally high especially in monsoon and post monsoon months. During rainy season, most of the areas of the district become swampy. Being in the fringe of Eastern Ghats ranges, the south western monsoon sets in it a little bit earlier. The forests have great influence on its climate. The district has a subtropical climate. South west monsoon is the principal source of rainfall. Rainfall pattern is uneven and erratic. The average annual rainfall gradually increases from South Westernto North Eastern parts of the district. The average annual rainfall varies from 994.05 mm to 1809.53 mm. The agricultural definition of drought takes into account the negative departure of seasonal rainfall from the mean seasonal rainfall. A perusal of the frequency of occurrence of drought indicates that mild to normal drought condition prevails in February. Maximum temperature rising up to 44^{o} Celsius is observed during May. In the summer months of April and May, hot winds from the west are generally experienced in the afternoon. December is the coldestmonth with lowest temperature during winter being 11^{o} Celsius. Monsoon generally lasts from the end of May to October. Occasional showers are received in the month of April, November and December.

4.4.2 Irrigation

The net irrigated area of the district is below 40 % of the cultivable land and in the surveyed blocks it is below 220 i.e. 25 %. The fibre crops are grown only in kharif season, and the irrigated fibre crop productivity is 1.4 times higher than that of rain fed crop. The source of water for irrigation can include surface water sources, ground water sources, and other agricultural and industrial process waste waters. The status of water availability varies over season and quantity depends on different type of irrigation sources in Malkangiri district. Water obtained for surface irrigation from canal through major and medium irrigation projects, minor irrigation tanks, through lift irrigation and from many other perennial sources. Ground water obtained only from open wells and deep tube wells.

4.5 Rayagada

Rayagada district is located between 1900’ and 19058’ north latitude and 82°05’ and 84°02’ east longitude in the southern part of Orissa. It is bounded by Gajapati district in the east, Koraput andKalahandi districts in the west, Kalahandi and Phulabani districts in the north and Koraput and Srikakulam (Andhra Pradesh) districts in the south. According to local people, the name Rayagada has been derived from ‘Raya’ means rock, ‘gadda’ means deep holes, which

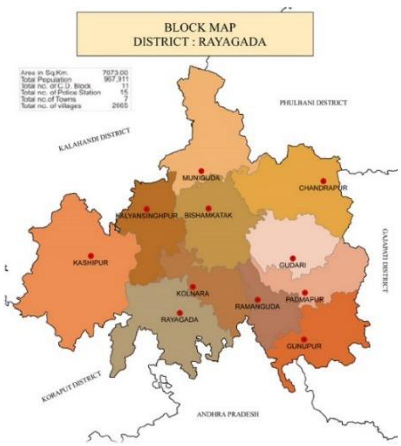


Figure 9: District map of Rayagada

signifies deep holes in the rocks. The history of the district is very much covered within the history of erstwhile Koraput district, from which it has been carved out during 1992. The district bounded by Kalahandi and Kandhamal districts in the North, Srikakulam district of Andhra Pradesh and Koraput district in South, Gajapati district in the East and Nabarangapur and Kalahandi districts in the West. Rayagada district came into existence on 2nd October 1992 consisting of Rayagada and Gunupur Sub-divisions of undivided Koraput district.

For the convenience of revenue administration, the district is divided into eleven tehsils namely, Bissamcuttack, Gunupur, Rayagada, Kashipur, Muniguda, Gudari, Chandrapur, Ramanaguda, Padmapur, Kalyansingpur and Kolnara. The developmental works in rural areas are maintained through eleven CD blocks in the district.

The district of Rayagada is constituted by five towns including two census towns and 2,667 villages spread over 11 community development blocks. It has 8 lakh population of which male constitutes 49.31% and females 50.69 %. The area of the district is 7073 sq. km and thus, the population density works out to be 118. The sex ratio (females per 1000 males) works out to be 1028 considering the total population of each sex and that of the population.

4.5.1 Climate

The climate of the district is typically tropical to subtropical with three distinct seasons e.g. summer, winter, and monsoon. December is the coldest month with mean daily average temperature of 20^{o} Celsius which reaches a maximum of 42^{o} Celsius in May. The rain fall in the area is mostly from the south west monsoon lasts from middle of June to October. The average annual rainfall varies from 1030.21 mm to 1569.50 mm.

4.5.2 Irrigation

Most of the tribal people are engaged in agriculture. Paddy, pulse crops, some oilseed crops along with brinjal, tomato, pumpkin, cabbage are grown in a small scale. There are no Major Irrigation Projects in the district. One Medium Irrigation Project namely Badanalla situated in Padampur Block designed to cater irrigation to an ayacut of 9874 ha is in Padmapur, Gunupur, Gudari and Ramanaguda Block. As per Rayagada District Irrigation Plan, 11 different Blocks designed to cater irrigation to an ayacut of 24621 ha. Similarly, 1010 Nos. of Lift Irrigation Points in all the Blocksdesigned to cater irrigation to an ayacut of 19243 ha. Further to supply irrigation to designed ayacut of 2870 ha in Gunupur Blocks Mega Lift Irrigation Project is taken up. As such Irrigation to a total Designed Ayacut of 56.608 ha of the cultivable area is provided through Irrigation Department.

Chapter 5
Use of technology for data collection and monitoring

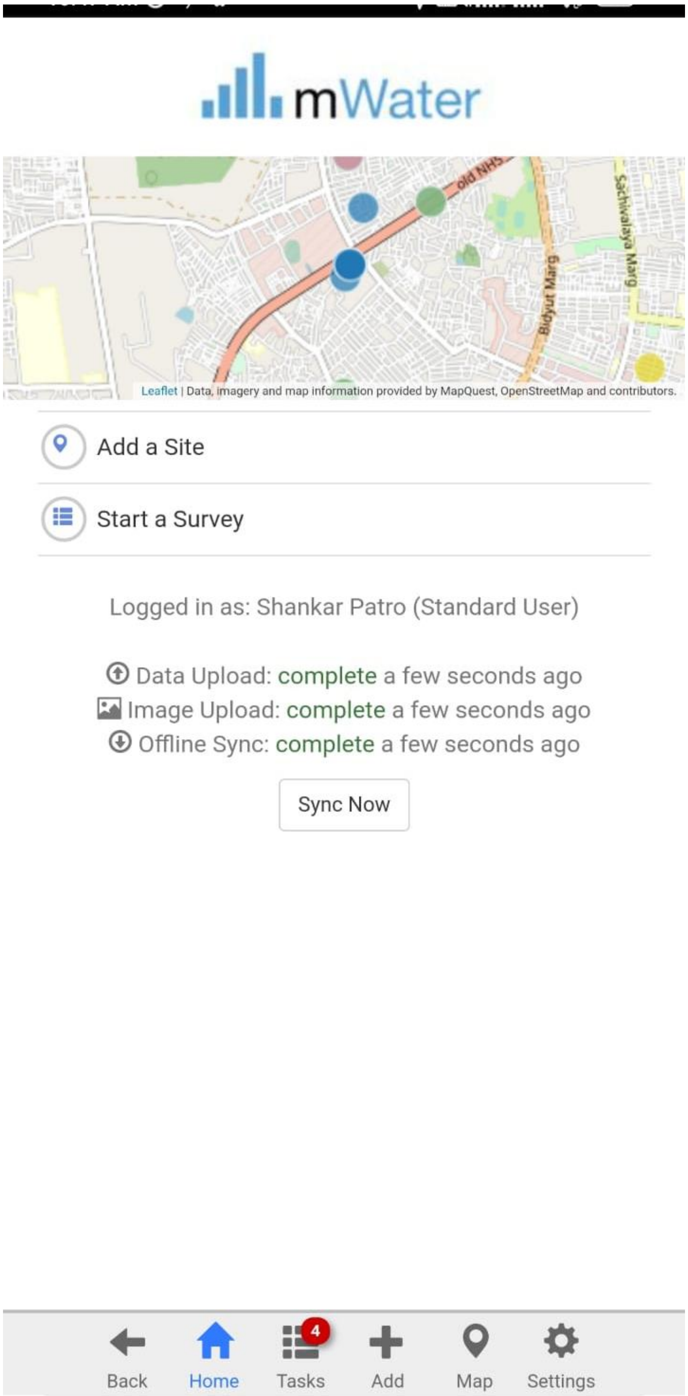
An online platform was used for collecting & monitoring data. To minimize the time for data collection, storage and visualization a Mobile Survey Tools (MSTs) was used. The process of collecting data no longer results in piles of paper on desks and walls of charts; instead, it is collected, collated, analyzed and responded to in real-time. Due to online data collection, all the data has been brought under one umbrella and monitoring becomes easy.

Needless to mention that information and communications technologies (ICTs) such as mobile survey tools (MSTS) facilitate field-level data collection to drive improvements in national and international development programs. MSTs allow users to gather and transmit field data in real-time, standardize data storage and management, automate routine analyses, and visualize data.

The online survey and data collection process is a very effective framework to examine & monitoring the database. To conduct a smooth and quality-based survey the study team used ‘ mWater’ application portal jointly developed by the Ministry of Tribal Affairs (MoTA), Govt of India and UNDP. mWater’ mobile application is simple to use and designed in such a manner that it can work without any internet access. The designed survey questionnaire in the application is used in the project to procure data.

5.1 Methodology & Process involved in the mWater application: -

mWater application is one of the good and user-friendly mobile survey tools and to starts with the application one only need the mobile phone. The step wise process involved in the survey tool is given below with the image illustration.



- mWater portal is designed to collect, store and analyze the data related to water /spring etc.https://portal.mwater.co/#/ :- This is the link to explore or visit the site.
- After clicking the above said link, the mWater home page will appear.
- The same can be used on the mobile phone through mWater apps which is available in Play store.
- One can collect and store the data at nonetwork zone and the same data will synchronize once the enumerator resumes back to network area.
- In order to collect and upload the data,the enumerator should use his/her login credentials. Once the account is created, authentication link will be sent to the administrator (Mr. Ashutosh Bhatt) which will be approved.
- Once the Login ID is approved, the enumerator can use it for survey and data collection.
- There are two sections involved in the data collection process i.e.

    i. Add a Site

    ii. Start a Survey

- After downloading login with your login credentials and press the ***sync now*** option.

After login, it shows your ID as shows logged in as "XXXXX". After Sync now click on the Add a Site option to start the survey	After that need to press the 'SYNC NOW' to synchronize all data collection format to the login id. After Sync now click on the Add a Site option to start the

ADD A SITE

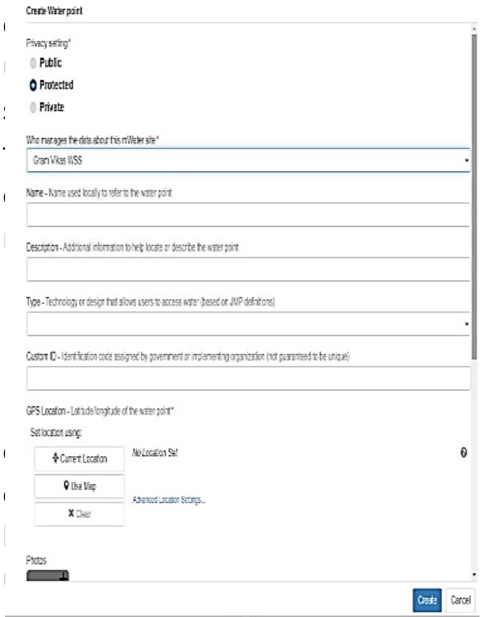
i. Now we can start the survey by clicking the option "Add a Site".

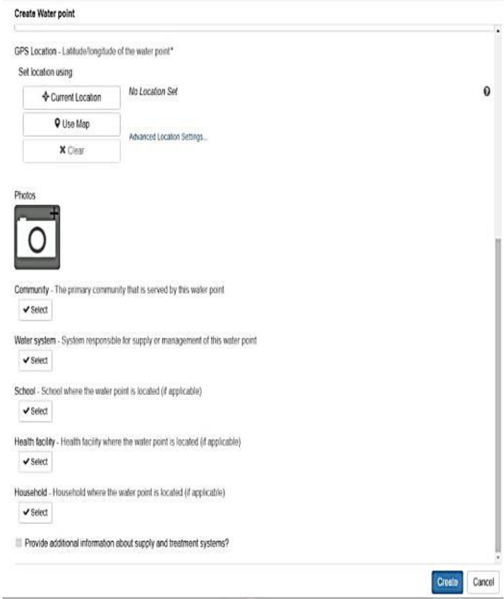
ii. After clicking on the option below mentioned dialogue box appearand asked to fill up for set of information about the spring.

iii. After that click on water point option.

iv. Next click on protected privacy setting and select option "GramVikas WSS" from the question who manages the data

v. Fill all the information on the field of Name, Description. In the type column select protected spring and go to





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n.

vi. In custom ID column enter "SCSTRTI <Dist. name><Sitename>

vii. Then collect the Latitude/Longitude of the spring usingcurrent location option

viii. Once the geo co-ordinate is captured, then go to a photo option for clicking the picture of the site.

ix. After that skip rest of the question and click on create button.

x. After creating the site, we need to go back home page and click on start a survey button

xi. Once the site addition over will move to next option i.e., "Startthe Survey".

Start a Survey

i. After clicking on the start survey button, the information dialogue box appears.

ii. The Research assistants and Community mobilizers will collect the said information.

iii. RAs will collect the information as per designed questionsin the portal.

iv. Once all the information is collected, then finish the surveyby clicking on the submit button.

- The same data can be monitored and vetted and if required field validation can be done.
- The collected data can also be exported in excel format for data cleaning purpose and after finalization the same data has forwarded for final upload on the Ministry site.

5.2 Description of survey tools integrated with mWater application

The survey part is divided into two parts i.e. "Add a Site" and "Start a Survey". One-part deals with the basic information along with location of site and the other part gives information about spring, water quality, discharge, land scenario etc. The details of each tool are given below:

Table 5: Description of survey tool integrated with mWater application

1. Add A Site	
Questions	**Description**
Privacy Setting (Public / Protected/Private)	This option refers to the creation of water pointsite as protected so that the developers have the right to access the information and authorizeothers to view the data.
Who manages the data about this mWater site?	Gram Vikas WSS has developed the site and manages the data on this portal. So while entering the data in this field we choose the "Gram Vikas WSS".
Name (Name used locally to refer to the waterpoint)	This column is for putting the local name of the spring which is usually called by the local peoplearound the spring.
Description (Additional information to help locate or describe the water	This is additional information about the water point/ spring site so that one can easily locate the data. The investigator will

point)	collect the data of any landmark provide description of distance of spring site from village etc.
Type (Technology or design that allows to access based on JMP definition)	Type is referring to the category of water inventory survey i.e., the study is about spring so investigator will select "protected spring"from different options.
Custom ID (Identification code assigned by a government or implementing organization)	This is a unique ID created for each and every spring collected on the basis of implementing organization. So we have developed a ID format i.e. "SCSTRTI<District name><Site Name>.
GPS Location (Set location using currentlocation)	This option is for collecting live location of the spring for geo tagging of the collected spring. The latitude and longitude value is collected.
Photo	Photographs of spring is also collected while doing the survey. The option is inbuilt in the survey tool for collecting photographs.

2. Start A Survey	
Select Site	This site is created at the time of "add asite" and that site will select here for collecting other information related to this site.
Time of measurement	This field records the information of the survey time and date. This is the auto-collected information.
Type of water sources (Dug well / Spring)	As this study is all about the identification of perennial spring, so spring option is selected form the option
Local name for water point	The spring name was given by local people or villagers
For how many months is this water available?	Some springs have water availability throughout the year and some have for few months. This input gives idea about the water availability and on the record, it is easy to identify whether the spring is perennial or not.
How old is the water point (in years)	It gives an impression approximate age of the springs.
Name of the Village / Habitation?	The enumerator will write the name of concerned village name in which the identified spring is located

Gram Panchayat	The enumerator will write the concerned panchayat name in which the identified spring is located.
Block	The investigator will write the concerned block name in which the survey is going on
District	The survey districts will be included here.
Is this water potable (Yes / No)	This field is about the collection of information of the spring water behavior whether it is used for drinking or not. If not, one more option is attached which is the reason for not being potable and a couple of response is given against the query.
Ownership of water point (Private/Community/Village/Shared/ other specify)	This question gives the sense of ownership of the water point.
Was any watershed activity undertaken in the area before? (Yes/No)	If yes selected then proper description is given with this i.e. what is the activity like checkdam, gully plugging, LBCD, etc.
What is the water point being used for? (Piped water supply system/Irrigation/Drinking water accessed at source itself and not enough through PWSS/other specify/not being used or abandoned specify)	This option gives information about the purpose of spring water

SPRING WATER DISCHARGE MEASUREMENT	
Is the discharge measurable? (Yes/No)	Water discharge gives the clear picture aboutthe quantum of water available in that particular discharge point.
If yes, then the discharge is measured using standard equipment provided by Gram Vikas?(Yes/No)	If yes comes then for measuring discharge some equipment is required and that equipment was purchased by the SCSTRTI. Then put no in the field as measuring kits has not been provided by Gram Vikas.
Size of the container used for discharge measurements (in milliliters) for 1 liter write 1000 and so on.	2 liters of beaker used for discharge measurement.

Discharge measurement - Time taken to fill acontainer - Trial 1/Trial 2/ Trial 3	There are three rounds of trial doing for measure the water discharge quantity and after that final discharge per minute, data is calculated by the software. In this trial, we have to place 2 liters of beaker under the water emitting source and collect water thrice and record thrice. This will also calculate the average water discharge by the source point.
Please take a photo of the discharge measurement.	During the discharge measurement activity,the investigator will capture the live photograph.
Is there any infrastructure constructed at the source? (Check dam/ Intake well for drinking water/Guard wall for protection/ Pond/other specify/No infrastructure near the source)	This option gives a sense of insight infrastructure development scenario. The question has given some possible option for the question and if other than that comes and it would be filled under other specific option.
Please add photographs of infrastructure	Also capturing the photograph of any infrastructure there.
Is there any vegetation cover in the catchment area? (Trees-forest type/Trees-horticulture type/Shrubs and mainly weed growth / Barren or sparse vegetation cover)	Mapping of vegetation cover in and around the spring area i.e. in spring catchment area.
Please take a picture of the vegetation coverage?	Photograph has also taken against the response.
Are there other villages in the same catchment area - Uphill and Downhill? (Yes/No) If yes, uphill, downhill, both uphill & downhill	This question is about the other villages located around the catchment area of spring in both the uphill and downhill.
Does the catchment area around the source belong to the same village?	This is a mapping catchment area and village.
Visible features near the water source? (Fractured Rocks/Loose soil deposits/Water source emitting at the foot of the trees/other specify/No features visible)	There may be a chance of having some features nearby the spring source like rocks, water coming out from the foot of trees or emerges from the loose soil etc. accordingly out of given option answer should be given.

WATER QUALITY PARAMETERS	
• TEMP: Temperature of water recorded using tracer kit (Deg Celcius). • pH: pH of the water sample from thesource • TDS: TDS measured using the tracerkit. • EC: Electrical Conductivity measuredusing the tracer kit	Water quality parameter is also one of the components in this study and for collecting data a set of instruments was used. These data was collected to ascertain the quality of water i.e. whether it is drinkable or not.
General comments about the water point, if any	If any other observation comes during the field work, then the investigator put that in the field.

5.3 Application of GIS and Remote Sensing technology in the survey

In order to identify, categorize and map the perennial spring potential zones in the project area, a comprehensive analysis was done by taking various map composites for integration and evaluation based on different criteria. An integrated analysis was carried out using remote sensing data and GIS technology. The study considers GPS survey, stream order analysis, elevation, slope, LULC and hydrogeomorphology as principal parameters for delineating perennial spring zones. The data & tools used to identify perennial spring are as following:

- Toposheet of the project area
- Satellite Imagery i.e., DEM/LISS-III
- GPS survey
- Geo tagging of perennial springs

The methodology involves preparation of hydrological map using toposheet &IRS-P6 LISS-III satellite imagery and also ASTER (DEM) and field observations also taken as reference for the study. Detailed field checks have been carried out to confirm the observations. Information layers such as elevation & slope structure, drainage density, land use have been generated for further investigation. In the study satellite data have been used for different analysis which is described below.

5.3.1 Digital Elevation Model / Elevation

Cartosat Digital Elevation Model (DEM) is utilized to get the elevation information over the entire basin and to delineate the different stream network. Cartosat-1 is a unique stereoscopic mission with the capacity of acquiring along track stereo images with fixed B/H ratio. The satellite was launched aboard PSLV-C6 on May 5, 2005 from SDSC Sriharikota by Indian Space Research Organization (ISRO). Cartosat-1 data is used widely by National and International community for applications related to infrastructure, urban development, forestry, watershed analysis etc.

The DEM data is distributed by National Remote Sensing Centre (NRSC) through its portal Bhuvan. Spatial resolution of the DEM is 30 m. DEM of the entire state is shown in given below figure. On the basis of homogeneity, continuity and physiographical characteristics, Odisha has been divided into five major morphological regions: the Odisha Coastal Plain in the east, the Middle Mountainous and Highlands Region, the Central plateaus, the western rolling uplands and the major flood plains.

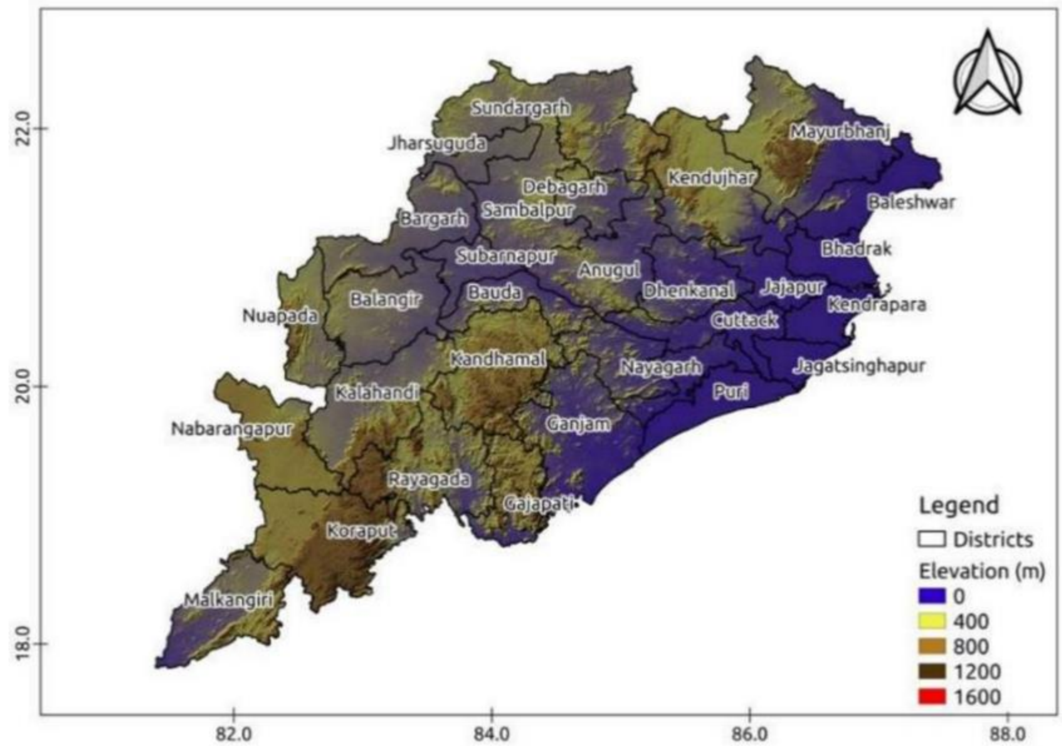


Figure 10:- Digital Elevation map of odisha

DEM is also used to generate the slope and elevation of each identified springs and accordingly its further land development activity purposed prior to different parameter taking into consideration. The stream order network map has been also derived from the DEM and the processof getting the stream order has start with putting the Cartosat-1 DEM in ARCGIS software. Natural flow routes and their charging sub-catchments were delineated using GIS and outlets were identified in the project area. The Cartosat DEM is filled by identifying and removing the sinks (Sinks are low elevation areas in digital elevation models (DEMs) that are completely surrounded by higher terrain) if present. Based on the direction of the steepest descent in each cell, flow direction is measured.

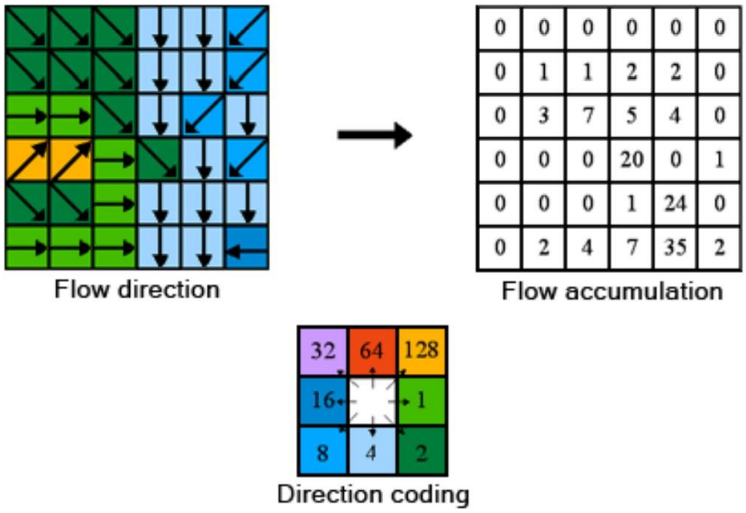


Figure 11:- D8 algorithm for calculation of flow direction

The D8 flow method is adopted for the computation of flow direction. In this method, the flow is from each cell to its steepest down-slope neighbour. The output of the Flow Direction tool run with the D8 flow direction type is an integer raster whose values range from 1 to 255. By providinga threshold value, the pixels contributing to that pixel are delineated and identified streams. The delineated stream-network was overlaid with the Google Earth images, LULC and Slope maps to visualize surveyed springs.

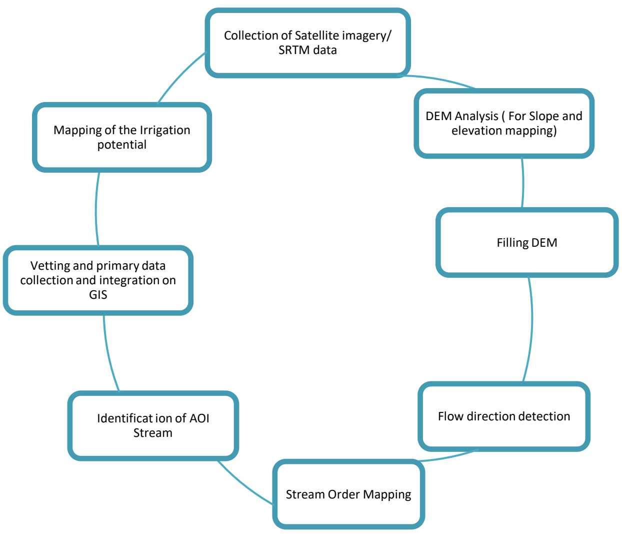


Figure 12:- Process flow for stream network analysis

5.3.2 Land Use and Land Cover

Land use land cover (LULC) describes the appearance of the landscape and is generally classified by the amount and type of vegetation, which is a reflection of its use, environment, cultivation and seasonal phenology. Land cover is an essential as it influences run-offs.

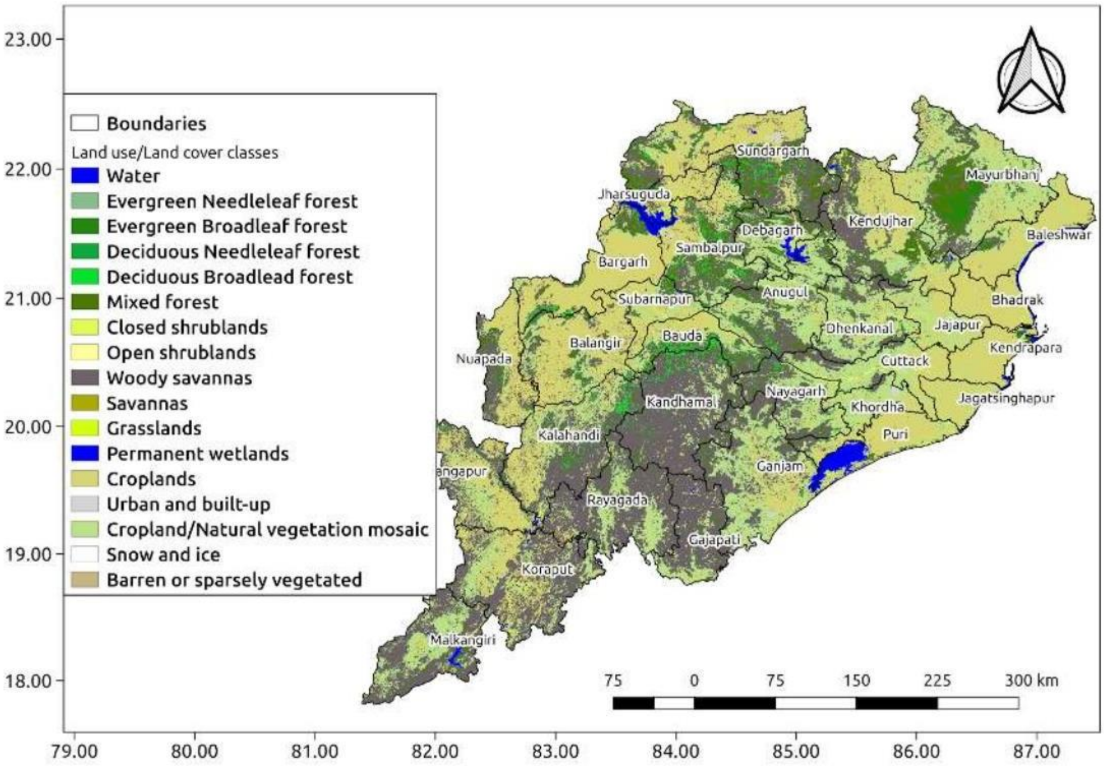


Figure 13:- Showing land use land cover map of Odisha

Chapter 6
GIS outcome, Socio-cultural importance and status of springs

The study aimed at identifying and mapping of potential perennial spring's zones in 5 TSP districts of Odisha with respect to its irrigation potential, domestic and other use using Remote sensing and GIS technology. Zones of water potentiality were mapped integrating various information layers in GIS environment which eventually helped stream network modelling to arrive at the final outcome. Hydrological mapping units such as slope, elevation, aspect, stream and other environment unit such as land use land cover were mapped to superimposing different layer information on each other. Eventually water potential zones in the project districts were mapped and categorised them on the basis of their discharge volume and land development activity depending on elevation and slope.

It is matter of fact that growth of population and their ever-expanding needs put lot of pressure on natural resource system such as land, water, forest, etc. which are very finite in nature. The human induced land utilization practices especially urbanization, industrialization, mining, grazing, and deforestation, unscientific agricultural practices etc. are mostly unsustainable and further making the availability of these resources scarce.

Among these resources potable water and water for agriculture and allied activities from groundwater / surface water is identified as a critical factor of any development endeavor. While the existing groundwater resource continues to deplete, the efforts are always on for finding, exploring and tapping the new sources. The objective of groundwater exploration is to locate aquifers capable of yielding water of suitable quality in economic quantities for drinking, agricultural and industrial purposes. Information pertaining to geology and field reconnaissance represents an important first step in any groundwater investigation. Traditionally groundwater identification studies are being carried out through geological and geophysical investigations by means of electrical conductivity, resistivity, drilling and other techniques. Similarly, Application of Remote Sensing and GIS technology is highly effective for quickly ascertaining hydro- morphological conditions and evaluating groundwater potential of a region. Remote sensing data has become increasingly valuable means for understanding geology and geomorphology and for effectively mapping sub-surface water scenario.

Similar studies on various river basins of India were attempted by researchers like Ravi Prakash and Mishra (1993), Mangrulkar et al. (1993). Since these methods are time consuming, tedious, labor and cost intensive, often the data collected through these methods are insufficient and the result often represent partial picture of the groundwater scenario and many a times prove unsuccessful. Application of Remote Sensing and GIS technology is highly effective for quickly ascertaining hydro-morphological conditions and evaluating groundwater potential of a region. Remote sensing data has become increasingly valuable means for understanding geology and geomorphology and for effectively mapping sub-surface water scenario. Sarada river is one of the prime sources of water for Visakhapatnam district in the state of Andhra Pradesh. The region is predominantly agricultural and known for cultivating commercial crops like sugarcane and paddy which are high water dependent crops.

As described earlier the natural springs or hill streams are life lines of tribal communities living in mountain and forest regions of Odisha and elsewhere. The tribal culture and livelihoods are deeply linked with the natural springs/hill streams, most of them being perennial in nature. The springs find descriptions in tribal folklore, myths and legends. Choice for settlements also depends on the proximity to streams and their water discharge capacities to cater to an estimated population depending on the streams. The perennial springs have vast potential to sustain the tribal agriculture and other land-based livelihood pursuits and hence are valued highly from economic and ecological perspectives. In this context, GIS technology-based survey of the perennial springs of five districts was undertaken to understand the status of springs, their discharge volume and quality of water in term of TDS, electro conductivity, temperature and pH.

6.1 Study Area

The project has extent over the 5 TSP district of Odisha which Sundargarh, Mayurbhanj, Rayagada, Koraput and Malkangiri district. The map of the project district has given below.

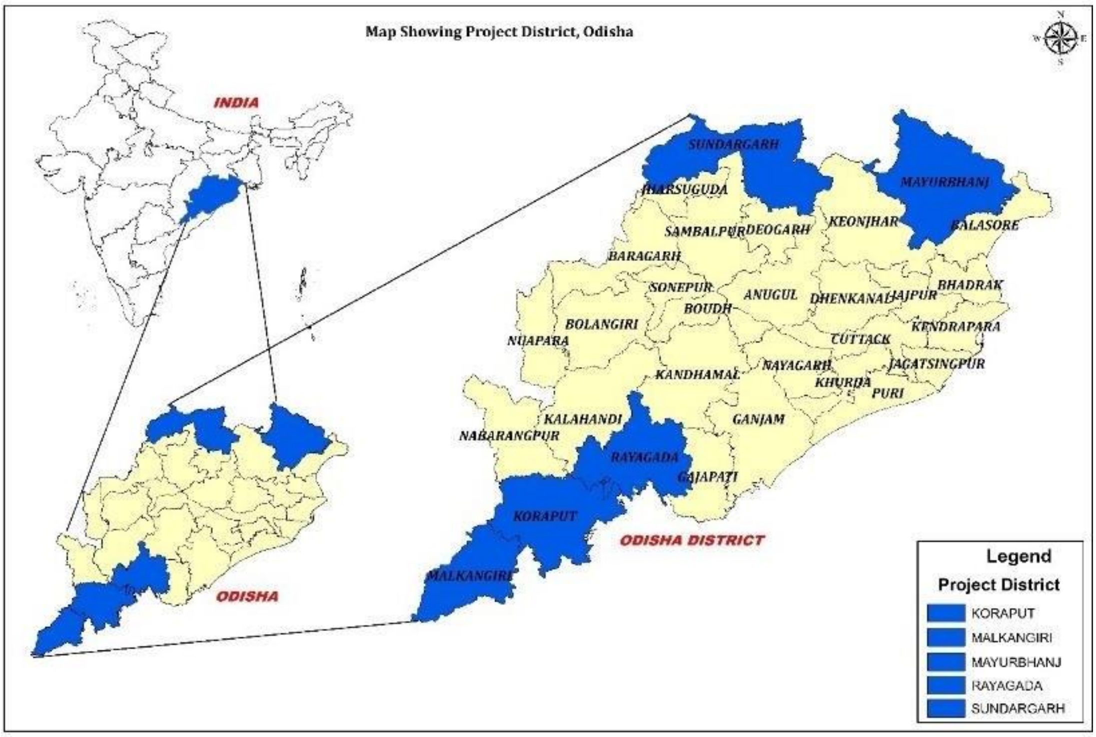


Figure 14:- Map showing coverage of project district

6.2 District and Block wise identified perennial springs

Altogether 688 springs were identified and surveyed in the 5 TSP project districts. In Sundargarh district 147 springs were identified followed by 141 springs in Rayagada, Malkangiri having 136, Koraput 134 and Mayurbhanj is at 130. The details of spring have been presented in the following table and graph.

District	Block	No. of Springs data collected
Koraput	Narayanpatana	16
	Koraput	2
	Nandapur	56
	Similiguda	60
	Sub Total	**134**
Malkangiri	Khairput	97
	Korukonda	26
	Malkangiri	3
	Mathili	10
	Sub Total	**136**
Mayurbhanj	Jashipur	56
	Karanjia	7
	Thakurmunda	67
	Sub Total	**130**
Rayagada	Kashipur	85
	Muniguda	12
	Bissamcuttack	30
	Kalyansingpur	14
	Sub Total	**141**
Sundergarh	Bonaigarh	8
	Gurundia	9
	Lahunipada	130
	Sub Total	**147**
	Total	**688**

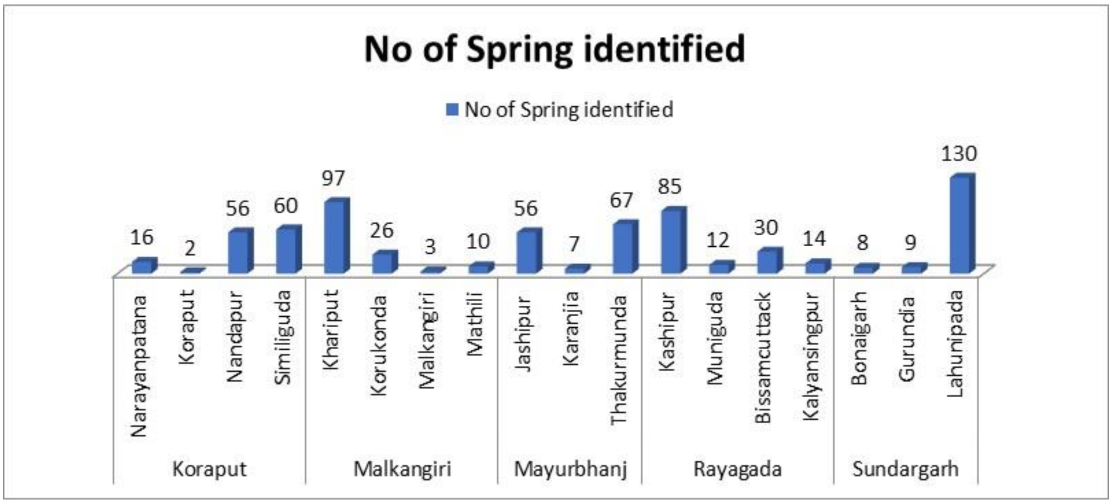


Figure 15:- Showing spring identified from different project districts

All the spring points were geo tagged and latitude longitude measures were collected from the field. The location map was prepared as per geo-coordinate of the springs. The given below map shows the location of all identified perennial springs in 5 TSP districts of Odisha.

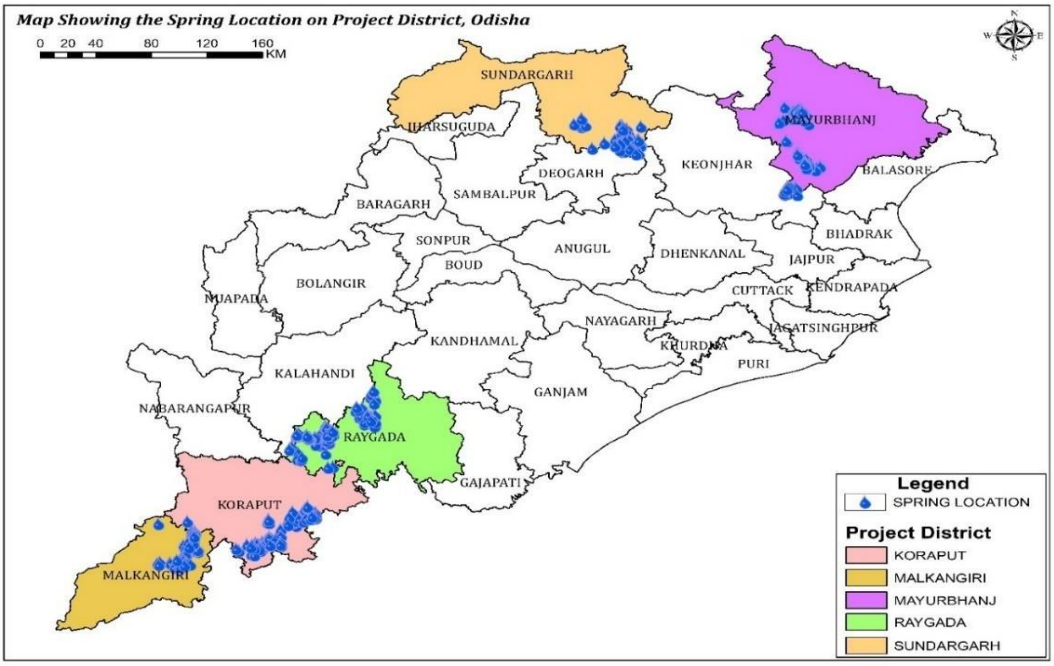


Figure 16:- Map Showing location of identified springs in different project district

6.3 Water potability of springs

Potable water known as drinking water comes from surface and ground sources and is treated to levels that meet quality standard set by the state for consumption. During the study, the team conducted the water quality test by doing PH, TDS & EC through testing equipment.

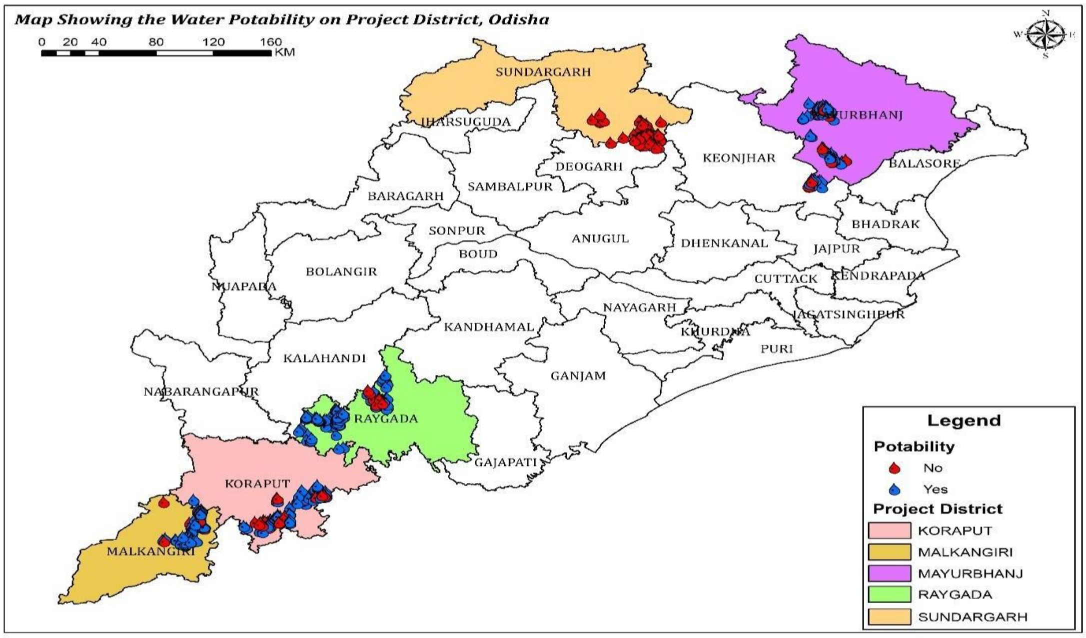
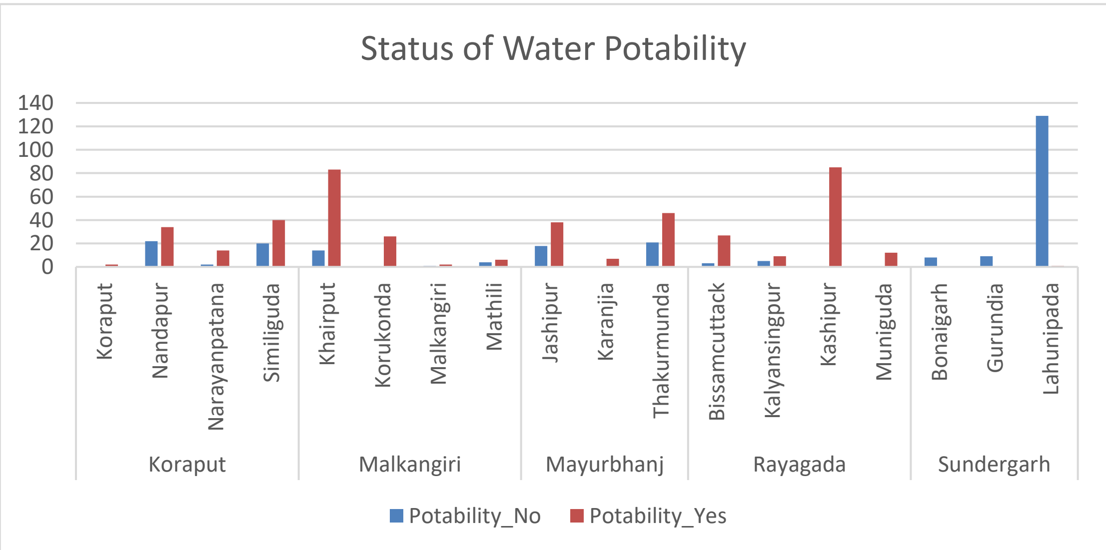


Figure 17:- Map showing water potability status of project districts

Table 6: Status of water potability of different springs in project districts

District	Block	Potability_No	Potability_Yes	Grand Total
Koraput	Koraput		2	2
	Nandapur	22	34	56
	Narayanpatana	2	14	16
	Similiguda	20	40	60
Malkangiri	Khairput	14	83	97
	Korukonda		26	26
	Malkangiri	1	2	3
	Mathili	4	6	10
Mayurbhanj	Jashipur	18	38	56
	Karanjia		7	7
	Thakurmunda	21	46	67
Rayagada	Bissamcuttack	3	27	30
	Kalyansingpur	5	9	14
	Kashipur		85	85
	Muniguda		12	12
Sundergarh	Bonaigarh	8		8
	Gurundia	9		9
	Lahunipada	129	1	130
	Grand Total	**256**	**432**	**688**

It is observed from the study that Kashipur block of Rayagada district has high water potability followed by Khairput block of Malkangiri district and Sundargarh district has highest number of non-potable springs. The major reason for non-potability is bacterial contamination, iron contamination and the community people inhabiting in the vicinity of the spring use the spring water for washing and livestock bathing purpose which leads the water to non potability.



6.4 Spring Usages

The identified springs are of different usages by the neighboring tribal community. People use spring water for drinking, irrigation, livestock rearing, washing, and bathing. Some springs are still not in use as they are distantly located and does not serve any immediate purpose like agriculture. The usage of spring water has been mapped as below

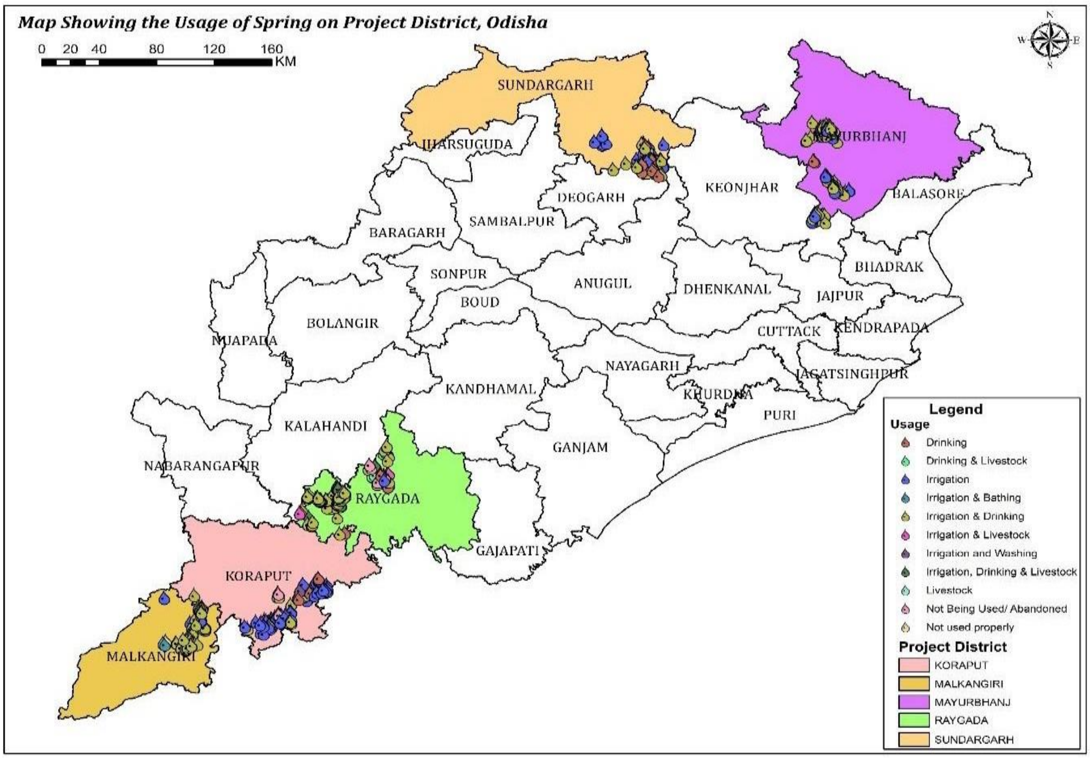


Figure 18:- Map showing usage of spring water across the study area

6.5 District wise GIS outcome of the study

6.5.1 Malkangiri District

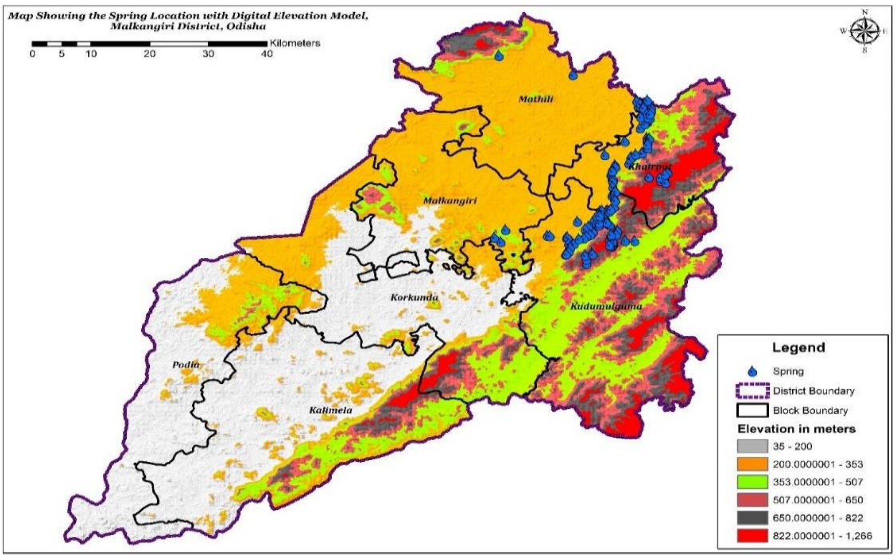


Figure 19:- Digital Elevation map of Malkangiri District

Malkangiri Block

The elevation map of Malkangiri reveals that the district is situated at the minimum 35 meter above mean sea level and maximum of 1266 meter above mean sea level. The whole district is segregated in six ranges in the range of 35-200 meter, 200-353 meter, 353-507 meter, 507-650 meter, 650-822 meter and 822-1266 meter. The maximum springs fall under the range of 200 to 353 meter followed by 822 to 1266 meter, 355 to 507 meter and 650-822 meter. The detailed block wise description is given below with superimposing of stream network.

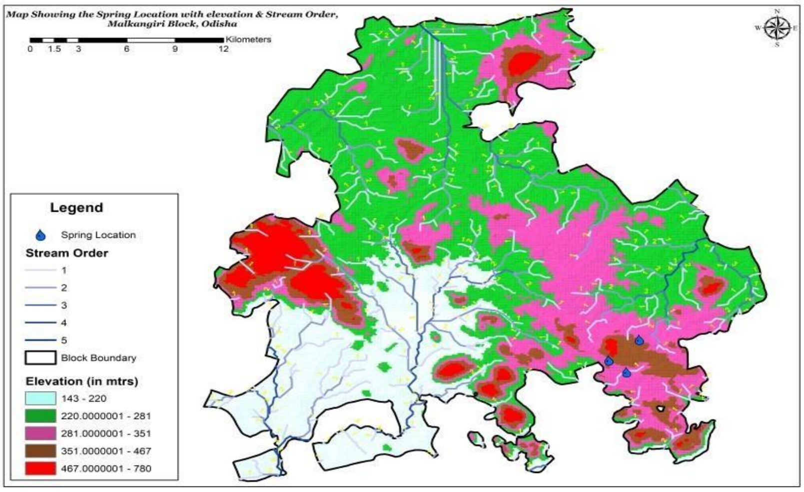


Figure 20:- Map showing spring location with elevation & stream network of Malkangiri Block

Mathili Block

The elevation map of Mathili block shows that the block has lowest point of 211 meter above mean sea level and highest point 1171 meter above mean sea level. All the spring identified in the Mathili block was located in the 1st order of stream with elevation range from 200 meter to 353 meter above sea level. One spring was located at the elevation of 353 to 507 meter above mean sea level. The map has given below for graphical representation of spring with respect to elevation and stream order.

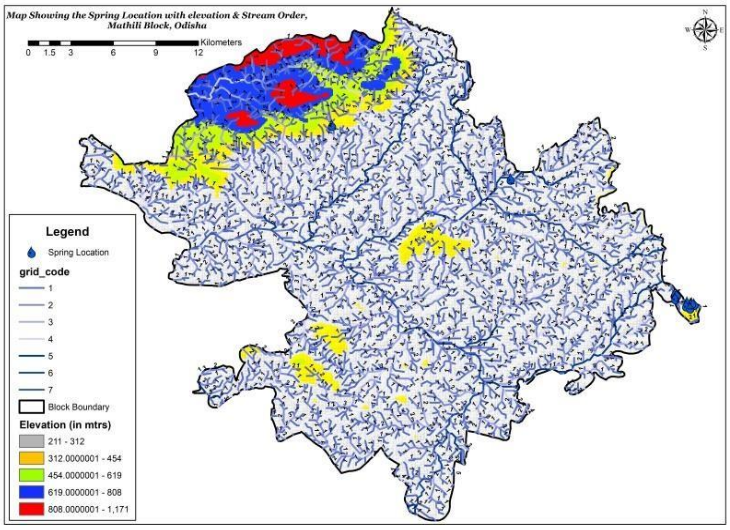


Figure 21:- Map showing spring location with elevation & stream network of Mathili Block

Khairput Block

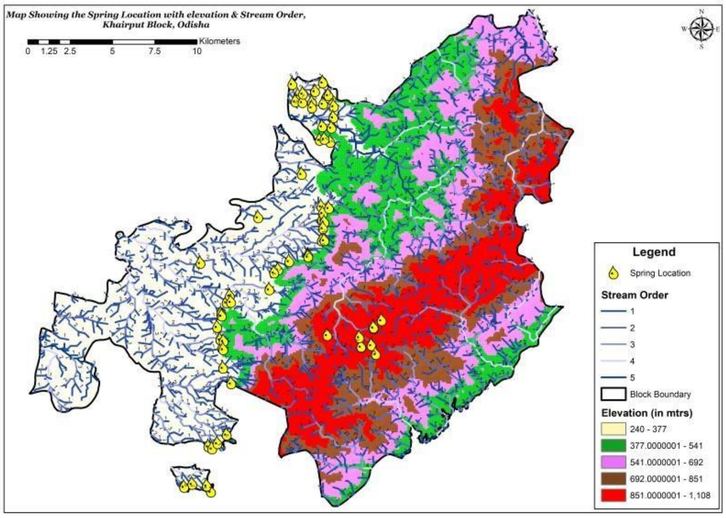


Figure 22:- Map showing spring location with elevation & stream network of Khairput Block

There were 97 springs identified in the Khairput block and the block is located between elevations of 240 to 1108 meter above sea level. All the spring located nearby first order of stream expect 3 springs in second order and 1 spring in third order. The 75 spring falls under the elevation range of 200 to 300 meter above mean sea level, 13 spring in 353 to 507 meter and 9 spring in 822 to 1266 meter above mean sea level respectively. The map given below for graphical representation of spring location with respect to elevation and stream order.

Kudumulguma Block/Korukonda (newly formed block)

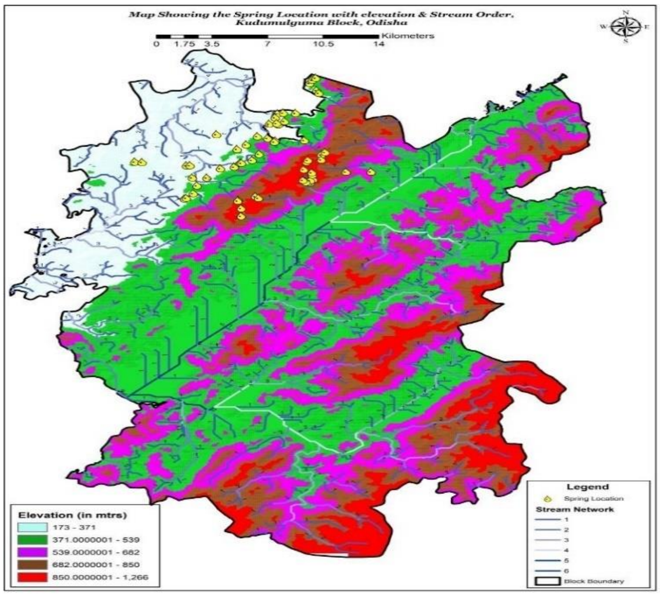


Figure 23:- Map showing spring location with elevation & stream network of Kudumulguma Block

There were 26 springs identified in the block and the block is located in the elevation extended from 173 meter to 1266 meter above mean sea level. All the spring which was identified in the block is located in the vicinity of first order spring. Maximum spring i.e., 13 spring are located in the highest elevation range between 822 to 1266 meter above mean sea level followed by 9 springsin 650 to 822 meter and 4 spring in 200 to 353 meter above mean sea level.

6.5.2 Koraput District

Koraput district lies on a section of the Eastern Ghats and consists of two natural divisions having mean elevations of 915 and 610 meters respectively above the sea level. There are number of mountain ranges and isolated hills that rise out of these table lands. Taking them inorder from north to south the most notable heights are Panchapat Mali (1336.89 mtrs), Karnapadi Dongar (1487.5 mtrs) Meyamali Parbat (1500.30 mtrs) Turia Dongar (1598.78 mtrs), Deomali (1672.56 mtrs), Polamakani Parbat (1585.67 mtrs) and Sirimanda Parbat or Damuku (1415.24 mtrs). The village Pottangi lies at the foot of the last-named Damuku. Deomali, also known as Duhdari, whose twin peaks can be clearly seen from Koraput on any fine day, is the highest mountain peak in the district as also in the whole of Odisha. The given below digital elevation map of the district reveals that the district lies between the range from 129 meters to 1651 meters above mean sea level. The map also shows the location of identifiedperennial spring with respect to elevation.

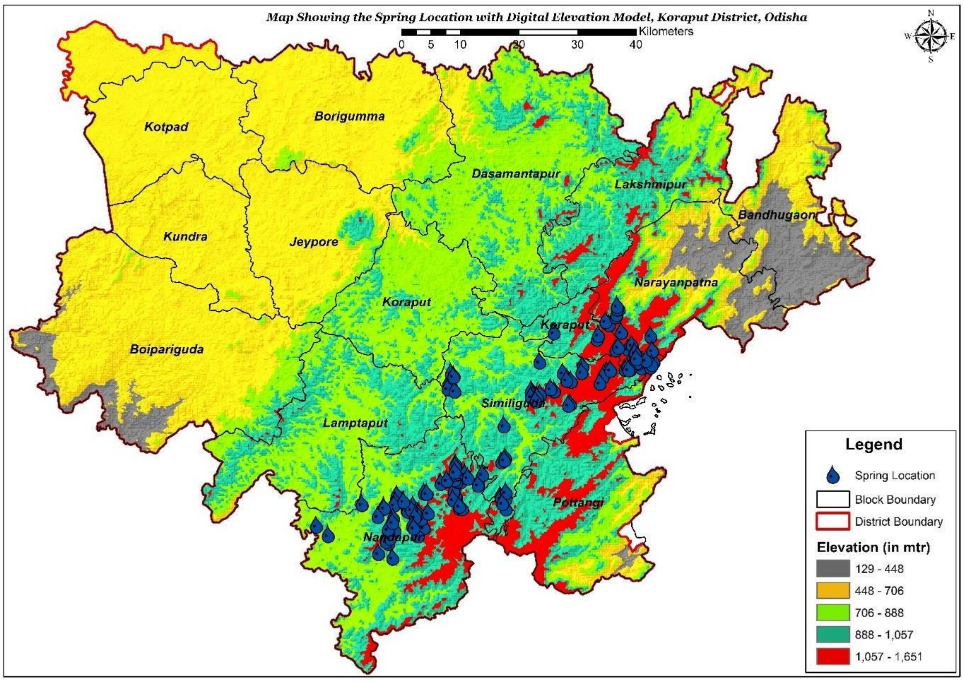


Figure 24: Map showing spring locations with elevation model of Koraput district

The hydrological analysis of the district has been run to get the stream order of the district andon the stream map, spring location is superimposed which reveals the co-relation between spring and stream order. The given below map shows the stream network analysis map of Koraput District.

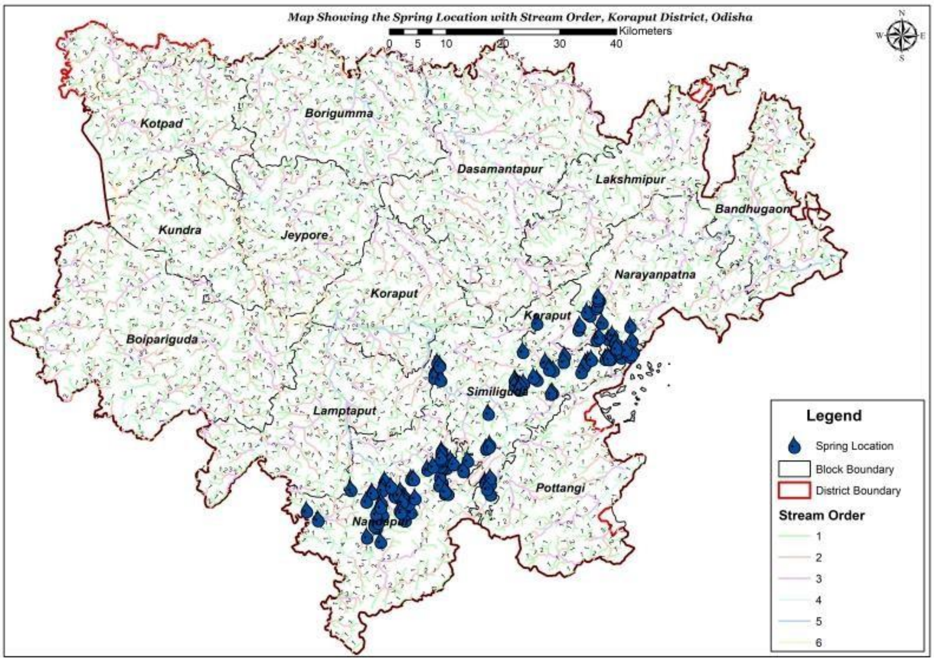


Figure 25: Map showing spring locations with stream network of Koraput district

Nandapur Block

There are 56 perennial springs has been identified in the Nandapur block and it is lies in the elevation of range from 706 meter to 1651 meter above mean sea level. Out of 56 spring 47 are fall in the vicinity of first order stream followed by 6 springs in second order, 2 spring in third order and 1 spring in fourth order stream. The map given below with elevation, stream and spring location.

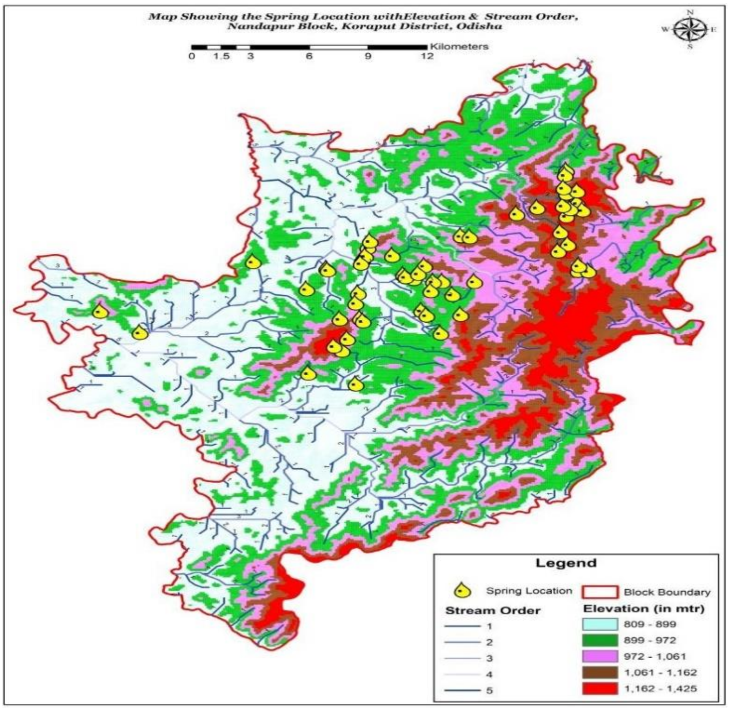


Figure 26:- Map showing spring location with elevation & stream network of Nandpur Block

Similiguda Block

There are 60 perennial springs has been identified in the Simliguda block and it is lies in the elevation range from 706 meter to 1651 meter above mean sea level. Out of 60 springs, 46 are fall in the vicinity of 1st order stream followed by 13 springs in 2nd order, and 1 spring in 5th order stream. The map given below with elevation, stream and spring location.

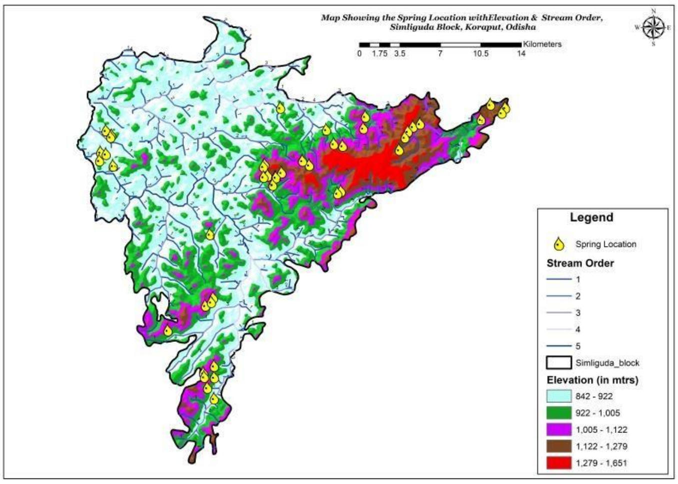


Figure 27:- Map showing spring location with elevation & stream network of Similiguda Block

Narayanpatna Block

There are 16 perennial springs identified in the Narayanpatna block and the block lies between 167 meters to 1531-meter ranges of elevation. Major of the spring falls in the high elevation range i.e., 1057 meter to 1651 meter followed by 888 – 1057 meter above mean sea level range. Stream order mapping has also superimposed in the elevation with spring location and it is found that most of the spring falls under the 1st order stream and one spring in each 2nd, 3rd & 4th order stream. The map given below for graphical representation of the project block.

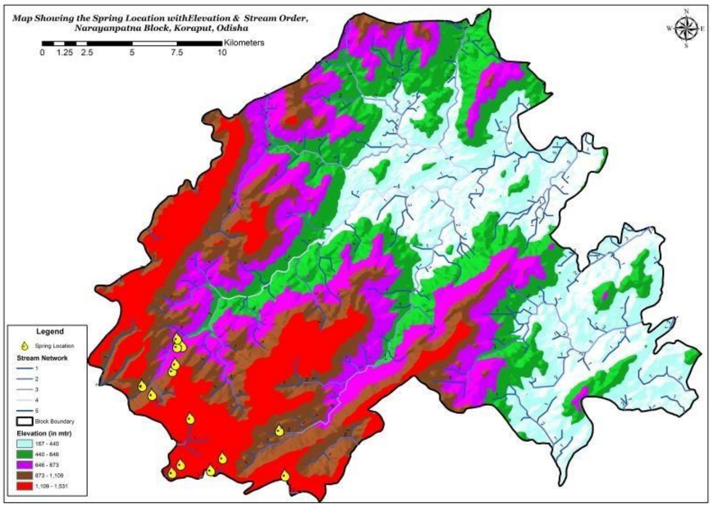


Figure 28:- Map showing spring location with elevation & stream network of Narayanpatna Block

Koraput Block

Koraput Block lies between the ranges of 612 meter to 1495 meter above mean sea level. The spring which is identified in the Koraput block is falls in the elevation from 888 meter to 1651 meter above mean sea level and all are comes under the vicinity of 1st order stream.

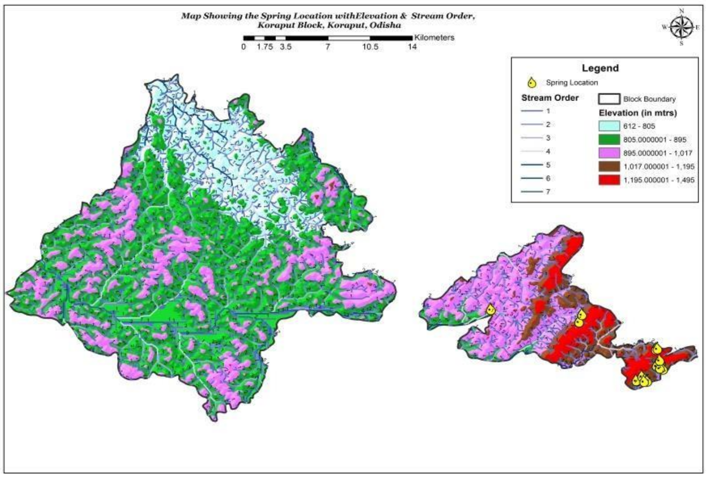


Figure 29:- Map showing spring location with elevation & stream network of Koraput Block

6.5.3 Sundargarh District

Topographically, this district is located between latitude 21 degree 36' N to 22 degree 32' N and longitude 83 degree 32' E to 85 degree 22' E. Out of 17 blocks, 3 block has taken for the research study, and 147 perennial springs has been identified. The district has lowest point of 119 meters mean sea level and the highest point of 1112 meter above mean sea level. The district has spread over the range of 119 meter to 1112 meters of elevation. The elevation mapwith superimposing identified perennial spring is given below. For the purpose of the study three blocks have been covered namely, Bonai, Lahunipada and Gurundia.

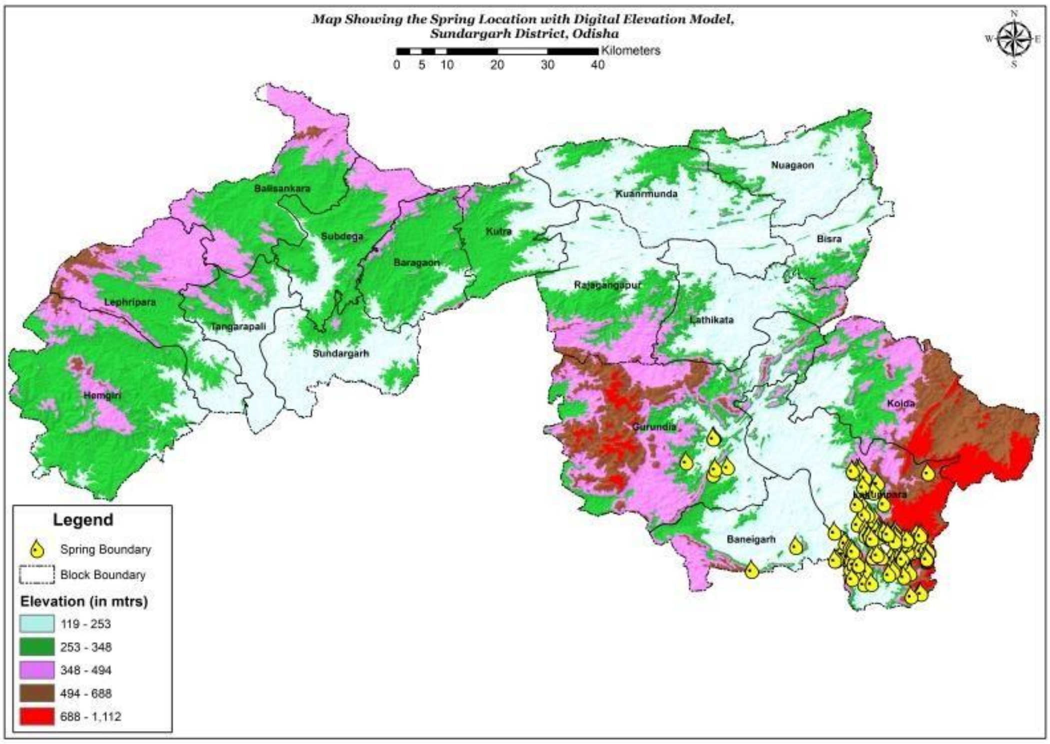


Figure 30: Map showing spring locations with digital elevation model of Sundargarh district

Lahunipada Block

There are 130 perennial springs identified in the Lahunipada block and the block lies between 129 meters to 1057 meter range of elevation. Most of the spring falls in the range of 253-348 meter elevation range followed by 253 – 348 meter & 348 – 494 meter above mean sea level. Stream order mapping has also superimposed in the elevation with spring location and it is found that most of the spring falls under the 1st order stream i.e. 58 springs followed by 46 springs in 2nd order stream, 23 springs in 3rd order and 3springs in 4th order stream. The map is given below for graphical representation of the project block.

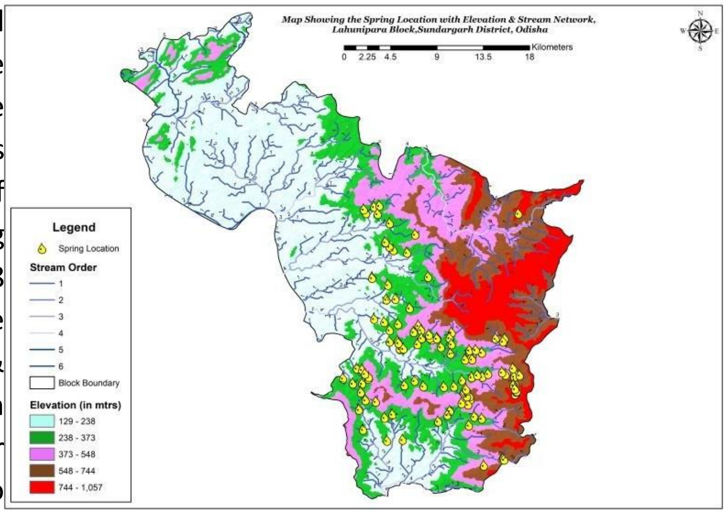


Figure 31:- Map showing spring location with elevation & stream network of Lahunipada Block

Gurundia Block

There are 9 springs has surveyed in the block and its lies between the 139 meter to 814 meter range of elevation above mean sea level. The elevation map of Gurundia blocks revels that the lowest point of the block is 139 meter whereas highest peak of the block is 814 meter above mean sea level. Out of 9 spring 7 springs falls in the 119 meter to 253 meter range and 2 in 494-688 meter range of elevation. All the spring comes under the vicinity of 2nd order stream. The map has given below for graphical representation of the block.

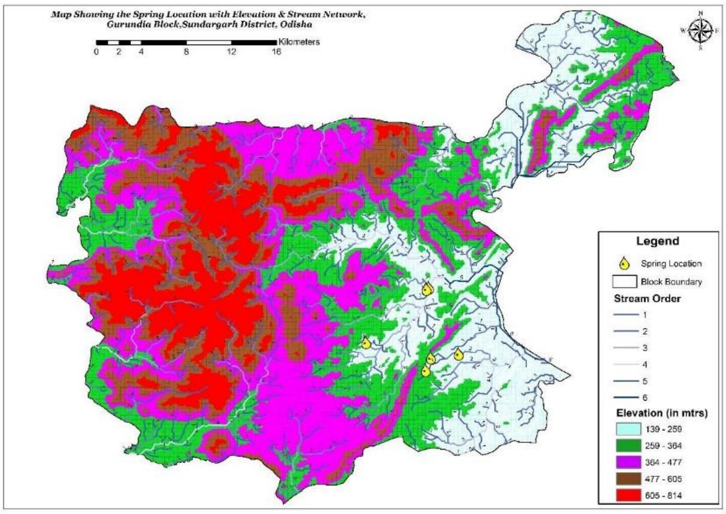


Figure 32:- Map showing spring location with elevation & stream network of Gurundia Block

Bonai Block

The block has lowest point of 119 meter and highest point of 680 meter above mean sea level.There are 8 springs identified in the block and out 8 spring 6 spring transpire in the 119-253 meter elevation and rest 2 are in the 119-253 meter range of elevation above the mean sea level. Most of the spring comes under the vicinity of the 2nd order stream followed by 1st & 3rd order stream.

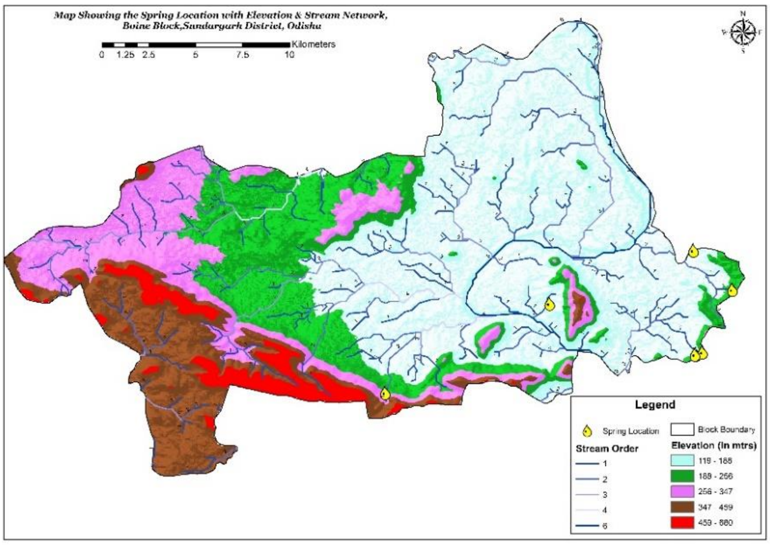


Figure 33:- Map showing spring location with elevation & stream network of Bonai Block

6.5.4 Rayagada District

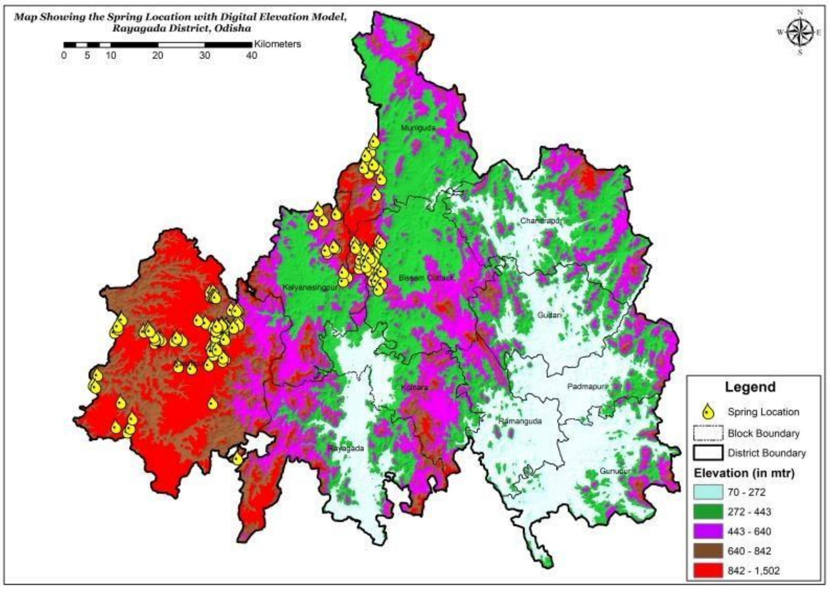


Figure 34:- Map showing spring location over the elevation model of Rayagada district.

Raygada district is situated in the southwestern part of Odisha lying between the north latitudes 18° 54' and 20° 00' N and east longitudes 82° 54' and 82° 02' E. The district covers an area of 7073 sq. km. and is divided into 11 administrative blocks. The elevation map shows that the district has spread over an elevation of 70 meter to 1502 meter above mean sea level. Out of 11 block 4 block been as selected for identification perennial spring and 141 springs has been identified. The spring has geotagged and superimposed with the elevation model to extract the range of elevation to each identified spring and it is observed that the majority of the spring fall under the highest range of the elevation i.e. 842-1502 meter above mean sea level. The study has covered four blocks of the district namely Muniguda, Kashipur, Kalyansingpurand Bissam Cuttack.

Muniguda Block

The block is spread over a wide range of elevation which varies from 237 meter to 1502 meterabove mean sea level. 12 perennials has been identified in the block and all the springs comes under the vicinity of the elevation 443-640 meter expect 1 spring which is in the range of 842-1502 meter above mean sea level. Out of 12 springs, 9 springs is in the vicinity of 1st order stream followed by 2 spring in 2nd order and 1 spring in 3 order stream.

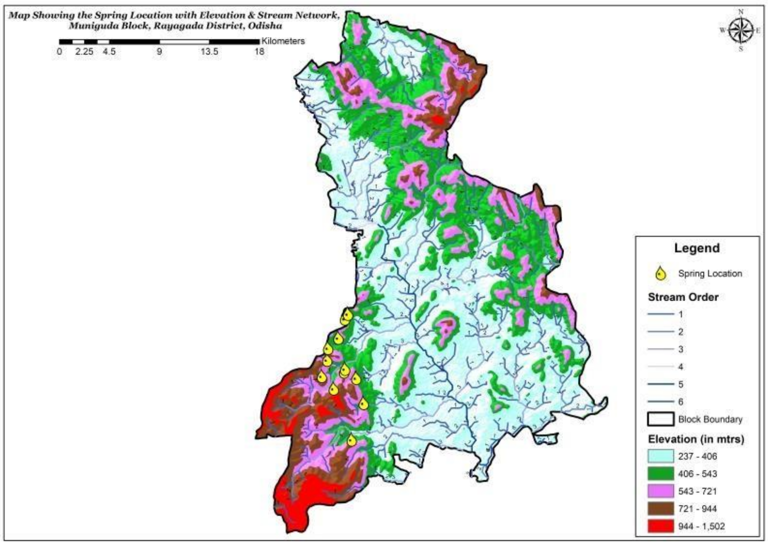


Figure 35:- Map showing spring location with elevation & stream network of Muniguda Block

Kashipur Block

The block is spread over a wide range of elevation which varies from 365 meter to 1276 meter above mean sea level. 85 perennial springs has been identified in the block and most of the springs come under the vicinity of the elevation 842-1502 meter i.e. 54 springs followed by 23 spring in 640-842 meter, 5 springs in 443-640 meter and 3 spring in 272-443 meter above meansea level.

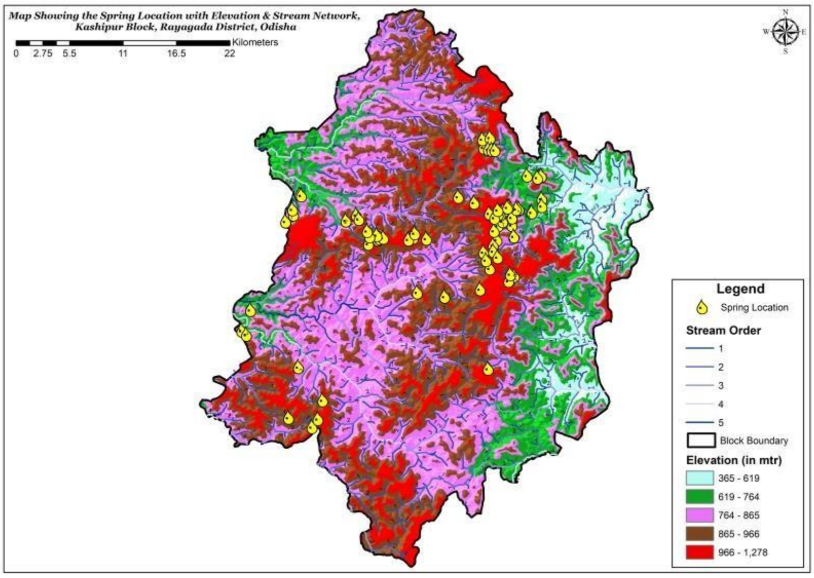


Figure 36:- Map showing spring location with elevation & stream network of Kashipur Block

Out of 85 springs, 63 springs is in the vicinity of 1st order stream followed by 17 springs in 2nd order and 5 springs in 5th order stream.

Kalyansinghpur Block

The lowest point of the block is 246 meters and the highest point is 1340 meters above the mean sea level. There are 14 springs has been identified in the block and 13 springs have found in the vicinity of 1st order stream followed by 1 spring in 2nd order stream. Most of the spring observed in the 443-640 meter range of the elevation followed by 640-842 meter and 842-1502meter range.

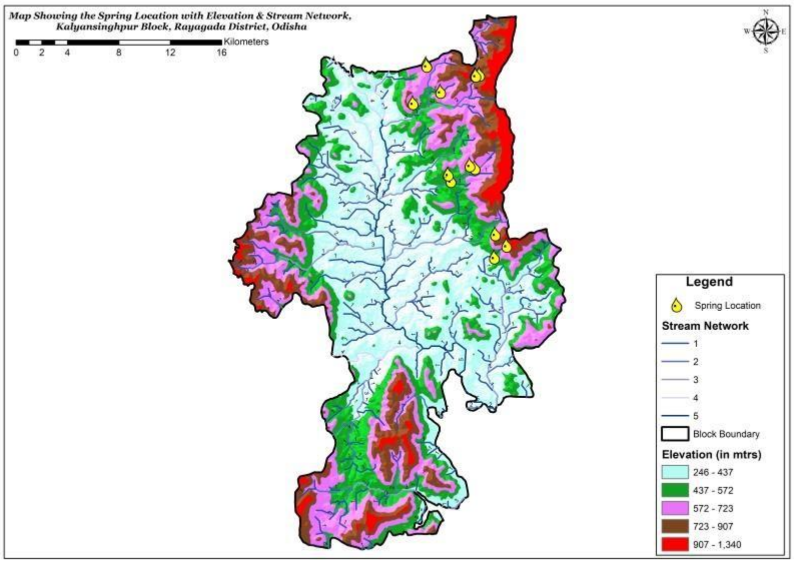


Figure 37:- Map showing spring location with elevation & stream network of Kalyansinghpur Block

Bissamcuttack Block

The block is spread over a range of elevation which varies from 233 meter to 1470 meter above mean sea level. 30 perennial springs has been identified in the block and most of the springs fall under the vicinity of the elevation 640-842 meter i.e. 13 springs followed by 11 spring in 443-640 meter, 2 springs in 842-1502 meter and 1 spring in 272-443 meter above mean sea level. Out

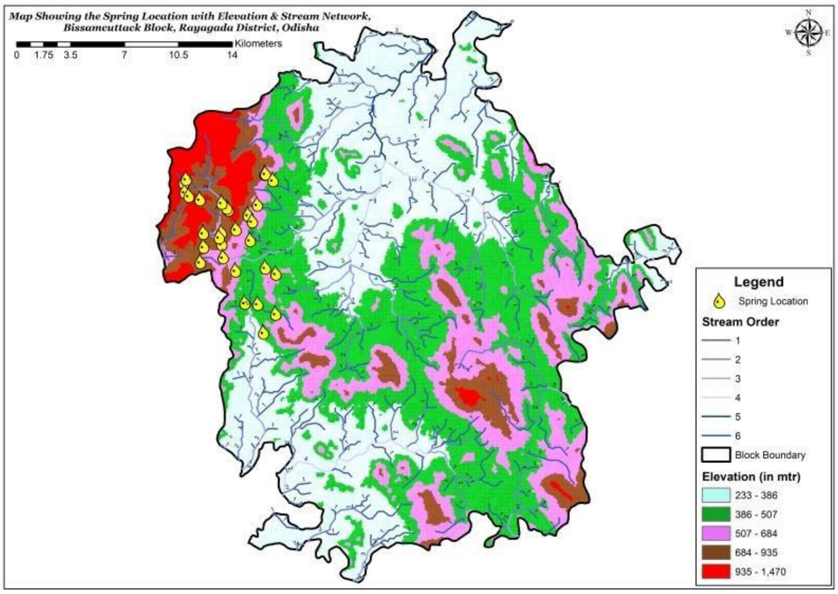


Figure 38:- Map showing spring location with elevation & stream network of Bissamcuttack Block

of 30 springs 21 springs is in the vicinity of 1st order stream followed by 8 springs in 2nd order and 1 spring in 4th order stream.

6.5.5 Mayurbhanj District

The district lies between 21° 16' and 22° 34' North latitude and 85° 40' and 87° 11' East longitudes. The western plains of Mayurbhanj are an extension of the Odisha Plateau. They are mostly flat with small hills and slopes but are at a higher altitude than the eastern plains, the height rising from north to south. The streams here drain into the Baitarani River in Kendujhar or flow into Jharkhand to the north. There are 130 springs has been identified from3 blocks. The district has lies between 163 meter to 1177 meter above the mean sea level of elevation. For the purpose of study three blocks were covered namely Thakumunda, Jashipur and Karanjia.

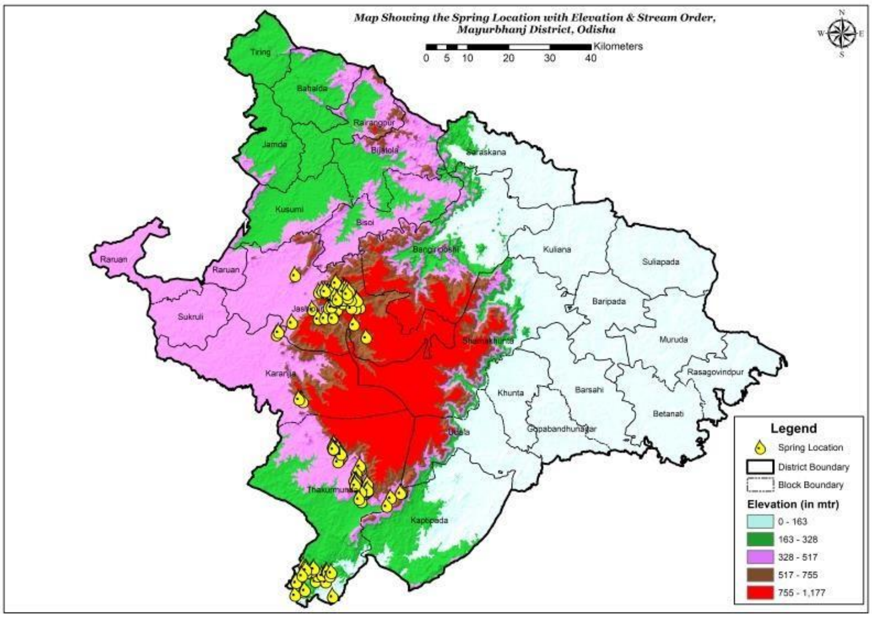


Figure 39:- Map showing spring location with elevation of Mayurbhanj district

Thakurmunda Block

The block is spread over a range of elevation which varies from 47 meter to 1177 meter above mean sea level. 67 perennial springs has been identified in the block and most of the springs fall under the vicinity of the elevation 328-517 meter i.e. 34 springs followed by 15 spring in 163-328

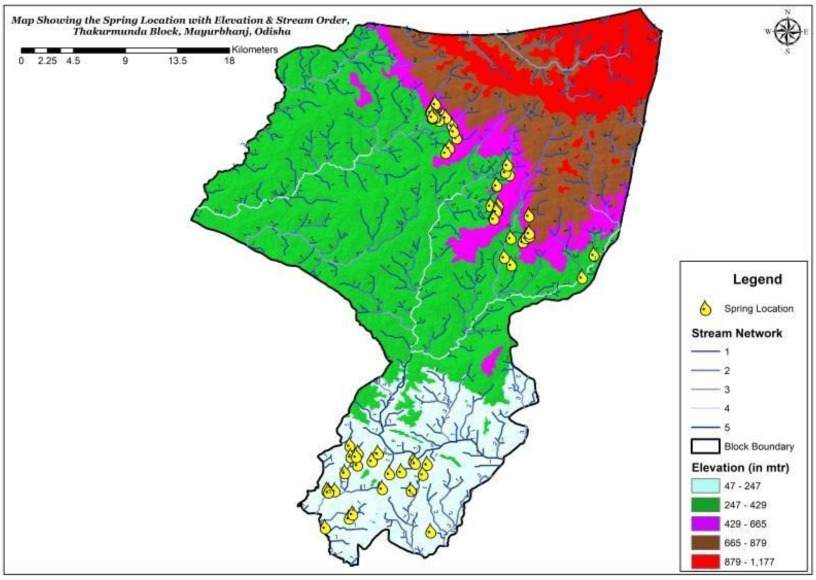


Figure 40:- Map showing spring location with elevation & stream network of Thakurmunda Block

meter, 9 springs in 0-163 meter and 9 spring in 517-755 meter above mean sea level. Out of 67 springs, 50 springs is in the vicinity of 1st order stream followed by 11 springs in 2ndorder, 4 spring in 3rd order stream and 2 spring in 4th order stream.

Karanjia Block

The block has lowest point at 336 meter of elevation and highest point at 1112 meter above mean sea level. 7 springs has been identified in the block and out of 7 spring 5 spring has an elevation of 328-517 meter and 2 spring has 517-755 meter.

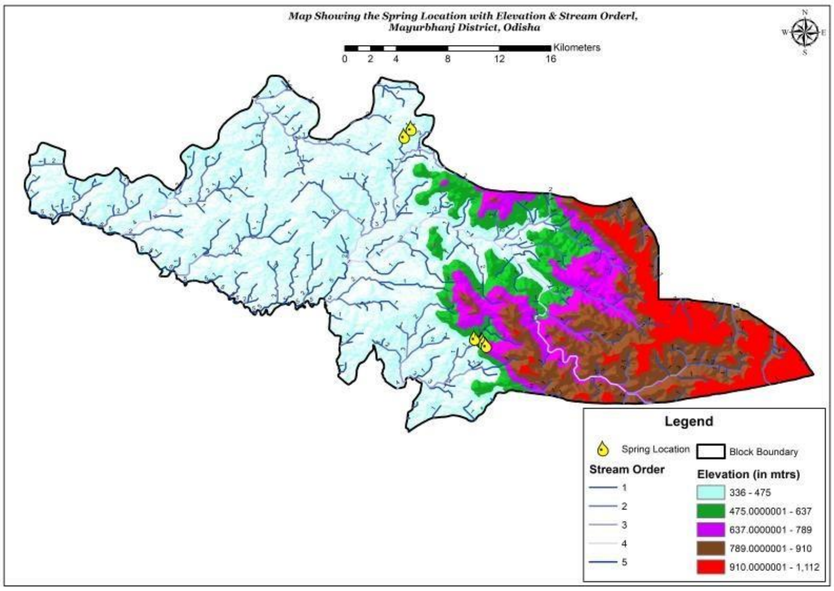


Figure 41:- Map showing spring location with elevation & stream network of Karanjia Block

Jashipur Block

The block is spread over a range of elevation which varies from 47 meter to 1177 meter above mean sea level. 56 perennial springs has been identified in the block and most of the springs fall under the vicinity of the elevation 517-755 meter i.e. 34 springs followed by 21 springs in328-517 meter, and 1 spring in 0-163 meter above mean sea level. Out of 56 springs, 26 springsis in the vicinity of 1st order stream followed by 18 springs in 2nd order, 8 spring in 3rd order stream and 4 spring in 4th order stream.

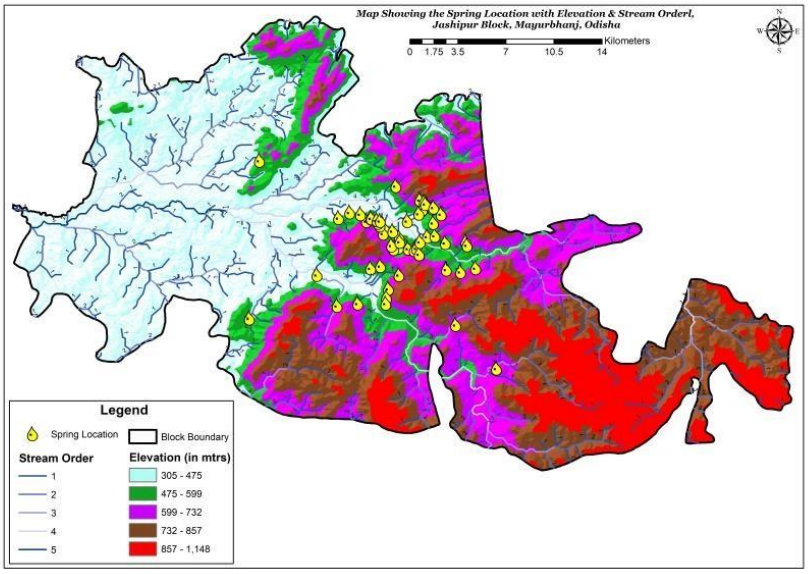


Figure 42:- Map showing spring location with elevation & stream network of Jashipur Block

6.6 Socio-cultural importance of springs

6.6.1 Malkangiri

When it comes to socio-cultural relevance, the natives of Malkangiri district regard the springsas “deity”. The MauliMaa (village deity) is worshiped along with the springs. It is believed thatif the goddess is worshipped along with the spring, the mauli maa will be the satisfied and blessthe villagers. As a result the villagers will never run out of water resulting in good harvests andeveryone will have food round the year and will be at peace. Annually all the villagers gather near the springs in the last Tuesday of the month of chaitra to worship the springs. Duck, goats, hen and coconut etc. are sacrificed to appease the goddess.

Villagers believe that when a child in a family becomes ill, the child, along with *Disari*[18] and other family members visit the spring, bath the baby, put on new clothes and the Disari worships. The Bonda believe that if the spring water is sprinkled on the child it is good for thechild and the family.

In some places, they believe fish caught from the spring and cooked will appease the goddess and there will be no shortage of water thought the year and result in good harvest. It is believedin Purunaguma village of Khairput block (chuapani spring) that villagers believe that the cavenear the spring has the sign of Lord Rama hand on it.

People or visitors going into caves will not get drenched in the rain and bathing here will washaway sins. It is said that Sitakund is the place where Lord Ram used to live when he was in exile and his wife Sita bathed in this Mudulipada Banda Valley. The natives believe that bathing here will wash away their sin. Apart from chaitra festival, the spring is offered with sacrifices during Dussehra as well.

Conservation of spring

The the villager’s plant trees nearby spring such as mango, pineapple and banana and other fruit bearing trees because they believe it enhances the water retention capacity of the aquifers.As a result, the productivity will be better, with relentless flow of water round the year. To protect the spring, they protect the source point by fence near the because they believe thatthe water inside the rock can stay for a long time without any human intervention.

In some places, villagers dig ponds are near the springs to store water; as a result water can beused for agriculture and many other livelihood purposes.

6.6.2 Rayagada

In tribal community, people believe spring as a source of wealth like tree and hills. During harvesting period, people collect money from all households of the village and worship the nearby spring by offering coconut and animals sacrifice like pigeon, pig, hen, goat and buffalonear the goddesses (village deity) of the respective community. It is offered by the “*Disari*” (village priest). It is believed by the community people that if the religious offering is not observed annually, people get affected and do not

[18] village priest in tribal community

sufficient water from the springs. People worship "*Gangi*" or *"Ranee Maa"* the Goddess of the spring, when diarrhoea spreads in the village. Villagers believe that the goddess provides water to the village. During marriage ceremonies "*Jani*" (priest) use water in worship for the sake of welfare of newly married couple.

During the field visit, it was observed that people exhibit more spiritual and emotional affiliation towards the hill than other nearby hills, from which spring originates and contributewater to the community throughout the year.

It was observed in upper mandijhola village of Khurigaon GP of Kashipur block that the villagers prohibit women and adolescent girls during their pregnancy and menstruation cycle to access water at origin of the spring, if violated, the spring water dries up. So, they fence thesource point of spring using thorn.

Among the Odarmajhi village of Khurigaon panchayat, newlywed bride fetch water from the spring at her first preparation of food in her in-laws house.

In Kashipur block "*Bohurani*" festival happens once in every three years in the village. Peoplerevere spring water as sacred and use it during celebration.

In any auspicious work like marriage or lying the foundation stone of home, at the time of firstentry of new house people also use spring water for worshipping the God.

The spring water has also spiritual attributes in agriculture. "*Kira*" celebration is also observed by the tribal community in the month of September. To avoid insects, farmers spray the springwater along with milk in the fields.

In Parajashila village of Kashipur panchayat during "*Chaitra parba*" and "*Duali parba*" peopleworship village Goddess by offering spring water.

It was observed in Lahunikhunti village of Kurli Panchayat in Bissam Cuttack that mother usesspring water at the time of bathing of new born baby for first 7 days to get healthy life.

Villagers sacrifice birds or animals with a faith that it will increase the water level of the springwhich will benefit the village.

Village people of Khajuri from Kurli Sram Panchayat believe that spring water has a medicinalvalue to prevent scabies or any skin disease.

Conflict resolution

If there was shortfall in rain, the discharge from the springs also has a declining trend. When there was a need of water, especially during the flowering season of the paddy some minor conflicts over distribution of water arises without any rancour. However, the matter gets resolved within them.

By nature, tribal community do not get into any dispute or conflict when it comes to the use ofspring water, as they adopt a very equitable approach so that maximum land in the command area get a share of the spring water.

In some villages population belonging to Scheduled Castes (SCs) and Scheduled Tribes (STs)live in harmony. It is also found that STs People have more land than SCs. Still there is no dispute among them with reference to spring water distribution.

Basically, the villagers who are living in the top of the hill and having land to the proximity ofthe spring, do not release water in time of the need to the lower village area. In thiscircumstance, dispute arises for a short period and then gets resolved with intervention of the community members and often officials of DKDA in some cases.

Generally, paddy is a water intensive crop. Where there is less water people usually don't go for paddy, rather they grow millet and pulses so that conflicts on water distribution is avoided.

Conservation

People consider that, if they give protection to the trees on the upstream of the spring, the springwater will not dry up and will provide water throughout the year. So, they do not cut or burn forest at least on the upstream patches of the springs.

With the project supported by IFAD, people have developed forest type trees like *Teak, Cashew, Chakhunda, Babool, Karanj, Mahaneem and Nilagiri* etc. in the government land andin the periphery of the spring before 20 years in the Kashipur area. They are not very sure whether water discharge volume of springs has increased or not, but they have concluded thatit has not come down or dried up.

In few places, people have also connected adjacent small springs into one big spring in some villages to get high discharge of water sufficiently.

In Dangaria Kandha Development Agency (DKDA) administered areas, many people have availed piped water from the streams for domestic use. At the origin of the source, some pit like structure has been constructed to collect water and supply the same through piped network. In some villages DKDA has also developed the water distribution system through stand posts in a row at a common location of the community. Sometimes the pipe network gets damaged by the intruding elephants in the area, thereby adversely affecting the water supply.

Figure 43:- Pipes installation by DKDA, Rayagada district

In some cases due to poor maintenance of PVC pipes, socket is displaced frequently and gets choked with sand, dry leaf and pebbles. As a result water cannot reach at the village without cleaning.

It was observed in many areas that check dam has been constructed by Minor Irrigation Division to control the spring water and channelize water smoothly to the farms. People are encouraged to grow varierties of vegtables being supported through OPELIP programme.

At some places villagers have planted many fruit bearing trees like mango, jackfruit, tuber, banana, lemon and orange in their land by the initiative of OPELIP, thereby intensifying the vegetation cover.

People generally don’t disturb the spring’s sources by avoiding cultivating in the upstream areas.

Community people store the spring water by making big pits for bathing purpose of livestocklike, ox, cow, buffalo whereas they make small pits with proper boundary in the upstream with loose bolder for drinking purpose so that the water is not contaminated.

Spring is the only source of water for many interior hamlets. No significant intervention has been done for optimal use of spring water for agriculture and allied activities as well as for thepurpose of drinking and sanitation. In a few villages though diversion drains have been constructed, leakage is rampant due to poor quality construction of the channels.

Distribution

Generally, farmers channelize the spring water to the field by making drain (trench) as far as they can. Some farmers also divert spring water through laying PVC pipes above the ground to reach at the farm. It is not a sustainable method for all poor families, because due to movement of cattle’s and wild animals, the pipes get damaged. People use locally available materials in jointing bamboo and small piece of asbestos in the spring for channelizing of springwater.

Figure 44:- Water storage in the water tank and measurement of discharge

At some places the local NGO "Agragamee" has constructed check dam near to the spring for conservation of spring water. But, due to poor maintenance of the same water leakage and wastage is a very common phenomenon.

Some Intake wells made by DKDA are in dilapidated condition, it enquires periodic maintenance.

Where the slope is very steep, staggered and contour trenches are required to arrest the run off water, rejuvate the springs, prevent soil erosion and improve the soil moisture profile.

Some solar powered based pipe water supply system that was installed by tribal development agency is not functional.

6.2.3 Mayurbhanj

Among the three blocks covered under the study, thakurmunda block has shown more socio- cultural festivities associated with the springs. In a village called Rajpal where about 10 festivals are celebrated round the year. They are *Baha Parab* (March), *Hera Parab* (June), *Dhodia Jantal Parab* (July), *Asadhia Parab* (August), *Jamnawa* (September), *Jantal* (October), *Ghatabhangha* (December), *Irsit* (January), *Magha Parab* (February), and *Phula Parbani* (March). Khadia (Kharia), Munda, Lodha are the prominent tribal groups who celebrate these festivals. In *Jamnawa* festival the villager's sacrifice animals like sheep/goat and they believe this would not let the springs dry. *Irsit* festival is celebrated to avoid the attacks of wild animal's specifically wild elephants in cropped lands. In all other festival the *Disari* (Village priest) offers sacrifice (red, black or white hen) near the spring source and worship the wooden sacrificing post.

In Sanjhili village of Jashipur block five major festivals are observed during the year which are *Magha* (January), *Asadhi* (June), *Mamoy* (October), *Baha Parab* (March) and *Sarahi* (March). These festivals are prevalent among Santal, Khadia and Kolha tribes. The community people worship the spring and the peripheral forest land with the belief to have better yield and infliction of wild animals in the coming years.

Besides, Bhumij and Kolha observe *Irmundi* festival in the month of December to celebrate harvesting season. They sacrifice one black hen / black goat and the blood of the sacrificed is kept in a vessel along with the seeds which is offered for worshipping near the springs. Post the ritual; the seeds are then distributed to the villagers which they are going to use in the forthcoming harvest season for a good yield.

Marriage

In marriage the spring water is considered sacred. The disari performs the rituals by using the spring water. Spring water is collected in container and the new bride takes bath in the spring water, after which the marriage is solemnized.

Conflict resolution

In case there is any conflict among the villagers regarding usages of the spring water for agriculture, then the village head settles the dispute through dialogue and often imposes penalty in kind such as one hen. They don't allow the intervention of any outsider in settlement of the dispute within the community. The villagers firmly believe that the forest officials are responsible for ruining the forest which adversely impacts the conservation of the springs. The officials hardly understand the importance of the springs in the lives and livelihoods of tribal community. Even the VSS (Vana Surakhya Samiti- which constitutes community and lower level forest officials) are not allowed to do any activity near the spring source. The community people have observed that over the time the spring water discharge has reduced enormously due to the forest degradation.

6.2.4 Sundargarh

Springs are the lifeline of tribal community as it serves as one of the major source of life and livelihood. Each village is culturally connected one or more springs and many villages have one or more springs in common. People worship near the hill spring during the month of October and November known as Kothipuja or Pallipuja every year. They believe that the by Kothipuja, it ensures good water flow in the spring for whole year and they will not face scarcity of water. During the festival, villagers sacrifice white hen, goat and other animals, near the springs.

6.2.5 Koraput

Across the district, *Chaiti Parab*, *Laxmi Puja* and Christmas is celebrated with pomp and splendor. In Tentuliguda village of Semiliguda block, the villagers lit a diya (small sacred lamp) close to the spring source during *Chaiti Parab* puja because they find springs to be sacred. The villagers avoid using shoes while going and touching to the spring source because they feel it might bring bad omen to the village and result in death too. The villagers take communal bath in the spring during *laxmi puja* and *chaitra puja*. After thedeath of a person, the purification rituals are observed nearby the spring.

In Nandapur block spring occupy an important place in their socio-cultural life of the people. In Badapadar village of Khurji Gram Panchayat, *Sutabandha* festival is observed for the pregnant women. The Disari accompanying the pregnant women and other village women go the spring and perform puja followed by animal sacrifice. The disari ties a religious thread around the expectant mother wrist for the well-being of newborn child, and mother. And the women keep the thread intact throughout her life. *Luga odhani* ritual is observed among the newlyweds in the village. The new bride and groom after marriage when return to village haveto visit the spring where a goat is sacrificed and the village people celebrate the occasion. *Khatar Parab* is celebrated after harvesting the major crop. The community people visit the spring site along with a sample of their harvested grain and offer a customary ritual after which they can bring the harvest back home. *Bhisani munda* and *Patadebata* (village deity) are worshipped annually in the month of January where spring water is used for the ritual. This iscelebrated for the common good of the villager people. In case of conflict among the people living in upstream and downstream areas for distribution of water, the issues are resolved amongst them through mutual dialogue. The community people undertake several land development activities like stone bonding, contour trenches, staggered trenches, guard wall for storage of water.

6.3 Conservation initiative's with support from different programs

So far as the conservation of springs is concerned, most of it happens at community level basedon their traditional wisdom. Vegetation in and around the spring and its catchment area consciously protected by the community. At some places for arresting run off rain water major conservation techniques adopted in different districts includes stone bonding, gully plugging, check dams and ponds carried out by community members with support from the government, DKDA, OPELIP, Panchayati Raj department, RWSS, NGOs. Apart from this, different government departments in the concerned blocks also encourage growing fruit bearing trees along with promoting agriculture. However, majority of the springs have remained out of any conservation related intervention by any government programme.

Figure 45:- Pond constructed through NREGS find in Simliguda, Koraput district

Figure 46:- Check dam constructed by PR Dept. in Kashipur, Rayagada district

6.4 Water discharge volume and irrigation potential of springs

Though measuring the water discharge volume of the springs was one of the mandates, it couldnot be possible in majority of the springs. Needless to mention that for measuring the water discharge volume some preliminary intervention in the springs is required such as channelizingthe discharged water to a single point so that it can be measured. Therefore, wherever there was either any individual, community and or any programmatic intervention effort was done for channelizing the spring water, the discharge volume could be measured. As a result out of 688 springs surveyed only in 121 springs approximate water discharge volume could be measured.

Based on the water discharge volume, the springs were divided into three categories such as high, medium and low. Depending on the discharge volume an approximate irrigation potentiality was calculated taking the expert opinion of officials from soil conservation and watershed department.

Table 7: Classification of discharge level of springs

Discharge level	Dischargevolume (2000 ml)	Irrigated Area (Acres)	No's of springs	%age (%)
High	<15 sec	31-50	80	66%
Medium	16-60 sec	25-30	36	30%
Low	>60 sec	0-24	5	4%

Table 8: Showing water discharge measurement

Water Discharge Volume	No of Springs	% age (%)
Measurable Springs	121	18
Non-Measurable Springs*	567	82
Total	**688**	**100**

***(Note:-** * some springs could not be measured because of lack of the minimum intervention to collect the water at a single point.)*

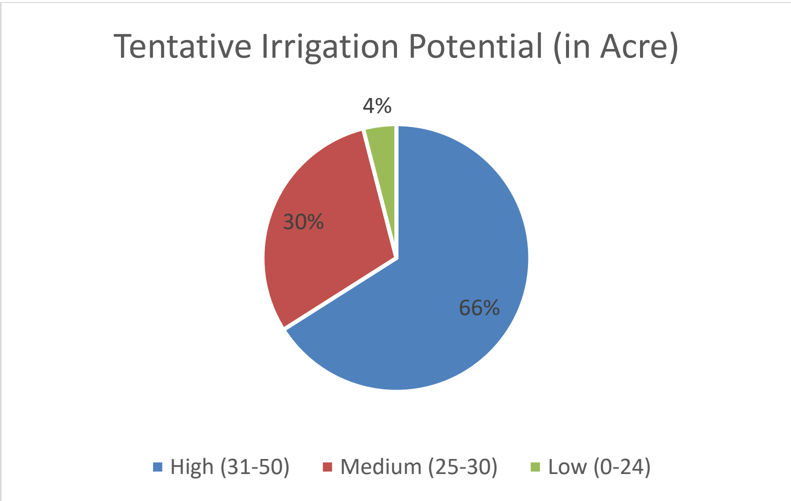


Figure 47: Pie chart showing the tentative irrigation potential

Chapter 7
Suggested Biophysical and Engineering Methods For Springs Conservation/Rejuvenation

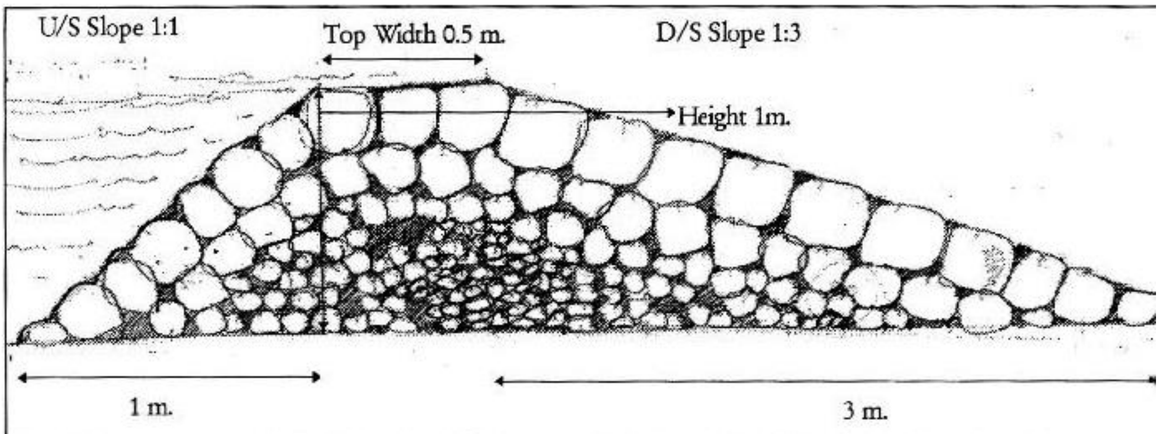
7.1 Drainage line treatment boulder checks

Boulder checks are loose rock dams made on small drainage lines, which have a catchment area of around 10 to 20 ha. As per rainfall parameters the permissible catchment area of the drain for the construction of loose boulder gully plug varies.

Objectives:

The main aim of constructing boulder checks is to reduce the velocity of water flowing through the drainage line. By reducing the velocity of runoff, boulder checks help in

- Reduction in soil erosion;



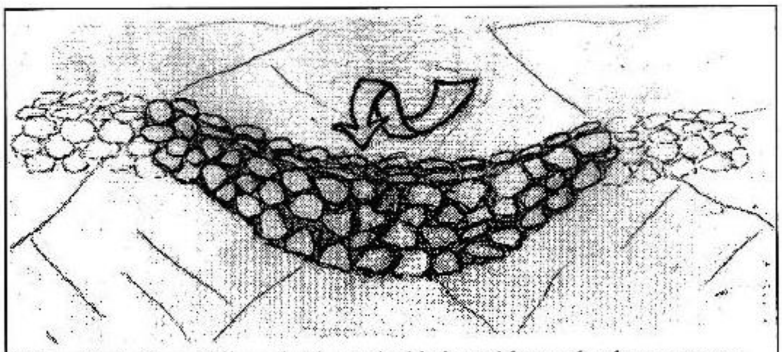
Typical cross section of a boulder check. In the construction of a boulder check, bigger boulders are placed outside and smaller ones inside. On the outside, the biggest boulders are placed on the downstream side.

- Trapping silt, which reduces the rate of siltation in water harvesting structures in the lower, reaches of the watershed.
- Creating a hydraulic head locally which enhances infiltration of surface runoff into the groundwater system; and
- Increasing the duration of flow in the drainage line. Therefore, the capacity of the water harvesting structures created downstream on the drainage line is utilized more fully as they get many more refills.

Location:

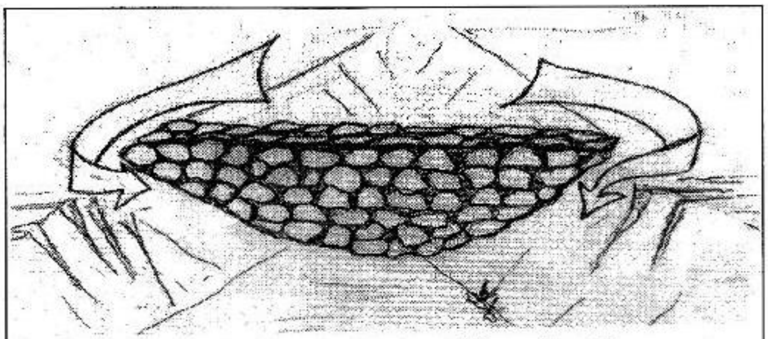
Boulder checks should be made as a series on a drainage line, with each structure dividing the overall catchments of the drainage line into smaller sections.

- The independent catchment of each boulder check should not be more than 1 to2ha.
- Boulder checks should not be made where the bed slope of the drainage line at that point is above 20% because the check will not be able to withstand the high velocity of water flow. However, on a drainage line with an overall high bed slope boulder checks can be constructed in sections where the local bed slope is less than 20%.

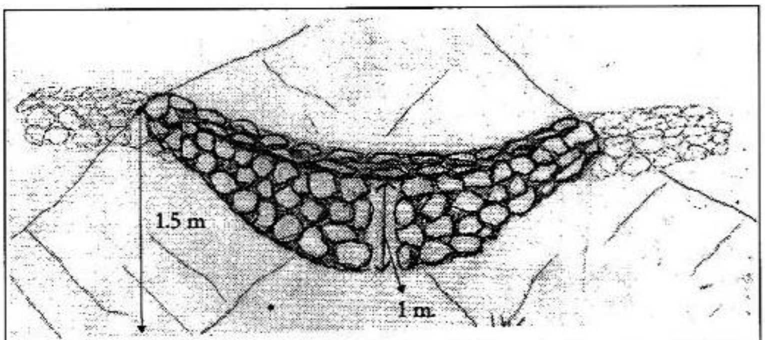


With a dip in the middle and sides embedded on either embankment, water flows over the dip safely without endangering the bund

- Boulder checks should be made where boulders are available in large quantities in the requisite size.
- A boulder check should be made where the embankments are well defined and stable, and high enough to accommodate peak flows even after the check has been made, thereby preventing water from rising over and cutting the banks. The height of the embankment at the location of the structure must at least equal the maximum depth of flow in the stream including the design height of the structure in the central portion of the drainage line. This rule is applicable to all structures in which overtopping is permissible.



If no dip is given in a boulder check in the middle, and its sides are not embedded in the embankments, water will tend to cut through the embankments on either side, thus eroding them



In order to create this dip, the height in the middle is kept less than that on the sides.

- Even though storage is not a primary consideration in the case of boulder checks, enhanced water retention and groundwater recharge is a desirable objective. Hence, locating the structure in those sections in the drainage line, where the upstream slope is flatter may be advantageous. The flatter the upstream slope, the greater would be the storage per unit height of the structure.

Layout:

On each drainage line there will be a series of boulder checks. The minimum vertical interval between two successive checks on a drainage line should be equal to the height of the structure, so that the water temporarily stored in one check will reach the toe of the another check upstream. Any interval below this limit would mean under utilization of the capacity of the downstream boulder check. What interval we keep above this limit would require a balance to be struck between cost considerations and volume of water to be stopped. Once this vertical interval is fixed, the horizontal interval between two successive checks would depend on the bed slope of the drainage line: for instance, with a constant vertical interval of 1m, the boulder checks would be spaced at a horizontal interval of 20 m on a 5% slope and 10 m on a 10% slope. In general the relationship can be expressed as follows:

$$HI = VI / S,$$

where HI = horizontal interval; VI = vertical interval and S = slope (%)

However, one must not follow this rule blindly without taking into account the catchment area that each boulder check has to handle. For example, on high slopes one may end up making too many checks even though there is very little water which each checks needs to handle. In practice, one must fix the maximum and minimum horizontal interval between two successive boulder checks:

- On high slopes, boulder checks should be spaced close but not closer than 10 m;
- As the slope decreases, boulder checks must be spaced farther, but not farther than 50 m.

Planning

Identify the drainage line to be treated by the checks. Start from the top. Fix the location of the topmost boulder check. Walk 5 m downstream. This gives the downstream bottom edge of the first boulder check. We have decided that the minimum horizontal distance between 2 boulder checks has to be 10 m. Measure the slope of the naala bed over the 10 m stretch, beginning with the bottom edge of the first boulder check.

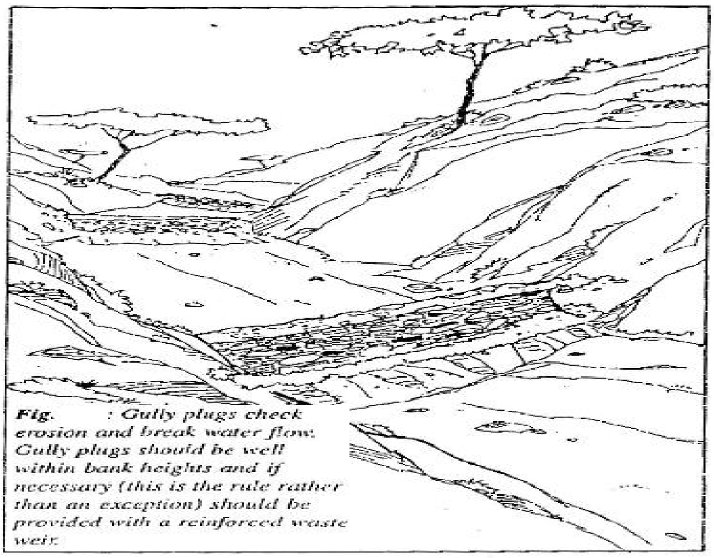


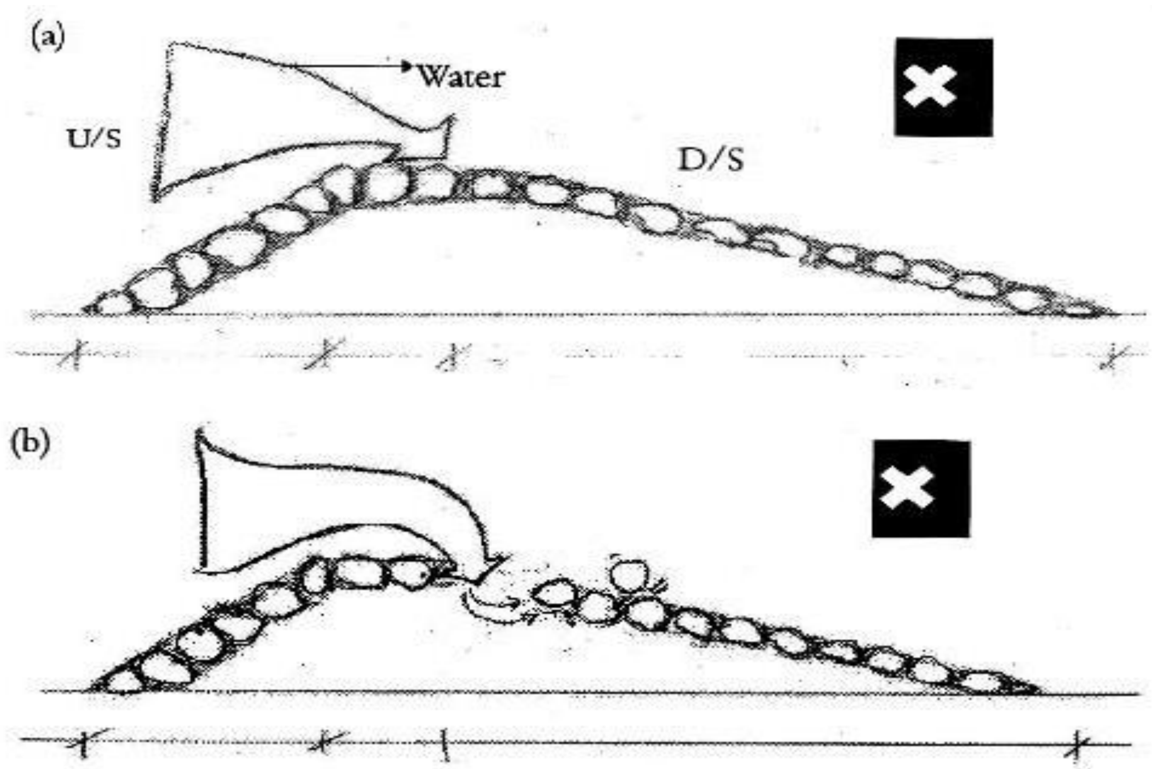
Fig. : Gully plugs check erosion and break water flow. Gully plugs should be well within bank heights and if necessary (this is the rule rather than an exception) should be provided with a reinforced waste weir.

If the slope is 10% or more, keep the horizontal distance between two boulder checks as 10 m. In case the slope is less than 10%, then increase the distance between the boulder checks, depending on the flatness of the slope. Thus, for instance, if the slope is 5%, the distance should be 20 m; if slope is 2%, the distance should be 50 m. Even if the slope is less than 2%, do not increase the distance beyond 50 m, which is the maximum distance we have fixed.

Thus, along the length of the drain, the location of the checks is marked.

Design:

Through years of experience in watershed development, the maximum height generally accepted for boulder checks is 1 m. The design height of 1 m means that the top of the check in the middle of the stream is 1 m above ground level. The top width of the boulder check is usually taken as 0.4 m. As the material used in the check has a high angle of repose, the upstream slope of the check should be fixed at 1:1 in general, to be varied only in exceptional cases where the structure has to handle very high volume of runoff and of high velocity. The downstream slope of the boulder check can vary from 2:1 to 4:1 depending on the volume and velocity of runoff. The higher the volume and velocity of runoff, the flatter the slope. Since the boulder check is composed of a highly porous material it is not expected to hold water for a long period. Hence, unlike in earthen structures, the downstream slope of the



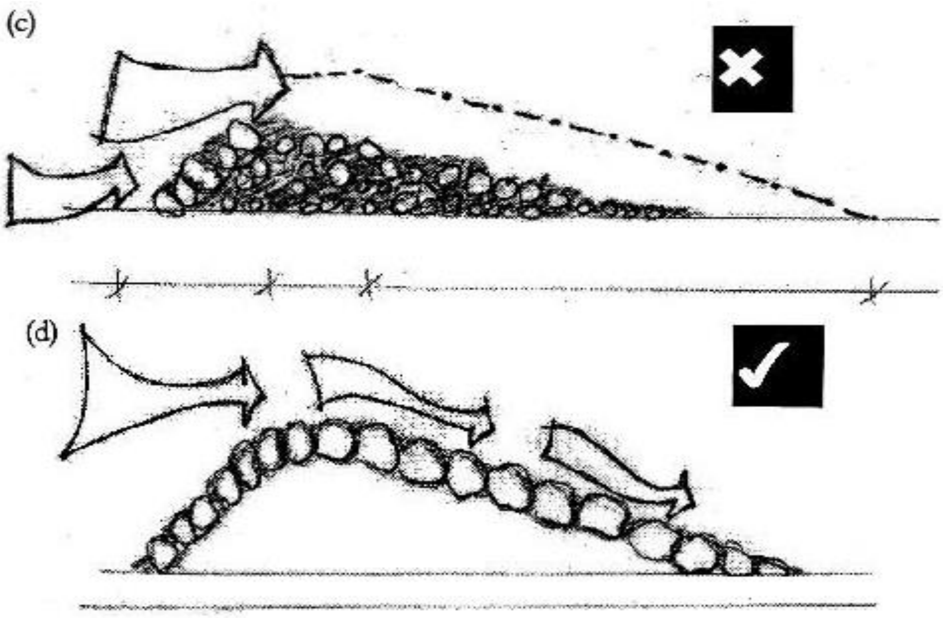
structure is not made to handle seepage problem. The downstream slope is given for two reasons:

- To absorb the impact of water which enters the structure at a high velocity; and, also
- To drain out water from the structure at a non-scouring velocity.If the top of the check is level, water will flow over the check uniformly at all points. It is advisable, however, to direct the maximum overflows through the middle of the structure so that the water does not erode the embankments. Therefore, there should be a dip in the middle of the structure and the top level of the structure should be higher towards the embankments on either side. The cross-section area of the dip depends on the depth of peak channel flow: the higher the depth, the more is the cross-section area. But the height of the boulder checks on either side should not exceed the height of the embankment or 1.5 m whichever is lower. The check should be embedded 0.5

m into both the embankments. This is to prevent erosion of the embankment where the check joins it. If the bed of the drainage line has only boulders, the boulder check can be constructed without any foundation digging. If there is mud or sand in the bed, this must be excavated up to a maximum depth of 0.30 m to secure an adequate foundation for the boulder check.

Construction:

Draw a line running through the center of the proposed site for the boulder check till it reaches those points on either side, which are 1.5 m above the bed of the naala. Naturally, if the embankments are less than 1.5 m high, this line will only reach till the top of the embankment. From this central line, mark 20 cm on the upstream and downstream sides and draw parallel lines from one embankment to the other embankment. These lines mark the boundaries of the crest.



If small boulders are placed on the outer, particularly downstream face of the boulder check, water will exert pressure on the outer face (a); dislodge the small boulders there (b) and wash down the check (c). Thus large boulders must be placed on the outer face, particularly on the downstream side (d)

Suppose the required slope is 1: 1 upstream and 3:1 downstream. Then from the center of the upstream crest line a point is marked at a distance of 1 m, along the perpendicular to this line. From the center of the downstream crest line also mark a point at a distance of 3 m, again along the perpendicular to this line. These points mark the upstream and downstream ends of the boulder check respectively. Draw lines connecting each of these points to the end of the crest lines on both sides.

The trench in a boulder check is not usually dug in the bed of the naala. But if there is a sand or mud at the base of the check, a foundation should be dug up to a depth of 0.25 m.

Generally, digging the trench is only required for embedding the check into the embankment. Along the centerline after it enters the embankments, dig a trench, which are half meter wide and half meter deep. The trench must extend half a meter beyond the point where the crest of the check meets the embankment on both sides. Now the filling begins. The check should be raised in horizontal layers. The largest of the boulders must be placed on the outer sides especially on the downstream face. The trenches cut into the embankments on either side of the check must also be filled with boulders. As successive layers are laid out, care must be taken that the downstream and upstream slopes are maintained as per design. When one reaches the crest of the check one must ensure that the top layer slopes down away from the embankments dipping towards the center of the check, thus providing a channel for the safe exit of excess runoff.

Materials:

- The larger boulders must be placed on the downstream face of the check. The outermost edge of the downstream side must be dug up to a depth of 0.25 m and the largest boulders available must be placed at the lowermost edge of the check on the downstream and anchored to the ground.
- Smaller stones can be used to fill up the interiors of the check.
- The use of boulders with a diameter of less than 15 cm (or weight less than 1 kg) must be avoided.
- The use of angular stones provides greater stability to the check than the use of rounded boulders.
- Shale, limestone, mudstone or any loosely cemented rock must not be used, because they disintegrate when in contact with water.

Costing:

First, arrive at the volume of each structure. Volume= Length of the Check x Average Cross Section Area. Since the cross section of the boulder check approximates the shape of a trapezium, the formula for cross section area becomes

$$A = 0.5h(a + b),$$

where A= cross section area, h= height of the structure, a=top width, and b = base width.

For the average cross section, measurements will have to be taken at 3 to 5 points along the length of the check. This volume is multiplied by the rate for the collection and arrangement of boulders (as per the rate schedule). Multiplying the rate per volume of work by the average cross section area would give the rate per running length of the structure.

Rate/Volume x Area = Rate/Running meter

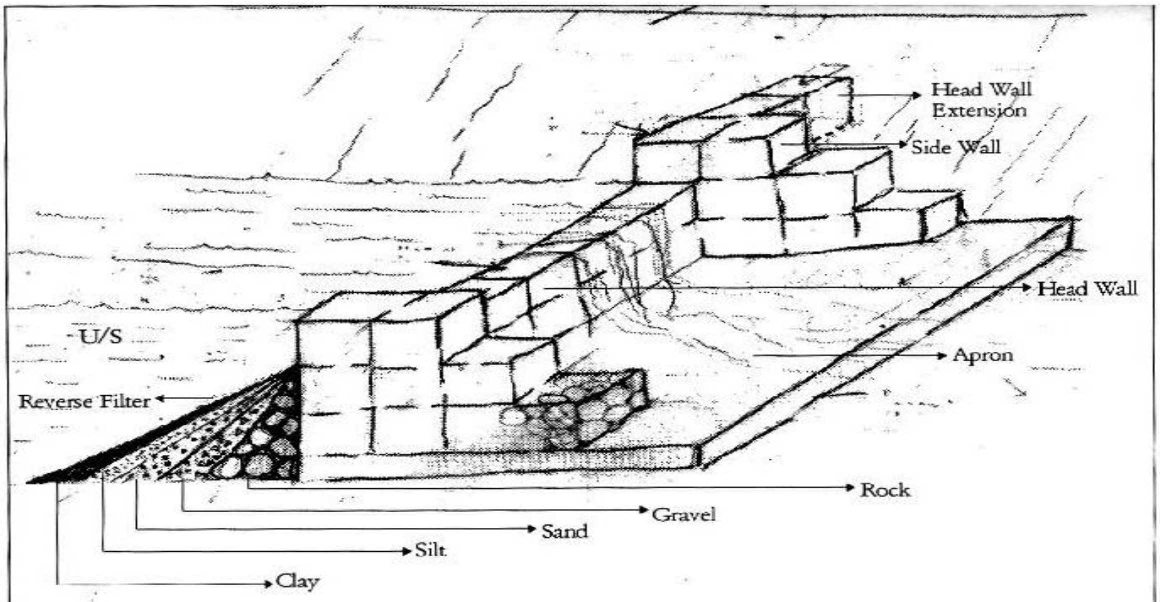
The cost of a 12 m long typical boulder check with 1 m height, 1:1 upstream and 3:1 downstream slopes and 0.3 m top width works out to Rs. 1500 at 2006-07 prices.

Dos and Don'ts:

- Locate the check only where the height of the stream embankment is greater than or equal to the sum of the peak depth of flow in the drainage line and design height of the structure.
- The top of the check should be lowest in the middle of the stream and highest at either embankment.
- The height of the check in the middle of the stream should be 1 m above ground level.
- Upstream slope of the check should be 1:1 while the downstream slope can vary from 2:1 to 4:1.
- The bed of the stream at the base of the check should be cleared of mud/sand up to 0.25 m depth.
- The top of the check should extend into either embankment by cutting a trench and filling it with boulders.
- Larger boulders should be placed on the outer portion of the check.
- The use of angular boulders is preferred.
- No checks should be placed at such locations where the bed slope is above 20%
- No checks should be constructed where boulders are not adequately available within a radius of 50 m.
- Do not use boulders dug up or picked up from the neighbourhood if such use would increase soil erosion in the area from where the boulders are picked up.
- Do not use boulders of diameter less than 0.15 m at any point, which comes into contact with flowing water.

7.2 Drainage line treatment Gabian structure

Gabian structures are rock and wire dams constructed across the drainage lines with a catchment area of 30-150 ha. They are also constructed to reinforce highly erodable stream



A Gabion Structure

embankments. In this module, we will first describe Gabians across drainage lines in great detail. In the end, we provide a short note on Gabians built along embankments.

Gabian Structure Across Drainage Line:

Objectives:

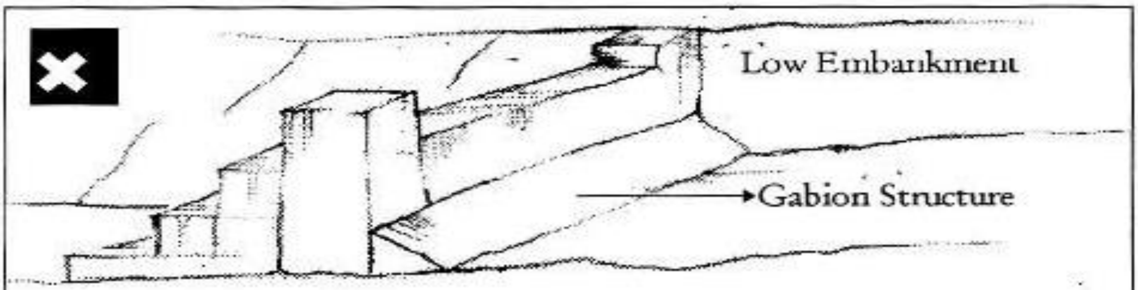
The main aim of constructing gabian structures is to reduce the velocity of water flowing through the drainage line. By reducing the velocity of runoff, gabian structures help in

- Reduction in soil erosion;
- Trapping silt, which reduces the rate of siltation in water harvesting structures in the lower reaches of the watershed.
- Creating a hydraulic head locally which enhances infiltration of surface runoff into the groundwater system; and
- Increasing the duration of flow in the drainage line. Therefore, the capacity of the water harvesting structures created downstream on the drainage line is utilized more fully as they get many more refills.

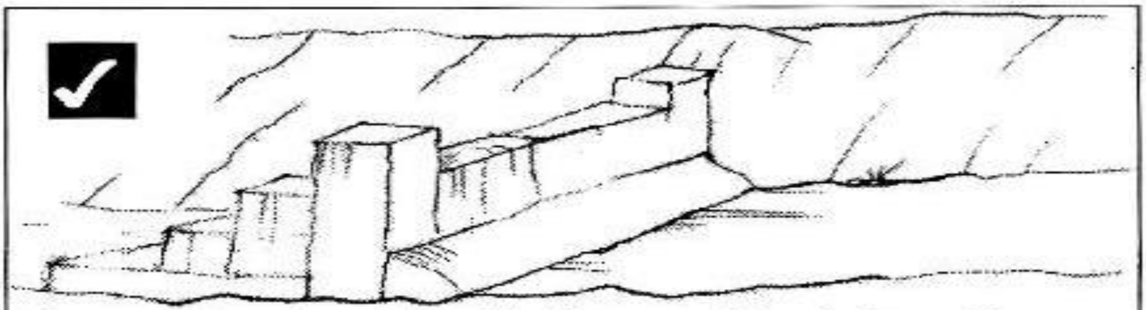
Location:

The minimum independent catchment area for a gabian structure is 5 ha. For a catchment area smaller than this even a loose boulder check may suffice. The precise location of a gabian structure depends on the following factors:

- Stability of the embankments is the primary consideration. The less stable and more erodable the material on the embankments is the weaker the structure is likely to be. In such a situation, making the structure stronger would render it too expensive.
- The elevation of side embankments from the bed of the stream at the least must



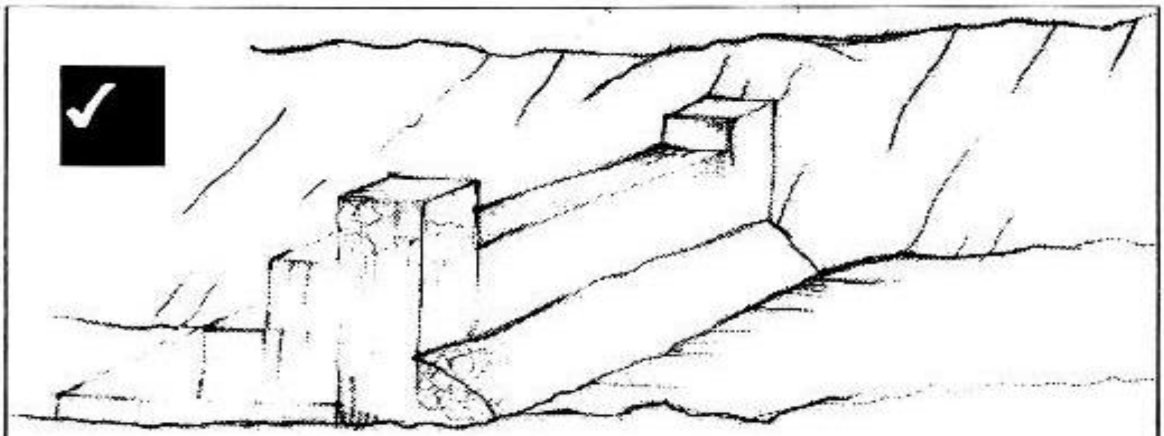
The height of the embankments of the drainage line must be greater than or equal to the sum of the depth of peak flow and the height of the structure. It is not advisable to locate structures where the embankments are low



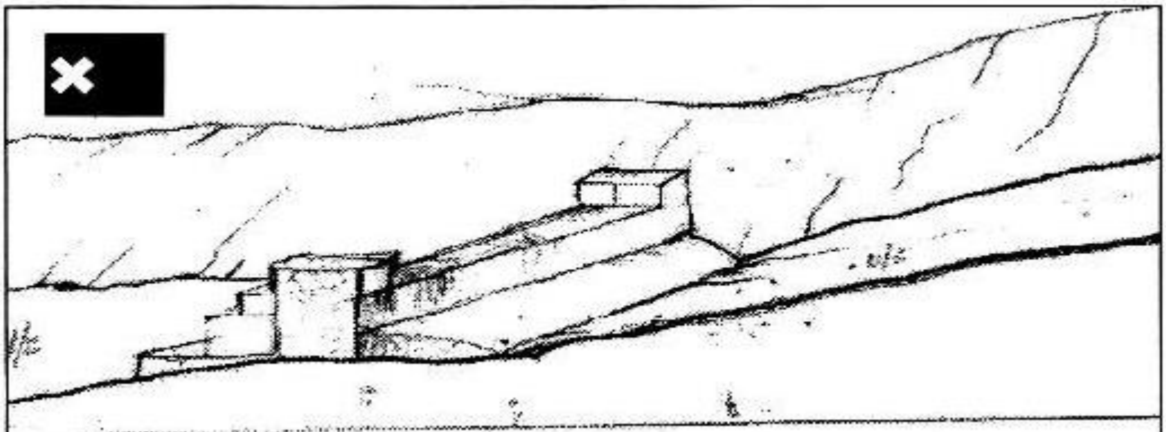
Choose a site where the embankments of the drainage line are high

equal the sum of the depth of peak flow in the stream and the designed height of the structure. For example, if the height of the embankments is 6 m and the depth of peak flow is 4 m, then the height of the gabian must not exceed 2 m to prevent the water from jumping over the sides. Hence, observation of the peak flows is imperative before a gabian structure is planned.

- For maximizing storage in the structure, the bed slope of the upstream portion should be low. The flatter the upstream slope, the greater will be the temporary storage per unit height of the structure.
- The material composing the bed of the drainage line upstream of the structure should not be completely impermeable, because what we are looking for is temporary storage followed by groundwater recharge.



Gabions should be constructed where the bed slope of the drainage line is flat. Other factors remaining the same, this leads to a greater volume of runoff conserved



If the bed slope of the drainage line upstream of the proposed site for construction of gabion structure is steep very little runoff will be conserved. In addition,there is a danger to the safety of the structure

Design:

There are two ways of reinforcing a loose boulder structure with wire mesh:

- To make the structure as per the dimensions of the design and wrap it with wire mesh on all sides except the bottom. This wrap is partially anchored under the bottom.
- To cage the boulders in rectangular boxes. The structure would be made up of several such boxes tied together. In such a structure the wire mesh not only provides a covering shell, it also gives horizontal and vertical reinforcements within the structure.

The second method is far superior to the first in terms of strength and is economical in the use of boulders, although more wire mesh is used in the latter than in the first method. In this module, we will concentrate on the second method.

The rectangular box type gabian structure has the following sections:

- **Foundation:** The foundation should be dug up to a depth of 0.6 m across the bed of the drainage line for the entire length and width of the Headwall of the structure. Where the streambed has a thick layer of sand or silt the foundation will have to be dug deeper till a more stable layer is encountered. This foundation should be filled with boulders and the wire mesh should be anchored under the boulders.
- **Headwall:** The headwall is built across the width of the stream from embankment to embankment. In most cases the top of the structure across the entire stream can be level. The entire length of the headwall serves a spillway for the stream. Where it is required that most of the flows be directed towards the center of the stream, that part of the headwall is lowered forming a weir. For a height of up to 2 m the width of the headwall can be restricted to 1 m. For heights beyond 2 m, it is advisable to design it as a step-like structure, where the downstream face is constructed as a series of steps. For every 2 m fall a step should be provided of 1 m width.
- **Sidewalls:** Sidewalls are built to protect the embankments downstream from erosion by the stream spilling over the Headwall. On either end of the headwall, where the natural embankments begin, a block of the Sidewall is laid. The height of the sidewall measured from the top of the headwall is determined by the depth of peak flow in the stream. From here the Sidewall descends in a series of steps along the embankments to the bed of the stream.
- **Headwall Extension or Wing Walls:** The headwall is extended into both the embankments in order to anchor the structure and secure it against sagging on account of the pressure of water. From the same height as the top of the sidewall, the headwall extends into the embankments.
- **Apron:** During peak discharge, the stream spills over the headwall and falls on the streambed with considerable force and emerges with a strong up thrust a few meters downstream. This can cause severe erosion. Hence, some way has to be found to neutralize the force of falling water. In the gabian structure, a stone apron is usually provided as an energy-dissipating device. The naala bed downstream of the structure is dug up to a depth of 0.6 m for a distance of 3 to 6 m from the Headwall. This is filled with boulders and enclosed in a wire mesh, which is anchored under the boulders. The length

of the apron depends upon the radius of the arc made by the water spilling over the headwall. This in turn is determined by the depth of peak flow in the naala. Therefore, the higher the depth of flow, the longer the apron should be.

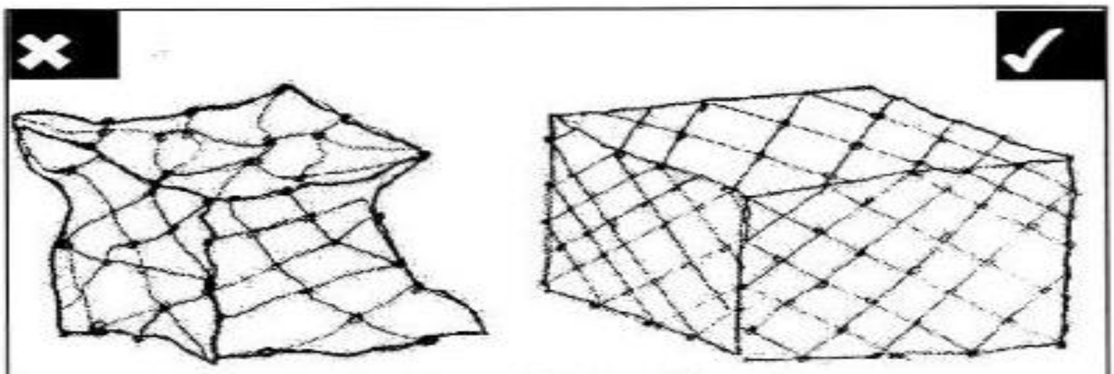
Materials:

Wire Mesh: Good quality galvanized wire of gauge 12-14 (chain link) must be used for constructing the gabian structures. Readymade mesh with a single twist is commercially available. In these meshes the gap should not be more than 7.5 cm x 7.5 cm. Alternatively the wire can be manually woven into a mesh. In this case even a double twist can be provided at each joint and the minimum gap can be increased to 10 cm x 10 cm.

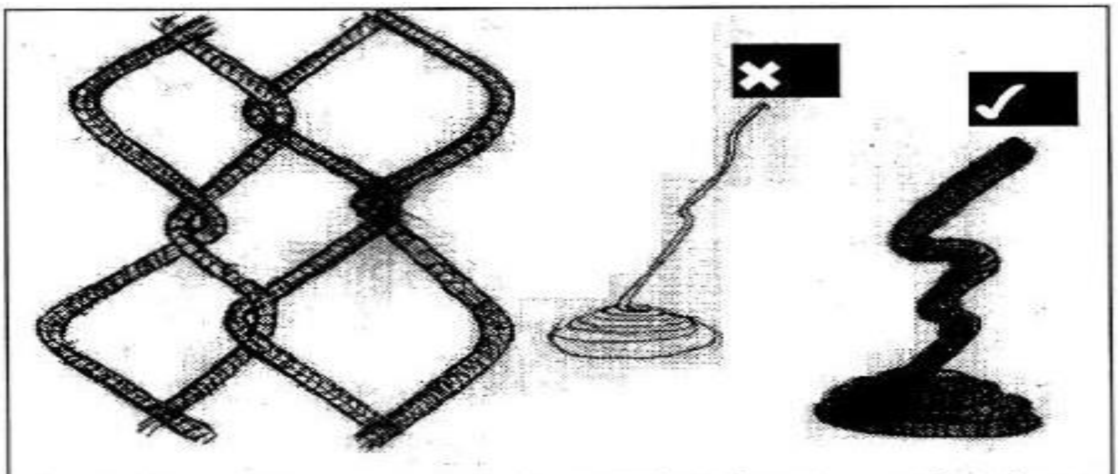
Boulders: The minimum size of the boulders is dictated by the gap size in the wire mesh. The boulders should be hard and should not deteriorate under water. Angular boulders are to be preferred to round boulders. Arrange smaller sized boulders in such a way that they fill the gap left by larger sized boulders. Besides rendering the structure less permeable, this minimizes the damage to the structure on account of settling and sagging. There are two types of pressures operating on a gabian structure: I) static pressure of standing water; and the ii) pressure of moving water. If small boulders are used in the structure, they would get shifted and dislocated on account of these pressures and the structure would tend to sag. The same problem will occur if the wire mesh is not drawn tight over the boulders or if the embankments are not stable or if the height of the structure for a specific top width exceeds the limit up to which it can withstand water pressure.

Construction:

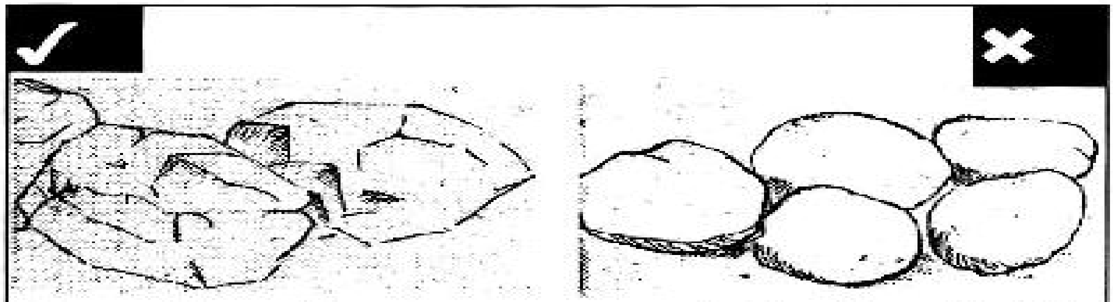
First of all boulders must be collected on the location site. If the structure is going to use woven wire mesh on the site then the weaving of the mesh in sections of 1 to 2 m lengths and 1 m width must commence. For the Headwall, a 1 m wide and 0.6 m deep trench should be dug across the streambed from embankment to embankment. Foundation of similar depth should also be dug for the area demarcated for the apron and the sidewalls. For the headwall extension the embankments are cut to the appropriate depth.



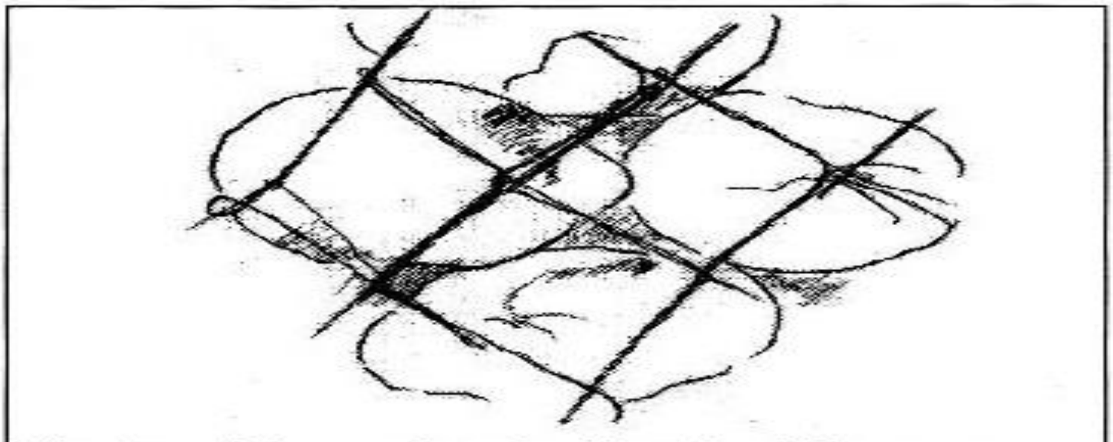
Boxes made out of wire mesh should not have any slack. The wire should be tight and taut



The design of the wire mesh. Ensure that the wire used to tie up the boxes should be of the same guage as the wire used to make the boxes



For making gabion structures, angular boulders should be used instead of rounded ones



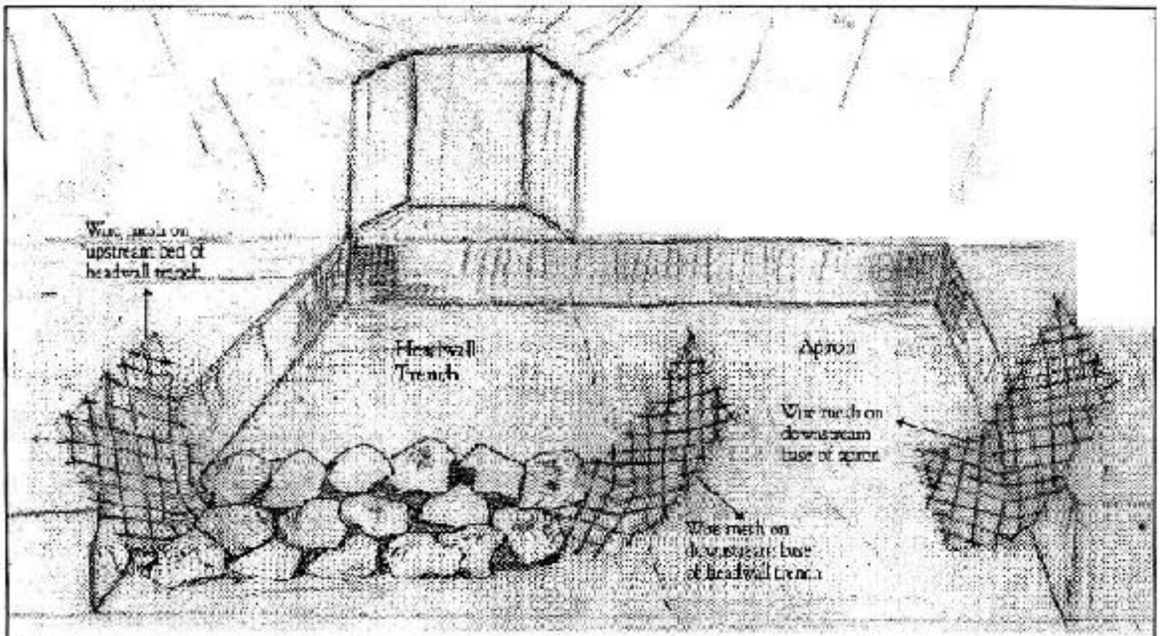
The size of the smallest boulder should be more than the gaps in the wire mesh

Before the foundation trench is filled, lengths of wire mesh are placed vertically at three places:

- The upstream edge of the foundation;
- Where the headwall ends and the apron begins; and

- Against the downstream edge of the apron.

At all the three places the wire mesh runs along the entire length of the structure.



Wire mesh is initially placed vertically and anchored below the boulders at three spots: the upstream base of the headwall trench of the gabion structure; the downstream base of the headwall trench and the downstream base of the apron

Everywhere, 0.15 m of the wire mesh is folded along the bed of the trench so that the mesh can be embedded under the boulders. After that the trench is filled with boulders up to ground level. Then the wire mesh is laid over the entire surface and tied to that mesh, which has been embedded under the boulders. The headwall as well as the sidewalls should be constructed as boxes of 1 to 2 m length and 1 m height.

First the four vertical faces of these boxes are erected with wire mesh, which is tied to the wire mesh in the section below as well as the section alongside. Then the boxes are filled with boulders and covered at the top with the wire mesh. This wire mesh is tied to each of the vertical faces on all four sides. Such boxes are filled up in succession till the structure is complete.

The main structural danger facing the gabian structure arises because of sagging and settling of boulders when they are not placed compactly within the box. Hence, care must be taken that the boulders are placed compactly against each other so that they do not slide or move under the impact of water. Smaller boulders must be placed in the interior part of these boxes while the larger ones must be placed on the outside. Even the smallest boulder should be bigger than the gap in the wire mesh. The wire mesh must be stretched out so that there is no bulging or sagging.

The wire used for tying the wire mesh sections must be of the same strength as the wire used in the wire mesh. It could either be of the same gauge or of a thinner gauge plied and twisted together.

To increase the impermeability of the structure, a reverse filter should be constructed on its upstream face. This device is made by placing layers of small boulders, gravel, sand and mud against the structure. However, the order of placement of these materials is exactly the opposite of the arrangement in a normal filter. The boulders are placed adjacent to the structure, with gravel, sand and mud being placed successively away from it. The reason for the reverse order is that it is desired that the finest material should come in contact with the water first. Following the normal filter scheme would have allowed water to pass unchecked through the boulders and coarser material on the outer surface. One can even try to place used cement or fertilizer bags filled with fine sand against the structure in several layers.

Costing:

The cost of a typical gabian structure, 2 m high, 1 m top width and, say, with a length of 17 m on a large stream with a catchment of 50 hectares works out to Rs.75000 at 2006-07 prices.

Dos and Don'ts:

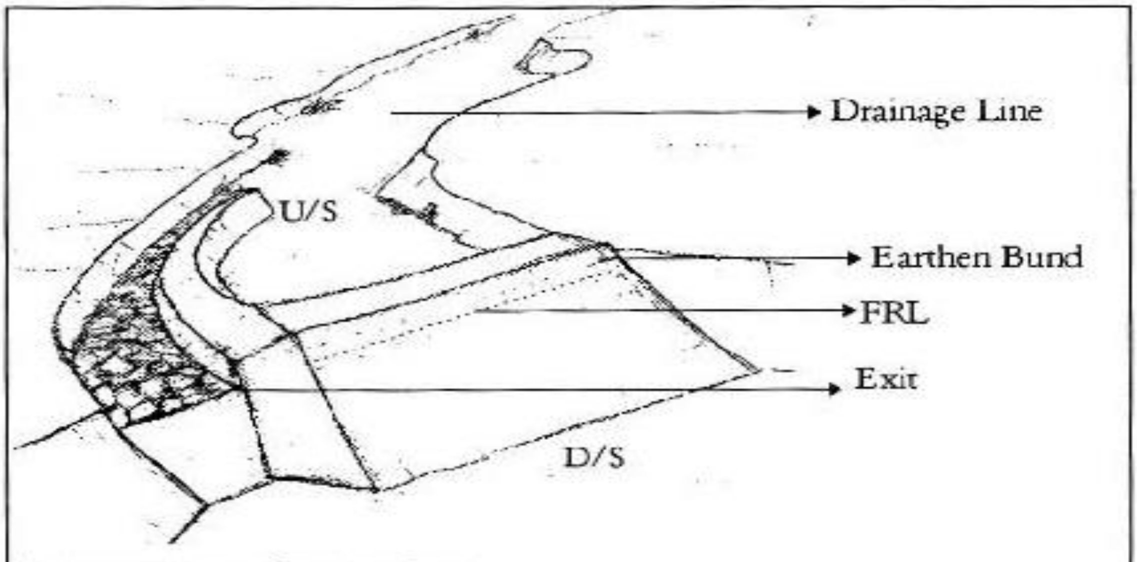
- Do not build a gabian structure where the embankment is highly erodable or is of insufficient height.
- Do not build a gabian structure at a point on the naala below, where the naala drops sharply.
- Locate the gabian structure where the naala width is relatively low.
- Locate the structure where the bed slope of the naala upstream of the structure is low.
- Care must be taken that the boulders are placed compactly against each other so that they do not slide or move under the impact of water.
- Smaller boulders must be placed in the interior part of these boxes while the larger ones must be placed on the outside.
- Even the smallest boulder should be bigger than the gap in the wire mesh.
- The wire mesh must be stretched out so that there is no bulging or sagging.
- The wire used for tying the wire mesh sections must be of the same strength as the wire used in the wire mesh. It could either be of the same gauge or of a thinner gauge plied and twisted together.
- For height above 2 m, the headwall must be made as a series of steps sloping on the down streamside to impart stability to the structure.

7.3 Gabian Structure Along Embankments

These structures are built to cushion the impact of water, preventing it from eroding the banks. On very high slopes as in the Himalayas, such structures are built along the contour lines to prevent landslides.

These should be located in those stretches where embankments are prone to severe erosion by the stream. Normally this happens where the stream turns sharply and its flows are directed towards the embankments.

The length of the embankment to be strengthened has to be determined. Along this length the rectangular boxes have to be placed as a straight wall with a vertical face. The wall width could be a standard 1m while the length and height both are dependent on the local conditions. The height of this wall should be at least 1 m above the peak flood levels of the stream. The upstream end of the gabian wall should be well embedded into the embankment so that the stream is not able to cut a path behind the structure. Care must be taken that the gap between the structure and the embankment is filled with rammed earth while raising the rectangular structure.



An overview of an earthen structure

7.4 Drainage line treatment: Earthen water harvesting structure

Types of Earthen water harvesting structure:

Earthen water harvesting structures can be of two kinds depending on the primary purpose for which they are built:

1. Percolation structure

2. Irrigation structure

Objectives of Percolation Structures:

Percolation structure is an earthen dam constructed to impound water flowing in a small drain or a medium drain for the primary purpose of increasing the rate of groundwater recharge. A percolation structure augments flows in the groundwater system by controlling the volume and velocity of surface water flow, thereby allowing water a greater time for percolation into the aquifer. This replenishment of groundwater benefits the irrigation wells situated downstream in the catchment. Enhanced groundwater recharge helps lengthen the life of the seasonal streams through regenerative base flows after the end of the rainy season. Depending on the capacity of the structure and duration of water storage, the pond can have secondary benefits (such as pisciculture) that are vital for the livelihood security of marginal farmers and landless laborer's.

Objectives of Irrigation Structures:

Irrigation structures that harvest surface runoff from a farm or a group of farms, forming small catchments of about 2-30 hectares, for the primary purpose of providing protective irrigation. Undulating topography forming a series of natural watersheds drained by small, well-defined drainage lines and with fallow land alongside is ideal for irrigation structure construction.

- Most parts of India typically receive rainfall between June and September, very intensely within a few hours and a few days. The number of rainy days does not average more than 40 - 50. Moreover, rains are extremely erratic, often characterized by the late onset and early withdrawal. Prolonged dry spells during the rainy season, resulting in agricultural droughts, are also frequent. Hence, the kharif crop needs to be drought-proofed through 'protective' irrigation, applied to overcome accumulated soil moisture deficits within the rainy season. Irrigation structures built to collect the runoff from small catchments provide this vital requirement. Such structures are very important in areas which are poor in groundwater resources and which do not have access to canal irrigation.
- In addition to providing irrigation, irrigation structures allow greater time for water to percolate into the aquifer. This replenishment of groundwater benefits the irrigation wells situated downstream in the catchment. Enhanced groundwater recharge helps lengthen the life of the seasonal streams through regenerative base flows after the end of the rainy season.
- Depending on the capacity of the structure and the duration of water storage, the structure can have secondary benefits (such as pisciculture) that are vital for the livelihood security of marginal farmers and landless labourers.
- Further, where soil depth and water holding capacity is sufficient a rabi crop such as gram or linseed can be sown in the bed of the pond after the water has been extracted for Irrigation.

Location:

The location of earthen structures is determined on the basis of the following considerations:

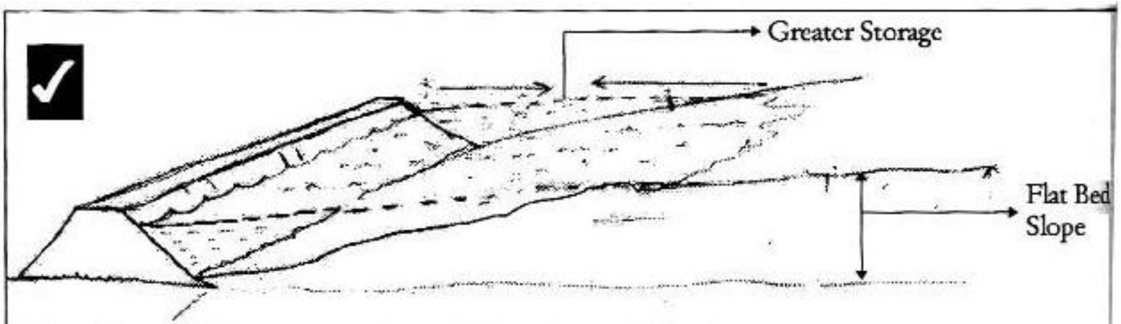
Effective Storage: The site for a earthen structure should be selected at a point where the total runoff is adequate to fill the structure to its full capacity, i.e., the total runoff should be at least greater than or equal to the 'effective' storage of the structure.

Effective storage = Storage capacity + Volume of water percolating from it during one season + Evaporation + Water used for protective irrigation.

Hence, an estimation of runoff from the catchment and the effective storage of the structure are essential to decide its location. On the other hand, it must also be ensured that the total runoff is not too large in relation to the effective storage of the structure, i.e., the structure should be able to hold most of the water flowing into it. A common mistake is to locate earthen structures in such a place where the catchment area of the stream is very large so that the inflow of water is much higher than structure capacity. Such a structure would necessarily have to let most of its inflow out through a waste weir, which literally means that we end up leaving the entire naala. Therefore given the cost constraints no structure should be constructed where its effective storage is less than 50% of total runoff. Thus matching runoff and storage entails a knowledge about the topography of the catchment, the geology of the bed of the structure and the net irrigation requirement for drought-proofing the kharif crop.

Embankments: At the point of location, the drainage line must have well defined embankments to, which the structures can be anchored. Since the structure is embedded into them, these embankments should be strong and not made of loose material like sand.

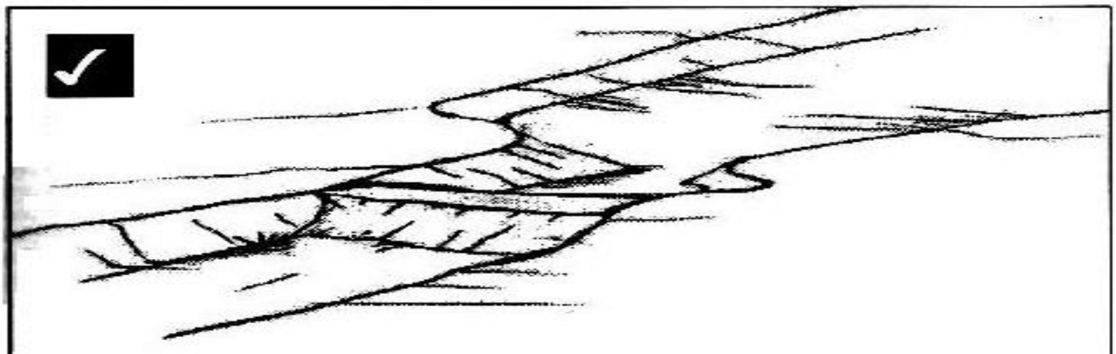
a. Slope of the Upstream Naala Bed: The bed slope should be relatively low (not



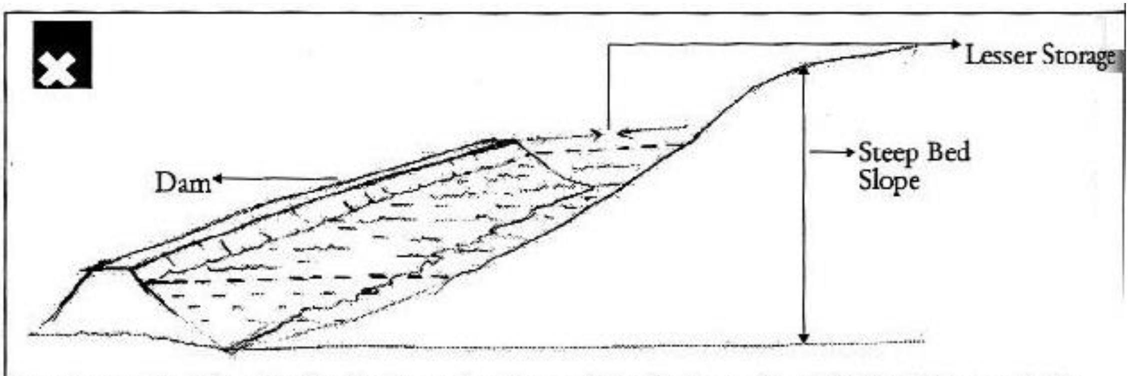
Sites where the slopes are gentle should be chosen instead

more than 5%) upstream of the site selected for the earthen structure, in order to maximize storage capacity.

b. Width of the Naala: At the site the embankment should be narrow and vertical. But as we move upstream, the naala should ideally widen so as to contain maximum storage within its banks.

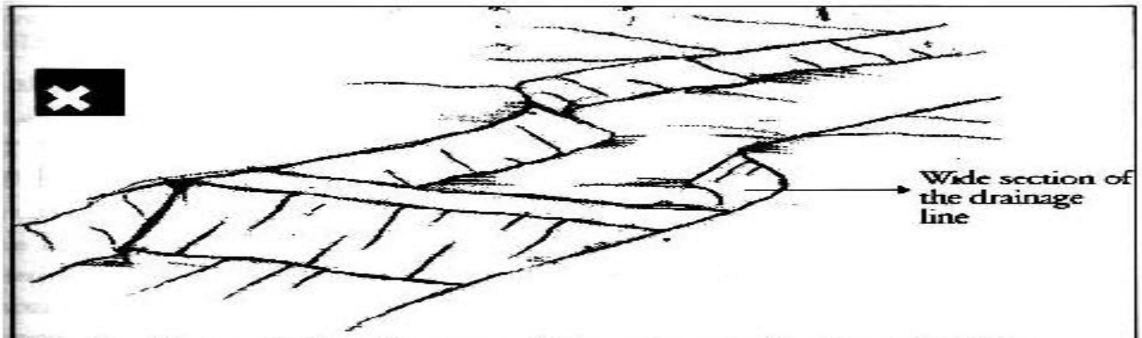


Instead choose a site where the drainage line is narrow and upstream of which the drainage line is wide



Structures should not be built where the slope of the drainage line is high. This results in lesser volume of storage (other factors remaining constant) and may breach the structure.

Geology:- Since the primary objective of structure is irrigation, the geology of the structure must be favorable for water storage, i.e., percolation losses must be minimal up to reasonable depths. In cases where percolation losses are high and the storage structure makes sense only as a groundwater recharge structure, it is advisable to dig intake wells on the downstream to collect the percolating water. If the percolation losses are high but the strata, which can be tapped by dug wells, yield very little water, the site should be abandoned since a structure here will neither store surface runoff nor recharge wells. In the case of the percolation structure, however, the primary consideration is groundwater recharge. Therefore, we would ideally like the bed of the structure to be made up of relatively pervious material. In both cases, the geology of the waste weir site should preferably be a hard rock so



All other factors being the same, it is not cost effective to build an earthen bund where the drainage line is wide.

that it does not erode very easily.

Availability of Materials: Even if all other factors are favorable and if the requisite materials are not easily available, one may be compelled to abandon the site.

Design:

The design of an embankment type structure refers to its full reservoir level, freeboard, settlement allowance, upstream and downstream slopes of the bund, dimensions of the cut-off trench, waste weir and toe drain and the embankment protection which is required to be provided.

Full Reservoir Level (FRL):

The FRL indicates the maximum capacity of any storage structure. As explained earlier, the FRL is determined bearing in mind the total runoff in relation to the effective storage potential of the site, which in turn depends on the shape of the side embankments, the upstream bed slope and geology of the drainage line and the width of flow. It is also important to assess the irrigation required from the farm pond for drought proofing the kharif crop. The pond capacity is determined on the basis of the net irrigation requirement of the pond and evaporation and percolation losses.

Pond capacity = Irrigation requirement + Evaporation + Percolation.

These losses together are normally estimated at 10% of the total storage. For instance, if the net irrigation requirement from the pond is 1000 cu.mt. and the percolation and evaporation losses from this storage during the monsoon are estimated at 100 cu.mt., the total pond capacity should be 1100 cu.mt.

In order to fix the FRL, we begin with a possible FRL and then using leveling instruments, we draw contour lines in the catchment of the pond. The submergence permissible in any such structure would depend upon the nature of the catchment especially with regards to whether it is inhabited, forested or whether it includes fertile agricultural land. The permission of those whose lands may be submerged would also need to be obtained prior to fixing the FRL. Ideally, they should be actively involved in the planning and design of such structures from the beginning to the end. In case they suffer a loss due to the structure, they must be adequately compensated possibly through sharing with them the benefits obtained from the structure.

The Free Board and the Top Bund Level (TBL):

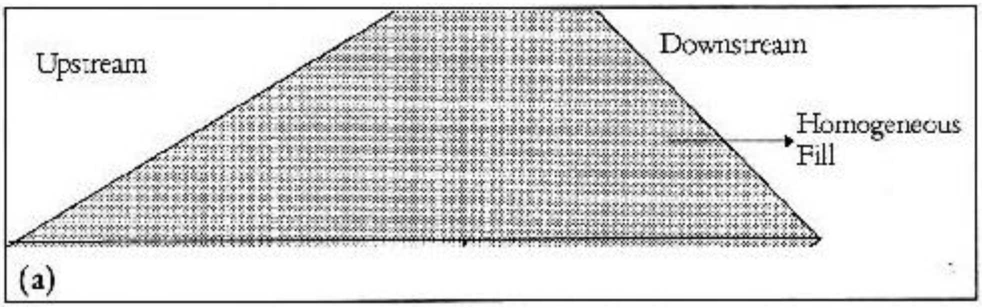
If water flows over the top of the bund in an earthen structure, the bund will break. Hence, unlike in masonry or boulder structures, the excess water cannot be directed over the top of an earthen structure. Therefore, the top bund level (TBL) in all earthen structures has to be kept higher than the FRL. The difference between the TBL and the FRL is called the 'freeboard'. In other words, freeboard is the difference in elevation between the top of the structure and the base of the waste weir. It has been found through the years of experience that for earthen structures with height less than 5 m, a freeboard of 1 m would be adequate. Keeping a higher freeboard makes the structure safer but it also reduces storage or makes the structure more expensive. One more thumb rule for deciding the free board is at 15% of maximum height of the structure, but free board should be of a minimum height of 1 m. Thus, while one must make full allowance for peak runoff as evident from long-term rainfall data, one must not give unnecessary freeboard beyond the level warranted by peak runoff.

Top Width:

Thumb rule for the calculation of top width of earthen structure is as follows:

Top width of structure = 1.5 + (Maximum height of dam/5)

But in some special case this formula can be avoided for the calculation of top width. Example, if the road is planned over the dam then the minimum road width should be provided on the top of the structure.

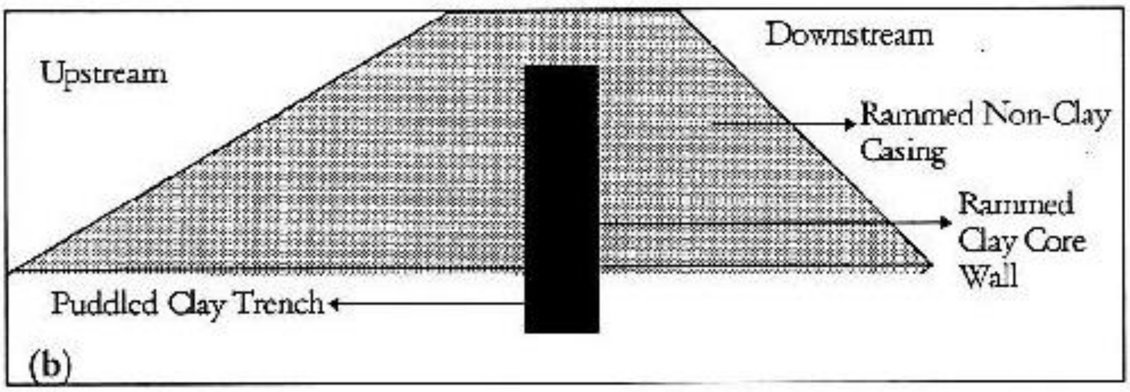


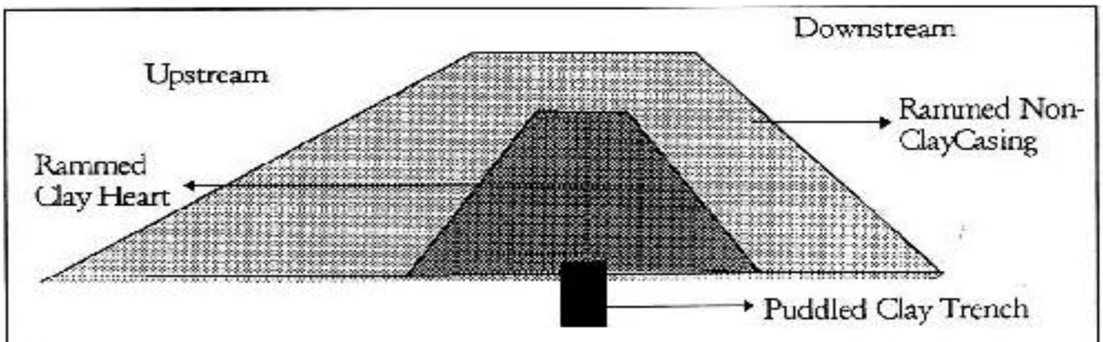
Type of earthen structures:

Depending on the construction materials used, three types of structures can be constructed:

Structure made of Homogenous Material: In places with an impervious foundation where availability of clay is virtually nil, structures can be made from a relatively more pervious material either by increasing the area of cross section, ramming the material to a greater extent or by providing a narrow clay blanket on the upstream side in order to control seepage.

Core Wall Type: Where both the pervious and the impervious materials are available, the structure wall can be partitioned between these according to their relative abundance. Where the availability of impervious clayey soil is limited, one can choose to economize on clay by puddling. In the core wall type structure, there is a narrow, impermeable wall, extending from embankment to embankment and made of puddled clay that forms the core of the structure. To support and protect this, the outer flanks of the structure are made of dry or wet rammed coarser soils, which are arranged by grade. The finest particles being placed inside, graduating to the coarsest material outside. The final shelter is provided by pitching, which involves giving a layer of boulders on the upstream face of the structure.



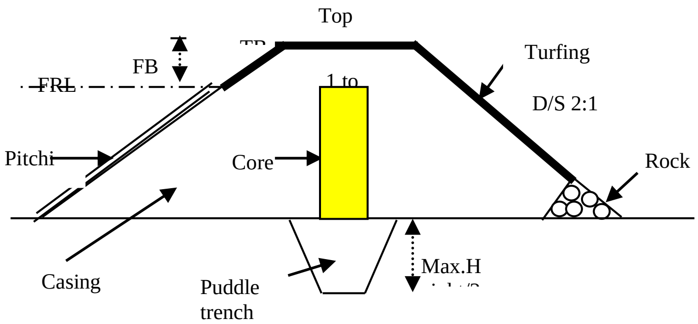


(c)
The 3 possible ways of making earthen bunds. (a) a bund made of homogeneous material. (b) a bund with a core wall made of rammed clay (c) a bund with a rammed clay heart

Heart type: Where clay is available easily and in large quantities, it is possible to construct the heart of the bund with wetted and rammed clay, and providing a casing of coarser soils to protect it. In situations where pure clay is not available, it is still possible to make a farm pond using finer and clayey soils for the heart of the structure and graduating to coarser soils in the casing.

Upstream and Downstream Slopes of Earthen structure:

The upstream slope of the structure is subject to erosion by intense rainfall and the sloughing action of receding water. The downstream slope of the bund is subject to erosion by intense rainfall and the scouring action of flowing water. In order to protect the bund from such erosive action, the slopes of the structure must be very carefully determined. The precise upstream and downstream slopes of the structure depend on the angle of repose and erodability of the materials used in the outermost faces. Through experience it has been found that for a stable earthen structure, the upstream slope should range from 2:1 to 4:1. The downstream slope should range from 2:1 to 3:1. In general 2:1 slope is provided on the upstream and downstream of the structure.



X Section

Settlement Allowance:

The soil used on the embankment of a structure is usually compacted to a certain degree. Even so, a certain allowance has to be made for consolidation of the fill and foundation materials due to the weight of the dam and the increased moisture caused by water storage. This settlement allowance depends on the type of fill material and the method and speed of construction. The design height of the dam will therefore be lower than the height immediately after construction. This means that the structure during the construction phase should be raised 10 to 25% in excess of the design height. An understanding of this is important because large settlement on structures could lead to overtopping of the structure. It must also be remembered that the structure settles the maximum in the portion where its height is also the maximum, i.e., over the deepest portion of the naala. Thus the structure must be convex shaped with the middle portion being higher than the sides.

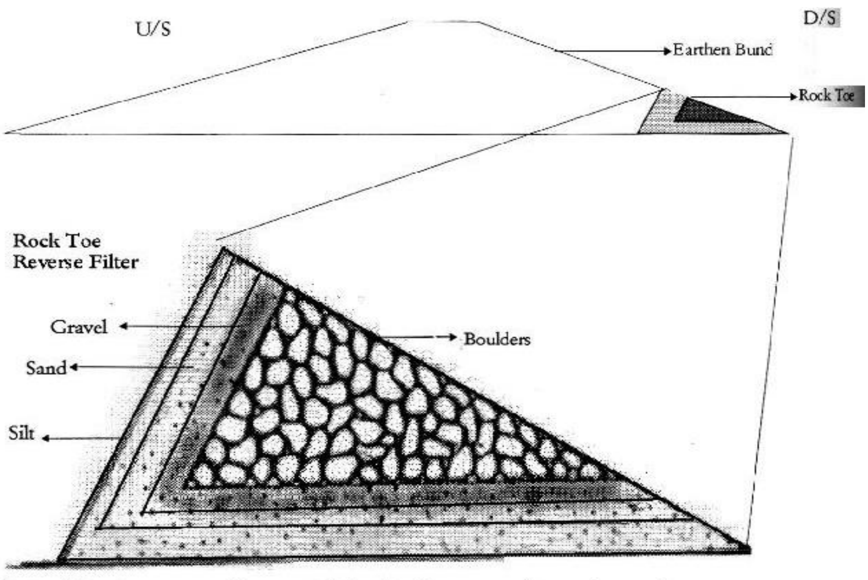
Cut-off Trench:

The purpose of the cut-off trench is to control excessive seepage below the structure. It is dug across the bed of the naala parallel to the central line of the structure and is filled with clayey soils, which are compacted either by puddling or ramming. In farm ponds, the depth of the cut-off trench is usually fixed as one-fourth of the height of the structure or till an impervious strata is reached, whichever comes earlier.

Pitching for Embankment Protection:

To protect the surface of the structure from erosion by rain and the sloughing action of receding water in the reservoir, pitching is done by giving a final layer of boulders on the slopes of the structure. The extent of pitching depends on the angle of repose of the material used on the upstream face of the embankment. Where boulders are not easily available, the freeboard zone on the upstream face and all of the downstream face can be protected by planting grass. The roots form a protective web that binds the soil together, and the grass blades cushion the force of raindrops making them less destructive.

Toe Drain or Rock Toe:



A Rock Toe is a reverse filter provided at the downstream base of an earthen bund. A multi-layered filter is provided in which each subsequent layer becomes coarser than the rest

Even in a relatively impervious structure, some amount of water stored in a reservoir percolates from the upstream side to the downstream through the body of the structure, thus forming a seepage line. If this line emerges above the base of downstream face, it would slowly cut into the downstream side and gradually erode it. This would pose a serious threat to the stability of the structure. In order to drag the seepage line downward so that the water is drained within the base of the structure, a toe drain or rock toe is provided. This toe drain is a reverse filter with each subsequent layer increasingly coarser than the previous layer. The filter material must be more pervious than the structure material so that the seeping water can be quickly removed.

Causes of Failure of Earthen structures

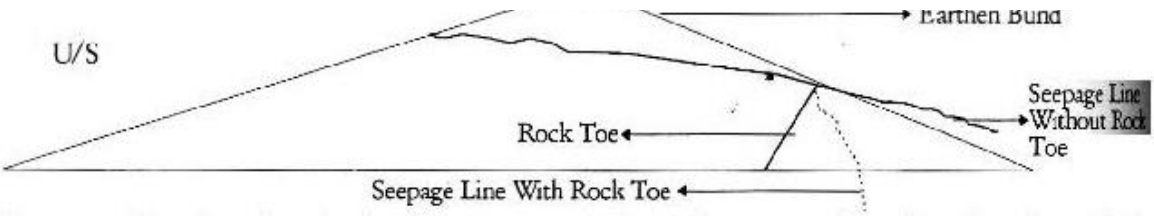
➢ **Seepage Line:** In any earthen structure, some water always seeps through the structure. The line along which the water seeps is called the seepage line. In relatively pervious and homogenous structures, the seepage line frequently crosses through the bund and appears on the downstream slope. Water which percolates either through the structure or under its foundations carries with it particles of soil thereby forming tunnels/ runs which once formed quickly enlarge, becoming cavities into which the structure sinks, enabling the water to top it and carry it away by erosion. The cause of this failure is a high percolation velocity greater than or exceeding the tolerance limit of the soil. Such a failure can be caused because of a lack of an effective stop wall to obstruct the path of percolation. It could also be caused by cracking of the soil, burrowing of animals and the decaying roots of trees.

The seepage line is defined as the line marking the boundary between the saturated (wet earth) and unsaturated (damp or dry earth) zones inside an earthen structure. Studies have shown that the slope marked out by the seepage line is different in different materials.

Even in a relatively impervious structure, some amount of water stored in a reservoir

Slope of Seepage Line in Different Materials

Material	Slope of Seepage Line (%)
Clay	25-30
Good compacted soils	25
Clayey Loams	20
Fine Silt	17
Loam	13
Fine Sand	12
Coarse Sand	10

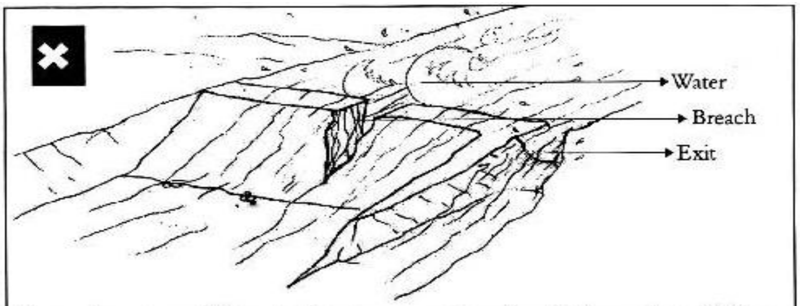


In any earthen dam there is always some seepage along the seepage line. A rock toe is made to drag down the seepage line in order to prevent it from cutting the width of the bund.

percolate from the upstream side to the downstream through the body of the structure, thus forming a seepage line. If this line emerges above the base of downstream face, it would slowly cut into the downstream side and gradually erode it. This would pose a serious threat to the stability of the structure. In order to drag the seepage line downward so that the water is drained within the base of the structure, a toe drain or rock toe is provided. This toe drain is a reverse filter with each subsequent layer increasingly coarser than the previous layer. The filter material must be more pervious than the structure material so that the seeping water can be rapidly removed.

➢ **Sloughing:** Sloughing of the side slopes of an earthen structure is said to take place when the water face of the structure is cut into and eaten away by the action of waves or receding water. As the water recedes it carries off some soil particles, leaving behind large pore spaces. On drying, these spaces collapse, leading to further erosion. This leads to the slope becoming so steep that slipping of the upper layers occurs and the top width of the structure is gradually eaten through so that the overtopping and failure ensue. To protect structures against this action, pitching or riveting is undertaken on the water face of the structure. Use of vegetative measures can also prove effective.

- **Scouring:** Rainwater falling on the bund acquires scouring velocity as it flows on the downstream face of the embankment. It, therefore, cuts channels on the downstream side and weakens the structure. Pitching and vegetative measures on the downstream side help keep the velocity of flow within the non-scouring limit.

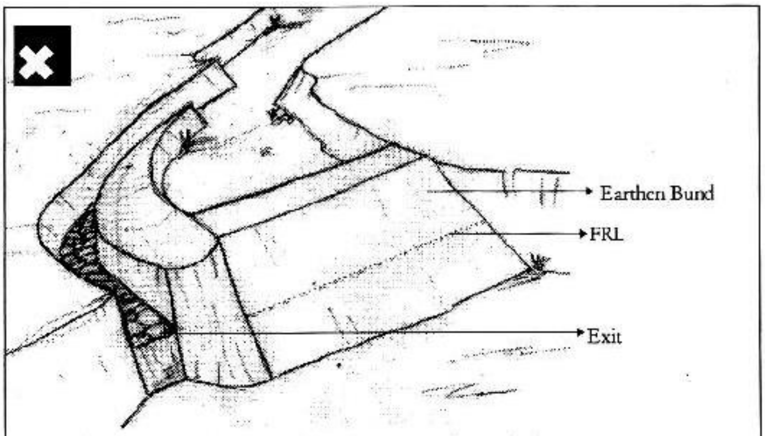


If an adequate exit is not given to an earthen bund, the water will flow over the top, causing a breach and eventual collapse

- **Overtopping:** All causes of earthen structure failure ultimately lead to overtopping. Water washing over the top of the structure gradually erodes the top and downstream slopes, thereby cutting a channel through the structure to a depth below the Full Reservoir Level (FRL), which speedily results in a breach. To prevent this, the top of a structure is raised to a certain height called the 'freeboard' above the FRL.

7.5 Waste Weir:

Water in excess of the FRL is drained out by a waste weir. After estimating the peak runoff from a catchment and the FRL of the structure, the dimensions of the waste weir are determined. The waste weir must have the capacity to safely drain out the peak runoff when the water is at FRL in the structure. Peak runoff from a watershed is estimated as per the Rational formula:



For a given volume of water which is to pass through the exit, a narrow and deep exit leads to a lower storage . . .

$$Q=CIA/360,$$

where Q=Peak runoff (cubic meter per seconds); C=runoff coefficient;

I = Intensity of rainfall (mm/hr); and A=watershed area (ha).

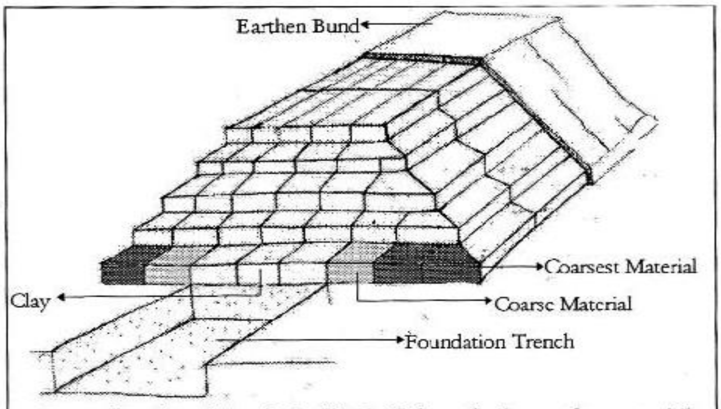
Wherever possible, it is better to have a broader waste weir for a given volume of excess runoff rather than a deeper one so as to maximize the storage capacity. The discharge capacity of the waste weir is given by the crested weir formula,

$$Q = 1.75LH^{3/2},$$

where, Q=discharge (cubic meter per second), L=weir width (m) and H=depth of flow (m).

Construction:

- Fix the FRL for the structure following the procedure outlined in the Design section.
- Draw a line along the center of the proposed structure from embankment to embankment and determine the height of the bund (including freeboard) at different locations along this line. Wherever the ground level is lower, extra work will be needed to raise the structure to the required height. Settlement allowance must be added to this height at each point. On the basis of the slope parameters decided, indicate distances on the upstream and downstream side at each location and draw lines through these points. Care must be taken to provide the required top width. For instance, if the structure height is 3 m, crest width 2 m and upstream and downstream slopes 2.5:1 and 2:1 respectively, the upstream edge of the structure must be marked at (3 x 2.5) + 1 = 8.5m distance and the downstream edge at (3 x 2) + 1 = 7 m distance.
- Dig trial pits at 3 - 4 locations at the base of the proposed structure. The percolation rate in these pits would help determine the depth of the cut-off trench along the base of the structure.
- Dig a 1 m wide trench of required depth along the centerline of the proposed bund. On both the sides the trench must at least extend, till the point where the top of the bund meets the embankment.
- In a core wall type of structure, the clay is soaked, kneaded and rammed to make a thin impermeable wall. The cut-off trench is filled with puddled clay till the ground level is reached. This is a labor-intensive method but it maximizes impermeability of clay.



An earthen bund "peeled off". Built layer by layer, the materials get progressively coarser as we move from the inside to the outside

Where there is an easy availability of clay, a heart type of structure may be made. A thicker wall of clay can be raised by laying, wetting and ramming. After the cut off trench has been filled, the structure comes up in horizontal layers. All sections of the structure must be raised together. In a core wall type, the puddle core wall and the shell must be simultaneously raised. In the heart type, both the hearting and the casing must be done together. The layers should be 6 to 8 inches on either side, which are layed, wetted and rammed. While laying it should be kept in mind that the finer soils should be laid inside, i.e., closer to the clay core, and the coarser soils should graduate outwards. The height of the core wall/hearting must be 0.5 - 0.75 m less than the top bund level. As layer after layer gets compacted, the width of the casing is reduced to create the slopes of the upstream and downstream sides of the structure till the desired height is arrived at.

Dos And Don'ts:

- The effective storage capacity of the structure should not be either too large or too small in relation to total runoff.
- The upstream bed of the structure site should not have a high slope.
- At the point of location of the structure, the drainage line must have well defined embankments in which the structure can be anchored.
- The permission of those whose lands may be getting submerged would also need to be obtained prior to fixing the FRL. Effort must also be made to actively involve them in the planning and design of such structures from the beginning to end.
- Adequate freeboard must be provided to the structures on the basis of the peak runoff rates computed from long-term rainfall data.
- The waste weir must be designed so as to drain out the peak runoff safely when the water is at FRL in the structure.
- In order to protect the safely from such erosive action of water, the upstream and downstream slopes of the safely must be very carefully determined on the basis of the angle of repose and erodability of the materials used. Do not use highly erodable material like clay on the outer faces.
- Adequate settlement allowance must be provided for consolidation of the fill and foundation materials due to the weight of the structure, rainfall and the increased moisture caused by water storage.
- Cut-off trenches to control excessive seepage below the structure must be filled with clayey soils compacted either by puddling or ramming.
- Toe drains must be provided to drag the seepage line downwards so that the water is drained within the base of the structure.

Costing:

Cost of a earthen structure with structure length of 30 m, height 3 m, upstream slope of 3:1 and downstream slope of 2.5:1 and a total storage capacity of 0.75 ha-m works out to Rs. 100000 at 2006-07 prices. A typical cost sheet is appended below:

7.6 Dugout type Farm Pond

It is a water harvesting structure suitable for the plane area. Main purpose of the structure is to ensure protective irrigation for the kharif crop. Topography of Bengal, Orissa, Chattisgarh & Bihar is suitable for construction of these types of structures.

Site selection criteria: Following are the criteria for the site selection of a dugout pond:

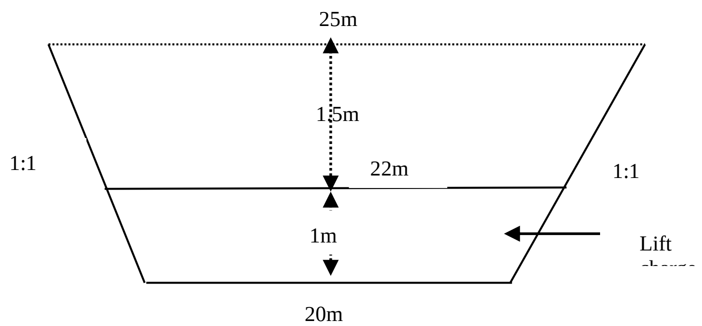
- Location of the structure should be near to farmland so that it can be used for protective irrigation and benefited in the well recharging.
- Catchment area of the pond should be within 2 - 20 hectares.
- Soil strata up to 3 m depths should not be in the form of disintegrated rock or hard rock.
- If any well is there, then the farm pond should be on the upstream side of the well.
- Soil of the dugout should be impermeable so that water can be stored for a longer period.
- One thousand cubic meter (20 m x 20 m x 2.5 m) storage capacity of farm pond required for the protective irrigation of one hectare of the land. Five percent land is required for serving the said requirement. Beneficiaries should be selected as per the requirement of the land for the construction of farm pond.
- At least three to four hectares catchment area is required for storing 1000 cubic meter water in a farm pond.

We can construct two types of farm ponds:

1. **Dugout type:** Where the slope of the field is relatively low and there are no well-defined drainage channels, the pond will have to be created by excavation. The storage capacity will be confined to this excavated portion. Because of the low slope, there will be little storage above the ground level. Such ponds are best located in the lowermost portion of the field. The runoff has to be directed into the pond through bunds or channels.

Trapezium type dugout pond:

Size of the tank depends on the requirement of water for protective irrigation. Depth of dug out pond depends on the soil strata. Side slope of

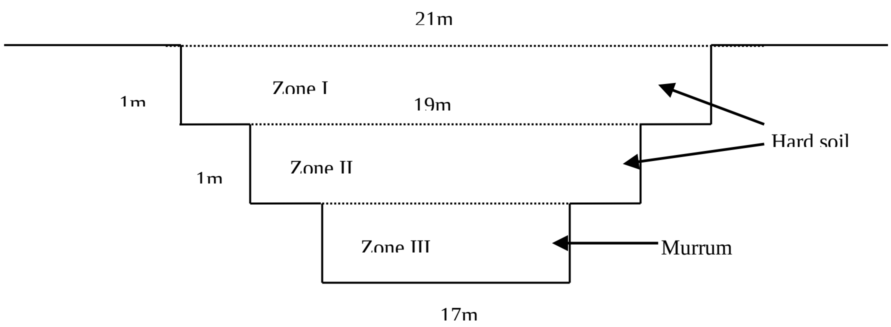


X-Section of dugout pond

the dug out pond depends on the angle of repose, generally 1:1 side slope is provided in cutting section.

Stepped dugout pond:

It is preferred in that location where community may use the pond for their daily work.



X-section of dugout

2. Dugout cum Embankment type: Where there is no well-defined channel and the slope of the farm is medium, farm pond should be of the dugout cum embankment variety. Here, the mud excavated should be used to form an embankment all around the pond except at the inlet. At the full reservoir level, the water level will be higher than the ground level and the embankment will serve as a retaining wall. Therefore, even while the dugout portion will be a significant part of the total storage volume, there will be some storage above the dugout portion retained by the embankments.

The main difference between the embankment and dugout types of farm ponds is that the dugout variety can be made in virtually any topographic situation without reference to the drainage line. As for the design, the freeboard in a dugout pond refers to the difference between the base of the waste weir and the top of the dugout portion of the structure. The freeboard is given mainly to prevent water from flowing into nearby fields during flash floods. Since the main storage is not through the bund, most of the discussion regarding bund parameters becomes redundant. But a certain degree of care has to be exercised in order to protect the pond from erosion by the intense rainfall and the sloughing action of the receding water. Here, the same considerations apply as in determining the slope of the dugout area. If the pond face is made of a material, which has a low angle of repose, it should be cut at an appropriate angle to form a series of steps. The resultant reduction in the pond capacity is to be balanced against the considerations of stability. Pitching should also be done where required. Where percolation losses are high, it may be advisable to allow a layer of transported soil to get deposited on the pond bed during the initial year. By acting as a clay blanket, this layer would reduce percolation losses. In subsequent years, a silt trap can be made in the inlet channel. The inlet channel should be lined with boulders to make it safe against erosion. Before the channel reaches the pond, a silt trap should be placed either by digging a trench or through constructing a boulder check.

A farm pond of 1000 cu.mt., with a catchment of 0.6 ha, can protect 1 ha of standing paddy crop. The cost of construction of such a farm pond would work out to about Rs. 10,000 to 15,000 per hectare. Where the percolation losses of this on-farm reservoir (OFR) could be controlled by the puddling of the reservoir bed, the returns for the investment are likely to be high. In low lying land which gets considerable natural recharge from the water table, the OFR of even smaller size can protect paddy against the agricultural droughts. Even in other types of land situations, the total storage during the season can be substantially raised above the static storage capacity of the OFR, if the conserved water is used strategically. Appropriately located farm ponds would allow for a second crop as well. The moisture stored in the soil profile in a lowland area after the harvest of rice or soyabean is nearly the same as that of the upland region during the rainy season. Hence, suitable upland crops can be grown in this portion as the second crop. Utilisation of soil moisture by these crops proves difficult on account of the drying up of the topsoil layers, which results in the poor germination percentage. The residual storage available in the OFR can be used to ensure better establishment of an upland crop in the post rainy season, which could then utilise the available soil moisture for its growth.

Crop systems combining the farm pond concept with the paddy and soyabean cultivation in 1 hectare plots can also be tried out on vertisols and inceptisol. This system has the following components:

- Small dugout farm ponds are created using 10% of the area, with enough catchment to generate runoff to fill the pond during the main rainy spells. The excavated material is used for improving the drainage characteristics and moisture retention in the catchment of the OFR.
- Rice is grown in the lower portion of the field in about 30% of the area, during the rainy season. The runoff collected in the OFR stabilizes the yield of rice to such a level that the production from this portion is equal to or more than the output from the whole farm before the OFR was established.
- High value legumes such as soyabean and pigeon pea are grown in the catchment of the OFR, in about 60% of the area. The drainage from this area fills the OFR.
- During the post-rainy season, suitable dryland crops are grown in as big an area as is feasible using the water saved in the OFR. In ascending order of water availability, the post-rainy crop could be gram, wheat, sunflower or vegetables.
- Fish fingerlings could be grown in the OFR during the months of July to October.
- Results of an evaluation of the yield performance of crops with OFR on vertisol fields are depicted in the table below. It can be seen that construction of farm ponds can have a significant impact on yield stabilisation.

Precautions:

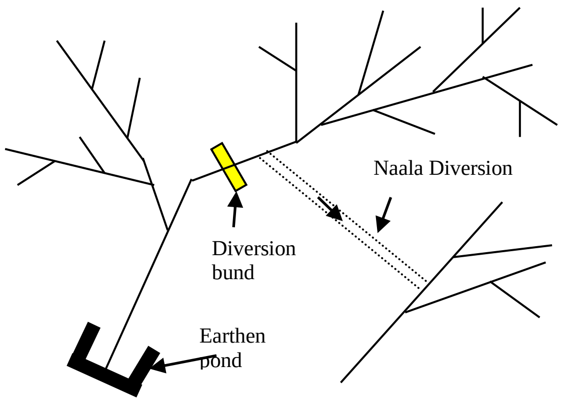
- Catchment area should be treated for the soil conservation interventions otherwise pond will silt up.
- It should be constructed on small drain or the first order drain
- If the dug out pond is used for meeting daily water requirements then stepped type dugout should be preferred.
- Prefer those beneficiaries who have no source of irrigation.
- Select the deep pond instead of a shallow pond
- Exit of a dug out pond should be at the ground level and side of the embankment should be protected with stone pitching.
- Dugout soil should be stacked in form of embankment with a one-meter burm.

7.7 Naala Diversions and Naala Training

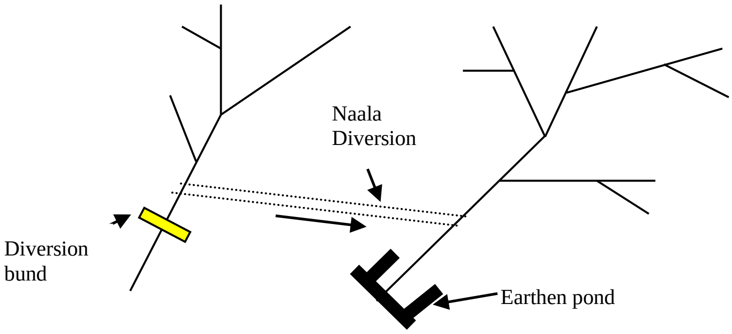
Naala diversion:

While planning for water harvesting structures naala diversion is sometimes necessary. Following are the situations where the naala has to be diverted from its natural path:

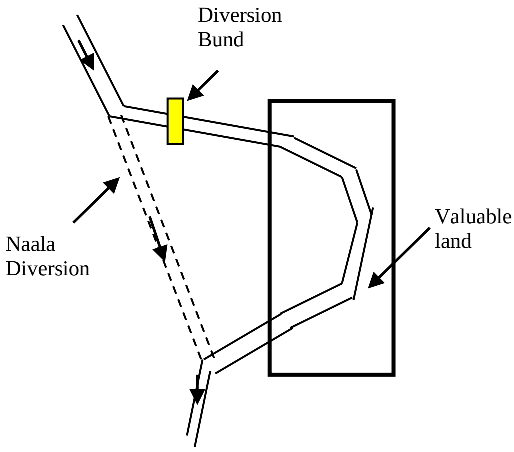
- When a site fulfills all the points of an ideal site selection criteria but is problematic only with regards to the excess catchment; and when there is not enough space for providing an exit: - In that situation, part of naala (as per requirement) can be diverted through an artificial channel to the nearby drain. Caution should be taken while planning for diversion so that the artificial channel should not erode any valuable land. If the cost of structure and cost of diversion is justified in terms of the cost benefit ratio then this type of plan may be thought for implementation.



- When a site fulfills all the points of ideal site selection criteria, with an exception that the catchment is not enough for planned storage capacity of water harvesting structure: - In that situation, nearby naala (as per requirement) can be diverted through an artificial channel into the main naala. Caution should be taken while planning for diversion so that the artificial channel should not erode any valuable land. If the cost of the structure and cost of the diversion justified in term of cost benefit ratio then this type of plan may be thought for implementation



- When a valuable land is eroded by naala: - In that situation, naala can be diverted through artificial channel to near by drain. Caution should be taken while planning for diversion that the artificial channel does not erode any valuable land. If it is justified in terms of the cost benefit ratio than this type of plan may be considered for implementation



- Number of water harvesting structure, which can be connected through an artificial channel. It is required for the paddy-cultivated area. It is very important that the level of exit should be decided on the basis of our plan of connections. Example: Structure Nos 1, 2, 3 & 4 are planned for interlinking. We would like, that the over flow of structure No 1, should be diverted in structure No 2 and of No 2 to No 3 and No 3 to No 4 structure. In such a case elevation of the exit of structure Nos 1, 2, 3 & 4 should be in decreasing order. While planning caution should also be taken against any erosion of the valuable land by the artificial channel. If the costs of the structure and cost of the diversion are justified in terms of the cost benefit ratio than this type of plan may be considered for implementation.

Training a Naala:

Erosion of naala depends upon the soil strata, if the hard strata is present in the bed of naala, then the naala erodes the embankment and shape of naala in this case will be U shape. If the hard strata is present the sides of the embankment of naala, then the naala erodes the naala bed and shape of naala in this case will be V shape.

Main problem of a U shape naala is that at the turn, the embankment on one side gets continuously eroded while on the other side silt heaps on depositing every year. In this way a naala changes its course every year. The purpose of training a naala is to protect the curve from the loosening of a portion of an embankment, and prevent the erosion of the loosened embankment. At times, naala has to be diverted through straight channels.

Following structures can do training of a naala:

Gabian spur- It is a structure constructed in the curved portion of naala. It is located in angular shape. Materials used for gabian spur are G.I. wire mesh and boulder.

Gabian retaining wall- It is a wall constructed parallel to the embankment for the protection of loose side embankment.

Chapter 8
Conclusion and Way forward

Springs are the lifeline for the people living in hilly and upland terrain. During this study some interesting facts about the springs came out during the course of discussion with the elderly people of the community.

According to them:-

- About 30-40 % of the springs have dried up in last three to four decades
- Discharge volume in almost all the perennial springs have reduced to varied extent

This corroborates with the data provided in the NITI Aayog report, which says that nearly 50

% of the springs in the Indian Himalayan Region (IHR) are drying up, which affect thousandsof villages that depend on natural spring water for domestic and livelihood needs. It is said thatalmost all mountainous regions in the country report decline in the number of functional springs. For example the number of functional springs in the Almora region of Uttarakhand has gone down from 360 to about 60 over last 150 years which is a huge concern for the naturalecosystem and hence the biodiversity[19]. Needless to mention that with drying springs, our rivers are also drying and causing huge stress on the extraction of ground water. The drying springs, inter alia, further added to the work burden of women, who are forced to manually carry the water from distant locations, the wildlife encounter their survival threat, and the water security become a bigger challenge for the forest and national parks.

Springs and their conservation has enever got the attention of a national level development planand programme even today. Community (who are largely tribals) living in proximity to the springs have made their efforts to a varied extent for keeping the springs alive because their life and livelihoods will come to a standstill in the absence of springs. With this backdrop the ‘1000’ springs intiative by the Ministry of Tribal Affairs and United Nations Development Programme has come as a big hope for not only improving the quality of life of the tribal community but also conserving and rejuvenating the natural resource system.

The present study is like a pilot one which adopted a relatively easier method of mapping and geo tagging the existing perennial springs located at the tribal hinterland of Odisha. Though, the study was undertaken in five TSP districts namely Koraput, Malkangiri, Mayuubhanj, Rayagada and Sundargarh, it could not cover all the springs existing in each district due to time and resource constarints.

[19] https://www.downtoearth.org.in/news/water/crisis-in-the-himalayas-nearly-50-perennial-springs-in-the- region-have-dried-up-61482 accessed on 28th Dec, 2021

There are thousands of springs in each district which needs to be mapped and subsequently intervention plan can be designed for their conservation as well optimal use for the benefit of the community living in their proximity. A detailed identification of each spring- its local name, village, grampanchayat, block, district, GPS location, photographs of spring, its present status in term of discharge volume, conservation, usage, intervention etc have been collected and uploaded in the mWater portal of the Ministry of Tribal Affairs. This data base can be used for any development plan, programmes and convergence with the existing natural resource management programmes.

The approach adopted in the study can be applied anywhere in the world using minimal data resources, although the applicability of the assumptions to other locations should be carefully considered and be based on a working knowledge of the fundamental hydrological processes of the area under study. Tapping the tacit knowledge available with the local community on springs will be of great help in their conservation and optimal utilisation for the benefit of people.

Though the study does not have the mandate to make any suggestion or recommendation, however the study team feel it would be helpful if some light is thrown on the following aspectswhile planning for spring based interventions.

i. With declining discharge of water invariably from all the springs, urgent attention mustbe given for their conservation, rejuvenation and efficient use of water resources for thepurpose of irrigation and dinking water. All flagship programmes relating to irrigation,drinking and natural resource management should be undertaken towards the conservation and rejuvenation of springs in hilly terrain of all the districts of Odisha.

ii. While reviewing the district irrigation plan (Pradhan Mantri Krishi Sinchayi Yojana - PMKSY) of the five districts that was prepared in the year 2016, it was found that springs have not received any specific attention while discussing about the current irrigation ststus as well as potential for further expansion. Needless to mention that perennial springs play a very critical role for meeting the need of the tribal community in respect of their drinking water and water for irrigation. It is pertinent to mention that many tribal communities have started practicing settled agriculture since quite for some time. It is suggested PMKSY may incorporate spring based intervention in the revised plan.

iii. Springs can be taken up as micro level irrigation plan thus serving as a hub for drinking water and other domestic usage, horticulture, and agriculture at village or in a cluster of villages.

iv. Springs with relatively higher discharge volume of water with steep elevation has got potentiality to be developed as a micro hydro power generation unit to serve the villages in the proximity. There are a few examples in Koraput district where micro-hydro- power units which run in an entrepreneurship mode. They not only provide power to the villages, but also run the processing unit such as rice huller, mini flour mill etc.

v. In line with the Pani Panchyat, the srings in one area area can be clubbed and community level institution can be promoted for its conservation and laying down the benefit sharing mechanism.

vi. In the downstream villages of the springs, multi cropping agricultural techniques should be encouraged instead of focusing on single and water intensive cropping pattern.

vii. Piped Water Supply System (PWSS) and Rural Water Supply and Sanitation (RWSS) should systematically focus on conserving the springs and tapping the water for the optimal use by the community. Ironical coexistence of the perennial springs and scarcity of drinking water in the nearby villages can be altered easily.

viii. The water discharge in almost all the springs are in declining trend, so some intervention for their conservation as well as rejuvenation should be taken up on high priority basis. This plan can be incorporated in the Gramsabha of the Panchayat and theneedful can be done.

ix. The officials of the government line department at Block and District level should be thoroughly educated about the spring eco-system and how different prorgammes andschemes can be integrated for its conservation and benefit sharing.

x. Most of India's water policies are designed around large structures such as dams, canal, lake/pond or in the form of tube wells. However, there is no national level policy on springs and their management. Having the same is the need of the hour.

xi. A digital atlas of springs should be developed at state as well as national level as to monitor their status and intervention.

xii. Community has already rich knowledge system on springs, which can further be strengthened with scienfic inputs by organizing Gram Panchayat level workshops. Thiswill further sensitize them for better conservation of springs.

xiii. An adaptive strategy can be developed based on hydrogeological investigation and demand-supply model for vulnerable springs.

xiv. Intervention strategy can be drawn for reviving the recently dried up springs with activeparticipation of the community.

xv. Springs and springhed development can contribute to improving water security in mountainous areas by providing safe water thus contributing toward meeting commitments under the Sustainable Development Goals

(SDGs) especially SDG 6. Thus, linkage with SDGs could facilitate multi-stakeholder collaborations required for effective implementation of springshed management.

xvi. Mainstreaming and convergence of springshed management with other developmentalprogramme such as MGNREGA and ‘ Har Ghar Nal Se Jal’

xvii. Encouraging creation of water recharge structures such as contour trenches, deep pits and percolation pits during monsoon help in collection and storage of rainwater that further percolates into aquifer and prevent run-off. This process helps to protect the local vegetation, preserving soil moisture profile and rejuvenate the springs.

Annexure

Annexure-I Details of Identified spring with other details of Malkangiri District

Sl. No	Latitude	Longitude	Spring Name	Village Name	Gram Panchayat	Block	Elevation above MSL (meter)	Stream Order	Potability	Non-Potability	Owner	Usage
1	18.6663	82.0555	Akagodi	Chamundarasi	Salimi	Mathili	200 - 353	1	No	Bacterial Contamination	Community/ Village	Irrigation
2	18.6836	82.2442	Ranijodi	Khadikajodi	Kutunipalli	Mathili	200 - 353	1	Yes		Community/ Village	Irrigation & Drinking
3	18.3614	82.0656	Nangamali jharana	Admunda	Gangla	Malkangiri	200 - 353	1	Yes		Private	Not used properly
4	18.371	82.2237	Anakota	Oringi	Rasbeda	Khairput	353 - 507	1	No	Abandoned/ Dirty/ Unclean	Other (please specify) forest land	Irrigation & Bathing
5	18.3701	82.2095	Bahasajharana	Oringi	Raspada	Khairput	200 - 353	1	No	Abandoned/ Dirty/ Unclean	Other (please specify) forest land	Irrigation & Bathing
6	18.348	82.0486	Chiduchal Jharana	Metaguda	BL Pur	Malkangiri	200 - 353	1	Yes		Other (please specify) forest land	Drinking & Livestock
7	18.3402	82.0585	Dangala jharana	Metaguda	BL Pur	Malkangiri	200 - 353	1	No	Abandoned/ Dirty/ Unclean	Other (please specify) forest land	Irrigation & Bathing
8	18.4477	82.3037	Gaurabada	Bandhaguda	Mudulipada	Khairput	822-1266	1	Yes		Private	Irrigation & Drinking
9	18.4479	82.3037	Gurabada-2	Bandhaguda	Mudulipada	Khairput	822-1266	1	No	Used for cattle/ Bathing	Community/ Village	Drinking & Livestock

Sl. No	Latitude	Longitude	Spring Name	Village Name	Gram Panchayat	Block	Elevation above MSL (meter)	Stream Order	Potability	Non-Potability	Owner	Usage
10	18.454	82.2856	Babulrai	Bandiguda	Mudulipada	Khairput	822-1266	1	Yes		Community/ Village	Irrigation & Drinking
11	18.4487	82.3091	Sitakund	Padeiguda	Mudulipada	Khairput	822-1266	1	Yes		Community/ Village	Irrigation & Drinking
12	18.444	82.3114	Silimati	Padeiguda	Mudulipada	Khairput	822-1266	1	No	Abandoned/ Dirty/ Unclean	Community/ Village	Irrigation
13	18.453	82.3027	munabeda	Bandhaguda	Mudulipada	Khairput	822-1266	2	Yes		Community/ Village	Irrigation & Drinking
14	18.4577	82.3103	Tursimabada	Dantipada	Mudulipada	Khairput	822-1266	1	No	Abandoned/ Dirty/ Unclean	Community/ Village	Irrigation & Bathing
15	18.4619	82.3145	Inchugudabada	Dantipada	Mudulipada	Khairput	822-1266	1	Yes		Community/ Village	Irrigation & Drinking
16	18.4581	82.3103	Dangada	Dantipada	Mudulipada	Khairput	822-1266	1	Yes		Private	Irrigation & Drinking
17	18.3583	82.2002	Tupijala	Chilipadar	Kudumulguma	Khairput	353 - 507	1	Yes		Other (please specify) forest land	Irrigation & Drinking
18	18.3741	82.1992	Nalachu	Purunaguma	Kudumuluguma	Khairput	200 - 353	1	Yes		Community/ Village	Irrigation & Drinking
19	18.4967	82.2754	Chuapani-2	Phusuriguda	Kadamguda	Khairput	200 - 353	1	No	Abandoned/ Dirty/ Unclean	Community /Village	Not Being Used/ Abandoned
20	18.4957	82.2754	Chuapani	Phusuriguda	Kadmaguda	Khairput	200 - 353	1	Yes		Community/ Village	Irrigation & Drinking
21	18.337	82.1706	Saniajharana	Majurilendi	Kudumulguma	Khairput	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking

Sl. No	Latitude	Longitude	Spring Name	Village Name	Gram Panchayat	Block	Elevation above MSL (meter)	Stream Order	Potability	Non-Potability	Owner	Usage
22	18.5395	82.272	Amachuajharana	Mundaguda	Gobindapally	Khairput	200 - 353	1	No	Used for cattle/ Bathing	Community/ Village	Irrigation & Livestock
23	18.5466	82.2794	Jamujhala	Khemaguru	Gobindapally	Khairput	200 - 353	1	Yes		Community/ Village	Irrigation & Drinking
24	18.5576	82.2816	Jala	Champajharan	Udlibeda	Mathili	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
25	18.5565	82.2872	Samarkatajala	Champajharan	udulibada	Mathili	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
26	18.5608	82.2729	Mahulikunda	Bhoiguda	Udulibeda	Mathili	200 - 353	1	No	Abandoned/ Dirty/ Unclean	Private	Irrigation
27	18.5607	82.2743	Baiparimasanijhali	Bhoiguda	Udulibeda	Mathili	200 - 353	1	No	Abandoned/ Dirty/ Unclean	Private	Irrigation
28	18.5585	82.2734	Nuapokhorijala	Bhoiguda	udulibeda	Mathili	200 - 353	1	No	Abandoned/ Dirty/ Unclean	Private	Livestock
29	18.4924	82.2181	Kumudabeda	KandhaAtalguda	Khairiput	Khairput	200 - 353	1	No	Abandoned/ Dirty/ Unclean	Private	Irrigation
30	18.5582	82.2841	Pandriamajala	Champajharan	Udulibeda	Mathili	353 - 507	1	Yes		Other (please specify) forest land	Irrigation & Drinking
31	18.5973	82.2956	Purunapani	Baliamba	Gobindapally	Khairput	353 - 507	1	Yes		Community/ Village	Irrigation & Drinking
32	18.6	82.2957	Baiabjala	Baliamba	Gobindapally	Khairput	200 - 353	1	Yes		Community/ Village	Irrigation & Drinking
33	18.5962	82.2905	Maulima	Baliamba	Gobindapally	Khairput	200 - 353	1	Yes		Community/ Village	Irrigation & Drinking
34	18.4584	82.2271	Kadalichua	Mundiguda	Rasbeda	Khairput	200 - 353	1	Yes		Other (please	Irrigation &

Sl. No	Latitude	Longitude	Spring Name	Village Name	Gram Panchayat	Block	Elevation above MSL (meter)	Stream Order	Potability	Non-Potability	Owner	Usage
											specify) forest land	Drinking
35	18.4518	82.2287	Padheichua	Bandhaguda	Rasbeda	Khairput	200 - 353	1	Yes		Community/ Village	Irrigation & Drinking
36	18.4472	82.2296	Purunapani	Bandhaguda	Rasbeda	Khairput	353 - 507	1	Yes		Community/ Village	Irrigation & Drinking
37	18.4509	82.2305	Haladichua	Bandhaguda	Rasbeda	Khairput	353 - 507	1	Yes		Community/ Village	Irrigation & Drinking
38	18.4465	82.2303	Limachuajala	Rasbeda	Rasbeda	Khairput	353 - 507	1	Yes		Community/ Village	Irrigation & Drinking
39	18.4715	82.2321	Dambahal	Khairiput	Khairiput	Khairput	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
40	18.47 5	82.2338	Kalakurajharana	Khairiput	Khairiput	Khairput	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
41	18.4717	82.2344	Badakadaki	Khairiput	Khairiput	Khairput	200 - 353	1	Yes		Community/ Village	Irrigation & Drinking
42	18.4657	82.2291	Tanga	Mundiguda	Rasbeda	Khairput	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
43	18.4644	82.2295	Purunapanijharana	Mundiguda	Rasbeda	Khairput	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
44	18.4888	82.2595	kokamahuli	kokabal	kadamguda	Khairput	200 - 353	1	Yes		Community/ Village	Irrigation & Drinking
45	18.4873	82.2574	Gulamba	kokabal	Kadmaguda	Khairput	200 - 353	1	Yes		Community/ Village	Irrigation & Drinking
46	18.4933	82.2654	Gulundajhara	kokabal	Kadmaguda	Khairput	200 - 353	1	Yes		Community/	Irrigation &

Sl. No	Latitude	Longitude	Spring Name	Village Name	Gram Panchayat	Block	Elevation above MSL (meter)	Stream Order	Potability	Non-Potability	Owner	Usage
											Village	Drinking
47	18.5043	82.2826	Gigindajala	Similiguda	Kadmaguda	Khairput	200 - 353	1	Yes		Other (please specify) forest land)	Irrigation & Drinking
48	18.5044	82.284	Suliadanger	Similiguda	Kadmaguda	Khairput	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
49	18.4217	82.2288	Gadiputsu	Gadiput	Rasbeda	Khairput	200 - 353	1	Yes		Community/ Village	Irrigation & Drinking
50	18.3949	82.2208	Petiadam	Machhaguda	Rasbeda	Khairput	200 - 353	1	Yes		Community/ Village	Irrigation & Drinking
51	18.4247	82.2303	Gumunda	Dasaunguda	Rasbeda	Khairput	200 - 353	1	Yes		Community/ Village	Irrigation & Drinking
52	18.5755	82.2891	Harijharana	Maliguda	Gobindapally	Khairput	200 - 353	1	Yes		Private	Irrigation & Drinking
53	18.5875	82.2906	Nalachu	Gobindapally	Gobindapally	Khairput	200 - 353	1	Yes		Community/ Village	Irrigation & Drinking
54	18.5814	82.2702	Goudamasani jola	Govindapalli	Govindapalli	Khairput	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
55	18.5927	82.2816	Maulma	Govindpally	Govindpally	Khairput	200 - 353	1	Yes		Community/ Village	Irrigation & Drinking
56	18.6007	82.269	Chuapani	Gojiaguda	Gobindapally	Khairput	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
57	18.5986	82.28	Kuasal	Kamalpadar	Gobindapally	Khairput	200 - 353	1	Yes		Private	Drinking
58	18.5884	82.2937	Durkajodi	Gobandapally	Gobindapally	Khairput	200 - 353	1	Yes		Community/ Village	Irrigation & Drinking

Sl. No	Latitude	Longitude	Spring Name	Village Name	Gram Panchayat	Block	Elevation above MSL (meter)	Stream Order	Potability	Non-Potability	Owner	Usage
59	18.5881	82.2833	Maulima	Gobandapally	Gobindapally	Khairput	200 - 353	1	Yes		Community/ Village	Irrigation & Drinking
60	18.5224	82.2824	Turai joli	Kasuguda	kadamguda	Khairput	200 - 353	3	Yes		Other (please specify) forest land	Irrigation & Drinking
61	18.515	82.2831	patana jola	Pakona guda	Kadamguda	Khairput	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
62	18.5152	82.2827	Molai pakana	Pakona guda	kadamguda	Khairput	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
63	18.5822	82.2727	putamunda jola	Govindapalli	Govindapalli	Khairput	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
64	18.5188	82.2832	Gaurabeda	Kasuguda	Kadmaguda	Khairput	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
65	18.5215	82.2864	Kukurjala	Kasuguda	Kadmaguda	Khairput	353 - 507	2	Yes		Community/ Village	Irrigation & Drinking
66	18.5165	82.2488	purnapani	Sargiguda	Kadamguda	Khairput	200 - 353	1	Yes		Private	Irrigation & Drinking
67	18.5777	82.2775	AraKuan	Govindapalli	Govindapalli	Khairput	200 - 353	2	Yes		Private	Irrigation & Drinking
68	18.5141	82.284	daubada jola	pakanaguda	Kadamguda	Khairput	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
69	18.5749	82.2774	Panikunda jola	Govindapalli	Govindapalli	Khairput	200 - 353	1	No	Abandoned/ Dirty/ Unclean	Private	Irrigation & Bathing
70	18.5696	82.2889	Munda jola	Kanduguda	Govindapal	Khairput	200 - 353	1	Yes		Private	Irrigation &

Sl. No	Latitude	Longitude	Spring Name	Village Name	Gram Panchayat	Block	Elevation above MSL (meter)	Stream Order	Potability	Non-Potability	Owner	Usage
					li							Drinking
71	18.5108	82.2834	Masani jola	pakanaguda	Kadamguda	Khairput	200 - 353	1	No	Smelly Water	Other (please specify) forest land	Irrigation
72	18.3479	82.159	Padatom jola	Tumarkanda	Parkonmala	Khairput	200 - 353	1	Yes		Private	Irrigation & Drinking
73	18.3481	82.1611	Tangaganjala	Kupuliguda	Kudumulguma	Khairput	200 - 353	1	Yes		Private	Irrigation & Drinking
74	18.3026	82.1897	Polokde	Konda Bamrengi	Nakamamudi	Korukonda	822-1266	1	Yes		Community/ Village	Irrigation & Drinking
75	18.3026	82.1899	Majasai bahade	Konda Bamrengi	Nakamamudi	Korukonda	822-1266	1	Yes		Community/ Village	Irrigation & Drinking
76	18.3096	82.1901	Polhesabahade	Konda Bamrengi	Nakamamudi	Korukonda	822-1266	1	Yes		Community/ Village	Irrigation & Drinking
77	18.3326	82.229	Putu bahade	Damodarbeda	Nakamamudi	Korukonda	822-1266	1	Yes		Community/ Village	Irrigation & Drinking
78	18.3356	82.2308	Gharmo bahade	Damodarbeda	Nakamamudi	Korukonda	822-1266	1	Yes		Community/ Village	Drinking
79	18.3347	82.2293	Goborba londe	Damodarbeda	Nakamamudi	Korukonda	822-1266	1	Yes		Community/ Village	Drinking
80	18.3944	82.2107	Kadopadar jola	Muduli guda	Rasbada	Khairput	200 - 353	1	Yes		Private	Irrigation & Drinking
81	18.3513	82.1297	Chuapani	Ranginiguda	Porkunmala	Khairput	200 - 353	1	Yes		Community/ Village	Irrigation & Drinking
82	18.3725	82.205	Brokesua	Oringi	Rasbeda	Khairput	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
83	18.3692	82.2089	Ruba	Oringi	Rasbeda	Khairput	200 - 353	1	Yes		Other (please specify) forest	Irrigation & Drinking

Sl. No	Latitude	Longitude	Spring Name	Village Name	Gram Panchayat	Block	Elevation above MSL (meter)	Stream Order	Potability	Non-Potability	Owner	Usage
											land	
84	18.3706	82.2259	Inkota pajara	Oringi	Rasbada	Khairput	353 - 507	1	Yes		Private	Irrigation & Drinking
85	18.3751	82.2138	Chuapani	Oringi	Rasbeda	Khairput	200 - 353	1	Yes		Private	Irrigation & Drinking
86	18.3509	82.1339	Mamor munda jola	Ganapatiguda	Porkan mala	Khairput	200 - 353	1	Yes		Private	Irrigation & Drinking
87	18.3735	82.2094	Kadumali	Oringi	Rasbeda	Khairput	200 - 353	1	Yes		Private	Irrigation & Drinking
88	18.3877	82.2146	Semabadia	Muduliguda	Rasbeda	Khairput	353 - 507	1	Yes		Other (please specify) forest land	Irrigation & Drinking
89	18.3667	82.1928	Matikajala	Matikal	Gudimulguma	Khairput	353 - 507	1	Yes		Other (please specify) forest land	Irrigation & Drinking
90	18.3909	82.2092	Bilabal	Muduliguda	Rasbeda	Khairput	200 - 353	1	Yes		Private	Irrigation & Bathing
91	18.3371	82.1623	Majurilendi chua	Majurilendi	Kudumulguma	Khairput	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
92	18.3626	82.1877	Balurtota	Durkaguda	Kudumulguma	Khairput	200 - 353	1	No	Abandoned/ Dirty/ Unclean	Private	Irrigation
93	18.3502	82.1894	Docanchua	Chilipadar	Kudumulguma	Khairput	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
94	18.3528	82.1962	Baghajala	Chilipadar	Kudumulguma	Khairput	353 - 507	1	Yes		Other (please specify) forest land	Irrigation & Drinking
95	18.3502	82.1902	Docanal	Chilipadar	Kudumulgu	Khairput	200 - 353	1	No	Abandoned/	Other (please	Irrigation

Sl. No	Latitude	Longitude	Spring Name	Village Name	Gram Panchayat	Block	Elevation above MSL (meter)	Stream Order	Potability	Non-Potability	Owner	Usage
					ma					Dirty/ Unclean	specify) forest land	
96	18.3468	82.1861	Saipamal	Chilipadar	Kudumulguma	Khairput	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
97	18.3853	82.2059	Suabeda	Muduliguda	Rasbeda	Khairput	200 - 353	1	No	Smelly Water	Private	Irrigation
98	18.3301	82.165	Kadamali jola	Majurlandi	Kudumuluguma	Khairput	353 - 507	1	Yes		Other (please specify) forest land	Irrigation & Drinking
99	18.4367	82.2302	Hadamunda jola	Sindiguda	Rasbada	Khairput	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
100	18.4265	82.2323	Ouijong jola	Budaguda	Rasbeda	Khairput	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
101	18.4285	82.2345	Nalachua	Budaguda	Rasbeda	Khairput	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
102	18.3952	82.2139	Palkabila	Machhaguda	Rasbeda	Khairput	200 - 353	1	No	Abandoned/ Dirty/ Unclean	Other (please specify) forest land	Irrigation
103	18.3951	82.2224	Bijaswan jola	Machhaguda	Rasbada	Khairput	200 - 353	1	Yes		Private	Irrigation & Drinking
104	18.3939	82.2244	Tupijola	Machhaguda	Rasbeda	Khairput	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
105	18.4013	82.2321	Adaamba	Gopaguda	Rasbeda	Khairput	200 - 353	1	Yes		Other (please specify) forest	Irrigation & Drinking

Sl. No	Latitude	Longitude	Spring Name	Village Name	Gram Panchayat	Block	Elevation above MSL (meter)	Stream Order	Potability	Non-Potability	Owner	Usage
											land	
106	18.3454	82.1783	Chua pani	Kantasaru	Kudumuluguma	Khairput	200 - 353	1	Yes		Private	Irrigation & Drinking
107	18.3967	82.2272	Dumurichua	Gopaguda	Rasbada	Khairput	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
108	18.3847	82.2111	Kasam bada	Muduli guda	Rasbada	Khairput	200 - 353	1	Yes		Private	Irrigation & Drinking
109	18.323	82.1628	Charkonda	Nuaguda	Somanathpur	Korukonda	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
110	18.3181	82.1578	Chuapani	Hatiamba	Somanthpur	Korukonda	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
111	18.3188	82.1589	Dhagidirani	Hatiamba	Somanathpur	Korukonda	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
112	18.5648	82.283	Panimunda	Bhaurikunda	Udulibeda	Mathili	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
113	18.5641	82.2878	Kuisal	Bhirikunda	Udulibeda	Mathili	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking
114	18.4155	82.2327	Kadali chuan	Palkaguda	Rasbeda	Khairput	353 - 507	1	Yes		Other (please specify) forest land	Irrigation & Drinking
115	18.3858	82.2102	Kumbada jola	Muduli guda	Rasbada	Khairput	200 - 353	1	Yes		Private	Irrigation & Drinking
11	18.4129	82.2341	Langal chuan	Palkaguda	Rasbada	Khairput	200 - 353	1	Yes		Other (please	Irrigation &

Sl. No	Latitude	Longitude	Spring Name	Village Name	Gram Panchayat	Block	Elevation above MSL (meter)	Stream Order	Potability	Non-Potability	Owner	Usage
6											specify) forest land	Drinking
117	18.3742	82.2215	Slowly pajara	Oringi	Rasbeda	Khairput	200 - 353	1	Yes		Private	Irrigation & Drinking
118	18.3397	82.2304	Kodambo bahade	Damodarbeda	Nakamamudi	Korukonda	822-1266	1	Yes		Community/ Village	Irrigation & Drinking
119	18.3416	82.2301	Aantiguda bahade	Damodarbeda	Nakamamudi	Korukonda	822-1266	1	Yes		Community/ Village	Irrigation & Drinking
120	18.3444	82.2255	Arjuna bahade	Damodarbeda	Nakamamudi	Korukonda	822-1266	1	Yes		Community/ Village	Irrigation & Drinking
121	18.3547	82.2353	Ghade	Bayapada	Nakamamudi	Korukonda	650-822	1	Yes		Community/ Village	Drinking
122	18.3577	82.2354	Dharande bahade	Bayapada	Nakamamudi	Korukonda	650-822	1	Yes		Community/ Village	Irrigation & Drinking
123	18.3513	82.2272	Hulibahade	Bayapada	Nakamamudi	Korukonda	650-822	1	Yes		Community/ Village	Irrigation & Drinking
124	18.3599	82.2376	Baresuka bahade	Bayapada	Nakamamudi	Korukonda	650-822	1	Yes		Community/ Village	Irrigation & Drinking
125	18.3532	82.2354	Kundide	Bayapada	Nakamamudi	Korukonda	650-822	1	Yes		Community/ Village	Irrigation & Drinking
126	18.3528	82.2279	Kundide	Bayapada	Nakamamudi	Korukonda	822-1266	1	Yes		Community/ Village	Drinking
127	18.3423	82.2494	Gehehu londe	Naringijhala	Nakamamudi	Korukonda	650-822	1	Yes		Community/ Village	Irrigation & Drinking
128	18.3424	82.2636	Dharabahade	Naringijhala	Nakamamudi	Korukonda	200 - 353	1	Yes		Community/ Village	Irrigation & Drinking
129	18.3332	82.2267	Dabolonde bahade	Damodarbeda	Nakamamudi	Korukonda	822-1266	1	Yes		Community/ Village	Irrigation & Drinking
13	18.31	82.1883	Barthohuli	Bajoguda	Nakamamu	Korukond	650-822	1	Yes		Community/	Irrigation &

Sl. No	Latitude	Longitude	Spring Name	Village Name	Gram Panchayat	Block	Elevation above MSL (meter)	Stream Order	Potability	Non-Potability	Owner	Usage
0	7		bahade		di	a					Village	Drinking
131	18.3164	82.1881	Hulibahade	Bajoguda	Nakamamudi	Korukonda	822-1266	1	Yes		Community/ Village	Irrigation & Drinking
132	18.3202	82.1981	Hukude bahade	Badagandhi	Nakamamudi	Korukonda	650-822	1	Yes		Community/ Village	Irrigation & Drinking
133	18.3188	82.1998	Kirkahu bahade	Badagandhi	Nakamamudi	Korukonda	650-822	1	Yes		Community/ Village	Irrigation & Drinking
134	18.3349	82.225	Durga Sai bahade	Damodarbeda	Nakamamudi	Korukonda	822-1266	1	Yes		Community/ Village	Irrigation & Drinking
135	18.3758	82.176	Samratpur jhola	Samratpur	Kudumulugumma	Khairput	200 - 353	1	Yes		Community/ Village	Irrigation & Drinking
136	18.4783	82.2548	Raja munda	Jhadia guda	Khairput.	Khairput	200 - 353	1	Yes		Other (please specify) forest land	Irrigation & Drinking

Annexure-II Details of Identified spring with other details of Koraput District

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtrs)	Stream Order	Potability	Owner	Usage
1	18.6739	82.8913	Badajhola	Kakariguda	Daleiguda	Similiguda	1057-1651	1	Yes	Other (please specify)	Irrigation
2	18.6723	82.8902	Mankadjhola	Kakariguda	Daleiguda	Similiguda	888-1057	2	Yes	Other (please specify)	Drinking & Livestock
3	18.7032	83.0067	Kidajhola (Tankubeda)	Tankubeda	Upperkanti	Similiguda	1057-1651	1	Yes	Community / Village	Irrigation & Livestock
4	18.6196	82.8485	Badanala	Bariguda	Gunthaput	Similiguda	888-1057	2	Yes	Community/ Village	Irrigation & Drinking
5	18.6652	82.8936	Bangitiamba	Tentuliguda	Daleiguda	Similiguda	1057-1651	1	Yes	Other (please specify)	Irrigation, Livestock & Drinking
6	18.6643	82.8903	Panichua jhola	Tentuliguda	Daleiguda	Similiguda	1057-1651	1	Yes	Other (please specify)	Drinking
7	18.6640	82.8995	Hunukudrijhola wterpoint, Tadimahamba	Mugnaguda	Daleiguda	Similiguda	888-1057	1	Yes	Community / Village	Irrigation
8	18.6676	82.9044	Jodoambajhola, Rabandaba	Mugnaguda	Daleiguda	Similiguda	1057-1651	1	Yes	Community / Village	Irrigation
9	18.6639	82.8999	Hunukudri - waterpoint -2	Mugnaguda	Daleiguda	Similiguda	888-1057	2	Yes	Community / Village	Irrigation
10	18.7530	82.9915	Panidabajhola Raidangar	Denganaguda	Dumuripadar	Koraput	1057-1651	1	Yes	Other (please	Irrigation & Drinking

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtrs)	Stream Order	Potability	Owner	Usage
										specify)	
11	18.7587	82.9937	Bilamadajhola	Denganaguda	Dumuripadar	Koraput	888-1057	1	Yes	Community/ Village	Irrigation
12	18.6531	82.9506	Gilamarijhola Bantabasa	Bhitarakata	Sorisapadar	Similiguda	888-1057	1	Yes	Community/ Village	Irrigation
13	18.6515	82.9478	Kabiladijhola, rachukata	Bhitarakata	Sorisapadar	Similiguda	888-1057	1	Yes	Community/ Village	Irrigation
14	18.6734	82.9259	Salapkandadijhola	Aligaon	Pakajhola	Similiguda	888-1057	1	Yes	Community/ Village	Irrigation
15	18.6767	82.9206	Sainimarkajhola	Aligaon	Pakajhola	Similiguda	888-1057	1	Yes	Community/ Village	Irrigation & Drinking
16	18.5703	82.8511	Champajhola	Marua (Talamarua ND Majhimarua)	Renga	Similiguda	888-1057	2	Yes	Community / Village	Irrigation
17	18.5643	82.8450	Badajhola water point	Marua (Talamarua ND majhimarua)	Renga	Similiguda	888-1057	1	Yes	Community / Village	Irrigation
18	18.5670	82.8496	Panderijhola talamarua	Marua (Talamarua and Majhimarua)	Renga	Similiguda	888-1057	1	Yes	Community / Village	Irrigation
19	18.7068	83.0342	Dandamundijhola, chitalmanjari	Chnitalmanjari	Upperkanti	Similiguda	888-1057	1	Yes	Community/ Village	Irrigation & Drinking
20	18.7101	83.0384	Khudkajhola water point, chitalmanjari	Chintalmanjari	Upperkanti	Similiguda	1057-1651	1	Yes	Community / Village	Irrigation

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtrs)	Stream Order	Potability	Owner	Usage
21	18.7009	82.9391	Baghajhola waterpoint	Sundhiput	Dudharii	Similiguda	888-1057	1	Yes	Community / Village	Irrigation
22	18.6883	82.9518	Totambajhola, Mandariguda	Mandariguda	Dudhari	Similiguda	1057-1651	1	Yes	Community / Village	Irrigation
23	18.6898	82.9450	Dadispa Water point, mandarGuda	Mandariguda	Dudhari	Similiguda	1057-1651	1	Yes	Community / Village	Irrigation & Drinking
24	18.4512	82.5788	Panichuajhola jabagarh	Jabagarh	Bilaput	Nandapur	888-1057	1	Yes	Community / Village	Irrigation & Drinking
25	18.4655	82.5606	Chandanachuajhola Talaharaganda, jabagarh	Talaharaganda	Bilaput	Nandapur	888-1057	1	Yes	Community / Village	Irrigation
26	18.5164	82.7263	Jamukolijhola Bisipur	Bisipur	Hikimput	Nandapur	888 - 1057	1	Yes	Community / Village	Irrigation
27	18.5158	82.7303	Sadarambajhola, Bisipur	Bisipur	Hikimput	Nandapur	888 - 1057	1	Yes	Community / Village	Irrigation
28	18.5087	82.6835	Pujaghatjhola, satsemili	Satsemili	Thuba	Nandapur	888-1057	1	Yes	Community / Village	Irrigation
29	18.5129	82.6845	Katiamasan, Satsemili	Satsemili	Thuba	Nandapur	888-1057	1	Yes	Community / Village	Not Being Used/ Abandoned
30	18.4607	82.6800	Burijhola, Taintar	Taintar	Bheja	Nandapur	888-1057	1	Yes	Community / Village	Irrigation
31	18.4590	82.6813	Mundrijhola, Taintar	Taintar	Bheja	Nandapur	888-1057	1	Yes	Community / Village	Irrigation
32	18.7627	82.9256	Gandalitadijhola,	Barakutuni	Dudhari	Similiguda	888-1057	2	Yes	Community / Village	Irrigation

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtrs)	Stream Order	Potability	Owner	Usage
			Barakutuni								
33	18.7110	82.9695	Betingtudijhola	Chikalmari	Dudhari	Similiguda	888-1057	1	Yes	Community / Village	Irrigation, Livestock & Drinking
34	18.7020	82.9680	Chymaaljhola	Haladibada	Dudhari	Similiguda	888-1057	1	Yes	Community/ Village	Drinking
35	18.5300	82.7747	Soradajhola	Sarabathi	Nandapur	Nandapur	1057-1651	1	Yes	Community/ Village	Irrigation
36	18.5314	82.7518	Edujhola	Sarabathi	Nandapur	Nandapur	1057-1651	1	Yes	Community / Village	Irrigation
37	18.5108	82.7754	Kundumuthichua	Darngaba	Kasandi	Nandapur	1057-1651	1	Yes	Private	Irrigation
38	18.5191	82.7720	Budubandajola	Darngaba	Kasandi	Nandapur	1057-1651	1	Yes	Community / Village	Irrigation
39	18.5062	82.7709	Kamalabandachua	Darngaba	Kasandi	Nandapur	1057-1651	1	Abandone d/ Dirty/ Unclean	Community / Village	Irrigation
40	18.5386	82.7797	Bhalujhola	Badapadar	Khurji	Nandapur	1057-1651	1	Yes	Community/ Village	Irrigation & Drinking
41	18.5339	82.7822	Bhitatmulajhola	Badapadar	Khurji	Nandapur	1057-1651	1	Yes	Community / Village	Irrigation, Livestock & Drinking
42	18.5347	82.7764	Jakarjhola	Badapadar	Khurji	Nandapur	1057-1651	1	Yes	Community / Village	Irrigation
43	18.5369	82.7731	Kadiamjhola	Badapadar	Khurji	Nandapur	1057-1651	1	Yes	Community / Village	Irrigation, Livestock & Drinking
44	18.7378	83.0392	Ranipanichua	Chikalgumandi	Talagumandi	Narayanpatana	1057-1651	1	No	Private	Irrigation
45	18.7439	83.0452	Padakana jhola	Chikalguman	Talagumandi	Narayanpata	1057-1651	1	Yes	Community	Irrigation

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtrs)	Stream Order	Potability	Owner	Usage
				di		na				/ Village	& Drinking
46	18.7313	83.0487	Bilamadajhola	Chikalgumandi	Talagumandi	Narayanpatana	1057-1651	1	No	Community / Village	Irrigation
47	18.7319	83.0500	Sukuljodijhhola	Chikalgumandi	Talagumandi	Narayanpatana	1057-1651	1	Yes	Community/ Village	Irrigation
48	18.7576	83.0736	Bailuajhola	Upperguman di	Talagumandi	Narayanpatana	888-1057	3	Yes	Community/ Village	Irrigation
49	18.6995	83.0027	Handibarajhola	UpperKanti	Upperkanti	Similiguda	1057-1651	1	Yes	Community / Village	Irrigation
50	18.6949	83.0003	Bidkamundijhola	UpperKanti	Upperkanti	Similiguda	1057-1651	1	Yes	Community/ Village	Irrigation & Drinking
51	18.6853	82.9958	Gadagandijhola	UpperKanti	Upperkanti	Similiguda	1057-1651	1	Yes	Community / Village	Irrigation
52	18.7365	83.0199	Sundamarichua	Jamukoli	Bijaghati	Narayanpatana	1057-1651	2	Yes	Community / Village	Irrigation
53	18.7406	83.0242	Panasmundijhola	Jamukoli	Bijaghati	Narayanpatana	1057-1651	1	Yes	Community / Village	Irrigation & Drinking
54	18.7636	83.0290	Narsimula	Jhadipadar	Bijaghati	Narayanpatana	1057-1651	1	Yes	Community / Village	Irrigation
55	18.6835	82.7634	Andikundjhola	Padagada	Rajput	Similiguda	706-888	1	No	Community / Village	Irrigation
56	18.6819	82.7677	Champajhola	Padagada	Rajput	Similiguda	706-888	1	No	Community / Village	Irrigation & Livestock
57	18.6769	82.7625	Ahadajhola	Padagada	Rajput	Similiguda	706-888	1	No	Private	Livestock
58	18.5357	82.7613	Dabajhola	Sarabati	Nandapur	Nandapur	888-1057	1	No	Private	Irrigation
59	18.4392	82.6716	Taimaljhola	Chilambalda	Balda	Nandapur	888 - 1057	1	Yes	Community/	Irrigation

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation(in mtrs)	Stream Order	Potability	Owner	Usage
										Village	
60	18.4421	82.6680	Bandhajhola	Balda	Balda	Nandapur	888 - 1057	1	Yes	Community/ Village	Irrigation & Drinking
61	18.4470	82.6741	Badadebazajhola	Balda	Balda	Nandapur	1057-1651	1	Yes	Community / Village	Irrigation
62	18.5442	82.7896	Jamuchua	K sunabeda	Parakamuthai	Similiguda	1057-1651	1	No	Community / Village	Not Being Used/ Abandoned
63	18.5452	82.7747	Totambapada	Podapadar	Khurji	Nandapur	1054 - 1651	2	No	Private	Irrigation
64	18.5606	82.7746	Masanchua	Kirajola	Khurji	Nandapur	888 - 1057	1	No	Private	Irrigation
65	18.5467	82.7797	Rajajhola	Podapadar	Khurji	Nandapur	1054 - 1651	1	No	Community / Village	Irrigation
66	18.5303	82.8090	Kamarijhola	Mangeliguda	Parajamuthai	Similiguda	888 - 1057	2	No	Community / Village	Irrigation
67	18.5455	82.7890	Gadajhol	K sunabeda	Parajamuthai	Similiguda	1054 - 1651	1	No	Community / Village	Irrigation
68	18.5575	82.7741	Panigadachua	Kirajola	Khurji	Nandapur	888 - 1057	1	Yes	Private	Irrigation & Drinking
69	18.5450	82.8158	Balsamjhola	Lekdiguda	Parajamuthai	Similiguda	888 - 1057	1	No	Community / Village	Irrigation
70	18.5397	82.7935	Damunijhola	K sunabeda	Parajamuthai	Similiguda	1054 - 1651	1	No	Community / Village	Irrigation
71	18.5488	82.7735	Matiamjhola	Hirajhola	Khurji	Nandapur	1054 - 1651	1	Yes	Community / Village	Not Being Used/ Abandoned
				Mangeliguda						Community	

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtrs)	Stream Order	Potability	Owner	Usage
72	18.5287	82.8091	Mouambachua		Parajamuthai	Similiguda	888-1057	1	No	/ Village	Irrigation
73	18.4604	82.6707	Bicholaragini	Katalaput	Badel	Nandapur	888-1057	1	No	Community / Village	Irrigation
74	18.4963	82.7095	Dabanchua	Katarba	Raising	Nandapur	888 - 1057	1	No	Community / Village	Irrigation
75	18.6965	82.7720	Suliiajhola	Patraput	Rajput	Similiguda	888 - 1057	1	No	Community / Village	Not Being Used/ Abandoned
76	18.7002	82.7676	Jodambajhola	Pujariput	Rajput	Similiguda	706-888	2	No	Community / Village	Irrigation & Livestock
77	18.6730	82.7731	Asurkund	Chalanput	Rajput	Similiguda	706-888	2	Yes	Community / Village	Irrigation & Drinking
78	18.6953	82.7713	Gutajhola	Patraput	Rajout	Similiguda	888 - 1057	1	No	Community / Village	Not Being Used/ Abandoned
79	18.7089	83.0596	Kridaushajhola	Sananarangipadar	Upperkanti	Similiguda	1057-1651	1	Yes	Community/ Village	Irrigation
80	18.7184	83.0493	Saphanjhola	Sananarangipadar	Upperkanti	Similiguda	1057-1651	1	Yes	Community/ Village	Irrigation
81	18.7158	83.0541	Dangamadijhola	Sananarangipadar	Upperkanti	Similiguda	1057-1651	2	Yes	Community/ Village	Irrigation & Drinking
82	18.7166	83.0518	Pringeyamalijhola	Sananarangipadar	Upperkanti	Similiguda	1057-1651	1	No	Community / Village	Irrigation
83	18.7064	83.0424	Sapajhola	Gichhamanjari	Upperkanti	Similiguda	888-1057	2	Yes	Community/ Village	Irrigation
84	18.7178	82.9035	Atrijhola	Talamania	Pakajhola	Similiguda	888-1057	2	Yes	Community/	Irrigation and

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtrs)	Stream Order	Potability	Owner	Usage
										Village	Washing
85	18.4634	82.7261	Badajala	Kakada	Raising	Nandapur	888 - 1057	1	No	Community / Village	Irrigation & Drinking
86	18.4769	82.7224	San jala	Kakada	Raising	Nandapur	888-1057	1	Yes	Community / Village	Irrigation
87	18.4508	82.7169	Devtajala	Mulda	Raising	Nandapur	888 - 1057	1	No	Community / Village	Irrigation
88	18.7754	83.0099	Pajimarajhola	Birjaghati	Bijaghati	Narayanpatana	888-1057	1	Yes	Community / Village	Irrigation
89	18.7799	83.0049	Lodakada	Champapadar	Bijaghati	Narayanpatana	888-1057	1	Yes	Community / Village	Irrigation
90	18.7873	83.0200	Khidkajhola	Birjaghati	Bijaghati	Narayanpatana	888-1057	1	Yes	Community / Village	Irrigation & Livestock
91	18.7907	83.0215	Kholajhola	Birjaghati	Bijaghati	Narayanpatana	888-1057	1	Yes	Community / Village	Irrigation
92	18.4857	82.7177	Champa gad	Mangrel	Raising	Nandapur	888 - 1057	1	Yes	Community / Village	Irrigation & Drinking
93	18.4875	82.7046	Pipal gacha chua	Katarba	Raising	Nandapur	888 - 1057	1	Yes	Community / Village	Irrigation & Drinking
94	18.5119	82.8436	Panichua	Jubarajpeta	Sadam	Similiguda	888 - 1057	1	Yes	Community / Village	Irrigation
95	18.5088	82.8441	Kudamjhola	Majhijangarada	Sadam	Similiguda	888 - 1057	1	No	Private	Irrigation
96	18.5085	82.8519	Madanchua	Jubarajpeta	Sadam	Similiguda	888 - 1057	2	No	Private	Irrigation
97	18.5174	82.8518	Budungujhola	Jubarajpeta	Sadam	Similiguda	888-1057	1	Yes	Community/ Village	Irrigation
				Chili						Community	

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtrs)	Stream Order	Potability	Owner	Usage
98	18.5000	82.6809	Podamara chua	put , Po- Raising	Raising	Nandapur	888-1057	1	No	/ Village	Irrigation
99	18.4921	82.8519	Nadichua	Badajangarada	Sadam	Similiguda	888-1057	5	Yes	Community / Village	Not Being Used/ Abandoned
100	18.5029	82.6824	High school chua	Paik Thuba	Thuba	Nandapur	888-1057	1	No	Community / Village	Not Being Used/ Abandoned
101	18.4980	82.6804	Had chua	Paik Thuba	Thuba	Nandapur	888-1057	1	No	Community / Village	Not Being Used/ Abandoned
102	18.5004	82.8466	Badadebatajhola	Badajangarada	Sadam	Similiguda	888-1057	1	Yes	Private	Irrigation & Drinking
103	18.7997	83.0250	Jakarjhola	Pilapanasa	Bijaghati	Narayanpatana	706-888	1	Yes	Community / Village	Irrigation & Drinking
104	18.7994	83.0223	Masanchua	Pilapanasa	Bijaghati	Narayanpatana	448-706	4	Yes	Community / Village	Irrigation
105	18.8035	83.0224	Patamrijhola	Pilapanasa	Bijaghati	Narayanpatana	706-888	1	Yes	Community / Village	Drinking
106	18.4903	82.6998	Adia jadi chua	Chiliput	Raising	Nandapur	888 - 1057	2	Yes	Community / Village	Irrigation
107	18.4888	82.7008	Chua Beda	Chiliput	Raising	Nandapur	888 - 1057	1	Yes	Private	Irrigation
108	18.4856	82.7325	Chira chua	Raising	Raising	Nandapur	888 - 1057	1	Yes	Community / Village	Irrigation
109	18.4857	82.7136	Damani band chua	Mangrel	Raising	Nandapur	888 - 1057	3	No	Community / Village	Irrigation

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtrs)	Stream Order	Potability	Owner	Usage
110	18.4910	82.7067	Podai gacha chua	Katarba	Raising	Nandapur	888 - 1057	2	Yes	Community / Village	Irrigation & Drinking
111	18.5032	82.6947	Bitar jala chua	Sankidi	Hikimput	Nandapur	888 - 1057	1	No	Community / Village	Irrigation
112	18.4237	82.6562	Munda chua	Modeiguda	Balda	Nandapur	888 - 1057	1	Yes	Community / Village	Irrigation
113	18.4794	82.7124	Pani chua	Karanjaguda	Raising	Nandapur	888 - 1057	4	Yes	Community / Village	Irrigation & Drinking
114	18.4660	82.7081	Kia phula gacha chua	Katia put	Bheja	Nandapur	888 - 1057	1	No	Community / Village	Irrigation
115	18.4629	82.7105	Dhani gaad	Petal	Raising	Nandapur	888 - 1057	2	Yes	Community/ Village	Irrigation
116	18.4164	82.6780	Pani kundi	Sublar	Kulabir	Nandapur	706-888	2	Yes	Community / Village	Irrigation
117	18.4779	82.6790	Kiaphula gacha chua	Bheja	Bheja	Nandapur	888-1057	1	No	Community / Village	Irrigation
118	18.6580	82.8974	Safadanga	Mugunaguda	Daleiguda	Similiguda	888-1057	1	Yes	Community/ Village	Drinking
119	18.7055	83.0121	Edoidonger	Tankubeda	Upperkanti	Similiguda	1057-1651	2	No	Community / Village	Irrigation
120	18.7179	83.0785	BADAJHOLA	Naringpadar	Upper Kanti	Similiguda	1057-1651	1	No	Community / Village	Irrigation
121	18.7352	83.0765	Paldimundijhola	Bari (Matiasahi)	Talagumandi	Narayanpatana	1057-1651	1	Yes	Private	Irrigation
122	18.7101	83.0733	Nagadamadijhola	Naringpadar	Upper Kanti	Similiguda	1057-1651	1	No	Community / Village	Irrigation
123	18.7140	83.0757	Betingtudijhola	Naringpadar	Upper Kanti	Similiguda	1057-1651	1	Yes	Community / Village	Irrigation
124	18.7061	83.0399	Ambajhola	Gichhamanjari	Upperkanti	Similiguda	888-1057	1	Yes	Community / Village	Irrigation

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation(in mtrs)	Stream Order	Potability	Owner	Usage
125	18.7203	83.0670	Kalibarajhola	Naringpadar	Upperkanti	Similiguda	1057-1651	1	No	Community / Village	Irrigation
126	18.7227	83.0517	Bilamadajhol	Naringpadar	Upperkanti	Similiguda	1057-1651	1	No	Community / Village	Irrigation
127	18.4945	82.6646	Dubki chua	Hanjar pent	Bheja	Nandapur	706-888	1	No	Community / Village	Irrigation
128	18.4934	82.6652	Bad chua	Hanjar pent	Bheja	Nandapur	706-888	1	No	Community / Village	Irrigation
129	18.4711	82.6779	Bada Band chua	Kitba	Badel	Nandapur	888-1057	1	No	Community / Village	Irrigation
130	18.4990	82.6308	Pani gad	Musri	Badel	Nandapur	888-1057	1	No	Community / Village	Irrigation
131	18.4806	82.6554	Pani gad	Badel	Badel	Nandapur	888-1057	1	No	Community / Village	Irrigation
132	18.4930	82.7800	Daba jala	Sisaguda	Khemundu guda	Nandapur	1057 - 1651	1	Yes	Community/ Village	Drinking
133	18.4928	82.7848	Pani chua	Sisaguda	Khemundu guda	Nandapur	888 - 1057	3	Yes	Community/ Village	Irrigation
134	18.4964	82.7804	Kadali badi chua	Katruguda	Khemund uguda	Nandapur	888 - 1057	2	No	Community / Village	Irrigation

Annexure-III Details of Identified spring with other details of Sundargarh District

Sl. No	Latitude	Longitude	Site Name	Village Name	GP	Block	Elevation(in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
1	20.2890	85.8085	Chhaliatoka	Phuljhar,(pufadihi)	Phuljhar	Lahunipada	119-253	1	No	Abandoned/ Dirty/ Unclean	Other (please specify)	Irrigation & Drinking
2	21.8133	85.0652	Dhudipani, kardakudar	KardakUpdate, dudipani	Talbahali	Lahunipada	253-348	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
3	21.8065	85.0723	Kardakudar, banuapani	KardakUDar, banuapani	Talbahali	Lahunipada	119-253	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
4	21.8201	85.0913	Nadiadihi	Nadiadihi	Talbahali	Lahunipada	348-494	3	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
5	21.8387	85.0484	Hatikani	Khatiyabhanguni	Talbahali	Lahunipada	119-253	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
6	21.8300	85.0689	Sannuagan	Sannuagan	Talbahali	Lahunipada	253-348	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
7	21.6870	85.1163	Nagariya	Nargaria, belasahi	Fuljhr	Lahunipada	253-348	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
8	21.6873	85.1252	Hatisul	Hatisul	Fuljhar	Lahunipada	253-348	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
9	21.6944	85.0282	Shihidia	Shihidia	Ruguda	Bonaigarh	119-253	2	No	Abandoned/ Dirty/	Community / Village	Irrigation

Sl. No	Latitude	Longitude	Site Name	Village Name	GP	Block	Elevation(in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
										Unclean		
10	21.6958	85.1501	Rugudi	Rugidi	Fuljhar	Lahunipada	253-348	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
11	21.6984	85.1549	Rugudi	Rugidi	Fuljhar	Lahunipada	253-348	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
12	21.6955	85.1406	Patamund	Patamund	Fuljhar	Lahunipada	253-348	3	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
13	21.6928	85.1322	Patamund	Patamund	Fuljhar	Lahunipada	253-348	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
14	21.7217	85.1139	Phuljhar	Phuljhar	Phuljharan	Lahunipada	253-348	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
15	21.6875	85.0985	Uperginiya	Uperginiya	Fuljhar	Lahunipada	253-348	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
16	21.6883	85.0819	Talginiya	Talginiya	Fuljhar	Lahunipada	119-253	3	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
17	21.6900	85.0367	Mahuldiha	Mahuldiha	Ruguda	Bonaigarh	119-253	3	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
18	21.7831	85.1026	Budhabhumi	Bhdhabhumi	Talbahali	Lahunipada	253-348	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation

Sl. No	Latitude	Longitude	Site Name	Village Name	GP	Block	Elevation(in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
19	21.8096	85.0688	Kardakudar	Karadakudar	Talbahali	Lahunipada	119-253	1	No	Used for cattle/ Bathing	Private	Irrigation & Drinking
20	21.8042	85.0842	Badanuagon	Badanuagon	Talbahali	Lahunipada	253-348	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation & Drinking
21	21.7135	85.0327	Mahuldiha	Mahuldiha	Ruguda	Bonaigarh	119-253	3	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
22	21.7558	85.0865	Sanjal	Sanjal	Haldikudar	Lahunipada	253-348	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
23	21.7418	85.0763	Sanjola	Sanjal	Haldikudar	Lahunipada	119-253	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
24	21.7761	85.0676	Mukulapani	Mukulapani	Haldikudar	Lahunipada	253-348	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
25	21.6981	85.1787	Sasa	Sasa	Fuljhar	Lahunipada	494-688	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
26	21.6819	85.1796	Sasa	Sasa	Fuljhar	Lahunipada	494-688	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
27	21.6806	85.1788	Sasa	Sasa	Fuljhar	Lahunipada	688-1112	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
28	21.6806	85.1786	Sasa	Sasa	Fuljhar	Lahunipada	688-1112	2	No	Abandoned/ Dirty/	Community / Village	Irrigation

Sl. No	Latitude	Longitude	Site Name	Village Name	GP	Block	Elevation(in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
										Unclean		
29	21.6897	85.1788	Ladidihi	Sasa	Fuljhar	Lahunipada	494-688	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
30	21.7000	85.1777	Melani	Melani	Fuljhar	Lahunipada	494-688	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
31	21.6976	85.1703	Melani	Melani	Fuljhar	Lahunipada	494-688	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
32	21.6997	85.1672	Jirpani	Jirpani	Fuljhar	Lahunipada	348-494	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
33	21.6972	85.1455	Sasa, uludisahi	Sasa, Uludisahi,	Fuljhar	Lahunipada	253-348	4	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
34	21.6960	85.1778	Sasa, dandasager	Sasa, Dandasagar	Fuljhar	Lahunipada	494-688	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
35	21.7032	85.1767	Sasa, gurudihi	Sasa, gurudihi	Fuljhar	Lahunipada	494-688	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
36	21.7345	85.1231	Pudadihi	Pudadihi	Fuljhar	Lahunipada	348-494	3	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
37	21.7293	85.1215	Podadihi	Pudadihi	Fuljhar	Lahunipada	348-494	3	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation

Sl. No	Latitude	Longitude	Site Name	Village Name	GP	Block	Elevation(in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
38	21.7298	85.1213	Jampani	Jampani	Fuljhar	Lahunipada	348-494	3	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
39	21.6923	85.0908	Kendupani	Kendupani	Fuljhar	Lahunipada	119-253	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
40	21.6971	85.1824	Melansahi	Melansahi,sasa	Fuljhar	Lahunipada	494-688	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
41	21.7292	85.1615	Uperuskela	Uperuskela	Fuljhar	Lahunipada	494-688	4	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
42	21.7141	85.1412	Uskela,khuntitentuli	uskela,khuntitentuli	Fuljhar	Lahunipada	253-348	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
43	21.6971	85.1826	Uperuskela	Uperuskela, mayadala	Fuljhar	Lahunipada	494-688	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
44	21.7169	85.1495	Uperuskela,spring,champapani	Uperuskela, mayadala	Fuljhar	Lahunipada	253-348	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
45	21.7177	85.1384	Uskela	Uskela	Fuljhar	Lahunipada	253-348	3	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
46	21.7323	85.0141	Badjal	BadKal, nera Mundadahi	Fuljhar	Lahunipada	119-253	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
47	21.7405	85.0941	Badjal	Badhjal,nera	Fuljhar	Lahunipad	253-348	3	No	Abandoned/	Community	Irrigation

Sl. No	Latitude	Longitude	Site Name	Village Name	GP	Block	Elevation(in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
				kalaradihi		a				Dirty/ Unclean	/ Village	
48	21.7130	85.1402	Banshi chuyan	Uskela	Fuljhar	Lahunipada	253-348	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
49	21.7111	85.1410	Uskela	Uskela	Fuljhar	Lahunipada	253-348	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
50	21.7297	85.0970	Badajal	Badjal	Fuljhar	Lahunipada	253-348	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
51	21.7366	85.0965	Badjal	Badjal	Fuljhar	Lahunipada	253-348	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
52	21.7108	85.1349	Talk uskela	Uskela Talasahi	Fuljhar	Lahunipada	253-348	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
53	21.7296	85.0970	Badjal,	Badjal	Fuljhar	Lahunipada	253-348	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
54	21.7349	85.0900	Badjal	Badjal	Fuljhar	Lahunipada	253-348	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
55	21.7284	85.1058	Dulduli	Fuljhar	Fuljhar	Lahunipada	119-253	4	Yes		Private	Irrigation & Drinking
56	21.7243	85.0933	Badjal	Badjal	Fuljhar	Lahunipada	119-253	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation

Sl. No	Latitude	Longitude	Site Name	Village Name	GP	Block	Elevation(in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
57	21.7201	85.0806	Badjal	Badjal	Fuljhar	Lahunipada	119-253	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
58	21.7200	85.0779	Badjal	Badjal	Fuljhar	Lahunipada	688-1112	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
59	21.7196	85.8508	Badjal	Badjal	Fuljhar	Lahunipada	119-253	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
60	21.7204	85.0777	Badjal	Badjal	Fuljhar	Lahunipada	253-348	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
61	21.7298	85.1106	Hatidhuli	Fuljhar	Fuljhar	Lahunipada	348-494	3	No	Bacterial Contamination	Community / Village	Irrigation
62	21.7298	85.1042	Pukharaghar jharan	Badjala	Fuljhar	Lahunipada	348-494	3	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
63	21.7190	85.1387	Uskela	Uskela	Fuljhar	Lahunipada	348-494	3	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
64	21.7193	85.1441	Uskela	Uskela	Fuljhar	Lahunipada	494-688	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
65	21.7285	85.1693	Uperuskela	UperUskela	Fuljhar	Lahunipada	348-494	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
66	21.7242	85.1231	Fuljhar	Fuljhar	Fuljhar	Lahunipada	348-494	1	No	Abandoned/ Dirty/	Private	Irrigation

Sl. No	Latitude	Longitude	Site Name	Village Name	GP	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
										Unclean		
67	21.7161	85.1222	Fuljhar, badmsal	Fuljhar	Fuljhar	Lahunipada	494-688	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
68	21.6827	85.1795	Sasa	Sasa	Fuljhar	Lahunipada	494-688	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
69	21.6851	85.1786	Sasa	Sasa		Lahunipada	494-688	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
70	21.6891	85.1775	Sasa	Sasa	Fuljhar	Lahunipada	494-688	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
71	21.6885	85.1771	Nagariya	Nagariya	Fuljhar	Lahunipada	119-253	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
72	21.7436	85.0641	Budhandi	Budhandi	Halldikudr	Lahunipada	119-253	3	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
73	21.7638	85.0740	Sanjal	Sanjal	Haldikudar	Lahunipada	119-253	3	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
74	21.7634	85.0661	Sanjal	Sanjal,bandhadi hisahi	Halldikudr	Lahunipada	119-253	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
75	21.7829	85.0538	Arjunjhary	Arjunjhary	Tlbahali	Lahunipada	494-688	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation

Sl. No	Latitude	Longitude	Site Name	Village Name	GP	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
76	21.6760	85.1395	Pokharapani spring	Hatisul	Fuljhar	Lahunipada	494-688	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Drinking
77	21.6787	85.1390	Rengadalia	Hatisul	Fuljhar	Lahunipada	348-494	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation & Drinking
78	21.6786	85.1365	Mandiagara	Hatisul	Fuljhar	Lahunipada	348-494	1	No	Bacterial Contamination	Community / Village	Irrigation & Drinking
79	21.6715	85.1375	Kharsuandihi jharan	Hatisul	Fuljhar	Lahunipada	348-494	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation & Drinking
80	21.6715	85.1375	Kharsuandihi jharan	Hatisul	Fuljhar	Lahunipada	348-494	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation & Drinking
81	21.6787	85.1364	Mandiagara Dalkijharan	Hatisul	Fuljhar	Lahunipada	253-348	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation & Drinking
82	21.8443	85.0554	Damnikucha	Khatiabhanguni (Jangpat)	Talbahali	Lahunipada	253-348	3	No	Abandoned/ Dirty/ Unclean	Community / Village	Drinking
83	21.8453	85.0600	Dangadara kusumdihi jharan	Khatiabhanguni (Jangpat)	Talbahali	Lahunipada	253-348	3	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation & Drinking
84	21.8453	85.0599	Dangadara Dalki jharan	Khatiabhanguni (Dangadara)	Talbahali	Lahunipada	348-494	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Drinking
85	21.8381	85.0585	Jangpat Jharan	Khatiabhanguni Jangpat	Talbahali	Lahunipada	119-253	3	No	Abandoned/ Dirty/	Community / Village	Drinking

Sl. No	Latitude	Longitude	Site Name	Village Name	GP	Block	Elevation(in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
										Unclean		
86	21.7464	85.0554	Khajirnali	Khjirnali	Haldikudar	Lahunipada	119-253	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
87	21.7822	85.0537	Arjunjhary	Arjunjhary	Talbahali	Lahunipada	494-688	2	No	Abandoned/ Dirty/ Unclean	Private	Irrigation
88	21.6832	85.1800	Sasa	Sasa	Fuljhar	Lahunipada	253-348	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation & Drinking
89	21.7324	85.1033	Dunguripani	Jampani	Fuljhar	Lahunipada	494-688	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
90	21.7289	85.1693	Uperuskela	UperUskela	Fuljhar	Lahunipada	119-253	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
91	21.7366	85.0690	Ranjapani jharan	Ranja	Haldikudar	Lahunipada	119-253	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation & Drinking
92	21.7266	85.0688	Purnapani Spring	Ranja	Haldikudar	Lahunipada	253-348	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Drinking
93	21.7270	85.0760	Panasapani jharan	Ranja	Haldikudar	Lahunipada	253-348	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Drinking
94	21.7254	85.0766	Bidapani Jharan	Ranja	Haldikudar	Lahunipada	494-688	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation & Drinking

Sl. No	Latitude	Longitude	Site Name	Village Name	GP	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
95	21.6851	85.1786	Sasa	Sasa	Fuljhar	Lahunipada	253-348	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
96	21.7293	85.1102	Hatidhuli jharan	Fuljhar(Barighar)	Fuljhar	Lahunipada	348-494	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Drinking
97	21.6727	85.1317	Sagadanal spring	Hatisul	Fuljhar	Lahunipada	348-494	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Drinking
98	21.6823	85.1333	Amilachuaspring	Hatisul	Fuljhar	Lahunipada	348-494	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation & Drinking
99	21.6835	85.1339	Jamnali Spring	Hatisul	Fuljhar	Lahunipada	348-494	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation & Drinking
100	21.6838	85.1364	Bijachua	Hatisul	Fuljhar	Lahunipada	348-494	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Drinking
101	21.6855	85.1349	Baghiachua	Hatisul	Fuljhar	Lahunipada	348-494	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation & Drinking
102	21.6848	85.1358	Aglachuaspring	Hatisul	Fuljhar	Lahunipada	348-494	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Drinking
103	21.7204	85.0811	Kanhukucha	Badjala	Fuljhar	Lahunipada	253-348	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
104	21.6600	85.0645	Kelachuaspring	Dhokamunda(T	Daleisara	Lahunipada	119-253	3	No	Abandoned/	Community	Drinking

Sl. No	Latitude	Longitude	Site Name	Village Name	GP	Block	Elevation(in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
				aldihi)						Dirty/ Unclean	/ Village	
105	21.6629	85.0713	Pachiripani Spring	Dhokamunda(Dangapani)	Daleisara	Lahunipada	119-253	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation & Drinking
106	21.6399	85.0667	Kanhukucha spring	Dhokamunda(Belmara)	Daleisara	Lahunipada	119-253	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Drinking
107	21.6407	85.0803	Baisamkucha	Dhokamunda(Belmara)	Daleisara	Lahunipada	494-688	2	No	Abandoned/ Dirty/ Unclean	Private	Irrigation & Drinking
108	21.7290	85.1695	Pattuli spring	Upper Uskela	Fuljhar	Lahunipada	253-348	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Drinking
109	21.6900	85.0449	Jamkani Spring	Mahuldiha	Ruguda	Lahunipada	253-348	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Drinking
110	21.6940	85.0502	Gujapathar spring	Mahuldiha	Ruguda	Lahunipada	253-348	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Drinking
111	21.6955	85.0508	Bharadipani Spring	Mahuldiha	Ruguda	Lahunipada	253-348	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Drinking
112	21.6670	85.0421	Gayalakata spring	Daleisara(Patharpunji)	Daleisara	Lahunipada	253-348	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation & Drinking
113	21.6822	85.0438	Rankulkul spring	Daleisara(Patharpunji)	Daleisara	Lahunipada	253-348	2	No	Abandoned/ Dirty/	Community / Village	Drinking

Sl. No	Latitude	Longitude	Site Name	Village Name	GP	Block	Elevation(in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
										Unclean		
114	21.6753	85.0478	Pachiripani	Daleisara(Patharpunji)	Daleisara	Lahunipada	253-348	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Drinking
115	21.6741	85.0568	Jhiripani jharan	Daleisara	Daleisara	Lahunipada	253-348	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Drinking
116	21.6496	85.0457	Sijhu jharan	Daleisara	Daleisara	Lahunipada	253-348	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Drinking
117	21.7031	85.0402	Napeichua spring	Mahuldia	Ruguda	Bonaigarh	253-348	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation & Drinking
118	21.7021	85.0449	Ekpadi spring	Mahuldia	Ruguda	Lahunipada	253-348	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation & Drinking
119	21.6985	85.0475	Sapapani spring	Mahuldia	Ruguda	Lahunipada	348-494	3	No	Abandoned/ Dirty/ Unclean	Community / Village	Drinking
120	21.6610	85.1429	Dangapani jharan	Derula	Mahulpada	Lahunipada	348-494	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation & Drinking
121	21.6593	85.1495	Kendupani spring	Derula(Kiri)	Mahulpada	Lahunipada	348-494	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation & Drinking
122	21.6533	85.1382	Kalsamang chua	Derula	Mahulpada	Lahunipada	253-348	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Drinking

Sl. No	Latitude	Longitude	Site Name	Village Name	GP	Block	Elevation(in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
123	21.6659	85.1216	Tatakala spring	Derula(Sagadasahi)	Mahulpada	Lahunipada	253-348	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation & Drinking
124	21.6625	85.1195	Mankadjanghi	Derula(Sagadasahi)	Mahulpada	Lahunipada	348-494	3	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation & Drinking
125	21.6568	85.1113	Jampani spring	Derula(Badbil)	Mahulpada	Lahunipada	348-494	3	No	Abandoned/ Dirty/ Unclean	Community / Village	Drinking
126	21.6234	85.1670	Belsarai spring	Tasada	Mahulpada	Lahunipada	348-494	3	No	Abandoned/ Dirty/ Unclean	Community / Village	Drinking
127	21.6242	85.1680	Kulgad spring	Tasada	Mahulpada	Lahunipada	348-494	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation & Drinking
128	21.6233	85.1690	Belsarai spring	Tasada	Mahulpada	Lahunipada	253-348	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation & Drinking
129	21.6182	85.1512	Kanda jharan	Tasada	Mahulpada	Lahunipada	253-348	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Drinking
130	21.8420	85.0464	Hatikani spring	Khatiabhanguni (Mundasahi)	Talbahali	Lahunipada	253-348	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation & Drinking
131	21.8300	85.0690	Samarkata spring	Sannuagaon	Talbahali	Lahunipada	119-253	3	No	Abandoned/ Dirty/ Unclean	Community / Village	Drinking
132	21.8135	85.0652	Dhudipani spring	Kardakudar	Talbahali	Lahunipada	119-253	3	No	Abandoned/	Community	Irrigation &

Sl. No	Latitude	Longitude	Site Name	Village Name	GP	Block	Elevation(in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
										Dirty/ Unclean	/ Village	Drinking
133	21.6823	85.0153	Burugala	Purnapani	Ruguda	Bonaigarh	119-253	1	No	Abandoned/ Dirty/ Unclean	Community / Village	Drinking
134	21.6823	85.0154	Phatatangar spring	Shihidia	Ruguda	Bonaigarh	253-348	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Drinking
135	21.6834	85.0184	Suke jharan	Purnapani	Ruguda	Bonaigarh	119-253	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Drinking
136	21.8355	84.7971	Lokaskocha	Rajabasa,lokaskuchha	Bhaludugur i	Gurundia	119-253	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
137	21.8455	84.8011	Sundursahi	Rajabasa,sundursahi	Bhaludunguri	Gurundia	119-253	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
138	21.8577	84.7494	Malusahi	Malusahi	Gurundia	Gurundia	494-688	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
139	21.8486	84.8234	Rajabasa	Rajabasa	Bhaludungiri	Gurundia	119-253	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
140	21.7266	85.1680	Uperuskela	Uperuskela	Fuljhar	Lahunipada	119-253	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation & Drinking
141	21.9004	84.7975	Kantapali	Kantapali	Gurundia	Gurundia	119-253	2	No	Abandoned/ Dirty/	Private	Irrigation

Sl. No	Latitude	Longitude	Site Name	Village Name	GP	Block	Elevation(in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
										Unclean		
142	21.6823	85.0148	Gamdhara	Sanjharan	Kasada	Lahunipara	119-253	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation & Drinking
143	21.6640	84.8663	Bramhanapoita spring	Kasada	Kasada	Bonaigarh	119-253	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation & Drinking
144	21.9003	84.7977	Chandiposodhinkia mnall	Chandiposi ,Dhinkiamanalla	Banaekela	Gurundia	119-253	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
145	21.9014	84.7996	Kulebaga,banghna oram	Kulebaga	Banekela	Gurundia	494-688	2	No	Abandoned/ Dirty/ Unclean	Private	Irrigation
146	21.9003	84.7977	Chandiposi, ulkuchanalla	Chandiposi ,ulukuchuanalla	Banekela	Gurundia	119-253	2	No	Abandoned/ Dirty/ Unclean	Community / Village	Irrigation
147	21.9004	84.7977	Chandiposi, mundarijharn	Chandiposi	Banekela	Gurundia	119-253	2	No	Abandoned/ Dirty/ Unclean	Private	Irrigation

Annexure-IV Details of Identified spring with other details of Rayagada District

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
1	19.3815	83.1263	Paruabadi	Talapanga	Talajhiri	Kashipur	842-1502	2	Yes		Community/ Village	Irrigation & Drinking
2	19.1222	83.1873	Rattajhola	Karajhola	Sankarada	Kashipur	640-842	1	Yes		Community/ Village	Drinking
3	19.3435	83.0282	Patramali	Durukhal	Chandragiri	Kashipur	842-1502	1	Yes		Community/ Village	Irrigation & Drinking
4	19.1149	83.1551	Aujhola	Boriguma	Sankarada	Kashipur	640-842	1	Yes		Community/ Village	Irrigation & Drinking
5	19.3650	83.0075	Tagachuan	Maligaon	Chandragiri	Kashipur	842-1502	2	Yes		Community/ Village	Irrigation & Drinking
6	19.2945	83.0988	Danga	Gudajhola	Renga	Kashipur	640-842	1	Yes		Community/ Village	Irrigation & Drinking
7	19.3852	83.1888	Badachuan	Baharpadamajhi	Mandibisi	Kashipur	842-1502	2	Yes		Other (please specify)	Irrigation
8	19.3481	83.0820	Amliam	Parajashila	Kashipur	Kashipur	842-1502	1	Yes		Private	Irrigation
9	19.2277	83.1391	Kanasajhola	Lambri	Gorakhapur	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
10	19.3013	83.1317	Mahujharan	Uppar Maligaon	Renga	Kashipur	842-1502	2	Yes		Other (please specify)	Irrigation & Drinking
11	19.5331	83.4099	Prispari	Khambesi	Kurli	Bissamcuttack	842-1502	1	Yes		Other (please specify)	Irrigation
12	19.5275	83.4105	Dumurua	Khambesi	Kurli	Bissamcuttack	443-640	2	Yes		Other (please specify)	Irrigation & Drinking
13	19.5202	83.4529	Gundangjodi	Lahunikhunti	Kurli	Bissamcuttack	443-640	1	Yes		Other (please specify)	Irrigation & Drinking
14	19.5142	83.4475	Wadikuda	Gandili	Kurli	Bissamcuttack	443-640	1	Yes		Private	Irrigation & Drinking
15	19.5104	83.4500	Panasajodi	Gandili	Kurli	Bissamcutta	640-842	1	Yes		Private	Irrigation &

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
						ck						Livestock
16	19.5172	83.4360	Kadigupa	Garteli	Kurli	Bissamcuttack	640-842	1	Yes		Private	Irrigation & Drinking
17	19.5184	83.4351	Kayutala	Garteli	Kurli	Bissamcuttack	443-640	2	Yes		Private	Irrigation & Drinking
18	19.5381	83.4572	Silamadi	Kinjamjodi	Chancharaguda	Bissamcuttack	443-640	2	Yes		Other (please specify)	Irrigation & Drinking
19	19.5383	83.4577	Sunakhanti	Kinjamjodi	Chancharaguda	Bissamcuttack	443-640	2	Yes		Other (please specify)	Irrigation & Livestock
20	19.5344	83.4621	Jamujhola	Balapai	Chancharaguda	Bissamcuttack	640-842	1	Yes		Other (please specify)	Irrigation & Livestock
21	19.4866	83.4196	Ladudi	Radang	Kurli	Bissamcuttack	640-842	1	Yes		Other (please specify)	Irrigation & Drinking
22	19.4956	83.4215	Tanikana	Radang	Kurli	Bissamcuttack	443-640	4	Yes		Other (please specify)	Irrigation & Drinking
23	19.5155	83.3588	Panjibanda	Tamakoshila	Parsali	Kalyansingpur	443-640	1	Yes		Other (please specify)	Irrigation & Drinking
24	19.5201	83.3569	Taku janda	Tamakoshila	Parsali	Kalyansingpur	640-842	1	Yes		Other (please specify)	Drinking & Livestock
25	19.4702	83.3978	Suna kuti	Upper musudi	Sunakhandi	Kalyansingpur	443-640	1	Yes		Other (please specify)	Drinking
26	19.4620	83.3892	Dudka Ambagacha	Tala musudi	Sunakhandi	Kalyansingpur	443-640	1	Yes		Other (please specify)	Irrigation & Drinking
27	19.5699	83.3323	Hutang	Tadmuhi	Parsali	Kalyansingpur	640-842	1	Yes		Other (please specify)	Irrigation & Drinking
28	19.6681	83.4381	Aikala	Serkapadi	Sibapadar	Muniguda	443-640	2	Yes		Other (please specify)	Irrigation & Drinking
29	19.6913	83.4328	Kranikapda	Batudi	Sibapadar	Muniguda	443-640	1	Yes		Other (please specify)	Drinking & Livestock
30	19.6783	83.4285	Piopata	Kesarpadi	Sibapadar	Muniguda	443-640	2	Yes		Other (please	Drinking &

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
											specify)	Livestock
31	19.6768	83.4563	Terkana	Goyalkana	M.patraguda	Muniguda	443-640	1	Yes		Other (please specify)	Irrigation & Drinking
32	19.6818	83.4464	Kirgadeli	Panimunda	Sibapadar	Muniguda	443-640	1	Yes		Other (please specify)	Drinking
33	19.6841	83.4472	Sarisua	Panimunda	Sibpadar	Muniguda	443-640	3	Yes		Other (please specify)	Drinking
34	19.6564	83.4624	Naringbadi	Boriguda	M. Patraguda	Muniguda	443-640	1	Yes		Other (please specify)	Irrigation & Drinking
35	19.7092	83.4419	Kayutula	Asurapada	Sibapadar	Muniguda	443-640	1	Yes		Other (please specify)	Irrigation, Drinking & Livestock
36	19.7010	83.4335	Madugutu	Asurapada	Sibapadar	Muniguda	443-640	1	Yes		Other (please specify)	Irrigation & Drinking
37	19.7248	83.4471	Jamunjodi	Dhepaguda	Sibapadar	Muniguda	272-443	1	Yes		Other (please specify)	Irrigation, Drinking & Livestock
38	19.7286	83.4497	Sralengkala	Dhepaguda	Sibapadar	Muniguda	443-640	1	Yes		Other (please specify)	Irrigation & Drinking
39	19.6268	83.4526	Uamba	Sakata	Munikhol	Muniguda	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
40	19.3206	83.1407	Siadimal	Amarsing guda	Khurigan	Kashipur	640-842	1	Yes		Other (please specify)	Irrigation & Drinking
41	19.2822	82.9190	Badam	K panjara	Kadipari	Kashipur	640-842	3	Yes		Other (please specify)	Irrigation & Drinking
42	19.2630	82.9109	Andrapanji	G panjara	Dangasail	Kashipur	640-842	1	Yes		Other (please specify)	Irrigation
43	19.2592	82.9152	Budkajagli	G panjara	Dangasail	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
44	19.2984	83.0735	Loradeo	Katali	Maicanch	Kashipur	842-1502	2	Yes		Other (please	Irrigation &

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
											specify)	Drinking
45	19.2584	82.9032	Suspar	G panjara	Dangasil	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Livestock
46	19.3491	83.0698	Satabhauni	Rasijhiri	Talajhiri	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
47	19.3709	83.1410	Ranidumiri	Upperjhiri	Talajhiri	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
48	19.3474	83.0653	Debata jharan	Rasijhiri	Talajhiri	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
49	19.3870	83.1114	Kaluakani	Kadkipadar	Talajhiri	Kashipur	842-1502	2	Yes		Private	Irrigation & Drinking
50	19.3716	83.1402	Jamabasa	Upperjhiri	Talajhiri	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation, Drinking & Livestock
51	19.3532	83.0712	Masanighat	Rasijhiri	Talajhiri	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
52	19.2292	82.9634	Bidrujhola	Khotalapadar	Dangasil	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation, Drinking & Livestock
53	19.3357	83.1349	Bhitarjhola	Gotiguda	Khurigan	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
54	19.1823	82.9542	Damjhola	Jabapadara	Kucheipadar	Kashipur	842-1502	1	Yes		Private	Irrigation & Drinking
55	19.1737	82.9760	Badgan	Malamb	Kucheipadar	Kashipur	443-640	2	Yes		Other (please specify)	Irrigation, Drinking & Livestock
56	19.1811	82.9814	Kasanmari	Malamb	Kucheipadar	Kashipur	443-640	2	Yes		Other (please specify)	Irrigation & Drinking
57	19.1985	82.9859	Barpata	Anagar	Dangasil	Kashipur	640-842	3	Yes		Other (please specify)	Irrigation & Drinking

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
58	19.4816	83.4401	Ladri	D kumbhardadi	Chatikana	Bissamcuttack	640-842	1	Yes		Other (please specify)	Irrigation & Drinking
59	19.4995	83.4487	Hikinikuti	Ranibandha	Chatikana	Bissamcuttack	640-842	2	Yes		Other (please specify)	Irrigation & Drinking
60	19.5898	83.3788	SANA JHARANA	Gumma	Parsali	Kalyansingpur	640-842	1	Yes		Other (please specify)	Livestock
61	19.5894	83.3757	Jhodi	Gumma	Parsali	Kalyansingpur	640-842	1	Yes		Other (please specify)	Livestock
62	19.5893	83.3763	Balabata	Gumma	Parsali	Kalyansingpur	842-1502	1	Yes		Other (please specify)	Irrigation, Drinking & Livestock
63	19.3136	83.1634	Rukuni jhola	Upper mandijhola	Khurigan	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
64	19.3092	83.1581	Rangajhola	Upper mandijhola	Khurigan	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
65	19.3152	83.1597	Dabchuan	Upper mandijhola	Khurigan	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation, Drinking & Livestock
66	19.3282	83.1373	Jalkundi	Khurigan	Khurigan	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
67	19.3472	83.1472	Rupajharan	Rautghati	Khurigan	Kashipur	842-1502	2	Yes		Other (please specify)	Irrigation & Drinking
68	19.3421	83.1437	Adapat	Rautghati	Khurigan	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation, Drinking & Livestock
69	19.3365	83.1440	Bhimabali	Rautghati	Khurigan	Kashipur	640-842	1	Yes		Other (please specify)	Irrigation & Drinking
70	19.3311	83.1480	Akrasal	Rautghati	Khurigan	Kashipur	640-842	1	Yes		Other (please specify)	Irrigation & Drinking

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
71	19.3609	83.1611	Karijhola	Adarmajhi	Khurigan	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
72	19.3678	83.1613	Jamchuan	Adarmajhi	Khurigan	Kashipur	842-1502	2	Yes		Other (please specify)	Irrigation & Drinking
73	19.3601	83.1481	Bamanjharan	Adarmajhi	Khurigan	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
74	19.3554	83.1446	Dundujhola	Adarmajhi	Khurigan	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
75	19.3645	83.1532	Supilipao	Adarmajhi	Khurigan	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
76	19.3643	83.1527	Hundidamka	Adarmajhi	Khurigan	Kashipur	640-842	3	Yes		Other (please specify)	Irrigation & Drinking
77	19.3502	83.1629	Amileduku	Jalakhura	Mandibisi	Kashipur	640-842	1	Yes		Other (please specify)	Irrigation, Drinking & Livestock
78	19.3757	83.1677	Jelua	Bhitarpadamajhi	Mandibisi	Kashipur	640-842	1	Yes		Other (please specify)	Irrigation & Drinking
79	19.3783	83.1890	Ranimali	Metkes	Mandibisi	Kashipur	842-1502	1	Yes		Other (please specify)	Drinking
80	19.3756	83.1654	Champajhoran	Bhitarpadamajhi	Mandibisi	Kashipur	640-842	2	Yes		Other (please specify)	Irrigation & Drinking
81	19.4326	83.1348	Gulmijharan	Ragapadar	Mandibisi	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
82	19.4403	83.1339	Jelikhaman	Ragapadar	Mandibisi	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
83	19.4418	83.1408	Dengimaska	Ragapadar	Mandibisi	Kashipur	640-842	1	Yes		Other (please specify)	Irrigation & Drinking
84	19.4309	83.1395	Badamaska	Lelingpadar	Mandibisi	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
85	19.4303	83.1425	Gadapal	Lelingpadar	Mandibisi	Kashipur	842-1502	1	Yes		Other (please	Irrigation &

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
											specify)	Drinking
86	19.4302	83.1454	Apedmaska	Lelingpadar	Mandibisi	Kashipur	842-1502	2	Yes		Other (please specify)	Irrigation, Drinking & Livestock
87	19.3475	83.0371	Ranibasa	Talapatri	Chandragiri	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
88	19.3487	83.0384	Jatasil	Talapatri	Chandragiri	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation, Drinking & Livestock
89	19.3491	83.0421	Sanjharan	Talapatri	Chandragiri	Kashipur	842-1502	1	Yes		Private	Irrigation & Drinking
90	19.3514	83.0361	Kakrajharana	Talapatri	Chandragiri	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
91	19.3503	83.0294	Patjharan	Talapatri	Chandragiri	Kashipur	443-640	3	Yes		Other (please specify)	Drinking
92	19.3552	83.0271	Kidkajodi	Talapatri	Chandragiri	Kashipur	443-640	1	Yes		Other (please specify)	Irrigation & Drinking
93	19.5245	83.3757	Dokte Jhola	Tebapada	Sunakhandi	Kalyansingpur	443-640	2	No	Used for cattle/ Bathing	Other (please specify)	Drinking & Livestock
94	19.5265	83.3721	Laharagudi	Tebapada	Sunakhandi	Kalyansingpur	443-640	1	No	Used for cattle/ Bathing	Other (please specify)	Drinking & Livestock
95	19.5779	83.3515	Lita katha charcha	Chatikona	Parsali	Kalyansingpur	443-640	1	No	Used for cattle/ Bathing	Other (please specify)	Not Being Used/ Abandoned
96	19.5972	83.3416	GUDKUTI	KURUSHMUHI	Parsali	Kalyansingpur	640-842	1	Yes		Other (please specify)	Not Being Used/ Abandoned
97	19.5962	83.3419	Gandraba	KURUSHMUHI	Parsali	Kalyansingpur	443-640	1	No	Used for cattle/	Other (please specify)	Not Being Used/ Abandoned

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
										Bathing		
98	19.5036	83.4213	Karanipau	Khajuri	Kurli	Bissamcuttack	640-842	1	Yes		Other (please specify)	Drinking & Livestock
99	19.4833	83.4576	Graduaamba	Khajuri	Kurli	Bissamcuttack	443-640	1	Yes		Other (please specify)	Drinking
100	19.5038	83.4319	Nahudikuti	Khajuri	Kurli	Bissamcuttack	443-640	2	Yes		Other (please specify)	Drinking
101	19.4972	83.4321	Sibdaopao	Khajuri	Kurli	Bissamcuttack	842-1502	2	Yes		Other (please specify)	Irrigation & Drinking
102	19.5012	83.4306	Dumduma	Khajuri	Kurli	Bissamcuttack	842-1502	2	Yes		Other (please specify)	Not Being Used/ Abandoned
103	19.3726	83.1796	Kasamgach	Bhitarpadamajhi	Mandibisi	Kashipur	842-1502	1	Yes		Private	Irrigation & Drinking
104	19.3730	83.1508	Dangharachua	Rastuguda	Mandibisi	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
105	19.3739	83.1534	Warsilekada	Rastuguda	Mandibisi	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation, Drinking & Livestock
106	19.3705	83.1502	Titijharan	Rastuguda	Mandibisi	Kashipur	842-1502	2	Yes		Other (please specify)	Irrigation & Drinking
107	19.3778	83.1583	Miniyajhola	Rastuguda	Mandibisi	Kashipur	842-1502	2	Yes		Other (please specify)	Irrigation & Drinking
108	19.3771	83.1571	Kaduthuti	Rastuguda	Mandibisi	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
109	19.3707	83.1483	Kachelkajhola	Rastuguda	Mandibisi	Kashipur	272-443	2	Yes		Other (please specify)	Irrigation & Drinking
110	19.3676	83.1451	Handikhal	Rastuguda	Mandibisi	Kashipur	272-443	2	Yes		Other (please specify)	Irrigation & Drinking
111	19.3748	83.1482	Gontijharan	Rastuguda	Mandibisi	Kashipur	272-443	3	Yes		Other (please specify)	Irrigation & Drinking

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
112	19.4628	83.4456	Karjakardi	Papikhuti	Bhatapur	Bissamcuttack	272-443	1	Yes		Other (please specify)	Irrigation & Drinking
113	19.4621	83.4531	Palma	Hikeri	Bhatapur	Bissamcuttack	443-640	1	Yes		Other (please specify)	Irrigation & Drinking
114	19.4564	83.4636	Hemiwalka	Karinikupa	Bhatapur	Bissamcuttack	443-640	1	Yes		Other (please specify)	Irrigation & Drinking
115	19.4454	83.4565	Penua	Goudaguda	Bhatapur	Bissamcuttack	640-842	1	Yes		Other (please specify)	Drinking
116	19.4798	83.4637	Kudaguda	Nuagaon	Chatikana	Bissamcuttack	640-842	1	Yes		Other (please specify)	Irrigation & Drinking
117	19.4782	83.3899	Suha jharan	Railema	Sunakhandi	Kalyansingpur	443-640	1	No	Used for cattle/ Bathing	Other (please specify)	Not Being Used/ Abandoned
118	19.4057	83.1867	Amilechua	Potesh	Mandibisi	Kashipur	640-842	1	Yes		Other (please specify)	Irrigation & Drinking
119	19.4063	83.1885	Harumaska	Potesh	Mandibisi	Kashipur	640-842	1	Yes		Other (please specify)	Irrigation & Drinking
120	19.4067	83.1752	Trasgandara	Potesh	Mandibisi	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
121	19.4063	83.1883	Solpadonga	Potesh	Mandibisi	Kashipur	640-842	2	Yes		Other (please specify)	Irrigation & Drinking
122	19.4047	83.1849	Mahumaska	Potesh	Mandibisi	Kashipur	640-842	1	Yes		Other (please specify)	Irrigation & Drinking
123	19.5233	83.4194	Andraabeta	Kadragumaa	Kurli	Bissamcuttack	640-842	1	Yes		Other (please specify)	Irrigation, Drinking & Livestock
124	19.5213	83.4321	Lakamara jadi	Panasapadar	Kurli	Bissamcuttack	640-842	1	Yes		Other (please specify)	Drinking
125	19.5058	83.4404	Cibidaamba	Dangarranibandha	Kurli	Bissamcuttack	640-842	1	Yes		Other (please specify)	Irrigation & Drinking

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
126	19.3888	82.9647	Badajharan	Dangeshkhal	Chandragiri	Kashipur	640-842	1	Yes		Other (please specify)	Irrigation & Drinking
127	19.3882	82.9660	Lamberijharan	Dangeshkhal	Chandragiri	Kashipur	842-1502	1	Yes		Private	Irrigation & Drinking
128	19.3639	82.9518	Perhasjharan	Taldandabada	Chandragiri	Kashipur	640-842	1	Yes		Other (please specify)	Irrigation & Drinking
129	19.3641	82.9515	Kduktijharan	Taldandabada	Chandragiri	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
130	19.3641	82.9468	Palbongajharan	Taldandabada	Chandragiri	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
131	19.3732	82.9478	Aluejharan	Taldandabada	Chandragiri	Kashipur	443-640	1	Yes		Other (please specify)	Irrigation & Drinking
132	19.3750	82.9489	Masanijharan	Taldandabada	Chandragiri	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
133	19.3705	82.9588	Kadipat	Taldandabada	Chandragiri	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
134	19.3753	82.9579	Humajharan	Taldandabada	Chandragiri	Kashipur	640-842	1	Yes		Other (please specify)	Irrigation & Drinking
135	19.3778	82.9504	Gajamaska	Taldandabada	Chandragiri	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
136	19.3789	82.9528	Batule	Taldandabada	Chandragiri	Kashipur	842-1502	1	Yes		Other (please specify)	Irrigation & Drinking
137	19.5352	83.4113	Teduyuaa	Khambesi	Kurli	Bissamcuttack	640-842	1	No	Iron Contamination	Other (please specify)	Irrigation & Drinking
138	19.5253	83.4129	Latikanu chua	Khambesi	Kurli	Bissamcuttack	842-1502	1	No	Iron Contamination	Other (please specify)	Drinking
139	19.4894	83.4329	Paradipadi jala	Arishakani	Kurli	Bissamcuttack	842-1502	1	No	Iron Contamin	Other (please specify)	Irrigation

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
										ation		
140	19.3701	83.0170	Malipadar	Padampur	Chandaragiri	Kashipur	640-842	1	Yes		Other (please specify)	Irrigation, Drinking & Livestock
141	19.3664	83.0195	Bijrang jharan	Padampur	Chandragiri	Kashipur	640-842	1	Yes		Other (please specify)	Irrigation & Drinking

Annexure-V Details of Identified spring with other details of Mayurbhanj District

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
1	21.9542	86.21	Hati Mundi Nalla	Brundeiposhi & Jamuani Hamlet of Hati Mundi Rev.Village.	Podagarh	Jashipur	328-517	4	No	Bacterial Contamination	Community/ Village	Irrigation
2	21.944	86.2231	Kunda Garh Nalla	Asar Maharia Of Kunda Garh Rev. Village .	Poda Garh	Jashipur	328-517	3	No	Used for cattle/ Bathing	Community/ Village	Irrigation
3	21.9937	86.113	Tursi Jharana , Machha Kandana Rev. Village, Jashipur.	Reserve Forest Area (Hill) Of Machha Kandana Rev. Village.	Mahardapalsa	Jashipur	328-517	2	Yes		Community/ Village	Irrigation & Drinking
4	21.8577	86.2683	Sendha Nalla Spring, Khedia Dunguri, JSP.	Reserve Forest Area of Khedia Dunguri, (Sereng Iker) .	Gudugudia	Jashipur	517-755	1	Yes		Community/ Village	Irrigation & Drinking
5	21.9189	86.1507	Kania Duba Spring, Kaliani, Jashipur.	Origin from Reserve Forest Area of Alkudar Rev. Village (Mainly from Similipal T. R.) but Located Village is Kaliani.	Dhalabani	Jashipur	328-517	4	No	Used for cattle/ Bathing	Community/ Village	Irrigation
6	21.8862	86.2416	Billapagha Spring, Billapagha, Jashipur .	Reserve Forest Area of Jurimunda Hill of Billapagha Village.	Gudugudia,	Jashipur	517-755	1	No	Used for cattle/ Bathing	Community/ Village	Irrigation
7	21.8988	86.1639	Asura Kunda Spring, Alkudar Rev. Village, Jashipur.	Reserve Forest Area of Alkudar Rev.Village.	Dhalabani	Jashipur	517-755	1	No	Bacterial Contamination	Community/ Village	Irrigation

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
8	21.9099	86.1976	Hati Bati Spring, Kalika Prasad, Jashipur.	Reserve Forest Area of Kalika Prasad Rev.Village.(Origin From S. T. R.)	Dhalabani	Jashipur	517-755	1	Yes		Community/ Village	Irrigation & Drinking
9	21.9189	86.2045	Kankada Kachha Spring, Kalika Prasad, Jashipur.	Araraga Reserve Forest Area of Kalika Prasad Rev.Village.	Dhalabani	Jashipur	517-755	3	Yes		Community/ Village	Irrigation & Drinking
10	21.9002	86.1774	Kior Kochha Spring, Buru Sahi, Uttaras Rev. Village, Jashipur.	Reserve Forest Area of Basaburu Hill, Rev.Village.-Uttaras.	Dhalabani	Jashipur	517-755	3	Yes		Community/ Village	Irrigation & Drinking
11	21.9233	86.1859	Suna Kacha Spring of Thakurgada Rev. Village, Jashipur.	Dhanipat Reserve Forest Area of Thakurgada Rev. Village.	Dhalabani	Jashipur	328-517	1	No	Used for cattle/ Bathing	Community/ Village	Irrigation
12	21.9041	86.1963	Baba Gameya Spring, Kalika Prasad, Jashipur, MBJ.	Reserve Forest Area of Gameya Hill, Rev. Village. -Kalika Prasad.	Dhalabani	Jashipur	517-755	2	Yes		Community/ Village	Irrigation & Drinking
13	21.8904	86.1064	Gada Kachha Spring, Kumudabadi,Jashipur.	Origin from Reserve Forest Area of Rajaram hill of Kumudabadi Rev.Village.	Ektali,	Jashipur	328-517	3	Yes		Community/ Village	Irrigation & Drinking
14	21.9362	86.2106	Jam Chua Spring, Palogoda, Podagarh,	Origin from Matdunguri hill of S.T.R.Area.(Palogoda	Podagarh,	Jashipur	517-755	2	Yes		Community/ Village	Irrigation & Drinking

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
			Jashipur.	Rev. Village)								
15	21.9353	86.2145	Lal Spring, Palogoda, Podagarh, Jashipur.	Origin from Lanja Lata hill of S.T.R.Area.(Palogoda Rev. Village)	Podagarh	Jashipur	328-517	1	Yes		Community/ Village	Irrigation & Drinking
16	21.9364	86.2161	Hanu Ragha Spring, Palogoda, Podagarh, Jashipur.	Origin from Harba hill of S.T.R.Area.(Palogoda Rev. Village)	Podagarh	Jashipur	328-517	2	Yes		Community/ Village	Irrigation & Drinking
17	21.9325	86.2177	Chede Ragha Spring, Palogoda, Podagarh, Jashipur.	Origin from Karla Dunguri hill of S.T.R. forest.(Palogoda Rev.Village)	Podagarh	Jashipur	517-755	2	Yes		Community/ Village	Irrigation & Drinking
18	21.9406	86.2183	Tamak Dunguri Spring, Palogoda, Podagarh, Jashipur, MBJ.	Origin from Sinhi Ragha forest of S.T.R. area.(Palogoda Rev. Village)	Podagarh	Jashipur	328-517	1	Yes		Community/ Village	Irrigation & Drinking
19	21.9002	86.1958	Tumbedaha Spring, Kalika Prasad, Dhalabani, Jashipur.	Origin from Jangilghutu Hill of S.T.R. Forest. (Kalikaprasad Village)	Dhalabani	Jashipur	517-755	1	Yes		Community/ Village	Irrigation & Drinking
20	21.9248	86.1923	Gamuchhadaha Spring, Kalikaprasad, Dhalabani,	Origin from Satarighutu Forest of S.T.R. Area (Kalikaprasad Village	Dhalabani	Jashipur	517-755	2	Yes		Community/ Village	Irrigation & Drinking

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
			Jashipur.	).								
21	21.623	86.1973	Simnai Spring, Asankudar(Puruna KhadiaSahi), Hatigoda, Thakurmunda.	Origin from Dangapani Hill of S.T.R.forest (DURDUR) ,Village - Asankudar (Puruna Khadia Sahi).	Hatigoda	Thakurmunda	328-517	1	No	Used for cattle/ Bathing	Community/ Village	Irrigation
22	21.6248	86.1989	Dangaikir Spring, Asankudar, Hatigoda, Thakurmunda.	Origin from Similipal Biosphere ofAsankudar Village, Hatigoda G.P.Thakurmunda Block.	Hatigoda	Thakurmunda	328-517	4	Yes		Community/ Village	Irrigation & Drinking
23	21.6074	86.2122	Mad Kacha Spring of Asankudar Village, G.P.-Hatigoda, Block-Thakurmunda.	Origin from the Reserve Forest Area of Similipal Biosphere in Asankudar Village, Hatigoda G.P. Thakurmunda Block.	Hatigoda	Thakurmunda	328-517	1	Yes		Community/ Village	Irrigation & Drinking
24	21.6082	86.2117	Marajda Spring of AsankudarVillage, G.P.- Hatigoda in Thakurmunda Block.	Origin from the Reserve Forest Area of Similipal Biosphere in Asankudar Village, Hatigoda G.P.Thakurmunda Block.	Hatigoda	Thakurmunda	328-517	1	Yes		Community/ Village	Irrigation & Drinking
25	21.8643	86.0725	Batadhara Spring, Saradha, Badagaon, Karanjia.	Origin from Kanchula Area of Saradha Village.	Badagaon	Karanjia	328-517	2	Yes		Community/ Village	Irrigation & Drinking
26	21.8697	86.0773	Chapala Spring, Saradha, Badagaon, Karanjia.	Origin from Jara forest land of Chapala Area in Saradha	Badagaon	Karanjia	328-517	3	Yes		Community/ Village	Irrigation & Drinking

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
				Village.								
27	21.6157	86.2051	Tumba Pani Spring of Asankudar Village, G.P.- Hatigoda in Thakurmunda Block.	Origin from the Joda Karam Ghati Forest of Similipal Biosphere in Asankudar Village, Hatigoda G.P, Thakurmunda Block.	Hatigoda	Thakurmunda	328-517	1	Yes		Community/ Village	Irrigation & Drinking
28	21.6142	86.207	Khanduala Spring of Asankudar Village (Khanduala Sahi), G.P.- Hatigoda in Thakurmunda Block.	Origin from the Reserve Forest Land of Similipal Biosphere in Asankudar Village (Khanduala Sahi), Hatigoda G.P. in Thakurmunda Block.	Hatigoda	Thakurmunda	328-517	1	Yes		Community/ Village	Irrigation & Drinking
29	21.6123	86.2017	Pund Bhul Spring of Asankudar Village, G.P.- Hatigoda of Thakurmunda Block.	Origin from the Reserve Forest Area of Similipal Biosphere in Asankudar Village, G.P.- Hatigoda in Thakurmunda Block.	Hatigoda	Thakurmunda	328-517	1	Yes		Community/ Village	Irrigation & Drinking
30	21.5698	86.2565	Hati Kodan Spring of Mandaljhari Village, G.P.- keshadiha in Thakurmunda	Origin from the Sasanghasa Forest of Similipal Biosphere in Mandaljhari Village, G.P.- Keshadiha in	Keshadiha	Thakurmunda	328-517	1	Yes		Community/ Village	Irrigation & Drinking

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
			Block.	Thakurmunda Block.								
31	21.5717	86.2534	Tumenda Spring of Mandaljhari Village in Thakurmunda Block.	Origin from the Tumenda Hill of Similipal Biosphere in Mandaljhari Village, G.P.- Keshdiha in Thakurmunda Block.	Keshdiha	Thakurmunda	328-517	1	No	Used for cattle/ Bathing	Community/ Village	Irrigation
32	21.5773	86.255	Handi Lor Spring of Jay- Jaygutu Village,G.P.- keshdiha in Thakurmunda Block.	Origin from Handi Lor Reserve Forest Area of Similipal Biosphere in Jay-Jaygutu Village, G.P.- Keshdiha in Thakurmunda Block.	Keshdiha	Thakurmunda	328-517	1	Yes		Community/ Village	Irrigation & Drinking
33	21.5614	86.2465	Eche Goda Spring of Mandaljodi Village (Laco Sahi),G.P.- keshdiha in Thakurmunda Block.	Origin from the Mareda Hill of Similipal Biosphere in Mandaljodi Village (Lako Sahi), G.P.- Keshdiha in Thakurmunda Block.	Keshdiha	Thakurmunda	328-517	1	No	Used for cattle/ Bathing	Community/ Village	Irrigation
34	21.5983	86.2154	Bara-Jamu Spring of Ranihood Village in Thakurmunda Block.	Origin from the Gadigutu Hill of Similipal Biosphere in Ranihood Village, G.P.- Hatigada in Thakurmunda Block.	Hatigada	Thakurmunda	328-517	1	Yes		Community/ Village	Irrigation & Drinking

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
35	21.5906	86.2098	Kudur Spring of Ranihood Village in Thakurmunda Block.	Origin from the Janaghutu Hill of Similipal Biosphere in Ranihood Village, G.P.- Hatigada in Thakurmunda Block.	Hatigada	Thakurmunda	328-517	1	No	Used for cattle/ Bathing	Community/ Village	Irrigation
36	21.5869	86.2069	Balikudur Spring of the Ranihood (Balikudur) Village in Thakurmunda Block.	Origin from the Ranihood (Balikudur) Reserve Forest Land of Similipal Biosphere in Ranihood Village, G.P.- Hatigada in Thakurmunda Block.	Hatigada	Thakurmunda	328-517	1	Yes		Community/ Village	Irrigation & Drinking
37	21.6034	86.2133	Bhol Spring of Asankudar (Mohanta Sahi) Village in Thakurmunda Block.	Origin from the Reserve Forest Land (Chatri) of Similipal Biosphere in Asankudar Village, G.P.- Hatigada in Thakurmunda Block.	Hatigada	Thakurmunda	328-517	1	Yes		Community/ Village	Irrigation & Drinking
38	21.5074	86.3222	Mareda Kendu Nala Jhar in Dangadiha (Bangala Sahi) Village of Thakurmunda Block.	Origin from the Dangadiha Rev. Village of Champajhar G.P. in Thakurmunda Block.	Champajhar	Thakurmunda	328-517	4	Yes		Community/ Village	Irrigation & Drinking
39	21.5184	86.347	Chatalor Spring of Dangadiha Village	Origin from the Banji Kusum Hill of Similipal	Champajh	Thakurm	517-	1	No	Bacterial Contamin	Community/	Irrigation

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
			in Thakurmunda Block.	Biosphere in Dangadiha Rev. Village.	ar	unda	755			ation	Village	
40	21.5187	86.3464	Champajhar Spring of Dangadiha Village, G.P.- Champajhar in Thakurmunda Block.	Origin from the Banji Kusumi Hill of Similipal Biosphere in Dangadiha Rev. Village.	Champajhar	Thakurmunda	517-755	1	No	Bacterial Contamination	Community/ Village	Irrigation
41	21.5179	86.3434	Durdur Spring in Dangadiha Village of Thakurmunda Block.	Origin from the Banji Kusumi Hill of Similipal Biosphere in Dangadiha Village.	Champajhar	Thakurmunda	328-517	1	No	Used for cattle/ Bathing	Community/ Village	Irrigation
42	21.4898	86.313	Lalajhar Spring in Dangadiha Village of Thakurmunda Block.	Origin from the Lalabil Area of Similipal Biosphere in Dangadiha Village.	Champajhar	Thakurmunda	163-328	1	Yes		Community/ Village	Irrigation & Drinking
43	21.5381	86.2715	Godmunda Spring of Kirikichipal Village (Mohanty Beda) in Thakurmunda Block.	Origin from the Godmunda Hill of Similipal Biosphere in Kirikichipal Village (Mohanty Beda).	Champajhar	Thakurmunda	517-755	3	Yes		Community/ Village	Irrigation & Drinking
44	21.5378	86.2716	Ekpadi Spring of Kirikichipal Village in Thakurmunda Block.	Origin from the Ekpadi Hill of Similipal Biosphere in Kirikichipal Village.	Champajhar	Thakurmunda	517-755	3	Yes		Community/ Village	Irrigation & Drinking

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
45	21.4997	86.2579	Mangulichapal Spring of Kirikichipal Village in Thakurmunda Block.	Origin from the La-Kacha Reserve Forest Area of Similipal Biosphere in Kirikichipal Village.	Champajhar	Thakurmunda	328-517	1	Yes		Community/ Village	Irrigation & Drinking
46	21.6187	86.1948	Dumuri Jharan Spring of Khaparkhai Village in Thakurmunda Block.	Origin from the Kanhukacha Reserve Forest Area of Similipal Biosphere in Khaparkhai Village.	Saleibeda	Thakurmunda	328-517	1	No	Bacterial Contamination	Community/ Village	Irrigation
47	21.6191	86.1952	Da-Patek Spring of Khaparkhai Village in Thakurmunda Block.	Origin from the Da-Patek Hill of Similipal Biosphere in Khaparkhai Village.	Saleibeda	Thakurmunda	328-517	1	No	Used for cattle/ Bathing	Community/ Village	Irrigation
48	21.6184	86.1954	Khaparkhai Spring in Khaparkhai Village of Thakurmunda Block.	Origin from the Da-Patek Reserve Forest Area of Similipal Biosphere in Khaparkhai Village.	Saleibeda	Thakurmunda	328-517	1	No	Used for cattle/ Bathing	Community/ Village	Irrigation
49	21.6144	86.1987	Khadia-Sahi Jhar of Asankudar Village in Thakurmunda Block.	Origin from the Karanjamula (Dehuri Sahi) of Similipal Biosphere in Asankudar Village.	Hatigoda	Thakurmunda	328-517	1	Yes		Community/ Village	Irrigation & Drinking
50	21.6139	86.1963	Putesud Spring of Khaparkhai Village in Thakurmunda	Origin from the Kadambute Land of Khaparkhai Village	Saleibeda	Thakurmunda	328-517	2	Yes		Community/ Village	Irrigation & Drinking

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
			Block.	(Similipal Biosphere Area).								
51	21.6147	86.1966	Pundi Spring of Khaparkhai Village in Thakurmunda Block.	Origin from the Jagada Area of Khaparkhai Village (Similipal Biosphere Area).	Saleibeda	Thakurmunda	328-517	1	No	Used for cattle/ Bathing	Community/ Village	Irrigation
52	21.5177	86.2669	Sukila Jhar Spring in Kirikichipal Village (Ho Sahi) in Thakurmunda Block.	Origin from the Bhangahudi Hill of Similipal Biosphere in Kirikichipal Village (Ho Sahi).	Champajhar	Thakurmunda	328-517	1	Yes		Community/ Village	Irrigation & Drinking
53	21.5209	86.2693	Jalchua Spring in Kirikichipal Village of Thakurmunda Block.	Origin from the Jalchua Hill of Similipal Biosphere in Kirikichipal Village.	Champajhar	Thakurmunda	517-755	1	Yes		Community/ Village	Irrigation & Drinking
54	21.5221	86.272	Panda Basa Spring in Kirikichipal Village of Thakurmunda Block.	Origin from the Barubasa Hill of Similipal Biosphere in Kirikichipal Village.	Champajhar	Thakurmunda	517-755	2	Yes		Community/ Village	Irrigation & Drinking
55	21.5243	86.2719	Budiapaka Spring in Kirikichipal Village of Thakurmunda Block.	Origin from the Balughutu Hill of Similipal Biosphere in Kirikichipal Village.	Champajhar	Thakurmunda	517-755	1	Yes		Community/ Village	Irrigation & Drinking
56	21.5204	86.2575	Chhelibasa Spring in Kirikichipal Village of Thakurmunda	Origin from the Saratbhula Reserve Forest Area of Similipal Biosphere in Kirikichipal	Champajhar	Thakurmunda	328-517	1	Yes		Community/ Village	Irrigation & Drinking

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
			Block.	Village.								
57	21.5055	86.2525	Haguri Spring of Kirikichipal Village in Thakurmunda Block.	Origin from the Bankibeda Agril. Land of Kirikichipal Village.	Champajhar	Thakurmunda	163-328	1	No	Used for cattle/ Bathing	Community/ Village	Irrigation
58	21.7214	86.1264	Dahaniduba Spring in Bishpur Village of Karanjia Block.	Origin from the Dahaniduba Hill of Similipal Biosphere in Bishpur Village.	Patbil	Karanjia	328-517	1	Yes		Community/ Village	Irrigation & Drinking
59	21.7217	86.1272	Andharnali Spring in Bishpur Village of Karanjia Block.	Origin from the Andharnali Reserve Forest Area of Similipal Biosphere in Bishpur Village.	Patbil	Karanjia	328-517	1	Yes		Community/ Village	Irrigation & Drinking
60	21.72	86.1281	Pandachara Spring in Bishpur Village of Karanjia Block.	Origin from the Pandachara Hill of Similipal Biosphere in Bishpur Village.	Patbil	Karanjia	517-755	1	Yes		Community/ Village	Irrigation & Drinking
61	21.7182	86.1297	Kadsa Mana Spring in Bishpur Village of Karanjia Block.	Origin from the Kadsa Mana Hill of Similipal Biosphere in Bishpur Village.	Patbil	Karanjia	517-755	1	Yes		Community/ Village	Drinking
62	21.7233	86.1216	Bhalughara Spring in Bishpur Village of Karanjia Block.	Origin from the Bhalughara Reserve Forest Area of Similipal Biosphere in Bishpur	Patbil	Karanjia	328-517	1	Yes		Community/ Village	Drinking

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
				Village.								
63	21.3592	86.1322	Hurumbi Spring In Satakosia Village (Laxmiposhi) of Thakurmunda Block.	Origin from the Hurumbi Hudi Area in Satakosia Village (Laxmiposhi) of Thakurmunda Block.	Satakosia	Thakurmunda	163-328	1	Yes		Community/ Village	Irrigation & Drinking
64	21.324	86.1159	Dwarasuni Spring in Satkosia Village of Thakurmunda Block.	Origin from the Dwarasuni Hill (Godbhanga Ghati) in Satkosia Village of Thakurmunda Block.	Satkosia	Thakurmunda	0-163	1	Yes		Community/ Village	Irrigation & Drinking
65	21.3243	86.1144	Godbhanga Spring in Satkosia Village of Thakurmunda Block.	Origin from the Godbhanga Hill of Satkosia Reserve Forest in Satkosia Village of Thakurmunda Block.	Satkosia	Thakurmunda	0-163	1	Yes		Community/ Village	Irrigation & Drinking
66	21.3241	86.1206	Nakajori Spring of Satkosia Village in Thakurmunda Block.	Origin from the Godbhanga Hill of Satkosia Reserve Forest in Satkosia Village of Thakurmunda Block.	Satkosia	Thakurmunda	0-163	1	Yes		Community/ Village	Irrigation & Drinking
67	21.3258	86.1575	Chapal Spring of Duarasuni Village (Kuntikahani) in Thakurmunda Block.	Origin from the Reserve Forest Area of Duarasuni Village (Kuntikahani) in Thakurmunda Block.	Satkosia	Thakurmunda	163-328	2	No	Used for cattle/ Bathing	Community/ Village	Irrigation

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
68	21.3244	86.1799	Putesud Spring in DuarsuniVillage of Thakurmunda Block.	Origin from the Putesud Area of Satkosia Reserve Forest in Duarasuni Village of Thakurmunda Block.	Satkosia	Thakurmunda	0-163	3	Yes		Community/ Village	Irrigation & Drinking
69	21.3373	86.163	Naranga Spring in DuarsuniVillage of Thakurmunda Block.	Origin from the Naranga Area of Satkosia Reserve Forest in Duarasuni Village (Kandiang Sahi) of Thakurmunda Block.	Satkosia	Thakurmunda	163-328	1	No	Used for cattle/ Bathing	Community/ Village	Irrigation
70	21.3388	86.1723	Lohalor Spring	Origin from the Hembrum Chatani of Satkosia Reserve Forest Area in Duarasuni Village of Thakurmunda Block.	Satkosia	Thakurmunda	163-328	1	No	Used for cattle/ Bathing	Community/ Village	Irrigation
71	21.3473	86.1816	Kendu Spring in Duarsuni Village (Karnaborei Sahi) ofThakurmunda Block.	Origin from the Marang Sereng Reserve Forest Area of DuarasuniVillage (Karnaborei Sahi) in Thakurmunda Block.	Satkosia	Thakurmunda	163-328	1	No	Used for cattle/ Bathing	Community/ Village	Irrigation
72	21.3456	86.1832	Jhinkiundu Spring in Duarasuni Village of Thakurmunda Block.	Origin from the Jhinkiundu Area of Satkosia Reserve Forest in Duarasuni Village of Thakurmunda Block.	Satkosia	Thakurmunda	0-163	2	Yes		Community/ Village	Irrigation & Drinking

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
73	21.3369	86.1891	Papari Jharana in Duarsuni Village (Karnaborei Sahi) ofThakurmunda Block.	Origin from the Jayar-Gutu Hudi ofSatkosia Reserve Forest Area in Duarasuni Village (Karnaborei Sahi) of Thakurmunda Block.	Satkosia	Thakurmunda	163-328	1	No	Used for cattle/ Bathing	Community/ Village	Irrigation
74	21.3447	86.1924	Dasajhara Spring in Duarasuni Village (Karnaborei - Dasasahi) of Thakurmunda Block.	Origin from the Bai-Sereng Area ofSatkosia Reserve Forest in Duarasuni Village (Karnaborei - Dasasahi) of Thakurmunda Block.	Satkosia	Thakurmunda	328-517	2	Yes		Community/ Village	Irrigation & Drinking
75	21.5457	86.2418	Rahasjhar Spring in Keshdiha Village (Bhagana Sahi) of Thakurmunda Block.	Origin from the Gandaguda Reserve Forest Area of Similipal Biosphere in Keshdiha Village (Bhagana Sahi) of Thakurmunda Block.	Keshdiha	Thakurmunda	328-517	1	Yes		Community/ Village	Drinking
76	21.5442	86.2473	Dudichua Spring in Keshdiha Village of Thakurmunda Block.	Origin from the Dipedaha Hill of Similipal Biosphere in Keshdiha Village of Thakurmunda Block.	Keshdiha	Thakurmunda	328-517	1	Yes		Community/ Village	Drinking
77	21.5458	86.2477	Basadaha Spring of Keshdiha Village in Thakurmunda Block.	Origin from the Basadaha Hill of Similipal Biosphere in Keshdiha Village of Thakurmunda Block.	Keshdiha	Thakurmunda	328-517	1	Yes		Community/ Village	Drinking

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
78	21.5421	86.2471	Turam Gutu Spring in Keshdiha Village of Thakurmunda Block.	Origin from the Turam Gutu Hill ofSimilipal Biosphere Area in Keshdiha Village of Thakurmunda Block.	Keshdiha	Thakurmunda	328-517	1	Yes		Community/ Village	Irrigation & Drinking
79	21.5414	86.2462	Bulabeda Spring in Keshdiha Village of Thakurmunda Block.	Origin from the Remogoda Gutu Reserve Forest Area of Similipal Biosphere in Keshdiha Village of Thakurmunda Block.	Keshdiha	Thakurmunda	328-517	1	Yes		Community/ Village	Irrigation & Drinking
80	21.5362	86.244	Ghusaguda Spring in Keshdiha Village of Thakurmunda Block.	Origin from the Ghusaguda Reserve Forest Area of Similipal Biosphere in Keshdiha Village of Thakurmunda Block.	Keshdiha	Thakurmunda	328-517	1	Yes		Community/ Village	Irrigation & Drinking
81	21.5355	86.2444	Paga-Gajada Spring in Keshdiha Village of Thakurmunda Block.	Origin from the Paga-Gajada Reserve Forest Area of Similipal Biosphere in Keshdiha Village of Thakurmunda Block.	Keshdiha	Thakurmunda	517-755	1	Yes		Community/ Village	Irrigation & Drinking
82	21.968	86.2182	Sundara Kacha Spring	Origin from the Duru Hill of S.T.R. in Sanjhilli Village of Jashipur Block.	Podagarh	Jashipur	517-755	1	Yes		Community/ Village	Irrigation & Drinking
83	21.96	86.223	Duru Jharan Spring	Origin from the Duru Hill of S.T.R. Area in Sanjhilli	Podagarh	Jashipur	517-	1	Yes		Community/	Irrigation &

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
	5			Village of Jashipur Block.			755				Village	Drinking
84	21.9625	86.2265	Hatimundi Spring.	Origin from the Hatimundi Hill of S.T.R. Area in Sanjhilli Village ofJashipur Block.	Podagarh	Jashipur	328-517	2	No	Used for cattle/ Bathing	Community/ Village	Irrigation
85	21.9492	86.1951	Parua Jharan Spring	Origin from the Meram Dunguri Forest of S.T.R. in Madanmohanpur Village of Jashipur Block.	Podagarh	Jashipur	517-755	1	Yes		Community/ Village	Irrigation & Drinking
86	21.9461	86.1941	Ghatkeda Spring	Origin from the Triyadashna Reserve Forest Area of S.T.R. in Madanmohanpur Village of Jashipur Block.	Podagarh	Jashipur	328-517	1	Yes		Community/ Village	Irrigation & Drinking
87	21.9514	86.1919	Chatanida Spring	Origin from the Gumaibeda Hill of S.T.R. in Madanmohanpur Village of Jashipur Block.	Podagarh	Jashipur	328-517	1	Yes		Community/ Village	Irrigation & Drinking
88	21.9531	86.1908	Bakakacha Spring	Origin from the Samunia Hill of S.T.R. in Madanmohanpur Village of Jashipur Block.	Podagarh	Jashipur	328-517	3	Yes		Community/ Village	Irrigation & Drinking

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
89	21.9562	86.1648	Dhabagada Spring	Origin from the Ateda Hill of S.T.R. in Podagarh Village ofJashipur Block.	Podagarh	Jashipur	328-517	2	No	Used for cattle/ Bathing	Community/ Village	Irrigation
90	21.9598	86.1722	Garakacha Spring	Origin from the Lengakacha Hill of S.T.R. in Podagarh Village ofJashipur Block.	Podagarh	Jashipur	517-755	1	Yes		Community/ Village	Irrigation & Drinking
91	21.9542	86.1832	Dhangada Spring	Origin from the Nachini Hill of S.T.R. Area in Madanmohanpur Village of Jashipur Block.	Podagarh	Jashipur	517-755	2	Yes		Community/ Village	Drinking
92	21.956	86.186	Ulda Jharan Spring	Origin from the Kundu Hill of S.T.R. Area in Madanmohanpur Village of Jashipur Block.	Podagarh	Jashipur	517-755	2	Yes		Community/ Village	Drinking
93	21.956	86.1863	Sumunia Jharna	Origin from the Kandel Hill of S.T.R. Area in Madanmohanpur Village of Jashipur Block.	Podagarh	Jashipur	328-517	1	No	Bacterial Contamination	Community/ Village	Irrigation
94	21.9548	86.19	Pitam Jharan Spring	Origin from the Tarah Hill of	Podagarh	Jashipur	328-	2	No	Used for cattle/	Community/	Irrigati

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
				S.T.R. Area in Madanmohanpur Village of Jashipur Block.			517			Bathing	Village	on
95	21.9543	86.1922	Umesh Jharan Spring	Origin from the Chapad Land of S.T.R. in Madanmohanpur Village of Jashipur Block.	Podagarh	Jashipur	328-517	1	No	Used for cattle/ Bathing	Community/ Village	Irrigation
96	21.9587	86.1792	Bade Jharna	Origin from the Bhudruchede Hill of S.T.R. in Podagarh Village of Jashipur Block.	Podagarh	Jashipur	517-755	2	Yes		Community/ Village	Irrigation & Drinking
97	21.9771	86.2025	Triyo Jharan Spring	Origin from the Triyo Bhandar Hill of S.T.R. in Badjhilli Village of Jashipur Block.	Podagarh	Jashipur	517-755	1	Yes		Community/ Village	Irrigation & Drinking
98	21.9405	86.2483	Bhauri Jharana	Origin from the Porogada Reserve Forest Area of S.T.R. in Rajpal Village of Jashipur Block.	Podagarh	Jashipur	517-755	3	Yes		Community/ Village	Irrigation & Drinking
99	21.9234	86.2548	Podeikacha Spring	Origin from the Jandi Hill of S.T.R. Area in Rajpal Village of Jashipur Block.	Podagarh	Jashipur	517-755	3	No	Bacterial Contamination	Community/ Village	Irrigation

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
100	21.9209	86.2448	Dupai Jharana	Origin from the Churguni Hill of S.T.R. in Rajpal Village of Jashipur Block.	Podagarh	Jashipur	517-755	4	Yes		Community/ Village	Irrigation & Drinking
101	21.9225	86.2356	Kemp Spring	Origin from the Manda Reserve Forest Area of S.T.R. in Rajpal Village of Jashipur Block.	Podagarh	Jashipur	517-755	2	Yes		Community/ Village	Irrigation & Drinking
102	21.9384	86.2491	Ghandabasa Spring	Origin from the Jugumaria Reserve Forest Area of S.T.R. in Rajpal Village of Jashipur Block.	Podagarh	Jashipur	328-517	2	Yes		Community/ Village	Irrigation & Drinking
103	21.9433	86.2047	Kaliankacha Spring	Origin from the Neuro Reserve Forest Area of S.T.R. in Tingiriani Village of Jashipur Block.	Podagarh	Jashipur	517-755	1	No	Used for cattle/ Bathing	Community/ Village	Irrigation
104	21.9369	86.2041	Jamchua Spring	Origin from the Bodam Reserve Forest Area of S.T.R. in Tingiriani Village of Jashipur Block.	Podagarh	Jashipur	517-755	1	Yes		Community/ Village	Irrigation & Drinking
105	21.936	86.201	Jokda Spring	Origin from the Budhiul Reserve Forest Area of S.T.R. in Tingiriani Village of Jashipur Block.	Podagarh	Jashipur	517-755	1	No	Used for cattle/ Bathing	Community/ Village	Irrigation
106	21.9382	86.1996	Banaseya Spring	Origin from the Dumuni Dunguri Hill of S.T.R. in Tingiriani Village of Jashipur Block.	Podagarh	Jashipur	328-517	2	No	Bacterial Contamination	Community/ Village	Irrigation

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
107	21.9477	86.2004	Mareda Spring	Origin from the Triyodashna Hill of S.T.R. in Tingiriani Village of Jashipur Block.	Podagarh	Jashipur	0-163	1	No	Used for cattle/ Bathing	Community/ Village	Irrigation
108	21.3028	86.1317	Kendumula Spring	Origin from the Pichhila Reserve Forest Area of Chauljhari Village of Thakurmunda Block.	Salchua	Thakurmunda	0-163	1	Yes		Community/ Village	Irrigation & Drinking
109	21.306	86.1344	Pichhila Jharan Spring	Origin from the Reserve Forest Land of Chauljhari Village of Thakurmunda Block.	Salchua	Thakurmunda	0-163	2	Yes		Community/ Village	Irrigation & Drinking
110	21.2922	86.1951	Jujagenja Spring	Origin from the Kumbhitala Hill of Nada Forest Land in Bhagamara Village of Thakurmunda Block.	Salchua	Thakurmunda	163-328	2	Yes		Community/ Village	Irrigation & Drinking
111	21.3474	86.1495	Nanipula Spring	Origin from the Reserve Forest Area of Satkosia Village in Thakurmunda Block.	Satkosia	Thakurmunda	163-328	2	Yes		Community/ Village	Irrigation & Drinking
112	21.3533	86.1387	Nakjhari Spring	Origin from the Reserve Forest Land of Satkosia Village in	Satkosia	Thakurmunda	163-328	2	No	Used for cattle/ Bathing	Community/ Village	Irrigation

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
				Thakurmunda Block.								
113	21.3442	86.1382	Kirttandahi Spring	Origin from the Kashibahali Hill of Satkosia Village in Thakurmunda Block.	Satkosia	Thakurmunda	163-328	2	Yes		Community/ Village	Irrigation & Drinking
114	21.3533	86.1542	Bentkara Spring	Origin from the Bentkara Reserve Forest Area of Satkosia Village in Thakurmunda Block.	Satkosia	Thakurmunda	163-328	1	Yes		Community/ Village	Irrigation & Drinking
115	21.3506	86.1329	Kendubutelor Spring	Origin from the Reserve Forest Land of Satkosia Village in Thakurmunda Block.	Satkosia	Thakurmunda	163-328	2	Yes		Community/ Village	Irrigation & Drinking
116	21.3507	86.1372	Mahali Spring	Origin from the Baunshrai Hill of Satkosia Village in Thakurmunda Block.	Satkosia	Thakurmunda	0-163	1	Yes		Community/ Village	Irrigation & Drinking
117	21.2954	86.1131	Chiliriposhi Spring	Origin from the Reserve Forest Area of Chiliriposhi Village in Thakurmunda Block.	Godbhanga	Thakurmunda	0-163	1	No	Used for cattle/ Bathing	Community/ Village	Irrigation

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
118	21.3048	86.1065	Godbhanga Spring	Origin from the Reserve Forest Land of Godbhanga Village in Thakurmunda Block.	Godbhanga	Thakurmunda	163-328	3	No	Bacterial Contamination	Community/ Village	Irrigation
119	21.3232	86.1156	Dhatkidiha Spring	Origin from the Dwarasuni Reserve Forest Area of Dhatkidiha Village in Thakurmunda Block.	Godbhanga	Thakurmunda	328-517	1	Yes		Community/ Village	Irrigation & Drinking
120	21.3382	86.1284	Khajuribanian Spring	Origin from the Reserve Forest Area of Satkosia Village in Thakurmunda Block.	Satkosia	Thakurmunda	517-755	1	No	Used for cattle/ Bathing	Community/ Village	Irrigation
121	21.9618	86.2198	Setenda Spring	Origin from the Sanjhilli Village (Jharbeda) of Jashipur Block.	Podagarh	Jashipur	517-755	1	Yes		Community/ Village	Irrigation & Drinking
122	21.9668	86.2211	Talada Spring	Origin from the Duru Hill of S.T.R. in Sanjhilli Village of Jashipur Block.	Podagarh	Jashipur	328-517	2	Yes		Community/ Village	Irrigation & Drinking
123	21.9654	86.2219	Kurda Spring	Origin from the Duru Hill of S.T.R. Area in Sanjhilli Village of Jashipur Block.	Podagarh	Jashipur	328-517	2	Yes		Community/ Village	Irrigation & Drinking
124	21.9591	86.2175	Ulda Jharan Spring	Origin from the Ulda Area in Sanjhilli Village (Baletola) of Jashipur	Podagarh	Jashipur	517-755	4	Yes		Community/ Village	Irrigation & Drinking

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
				Block.								
125	21.9399	86.2349	Mutugande Spring	Origin from the Kumar Jahadi Reserve Forest Area of S.T.R. in Kundagarh Village of Jashipur Block.	Podagarh	Jashipur	517-755	3	No	Used for cattle/ Bathing	Community/ Village	Irrigation
126	21.9631	86.2272	Meltaloha Hadahadi Spring	Origin from the Da-Pute Reserve Forest Land of S.T.R. in Hatimundi Village of Jashipur Block.	Podagarh	Jashipur	517-755	2	Yes		Community/ Village	Irrigation & Drinking
127	21.9446	86.228	Mahariakacha Spring	Origin from the Brundaban (Chahala) Reserve Forest Area of S.T.R. in Kundagarh Village of Jashipur Block.	Podagarh	Jashipur	517-755	1	Yes		Community/ Village	Irrigation & Drinking
128	21.9587	86.2321	Tiriyo Spring	Origin from the Tiriyohuduang Bongadunguri Hill of S.T.R. in Hatimundi Village of Jashipur Block.	Podagarh	Jashipur	517-755	1	Yes		Community/ Village	Irrigation & Drinking
129	21.9407	86.2051	Ghagara Spring	Origin from the Naliul Reserve Forest Land of S.T.R. in Tingiriani Village of Jashipur Block.	Podagarh	Jashipur	517-755	1	No	Bacterial Contamination	Community/ Village	Irrigation

Sl. No	Latitude	Longitude	Site Name	Village Name	Gram Panchayat	Block	Elevation (in mtr)	Stream Order	Potability	Non-Potability	Owner	Usage
130	21.953	86.2269	Bhudka Spring	Origin from the Yeshbank Hill of S.T.R. Area in Bhodusole Village of Jashipur Block.	Podagarh	Jashipur	517-755	1	Yes		Community/ Village	Irrigation & Drinking

Annexure-VI Spring wise details of water discharge per day and tentative irrigation potential

Sl. No.	Village	GP	Block	District	Spring Name	Discharge per day (In Ltr)	Irrigation Potential (In Acres)
1	Talapanga	Talajhiri	Kashipur	Rayagada	Paruabadi	13470.88	31-50
2	Kakariguda	Daleiguda	Similiguda	Koraput	Badajhola	33432.22	31-50
3	Tankubeda	Upperkanti	Similiguda	Koraput	Kidajhola	5600.03	25-30
4	Karajhola	Sankarada	Kashipur	Rayagada	Rattajhola	4103.12	25-30
5	Durukhal	Chandragiri	Kashipur	Rayagada	Patramali	9138.02	25-30
6	Boriguma	Sankarada	Kashipur	Rayagada	Aujhola	23754.75	31-50
7	Maligaon	Chandragiri	Kashipur	Rayagada	Tagachuan	7377.05	25-30
8	Tentuliguda	Daleiguda	Similiguda	Koraput	Panichua jhola	28590.34	31-50
9	Gudajhola	Renga	Kashipur	Rayagada	Danga	2707.22	0-24
10	Baharpadamajhi	Mandibisi	Kashipur	Rayagada	Badachuan	10030.57	25-30
11	Mugnaguda	Daleiguda	Similiguda	Koraput	Jodoamba jhola	44059.15	31-50
12	Parajashila	Kashipur	Kashipur	Rayagada	Amliam	4085.3	25-30
13	Lambri	Gorakhapur	Kashipur	Rayagada	Kanasajhola	25737.27	31-50
14	Uppar Maligaon	Renga	Kashipur	Rayagada	Mahujharan	14085.43	31-50
15	Bhitarakata	Sorisapadar	Similiguda	Koraput	Gilamari jhola	25150.4	31-50
16	Khambesi	Kurli	BissamCuttack	Rayagada	Prispari	4168.74	25-30
17	Khambesi	Kurli	BissamCuttack	Rayagada	Dumurua	12956.11	31-50
18	Lahunikhunti	Kurli	BissamCuttack	Rayagada	Gundangjodi	11470.8	25-30
19	Gandili	Kurli	BissamCuttack	Rayagada	Wadikuda	14623	31-50
20	Garteli	Kurli	BissamCuttack	Rayagada	Kadigupa	17745.52	31-50
21	Garteli	Kurli	BissamCuttack	Rayagada	Kayutala	15847.88	31-50
22	Marua	Renga	Similiguda	Koraput	Bada jhola	5541.54	25-30
23	Marua	Renga	Similiguda	Koraput	Panderi jhola	28983.56	31-50
24	Kinjamjodi	Chancharaguda	Bissamcuttack	Rayagada	Silamadi	15477.86	31-50
25	Dantipada	Mudulipada	Khairiput	Malkangiri	Dangada	57850.69	31-50
26	Radang	Kurli	Bissamcuttack	Rayagada	Ladudi	14499.48	31-50
27	Radang	Kurli	Bissamcuttack	Rayagada	Tanikana	9863.95	25-30
28	Sundhiput	Dudharii	Similiguda	Koraput	Bagha jhola	52300.24	31-50

Sl. No.	Village	GP	Block	District	Spring Name	Discharge per day (In Ltr)	Irrigation Potential (In Acres)
29	Tamakoshila	Parsali	Kalyansinghpur	Rayagada	Taku janda	31001.08	31-50
30	Satsemili	Thuba	Nandapur	Koraput	Pujaghat jhola	14471.96	31-50
31	Satsemili	Thuba	Nandapur	Koraput	Katiamasan	4112.29	25-30
32	Upper musudi	Sunakhandi	Kalyansinghpur	Rayagada	Suna kuti	9107.04	25-30
33	Majurilendi	Kudumulguma	Khairiput	Malkangiri	Saniajharana	28860.93	31-50
34	Serkapadi	Sibapadar	Muniguda	Rayagada	Aikala	9654.89	25-30
35	Champajharan	udulibada	Mathili	Makangiri	Samarkatajala	7705.8	25-30
36	Chikalmari	Dudhari	Similiguda	Koraput	Betingtudi jhola	6685.5	25-30
37	Sarabathi	Nandapur	Nandapur	Koraput	Edujhola	29666.93	31-50
38	Darngaba	Kasandi	Nandapur	Koraput	Kundumuthichua	37836.65	31-50
39	Asurapada	Sibapadar	Muniguda	Rayagada	Madugutu	7154.69	25-30
40	Mundiguda	Rasbeda	Khairiput	Malkangiri	Kadalichua	1393.16	0-24
41	Darngaba	Kasandi	Nandapur	Koraput	Budubandajola	17668.71	31-50
42	Khairiput	Khairiput	Khairiput	Malkangiri	Dambahal	14111.88	31-50
43	Uppergumandi	Talagumandi	Narayanpatna	Koraput	Bailuajhola	76618.39	31-50
44	UpperKanti	Upperkanti	Similiguda	Koraput	Bidkamundi jhola	84802.88	31-50
45	Chilambalda	Balda	Nandapur	Koraput	Taimaljhola	36070.14	31-50
46	Balda	Balda	Nandapur	Koraput	Bandhajhola	14637.87	31-50
47	Balda	Balda	Nandapur	Koraput	Badadebaza jhola	22477.56	31-50
48	Govindapalli	Govindapalli	Khairaput	Malkangiri	Goudamasani jola	22833.99	31-50
49	Kasuguda	Kadmaguda	Khairiput	Malkangiri	Gaurabeda	22169.95	31-50
50	Khurigan	Khurigan	Kashipur	Rayagada	Jalkundi	32393.93	31-50
51	Podapadar	Khurji	Nandapur	Koraput	Totambapada	16132.95	31-50
52	Kirajola	Khurji	Nandapur	Koraput	Masanchua	10880.47	25-30
53	Kirajola	Khurji	Nandapur	Koraput	Panigadachua	34918.5	31-50
54	Hirajhola	Khurji	Nandapur	Koraput	Matiamjhola	6955.87	25-30
55	Damodarbeda	Nakamamudi	Korukonda	Malkangiri	Gharmo bahade	34385.78	31-50
56	Rajpal	Podagarh	Jashipur	Mayurbhanj	Kemp Spring	69379.01	31-50

Sl. No.	Village	GP	Block	District	Spring Name	Discharge per day (In Ltr)	Irrigation Potential (In Acres)
57	Katarba	Raising	Nandapur	Koraput	Dabanchua	1873.77	0-24
58	Patraput	Rajput	Similiguda	Koraput	Suliiajhola	4007.76	25-30
59	Pujariput	Rajput	Similiguda	Koraput	Jodambajhola	1519.17	0-24
60	Chalanput	Rajput	Similiguda	Koraput	Asurkund	30310.47	31-50
61	Matikal	Gudimulguma	Khairiput	Malkangiri	Matikajala	11100.17	25-30
62	Talapatri	Chandragiri	Kashipur	Rayagada	Patjharan	9320.22	25-30
63	Sasa	Phuljhar	Lahunipada	Sundargarh	Sasa	12698.72	31-50
64	Tingiriani	Podagarh	Jashipur	Mayurbhanj	Jokda Spring	10079.33	25-30
65	Tingiriani	Podagarh	Jashipur	Mayurbhanj	Banaseya Spring	9416.55	25-30
66	Chilipadar	Kudumulguma	Khairiput	Malkangiri	Docanchua	1233.67	0-24
67	Sananarangipadar	Upperkanti	Similiguda	Koraput	Kridaushajhola	35673	31-50
68	Sananarangipadar	Upperkanti	Similiguda	Koraput	Saphanjhola	15724.34	31-50
69	Sananarangipadar	Upperkanti	Similiguda	Koraput	Dangamadijhola	13563.93	31-50
70	Sananarangipadar	Upperkanti	Similiguda	Koraput	Pringeyamalijhola	18153.17	31-50
71	Gichhamanjari	Upperkanti	Similiguda	Koraput	Sapajhola	22357.36	31-50
72	Budaguda	Rasbeda	Khairiput	Malkangiri	Nalachua	19733.54	31-50
73	Talamania	Pakajhola	Similiguda	Koraput	Atrijhola	4411.76	25-30
74	Kakada	Raising	Nandapur	Koraput	Badajala	19812.73	31-50
75	Kakada	Raising	Nandapur	Koraput	San jala	22565.62	31-50
76	Mulda	Raising	Nandapur	Koraput	Devtajala	27917.5	31-50
77	Machhaguda	Rasbeda	Khairput.	Malkangiri	Tupijola	14075.48	31-50
78	Birjaghati	Birjaghati	Narayanpatna	Koraput	Pajimarajhola	20999.76	31-50
79	Champapadar	Birjaghati	Narayanpatna	Koraput	Lodakada	15134	31-50
80	Birjaghati	Birjaghati	Narayanpatna	Koraput	Khidkajhola	13033.64	31-50
81	Birjaghati	Birjaghati	Narayanpatna	Koraput	Kholajhola	3744.5	25-30
82	Nuaguda	Somanathpur	Korukonda	Malkangiri	Charkonda	4756.88	25-30
83	Mangrel	Raising	Nandapur	Koraput	Champa gad	16312.15	31-50
84	Katarba	Raising	Nandapur	Koraput	Pipal gacha chua	11142.64	25-30
85	Khajuri	Kurli	Bissamcutta	Rayagada	Sibdaopao	8421.05	25-30

Sl. No.	Village	GP	Block	District	Spring Name	Discharge per day (In Ltr)	Irrigation Potential (In Acres)
			ck				
86	Jubarajpeta	Sadam	Similiguda	Koraput	Panichua	6504.55	25-30
87	Majhijangarada	Sadam	Similiguda	Koraput	Kudamjhola	27787.31	31-50
88	Badajangarada	Sadam	Similiguda	Koraput	Nadichua	15788.99	31-50
89	Paik Thuba	Thuba	Nandapur	Koraput	High school chua	39422.05	31-50
90	Bhaurikunda	Udulibeda	Mathili	Malkangiri	Panimunda	53515.02	31-50
91	Rastuguda	Mandibisi	Kashipur	Rayagada	Dangharachua	40591.97	31-50
92	Rastuguda	Mandibisi	Kashipur	Rayagada	Warsilekada	70016.21	31-50
93	Rastuguda	Mandibisi	Kashipur	Rayagada	Handikhal	64285.71	31-50
94	Betipai	Birjaghati	Narayanpatna	Koraput	Jakarjhola	35255.71	31-50
95	Pilapanasa	Birjaghati	Narayanpatna	Koraput	Patamrijhola	9588.28	25-30
96	Hatimundi	Podagarh	Jashipur	Mayurbhanj	Meltaloha Hadahadi	6378.35	25-30
97	Kundagarh	Podagarh	Jashipur	Mayurbhanj	Mahariakacha	95769.44	31-50
98	Potesh	Mandibisi	Kashipur	Rayagada	Harumaska	20655.86	31-50
99	Bhodusole	Podagarh	Jashipur	Mayurbhanj	Bhudka Spring	38137.28	31-50
100	Potesh	Mandibisi	Kashipur	Rayagada	Mahumaska	40964.05	31-50
101	Chiliput	Raising	Nandapur	Koraput	Chua Beda	26016.26	31-50
102	Katarba	Raising	Nandapur	Koraput	Podai gacha chua	19903.25	31-50
103	Sasa-Daradadiya	Phuljhar	Lahunipada	Sundargarh	Daradadiya	12563.01	31-50
104	Modeiguda	Balda	Nandapur	Koraput	Munda chua	5896	25-30
105	Bayapada	Nakamamudi	Korukonda	Malkangiri	Ghade	9237.02	25-30
106	Bayapada	Nakamamudi	Korukonda	Malkangiri	Dharande bahade	38156.93	31-50
107	Bayapada	Nakamamudi	Korukonda	Malkangiri	Hulibahade	4910.21	25-30
108	Petal	Raising	Nandapur	Koraput	Dhani gaad	11068.17	25-30
109	Dangeshkhal	Chandragiri	Kashipur	Rayagada	Badajharan	50266.65	31-50
110	Taldandabada	Chandragiri	Kashipur	Rayagada	Palbongajharan	13721.55	31-50
111	Taldandabada	Chandragiri	Kashipur	Rayagada	Aluejharan	13888.44	31-50
112	Naringijhala	Nakamamudi	Korukonda	Malkangiri	Gehehu londe	7450.63	25-30
113	Damodarbeda	Nakamamu	Korukonda	Malkangiri	Durga Sai	26659.81	31-50

Sl. No.	Village	GP	Block	District	Spring Name	Discharge per day (In Ltr)	Irrigation Potential (In Acres)
		di			bahade		
114	Mugunaguda	Daleiguda	Similiguda	Koraput	Safadanga	13392.93	31-50
115	Tankubeda	Upperkanti	Similiguda	Koraput	Edoidonger	45928.94	31-50
116	Bari (Matiasahi)	Talagumandi	Narayanpatana	Koraput	Paldimundijhola	72351.71	31-50
117	Naringpadar	Upper Kanti	Similiguda	Koraput	Nagadamadi jhola	60398.46	31-50
118	Naringpadar	Upper Kanti	Similiguda	Koraput	Betingtudi jhola	47796.42	31-50
119	Gichhamanjari	Upperkanti	Similiguda	Koraput	Ambajhola	39895.34	31-50
120	Naringpadar	Upperkanti	Similiguda	Koraput	Kalibarajhola	41169	31-50
121	Naringpadar	Upperkanti	Similiguda	Koraput	Bilamadajhol	58815.52	31-50

Annexure-VII Elevation wise classification of springs

District	Elevation Range	No of spring
Koraput	1057-1651	48
	448-706	1
	706-888	10
	888-1057	75
Malkangiri	200 - 353	91
	353 - 507	14
	650-822	9
	822-1266	22
Mayurbhanj	0-163	10
	163-328	15
	328-517	60
	517-755	45
Rayagada	272-443	5
	443-640	34
	640-842	41
	842-1502	61
Sundargarh	119-253	40
	253-348	52
	348-494	29
	494-688	23
	688-1112	3
Total		**688**

Annexure-VIII FGD Questionnaire

FGD questionnaire

Name of the Research Assistant: - Date: -

District: - Block: -

GP: - Village: -

Section A – Basic Information of Springs	
Question	**Response**
1. How many springs were active in the hills near your localitysome 5-10 years ago?	
2. How many springs ae perennialin nature?	
3. How many are located in private land and how many on community or forest land?	
4. Their location (distance from the village) – range between nearest and farthest spring	
5. Is there any cultural or religious ritual associated withthe spring? If yes, describe briefly.	

Section B – Benefits from the spring	
Question	**Response**
1. Has there been any stone bonding to control the flow ofwater? Yes/No If yes, who has done? (people orunder some govt. prog)	
2. Has there been any channel to distribute water downstream? Yes/No If yes, who has done? (people orunder some govt prog)	
3. Usage of water for : - Irrigation - Drinking	

- Bathing& domestic use - Drinking for livestock (can be multiple response)	
4. How many households are the direct beneficiaries of the irrigation through the spring?	
5. Can more land be irrigated through this spring? Yes/NoIf yes, how?	
6. How many crops are grown in the command area ?	

Section C – Governance System	
Question	**Response**
1. Have there been any conflictsamongst people having land close to the spring and far away?	
2. Does the conflict persist or is resolved amicably? If resolved,how?	
3. How do people look at the Spring- as a common property resource (CPR) or property of people having land close to thespring?	
4. If CPR, do the community have a management mechanism- how the water resources shall be distributed	
5. Do people make any effort inthe aspects of conservation ofspring like promoting appropriate vegetation in andaround the spring (increasing density of vegetation)	

Annexure-IX Spring Photograph

Spring photos

Spring photo of KundagarhNalla,Jashipur Block

Spring photo of Machchakandana spring of Jashipur Block

Spring photo of kirkichipal, Thakurmunda block, Mayurbhanj

Spring photo of Kiorkachchaspring, Jashipur block, Mayurbhanj

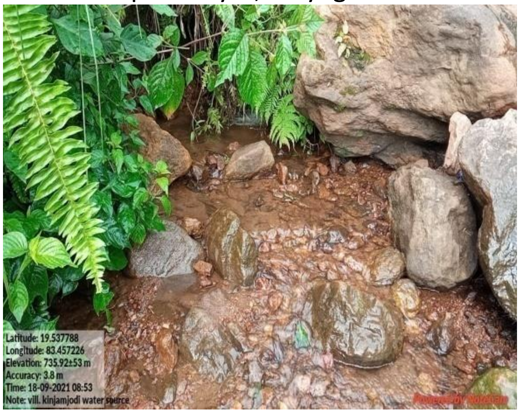
Spring photo of Sunakacha spring Thakurmunda Block, Mayurbhanj

Spring photo of Gameya spring Jashipur block, Mayurbhanj

Badachuan spring of Baharpadamajhivill. Of Mandibisi GP, kashipur, Rayagada

Upper maligaon spring, Renga Gram panchayat, Rayagada

Mahujharan spring of Upper Maligaonvill. Renga GP, Kashipur, Rayagada



Silamadi spring of Kinjamjodivill. Chancharaguda GP, Bissamcuttack, Rayagada

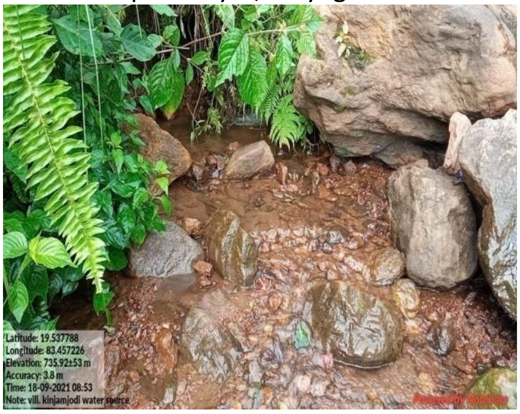
Jamujhola spring of Balapaivill. Chancharaguda GP, Bissamcuttack Rayagada

Dudka spring of TalaMusudivill. Sunakhandi GP. Kalyansingpur Rayagada

Badachuan spring of Baharpadamajhivill. Of Mandibisi GP, kashipur, Rayagada

Upper maligaon spring, Renga Gram panchayat, Rayagada

Mahujharan spring of Upper Maligaonvill. Renga GP, Kashipur, Rayagada



Silamadi spring of Kinjamjodivill. Chancharaguda GP, Bissamcuttack, Rayagada

Jamujhola spring of Balapaivill. Chancharaguda GP, Bissamcuttack Rayagada

Dudka spring of TalaMusudivill. Sunakhandi GP. Kalyansingpur Rayagada

Annexure-X Photograph of Land development activities from field

Water points created by DKDA agency in the village

Water points created by DKDA agency in the village

Gully plugging in Gandili village

Water channelized for domestic purposes in village

Banana cultivation in Garteli Village

Canal created for channelizing water to agricultural fields

Annexure XI: - FGD photos from the field


Latitude: 19.346283
Longitude: 83.022385
Elevation: 958.06±14 m
Accuracy: 1.5 m
Time: 13-08-2021 12:06
Note: durukhal water discharge
Powered by NoteCam


Latitude: 19.362075
Longitude: 83.003012
Elevation: 849.83±14 m
Accuracy: 3.0 m
Time: 13-08-2021 14:35
Note: maligaon dug pit
Powered by NoteCam


Latitude: 19.291111
Longitude: 83.104074
Elevation: 942.1±11 m
Accuracy: 3.0 m
Time: 14-08-2021 12:27
Note: gudajhola vill fgd
Powered by NoteCam


Latitude: 19.340789
Longitude: 83.084208
Elevation: 920.98±9 m
Accuracy: 3.0 m
Time: 16-08-2021 09:29
Note: parajasila vill fgd
Powered by NoteCam


Latitude: 19.530805
Longitude: 83.415077
Elevation: 899.12±44 m
Accuracy: 3.6 m
Time: 14-09-2021 13:35
Note: khambesi vill fgd
Powered by NoteCam


Latitude: 19.515912
Longitude: 83.434902
Elevation: 853.0±29 m
Accuracy: 6.5 m
Time: 17-09-2021 08:48
Note: vill. Gartteli fgd
Powered by NoteCam


Latitude: 18.453976
Longitude: 82.222467
Elevation: 341.22 m
Accuracy: 3.9 m
Time: 10-24-2021 14:05
Note: Bandhguda meeting


Latitude: 18.599604
Longitude: 82.269455
Elevation: 340.9 m
Accuracy: 3.9 m
Time: 11-18-2021 15:44
Note: chuapani Gojiaguda
Powered by NoteCam


Latitude 18.353317
Longitude 82.192329
Elevation 426.12±4 m
Accuracy 2.4 m
Time 21.09.2021 16:48
Note chilipadar
Powered by NoteCam


Latitude: 18.458283
Longitude: 82.223381
Elevation: 357.47 m
Accuracy: 3.9 m
Time: 10-24-2021 17:21
Note: Mundiguda village
Powered by NoteCam


Latitude: 18.453957
Longitude: 82.222488
Elevation: 342.44 m
Accuracy: 3.9 m
Time: 10-24-2021 14:06
Note: Bandhguda meeting
Powered by NoteCam


Latitude: 21.726553
Longitude: 85.168017
Altitude: 546.02±48 m
Accuracy: 4774.4 m
Time: 12-19-2021 14:24
Note: BadajalaTunguru Shai gp fuljhar har, block Lahunipada, Dist, sunderghra,
Powered by NoteCam


Latitude: 21.745451
Longitude: 85.157172
Elevation: 604.52±48 m
Accuracy: 3800.0 m
Time: 12-19-2021 12:09
Note: Aupear uskelagp fuljhar har, block Lahunipada, Dist, sunderghra,
Powered by NoteCam


Latitude: 21.690655
Longitude: 85.178206
Elevation: 582.25±24 m
Accuracy: 50.6 m
Time: 12-19-2021 10:33
Note: Sasa, lededihisahi, gp, fuljhar, block Lahunipada, Dist, sunderghra,
Powered by NoteCam


Longitude: 85.070777
Elevation: 255.37±97 m
Accuracy: 12.5 m
Time: 17-09-2021 12:38
Note: San.nuagaon

Research Assistant Manmohan Mishra measuring water volume using 2 L beakerin Malkangiri district.

RA testing water parameters in the field in using instruments in Malkangiri district

FGD, Village- Talapadi GP- Chandragiri ,Block- Kashipur, Dist- Rayagada

pH testing by RA of kemp spring in Rajpal village of Jashipur Block in mayurbhanj

FGD, Village gojasuda, GP-Govindapally, Block- khairput, Dist-Malkangiri

Water testing using instruments in Koraput district by community mobilizers nandapur block of Koraput district

Water volume measurement by Community mobilizers in Nandapur, Koraput

Panigada Spring Village- Kirajhola, GP- khurji Block-Nandapur, Dist-Koraput

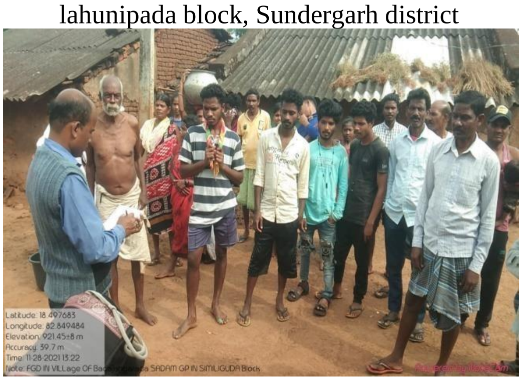
FGD by our RA in Rasadapadar village MandipisiGP Kashipurblock, Dist- Rayagada

Community mobilizers from Kashipur, Rayagada district measuring water discharge using beaker

Water testing done by community mobilizers from of lahunipada block from Sundergarh

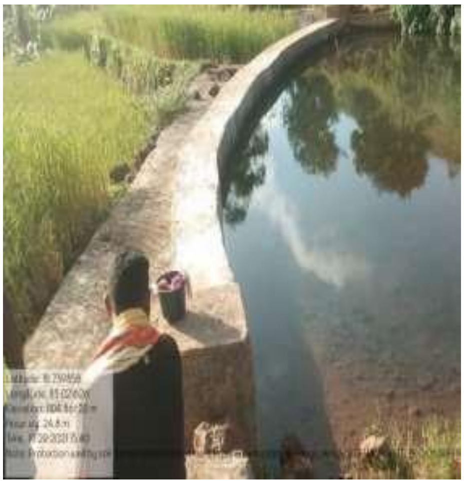
FGD conducted in Village- Arjunhari, lahunipada block, Sundergarh district

FGD, Village-sanjhili GP-podagarh , Block- Jashipur, Dist- Mayurbhanj



FGD conducted in sadam GP of Nandapur Block, Koraput District

Village-Majurilendi, GP-Kudumulugumma ,Block-Kahirput, Dist- Malkangiri



Protection wall by soil conservation department, Narayanpatna, Koraput

Pandachara spring Village- Bishpur GP- patbil ,Block- karanjia
, Dist- Mayurbhanj

FGD kendupani village GP- phuljhar Block-Lahunipada, Dist- sundergarh

RA in Koraput training the community mobilizers regarding mwater app

Pundi spring, village; khaparakal, GP; Salaebeda, block: thakurmunda, dist: Mayurbhanj

FGD, Dangadiha village Spring Village- GP- champajhar Block- Thakurmunda, Dist: Mayurbhanj

RA in Malkangiri training the community mobilizers about the mwater app

Jamukoli jhola spring Village- Bisipur , GP-Hikimput Block- Nandapur, Dist- Koraput

Raimultungru spring Vill-sasaladadihi sahi, GP-phuljhar block: ahunipada Dist-sundergarh

Water Harvesting Trench in Kirikichipal Village, G.P.- Champajhar, Block- Thakurmunda, Dist.- Mayurbhanj.

Purunapani spring Village- kendupani, GP-phuljhar Block- lahunipada Dist- sundergarh

Budhbandh jhola, village; darangaba, gp: kasandi, block: nandapur, dist: koraput

Chikalgumandi village, GP-Talgumandi, Block: Narayanpatna, Dist: koraput

Research Assistant Manmohan Mishra measuring water volume using 2 L beaker in Malkangiri district.

RA testing water parameters in the field in using instruments in Malkangiri district

FGD, Village- Talapadi GP- Chandragiri ,Block- Kashipur, Dist- Rayagada

pH testing by RA of kemp spring in Rajpal village of Jashipur Block in mayurbhanj district

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Water testing using instruments in Koraput district by community mobilizers in nandapur block of Koraput district

Water volume measurement by Community mobilizers in Nandapur, Koraput

Panigada Spring Village- Kirajhola, GP- khurji Block-Nandapur, Dist-Koraput

FGD by our RA in Rasadapadar village Mandipisi GP Kashipur block, Dist- Rayagada

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Water testing done by community mobilizers from of lahunipada block from Sundergarh

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FGD, Village-sanjhili GP-podagarh , Block- Jashipur, Dist- Mayurbhanj

FGD conducted in sadam GP of Nandapur Block, Koraput District

Katiamasam Spring Village- Satasemili, GP-Bheja, Block- Nandapur, Dist:koraputj

Champajhola Spring Village- Majhimarua, GP Renga Block- Similiguda, Dist-Koraput

Jamukolijhola spring Village-Bisipur, GP-Hikimput Block- Nandapur, Dist- Koraput

Chuapanispring Vill- Phusuruguda, block: KhairputDist-Malkangiri

Trusimabada spring Village-Dantipada, GP-Madulipada,Block- Khairiput, Dist- Malkangiri

Chederaghaspring Village-Palogoda, GP-Podagarh Block- JashipurDist- Mayurbhanj

FGD, Village-Kinjamjodi, GP-Chancharguda, Dist- Rayagada

Khumbhadudhaspring Village-Badanuagon Block- LahunipadaDist- Sundergarh

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