SPECIAL FEATURE · IMPACT PRACTICES

INSIGHTS FROM KARNATAKA

VITAL CAPITAL

INSIGHTS FROM KARNATAKA

Connecting with stakeholders to understand water security challenges

Vital Capital

Listening in to better understand social impact and connecting with people served by our portfolio companies

Vital Capital believes in the power of engaging not just with investors and portfolio companies, but with the communities that stand to benefit from our investments. Seeking out this input, company by company, project by project, and person by person, allows us to understand the critical social and environmental challenges faced by communities and enables us to develop the relevant, sustainable solutions that will drive positive impact.

OUR APPROACH TO DELIVERING MEANINGFUL OUTCOMES

Addressing the most critical challenges of our time, Vital Capital is focused on driving an inclusive climate transition by investing in food, water, healthcare and sustainable infrastructure in underfunded, high-demand consumer segments. We leverage our unique operational expertise to achieve impactful solutions that address global sustainable development priorities.

Our experience shows that impact investing designed to uplift the world's most underserved populations can achieve the greatest transformational value per dollar invested. Our impact practice is built at its foundation upon our investment thesis, which proposes that increasing the availability and affordability of essentials in growth markets will drive impact. We also believe that by working with companies to further climate resiliency and solutions, gender equity, and job quality and creation, we position our companies to ensure their future sustainability. Today, with over a decade of experience in managing and measuring impact, we leverage our proprietary, practical tools to achieve meaningful outcomes.

A key step in this practice is refining our understanding of how much impact can be achieved by a given project. We study who the project affects and how underserved this population is in relation to the outcome. Gathering good and reliable evidence in our markets can be challenging and, to the degree we can, we prefer to listen directly to project beneficiaries, ex-ante and ex-post, to validate our thesis and our results. This approach not only helps us develop better, more relevant solutions but inspires trust through authentic engagement.

DEVELOPING WATER INFRASTRUCTURE IN KARNATAKA

In 2020, we launched our environmental infrastructure platform, **VITAL ENVIRONMENT** (VCE). In this special feature, we share key learnings from beneficiary studies VCE conducted for two water infrastructure projects in Karnataka, India, with the support of Vital Capital and a local independent agency. The Raichur Water Distribution Project will provide the infrastructure needed to deliver tap water to households in rural Karnataka for the first time. The Karnataka Irrigation Project involves the construction of piped irrigation infrastructure for a severely drought-stressed region of Karnataka.

Both projects serve populations suffering greatly from the accelerating effects of the climate crisis and aim to increase their resiliency, improve health and alleviate poverty. By surveying local communities, we sought to better understand their specific challenges in order to improve both the projects' design, implementation (e.g., laying the foundation for good relationships during construction) and legacy (e.g., allowing the projects to serve as models for successful climate solutions). We invite your feedback and look forward to concluding our impact assessments after the water begins to flow.

Vital Environment

VITAL ENVIRONMENT (VCE) finances, develops and executes environmental infrastructure projects in fast-growing growth markets. VCE's projects are large-scale, high-impact and focused on long-term, sustainable solutions. They include complex and financed engineering, procurement and construction (EPC) projects, public-private partnerships (PPP) and management of portfolio assets including water, wastewater treatment and irrigation projects.

WATER RESILIENCE STRATEGIES

Recognizing the significance of sustainable use of finite natural resources for future growth, VCE is committed to addressing water management challenges vital for resilient economies. Through collaboration with innovative technology firms, we actively reduce water footprint and embrace net-zero commitments, fostering sustainable practices. Our expertise spans large-scale integrated solutions, investments and financing for environmental projects, serving both public and private clients. This encompasses supporting governments in delivering clean water and fulfilling environmental requirements, along with crafting tailor-made water solutions for major industries to ensure compliance with new standards and encourage responsible operations.

The Raichur Water Distribution Project

Connecting historically marginalized communities to tap water supply

THE CHALLENGE

India is home to 18% of the world's population, but has only 4% of its water resources. This makes it one of the most water-stressed countries in the world. The issue particularly affects the poor, women and children, who spend time and money securing water for their daily needs. A lack of household water connections and toilets contributes to waterborne illnesses, stunting and death. The climate crisis will further increase pressure on water resources, as floods and droughts become more frequent and intense.

Among the most water-stressed states is Karnataka in southern India, with roughly 77% of its land recognized as drought-prone. While Karnataka has made notable strides in rural water provision in the past three decades, ensuring a dependable supply is becoming more and more difficult.[1] To date, only 31.2% of the state's rural households are covered by tap water supply.

Raichur district in north-eastern Karnataka is among the regions that have been profoundly affected by the water crisis. Despite being bounded by the Krishna River to the north and the Tungabhadra River to the south, forming the Raichur Doab, the area experiences frequent droughts, exacerbated by scarce rainfall of just 376mm per year.[2] The groundwater table has been significantly depleted, putting further pressure on the district's limited water resources.

Raichur is classified by the Indian government as one of the country's 100 most underdeveloped districts. The district has a sizeable population of historically marginalized communities, including 24% Scheduled Castes/Scheduled Tribes (SC/ST) and 30% 'Other Backward Classes' (classes and citizens who are socially and educationally deprived). Despite being afforded special protection under India's constitution, these communities continue to be subject to deep-rooted caste, religious and gender-based inequalities, with infrastructure often designed to cater to dominant caste communities.

PROJECT BACKGROUND

VCE's Raichur Water Distribution Project addresses the lack of infrastructure that has trapped rural households in Raichur in a situation of dangerous water scarcity. The project will provide the infrastructure to bring drinking water to 860 rural villages and treated bulk water supply to seven urban local bodies in Raichur district. The water will be sourced from the backwaters of the Narayanpur Dam.

The project encompasses the construction of end-to-end infrastructure for water delivery, from intake structures and treatment plants to the distribution network and finally community-based overhead tanks. The government will extend this infrastructure to the household level.

Upon completion, the project will treat 160 million litres per day for a population of 1.77 million people, with 64% of them (1.14 million people) receiving first-time household tap water access.

Designed to meet water demand projections for the year 2053, the project takes into account population growth and increased water usage over the next 30 years. Thus, it not only provides access to tap water for the first time but equips communities to confront the climate crisis with greater resilience.

ABOUT THE SURVEY

To better understand how the project can address local needs, VCE commissioned a baseline beneficiary survey of residents in the project area. The survey was developed in collaboration with VITAL CAPITAL's impact teams and conducted in two phases together with independent local agencies, GreenC Consulting and Namma Nadu Aamsta. During the first phase, 15 focus group discussions were held in 11 villages, with the participation of 217 individuals, 35% of whom were women. In the second phase, the agency conducted a household survey in 32 villages, interviewing 178 people, of whom 15% were women (see fig. 1).

It was observed that participants, particularly women, tended to be more comfortable expressing their concerns in a group setting rather than in individual interviews. This preference on the part of participating residents accounts for the low number of female interviewees in the household survey.

In the surveyed villages, most residents belong to marginalized communities from 'Other Backward Classes', followed by communities categorized in 'General Caste' and finally 'Scheduled Caste'. We ensured that members of all social groups were included in our survey population so that their concerns and challenges could be adequately represented. An overwhelming number of survey participants were illiterate, reflecting poor literacy rates in Raichur compared with other parts of Karnataka.

According to the 2013-14 Economic Survey of Karnataka the poverty rate in the district is 37.6% (as defined by the Indian government as earnings of less than US $3/day).[3] Our survey found that the participants were even further economically disadvantaged, with 83% below the poverty line.

83% of participants live below the poverty line

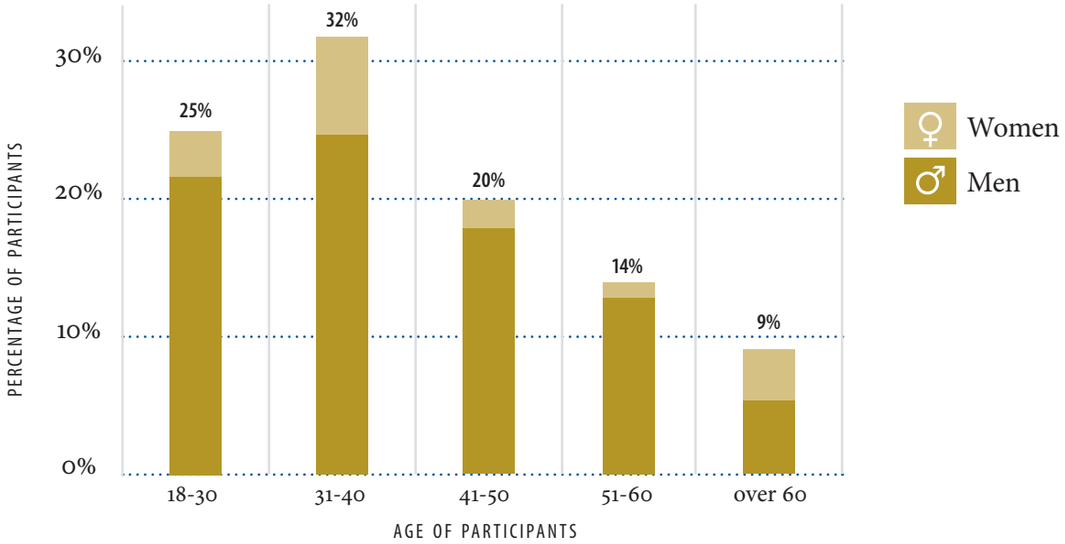


FIG. 1: *Survey participants by age and sex*

SURVEY INSIGHTS

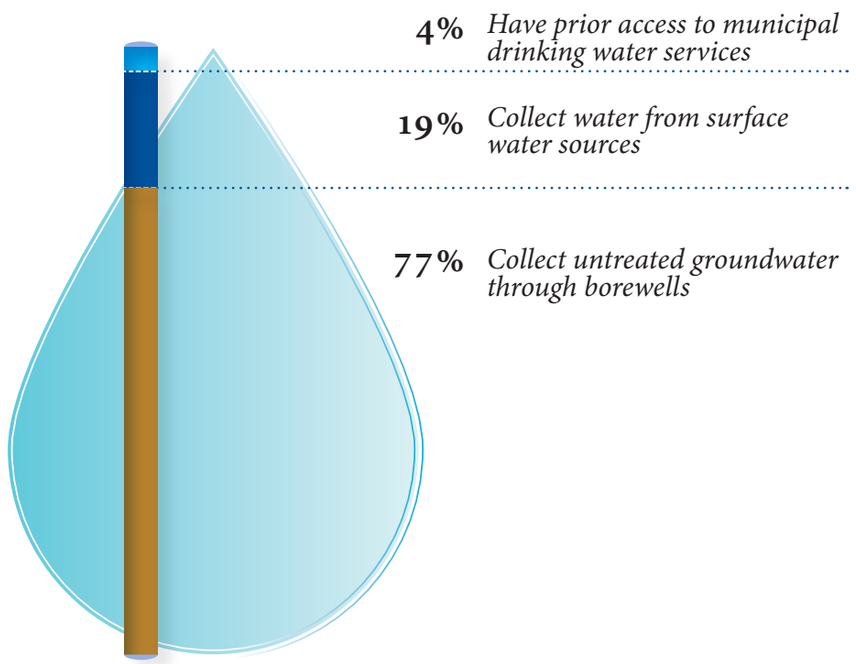
INSIGHT 1

About 96% of participants lack tap water supply at home, forcing them to rely on unsafe and unsustainable alternatives.

Of the 96%, 77% reported that they depend on groundwater, accessed through borewells, as an alternative water source. Studies of groundwater in the area have shown dangerous levels of fluoride and arsenic, making it unsafe to drink. Excessive reliance on groundwater also puts pressure on groundwater levels, already vulnerable due to inadequate rainfall. As a result, groundwater depletion in the district has become severe, to the point that it becomes inaccessible altogether during the summer months.

A further 19% of participants reported relying on surface water sources such as canals, rivers and ponds, which are susceptible to contamination from sewage and household waste. Only 18% of participants reported that they have access to water year-round.

HOW DO PARTICIPANTS OBTAIN WATER?



'Of the eight borewells in the village, seven are not functioning properly. We must depend on the only one that's left. We are scared what will happen if that one also stops functioning. Not everyone has the money to buy water from private water tankers.'

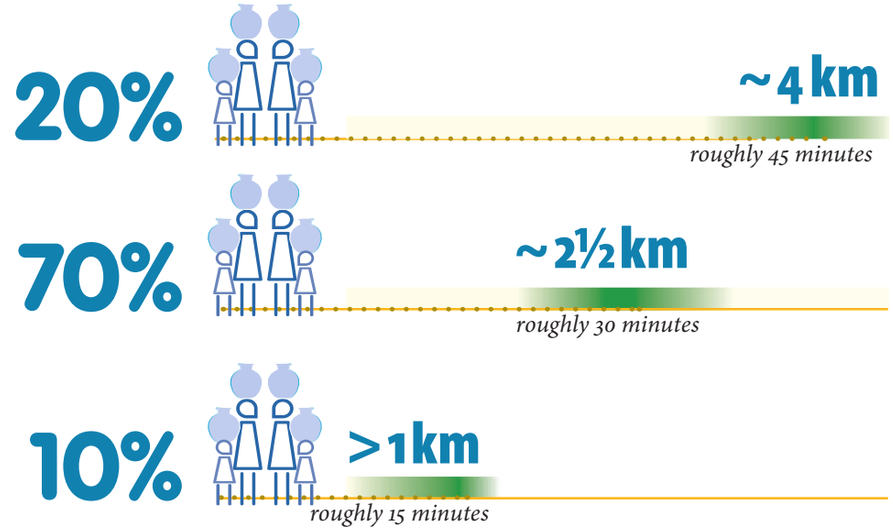
Hanumantha

INSIGHT **2**

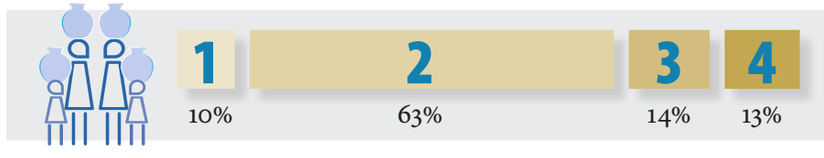
On average, participants must take two to three trips per day to fetch water, spending an average of 90 minutes on this task daily.

Water is typically collected in large plastic pots or cans known as *baltis*, which are transported on carts. The physical challenge posed by water collection forces elderly people and individuals with limited mobility to rely on family members or neighbours to fetch water, exacerbating their already vulnerable position.

HOW FAR DO PARTICIPANTS TRAVEL PER TRIP TO FETCH WATER?



HOW MANY TIMES PER DAY DO PARTICIPANTS FETCH WATER?



INSIGHT 3

The water crisis disproportionately affects women, consuming large amounts of their time and compromising their health, hygiene and overall well-being.

78% of participants reported that the burden of collecting water for the household is primarily shouldered by women and girls. They endure long journeys, waiting in line and heavy loads to secure water for their families.

78% of those who fetch the water are women and girls

Crucially, fetching water takes up time that could otherwise be spent on different tasks. Vital's experience in previous companies shows that women who gain time through labour-saving services become 1.6 times more likely to engage in economically productive activities. The Raichur Water Distribution Project will save precious time for families, and especially women, which they can choose to allocate towards economic activities or other household chores, as well as important human pursuits such as education, creative work and leisure. This has the potential to greatly enhance individuals' well-being and enable them to engage in a wider variety of external social roles.

INSIGHT 4

On average, each household is able to obtain around 100 litres per day, covering at most 30% of its water needs.

According to census data for Raichur district, the average household size is 5.6, corresponding to a minimum requirement of 308 litres of water per household per day according to the Ministry of Urban Development. The chronic unreliability of participants' water sources makes it impossible for them to come close to this minimum amount: participants reported that their households are able to collect about five large *baltis* each day (corresponding to roughly 100 litres).

About 76% of participants reported that their primary water source is available for less than two hours per day. Borewells

are subject to insufficient water tables, power cuts and limited hours of operation in the case of public installations. In many villages, people are only able to access water on alternate days. During the monsoon, the water crisis worsens, with unpredictable power cuts interrupting the water supply network or borewell pumping systems. The results of the survey stress the importance of increasing water availability not just in terms of physical access, but in terms of quantity and reliability.

'We only get water once every two days, and even then for one hour only. The water comes from the water tap located in the centre of the village. We have to come all the way from our houses to collect the water. It becomes difficult for us and takes a lot of our time.'

Chandbi

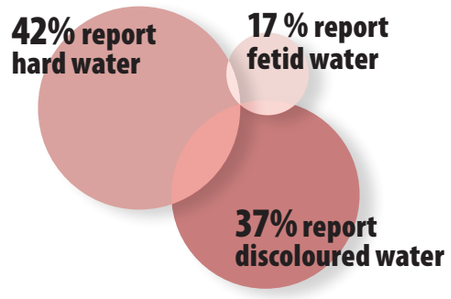
INSIGHT 5

68% of participants report poor water quality.

The region's groundwater, the primary source of water for most participants, is known to contain dangerous levels of arsenic, fluoride and total dissolved solids (TDS). Surface water, also relied upon by many participants, is vulnerable to biological contaminants. The major cause of surface water contamination is lack of access to safe sewage disposal. 73% of participants reported disposing of sewage behind their houses, while 26% dispose of it on the village roadsides, which are often near canals or bodies of water.

Participants dependent on public borewells for water find it unfit for drinking, with 42% reporting hard water, 37% observing discoloured water and 17% reporting fetid water.

HOW DO PARTICIPANTS EVALUATE THE QUALITY OF THEIR WATER?

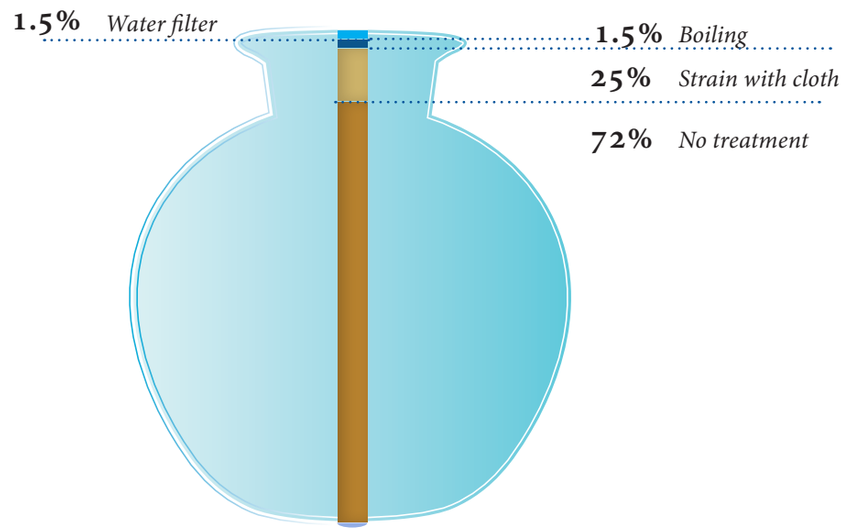


INSIGHT 6

Most participants do not treat water before consumption and store it in open containers, putting it at further risk of contamination.

Some participants reported using cloth to strain water before consuming it. Once the water is stored, however, generally no further measures are taken to avoid contamination. Only 14% take the precaution of covering the container and using a ladle to scoop out the water. In some villages, larvae have been observed in the water after two days of storage. Most participants who buy treated water from reverse osmosis plants also take no further precautions after purchase, suggesting a misconception that treated water is less susceptible to contamination. These practices indicate that there is a need for water safety education to ensure that clean drinking water supplied to homes in the future doesn't get contaminated at household level.

HOW DO PARTICIPANTS TREAT THEIR WATER?



INSIGHT 7

Nearly 100% of participants in the focus group discussions reported health issues, while 28% of participants in the household survey reported cases of specific waterborne diseases in their families.

Many villagers suffer from diseases that can be traced to chemical and biological contaminants in the drinking water (see fig. 2). Water contaminated with fluoride, arsenic and other heavy metals has caused bone diseases in many elderly residents, affecting their mobility. There have also been outbreaks of diarrhea and vomiting due to the presence of *E. coli* in the water. Although only 28% of participants in the household survey reported that their families had been affected by waterborne diseases, the focus group discussions revealed that villagers routinely suffer from stomach ailments and skin rashes during summer and monsoon.

In addition to water quality, water scarcity is its own health hazard that affects women and girls in particular. Frequent trips to water sources, bearing heavy loads, take a physical toll. Female participants also stressed that lack of water greatly affects menstrual hygiene. Focus group participants further noted that due to lack of water people are unable to maintain toilets at home and are forced to attend to their needs in the open. This impacts women's health as well as their safety.

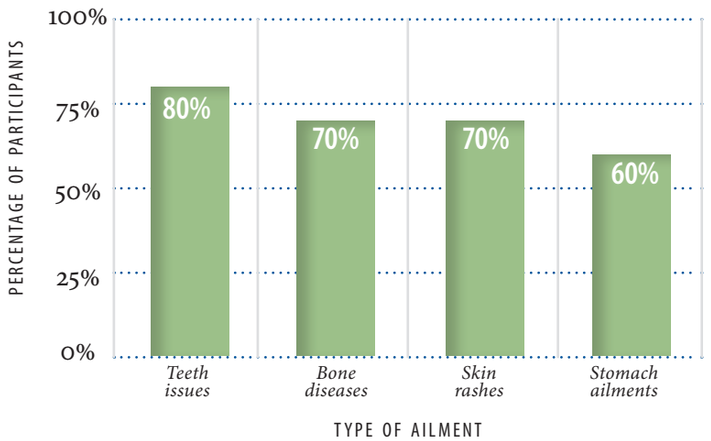
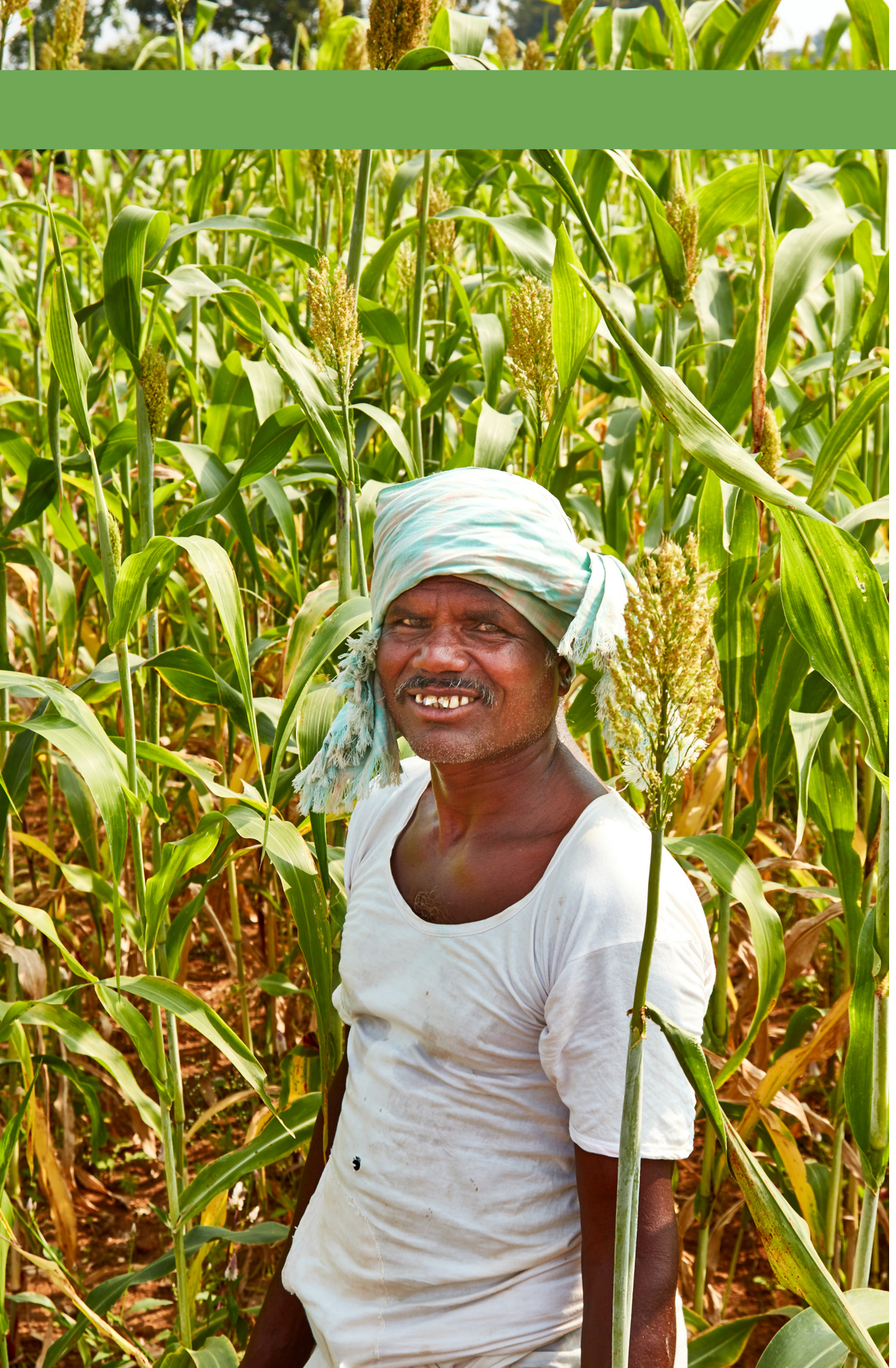


FIG. 2: *Health issues experienced by participants reporting ailments*

LESSONS LEARNED

Access to safe, high-quality drinking water is critical to communities' health, resilience and prosperity. Our survey of residents in Raichur district allowed us to conclude that the Raichur Water Distribution Project has the potential to improve the health of over 319,000 people by reducing the risk of waterborne disease. An estimated 570,000 women and girls will benefit disproportionately, reclaiming a combined 371,000 hours daily that are currently spent collecting water from unsafe, unreliable sources. Furthermore, we estimate that withdrawal from groundwater and surface water sources will be reduced by more than 20 million litres daily, alleviating water stress and increasing the sustainability of municipal water services.

To support the project's gains, we should work with the government to initiate water education programming for safe water storage. Reliable, high-quality water provision coupled with water safety education will empower communities in Raichur to build a more prosperous future and improve health.



The Karnataka Irrigation Project

Providing irrigation infrastructure for small farmers in a drought-afflicted region

THE CHALLENGE

In Karnataka, 75% of the rural population works in agriculture, the majority being smallholder farmers. Yet 70% of farmers lack access to irrigation, depending instead on increasingly scarce rainfall to water their crops. The 30% who do have irrigation systems in place must supply them with groundwater, which is often contaminated by harmful heavy metals and itself subject to scarcity. As a result, crop yields are low and crop failure common, with many farmers living in poverty. In dry seasons, many are compelled to seek work in nearby cities to supplement their income.

Farmers in the districts in northern Karnataka are among the most vulnerable. These districts experience frequent droughts and low rainfall (only 376mm per year in Raichur). Only 24.5% of agricultural land is irrigated.[4] Studies project a further decrease in rainfall and a long-term heating trend, with drought-afflicted areas set to increase. In the Kharif season from June to October, which farmers depend on for the increased rainfall from the monsoon, northern Karnataka is projected to experience a 10-80% increase in drought incidences, with some districts liable to double their frequency of drought.[5] For agriculture in the region to continue, irrigation infrastructure is desperately needed.

PROJECT BACKGROUND

The Karnataka Irrigation Project will provide first-time access to irrigation infrastructure for 12,150 farms in the districts. Covering 12,000 hectares of agricultural land, the project will bring water for irrigation to a previously unserved population of 60,750 people, using an estimated 28,316 million litres per year. Once operational, a steady, reliable water supply will be assured for 30 years.

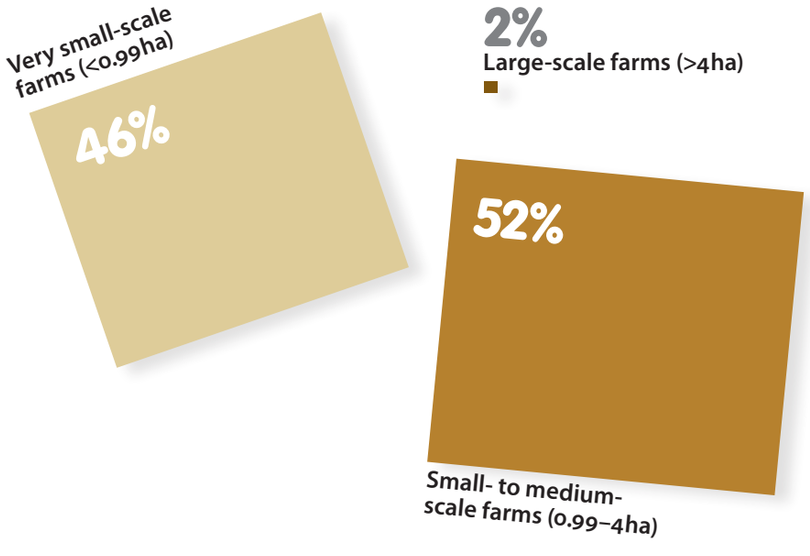
The project encompasses the construction of various components, including a sump pump house, a 13.8km main pipeline, 130km of distribution pipelines, a 55km rising main and a distribution network of pipes to farmlands.

Upon completion, the farmers will experience enhanced climate resilience, as the risk of crop failure due to erratic or insufficient rainfall is mitigated. This vital infrastructure will safeguard the livelihoods of farmers and their communities and provide the foundation for greater agricultural productivity and significant improvements in quality of life.

ABOUT THE SURVEY

To deepen our understanding of the project's contribution, VCE partnered with the local Namma Nadu Aamsta agency to conduct a baseline beneficiary survey of local residents. The survey took place over two months and encompassed interviews with 210 farmers across seven villages covering an area of 263.4 hectares. The primary aim of the survey was to gain insights into existing farming and irrigation practices and identify the challenges that the project needs to address. Additionally, the survey played a crucial role in validating our understanding of the potential impact VCE can achieve.

WHAT ARE PARTICIPANTS' FARM SIZES?



The landholders in the region are 46% very small-scale farmers, 34% small- to medium-scale farmers and 20% very large-scale farmers. Our survey area and participants have a greater representation of very small and small-medium landholdings: the survey participants were selected to accurately represent the prospective beneficiaries of the project. It is worth noting that the region has a very small percentage of female ownership of agricultural land, as traditionally land was inherited only by male family members. After reforms in land and family laws, land is now inherited by all family members, including women.

SURVEY INSIGHTS

INSIGHT **1**

73% of participants rely exclusively on rainfall to water their crops, making them extremely vulnerable to the impacts of the climate crisis.

Financial constraints prevent most farmers from investing in irrigation systems, putting them at the mercy of scarce and unpredictable rainfall. As a result, farmers in the region repeatedly experience financially devastating crop failures. Average crop yields lag behind the state average (see fig. 3).

Dependence on rainfall also severely restricts the types of crops farmers can grow, as well as how many growing cycles they can complete each year. 83% of participants (accounting for 98% of cultivated hectares) are restricted to cultivating crops during the Kharif season from June to October, when the monsoon provides sufficient rain. Only 10% of farmers are able to grow crops during the Rabi season from October to December, and only 5% are able to grow multi-seasonal 'cash crops'. Major crops include *tur* (pigeon pea, accounting for 37% of the sampled cultivated area), sunflower (35% of the sampled cultivated area), *bajra* (pearl millet, 11% of the sampled cultivated area) and groundnut (8% of the sampled cultivated area), while silk and cotton are grown as cash crops. Due to the difficult growing conditions, farmers are unable to diversify beyond these staple crops, limiting their income and increasing their vulnerability.

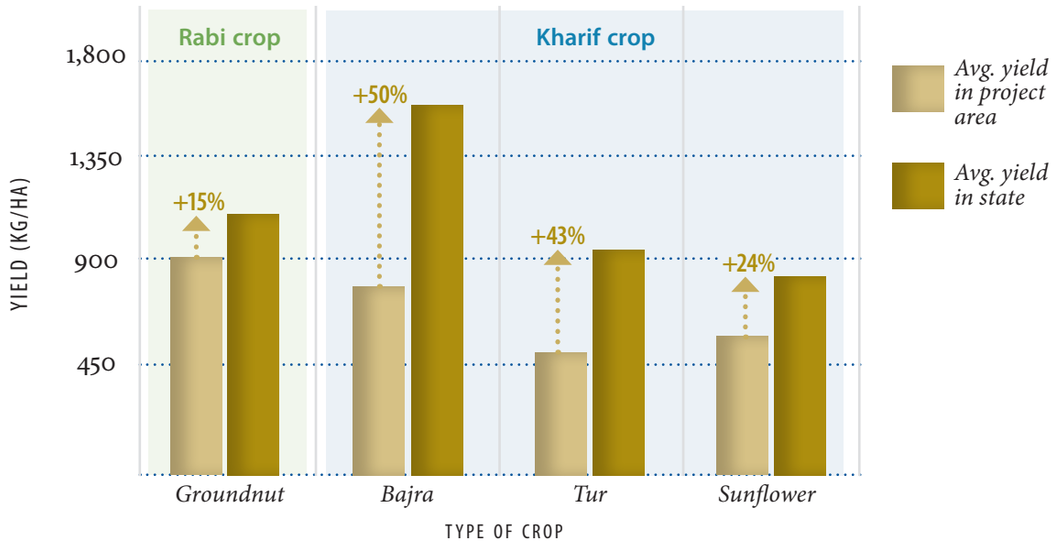


FIG. 3: *Differences in yield between project area and state*

INSIGHT 2

75% of participants with access to groundwater for irrigation feel their water requirements are not adequately met.

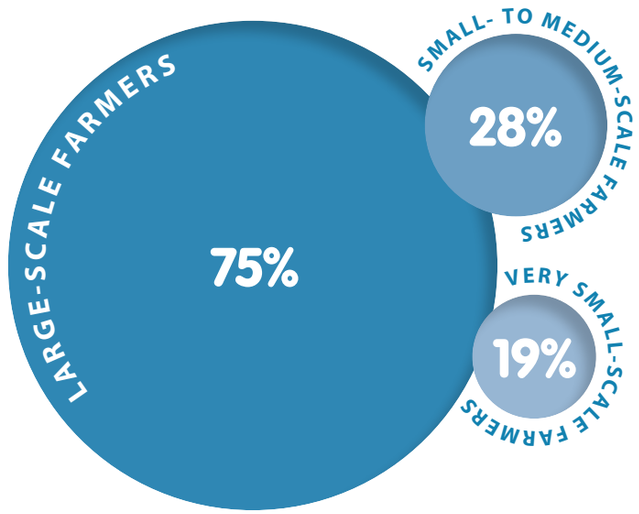
Only 27% of participants, chiefly larger landowners, have access to a secondary water source for irrigation. Of these farmers, 26% use groundwater, while 1% use farm ponds or other surface water sources. However, participants' responses made it clear that groundwater is an expensive, unreliable and qualitatively compromised source of water.

The region's uneven topography means that accessing groundwater can be difficult: the average depth of groundwater is 170ft and can get as deep as 350ft. Without government-sponsored initiatives to support farmers, the expense of exploring groundwater sources and operating pumps falls entirely to farmers themselves. This has effectively put this solution out of reach of small-scale farmers: among the survey participants, only 19% of very small-scale farmers use groundwater for irrigation, compared with 75% of large-scale farmers.

Further expenses are incurred by operating and maintaining the pumps used to retrieve the groundwater. Most participants rely on medium-size five-horsepower pumps, typically operated for five hours a day during each 45-50 day growing season. However, 69% of farmers use the pumps for just one season per year, as the groundwater level drops too much in dry seasons to support further irrigation.

In much of the region covered by the project, the groundwater moreover contains high levels of fluoride and arsenic. These substances not only affect crop yields, but are retained in the crop, with harmful effects on consumers.

WHO HAS ACCESS TO IRRIGATION INFRASTRUCTURE?



INSIGHT 3

32% of farmers are compelled to migrate to cities in search of additional income.

The average landholding among survey participants is just 1.26 ha, lower than the Karnataka state average of 1.39 ha. These small farms, dependent on rainfall and regularly affected by drought, experience significant economic distress. Around 83% of participants earn less than ₹50,000 per year in agricultural income. The average annual income is ₹45,461, the equivalent of less than US $1.60 per day – far below the poverty line of US $3/day in the state of Karnataka (see fig. 4). As a result, many farmers temporarily migrate to cities each year to work as labourers, returning to their farms for the growing season. Migration rates are highest among small landholders and lowest among large landholders (see fig. 5). 66% of farmers have no income besides what they earn from agriculture, with women and children in the family also participating in the farming.

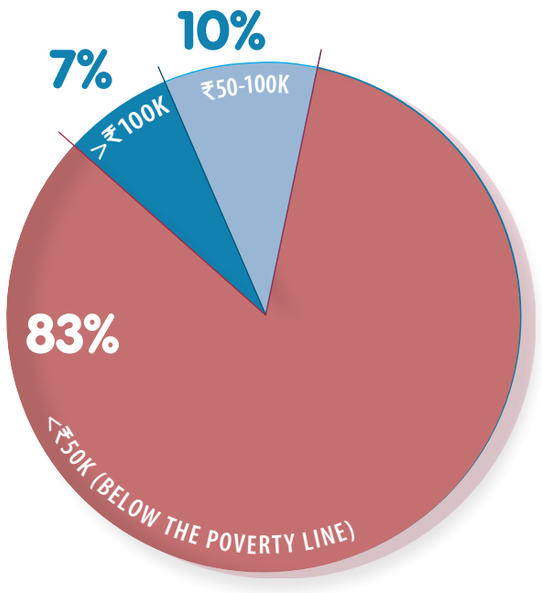


FIG. 4: *Income from agriculture in* ₹(INR)

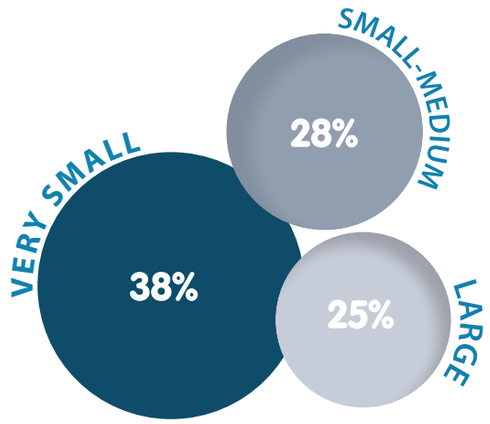


FIG. 5: *Migration rate in different landholding groups*

INSIGHT **4**

Farmers who gain access to irrigation infrastructure may double their incomes.

VCE's study found that irrigation increased crop yields by a reported 4-15% (see fig. 6). However, these results were influenced by favourable rainfall conditions over the past two to three years, where less irrigation was needed. Secondary data from our studies indicates that the difference in yields between irrigated and non-irrigated crops is typically more than 30%. The improved yield increased farmers' income by an additional ₹45,000-55,000 (US $550-670) per year, on average doubling the income generated by farming. The additional income from larger yields is expected to help farmers pass the national poverty line and enjoy significant improvements in quality of life,

including a reduced need for economic migration, the ability to invest in additional farm inputs and the countless benefits to health and well-being that come with reduced economic precarity.

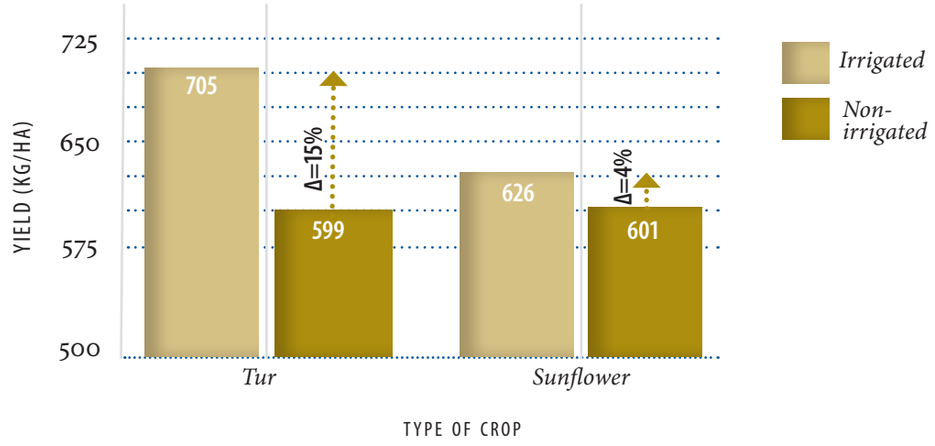


FIG. 6: *Difference in yield of major crops when irrigated*

LESSONS LEARNED

Heavy reliance on rainfall for agriculture in the project region has significantly impacted the agricultural income and living conditions of farmers. The lack of access to irrigation infrastructure has placed them in a situation of great economic precarity, with increasingly hot and dry climatic conditions threatening each harvest.

The Karnataka Irrigation Project will provide a reliable supply of water for irrigation, with 78 million litres available per day. The project is expected to improve crop yields and farm profitability, leading to enhanced economic security for farmers and their communities.

Crucially, the project will provide a foundation of climate resilience for a chronically drought-plagued region. By protecting farmers from water scarcity and reducing the need for economic migration, it is paving the way for a future where agriculture builds economic foundations and communities flourish.

'Every summer the women and children suffer from stomach aches. It is like a daily routine. We know it happens due to poor quality of water but we cannot do anything about it.'

Amina Bi, FGD participant

'Every year during summer the water crisis worsens. Most of the time we have to depend on the water tankers for drinking water. Many of them charge so much and it becomes difficult for us to sustain.'

Peeramma, FGD participant

'We only get two to three buckets of water per day per family, which is not sufficient for us. We are just barely managing to get by. The water quality is so poor and most of us have itching issues from it. The government RO [reverse osmosis] plant is also not working properly.'

Suvarna, FGD participant

'The water supply at the schools is not enough for the students. Many of them carry water from their homes for drinking purposes.'

Sharada, FGD participant

ENDNOTES

1 Press Information Bureau, 'Jal Jeevan Mission: Karnataka Plans to Provide 25 Lakh Tap Connections by March, 2022', Apr. 2021, p. 1

2 Central Groundwater Board, Groundwater Information Booklet Raichur District Karnataka, Dec. 2008, p. 3

3 Hindustan Times, 'Behind KCR-Bommai slugfest, data reveals backwardness of Raichur', Sep. 2022, www.hindustantimes.com/india-news/behind-kcr-bommai-slugfest-data-reveals-backwardness-of-raichur-101662834792084.html

4 Central Groundwater Board, Groundwater Information Booklet Raichur District Karnataka, Dec. 2008, p. 3

5 Water Resource Department Govt. of Karnataka, State Water Policy 2022 Karnataka, 2022, p. 2

INSIGHTS FROM KARNATAKA

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