

# **Nal Se Jal: Piped water for all**



# India Strategy

## Nal Se Jal –Piped water for all

Water is getting high attention from policy makers, media, and increasingly so from the markets given the rising concern on future availability as well as the deterioration in drinking water quality. In this note we study the key issues around water in India and are particularly excited by the expansion of the piped drinking water for all plan, also termed as “Nal Se Jal”. The government is planning an aggressive target of providing piped water to all households by 2024, up from c.18% at present. This indeed is a massive challenge given the sheer numbers involved – c.150mn households across 0.5mn+ villages need to be brought under the scheme over the next five years. At an aggregate level, there is water available for the expansion of piped water scheme, but there is wide regional disparity with high stress in north-west and south India (Exhibit 2&3). The successful expansion of sanitation coverage from 39% in FY14 to 99% in FY19 through the Swachh Bharat Abhiyaan (SBA) makes us optimistic on the take up of piped water scheme by the same administration. Based on our estimates, reaching 150mn households could mean a doubling of spending on water related infrastructure creation over the next 5 years as compared to FY15-19. In our view, the spending would be towards sectors such as pipes, EPC, water treatment, pumps & valves, cement, among others.

- **Merger of water related ministries, project in mission mode to aid “Nal Se Jal”:** Efforts on water and sanitation have generally had low political importance in emerging economies. A successful execution of “Nal Se Jal” is therefore hinged on the programme gaining wide acceptance from the political class and also from the larger user community. The government is likely to launch the scheme in mission mode and the experience of erstwhile program of SBA can be a good example where sanitation coverage went up from 39% in FY14 to 99% in FY19. The Water sector in the country was managed through multiple ministries and now (May'19) the government has merged rural drinking water & sanitation and the river water, ganga rejuvenation and water resources in a single ministry. **The merging of ministries would bring in the departments of ground water, surface water and the executing departments under one ministry, and could therefore make a big difference in the execution of rural drinking water project going ahead.**
- **What are the issues related to water in India?** Ground water is used for 85% of rural drinking water requirement and 50% of urban. At an all-India level, 62% of ground water (c.410 BCM or billion cubic metres) is presently utilised, leaving a total of c.150 BCM available for additional use. The present usage of ground water for drinking and industrial use is 25BCM, and therefore at an aggregate level, water availability should not be a challenge. However, there is high usage and depletion of groundwater in few regions (north-west India, south India) necessitating a policy shift to encourage (a) water recharge, (b) cropping pattern shift (less paddy and sugarcane in rain deficit areas), (c) expansion of micro-irrigation etc. In addition, a key challenge for the country is contamination of drinking water, and should therefore be eliminated through sustainable irrigation practices (proper use of agro-chemicals), increase in urban sewage treatment (only c.37% done at present) and with the clean-up of rivers.
- **Investments in water area to double in the next 5 years:** As per our study of various water supply projects and proposals from the past, the estimated per capita spending for piped water projects could be c.INR 8,000-9,000, **which means that for complete coverage, the spending on the water network would be at least doubled in FY20-25 as compared to FY14-19.** In individual projects, the overall cost across sub-segments would vary based on the projects (access to drinking water, quality of water, terrain etc.), but on an aggregate level, the major project cost would be on (a) the distribution pipes (40%), (b) EPC-civil work (25%), (c) water treatment (25%) and (d) pumps and valves (10%). We have highlighted few companies in the water infrastructure value chain in the Exhibit 20.

Arshad Perwez

arshad.perwez@jmfl.com | Tel: (+91 22) 66303080

Suhas Harinarayanan

suhas.hari@jmfl.com | Tel: (+91 22) 66303037

Aishwarya Pratik Sonker

aishwarya.sonker@jmfl.com | Tel: (+91 22) 66303351

Manish Agrawal

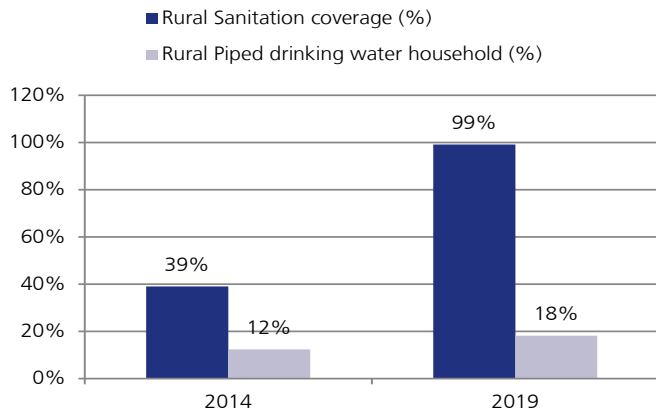
manish.agrawal@jmfl.com | Tel (+91 22) 66303068

JM Financial Research is also available on:  
Bloomberg - JMFR <GO>,  
Thomson Publisher & Reuters  
S&P Capital IQ and FactSet

Please see Appendix I at the end of this report for Important Disclosures and Disclaimers and Research Analyst Certification.

Focus charts....

**Exhibit 1. Rural sanitation coverage saw a massive jump between 2014-19 given the implementation in mission mode; piped drinking water project likely to get similar attention now**



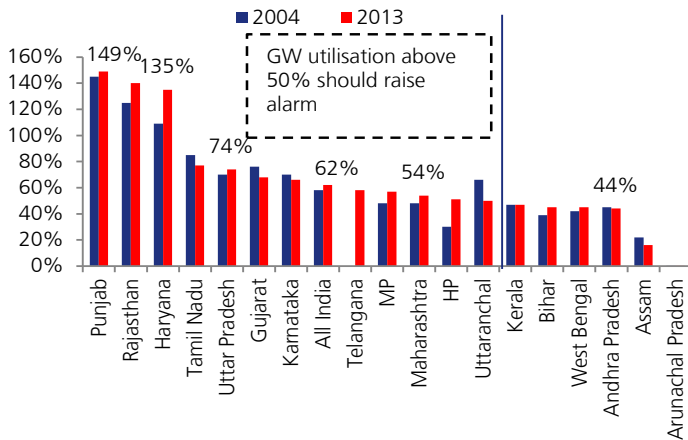
Source: SBA, JM Financial

**Exhibit 2. India' ground water supply & demand – At an aggregate level, India does have adequate groundwater for additional use**

(BCM)	Mar'04	Mar'09	Mar'11	Mar'13
Recharge from rainfall	290	292	293	300
Recharge from other sources	143	139	139	146
<b>Total</b>	<b>432</b>	<b>430</b>	<b>432</b>	<b>446</b>
Natural Discharge during non-monsoon season	(34)	(35)	(35)	(35)
<b>Available Ground Water</b>	<b>399</b>	<b>395</b>	<b>398</b>	<b>411</b>
<b>Usage of ground-water</b>				
Irrigation	(212)	(221)	(222)	(228)
Domestic and industrial users	(18)	(22)	(23)	(25)
<b>Annual Ground Water Draft</b>	<b>(230)</b>	<b>(243)</b>	<b>(245)</b>	<b>(253)</b>
Usage as % of available	58%	61%	62%	62%
<b>Ground water available for use</b>	<b>162</b>	<b>153</b>	<b>154</b>	<b>162</b>

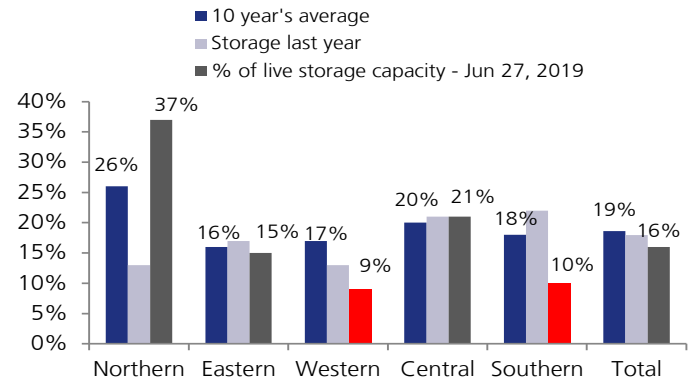
Source :CGWB, JM Financial

**Exhibit 3. However wide variation in ground water usage across states (usage / availability)– water preservation efforts urgently required in north western and southern states, in particular**



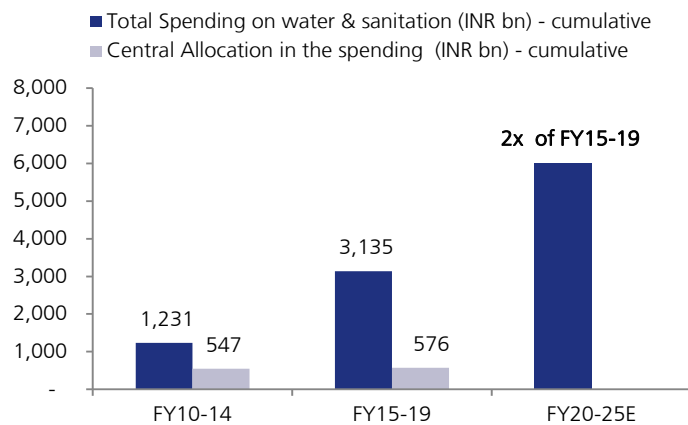
Source: CGWB, JM Financial

**Exhibit 4. A deficit rainfall in Jun'19 (-32% below normal) has exacerbated the water levels in the present year, particularly in western and southern India**



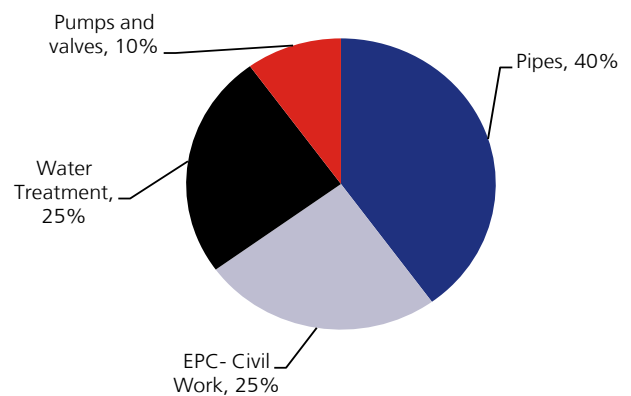
Source: CMIE, JM Financial

**Exhibit 5. Total spending on water and sanitation likely to double in FY20-25 from FY15-19, as implementation of piped water for all rolls out**



Source: NRDWP, RBI, JM Financial, Estimates based on industry interactions and prior government estimates

**Exhibit 6. Key beneficiary from the expansion of piped water distribution – Summary break up of cost for a typical piped drinking water project**



Source: Industry, JM Financial

## 2014-19: Focus on "Sanitation"; Now, is it the turn of drinking water?

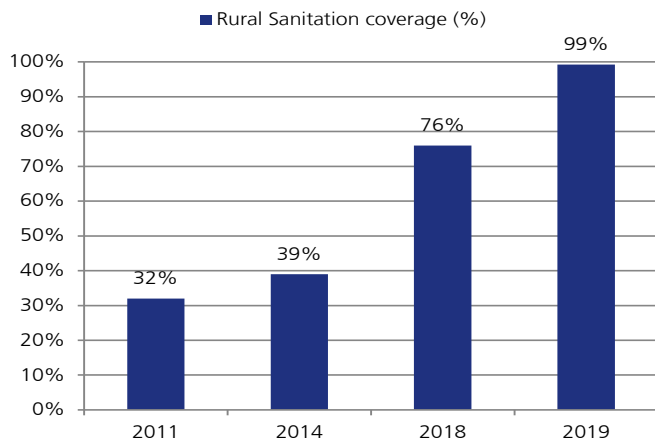
Among the key natural resources, attention towards water is gaining traction from citizens to policy makers given the rising concern on future availability as well as the deterioration in drinking water quality. Access to clean and unpolluted water is necessary for the well-being of the population and is also a part of United Nation's sustainable development goals (SDG) (agreed in 2015) which among others requires all countries to provide universal and equitable access to safe and affordable drinking water for all by 2030.

The current BJP-led NDA government has proposed making piped drinking water available to every house-hold in India by 2024 (as part of its election manifesto). In this note we look at the historical progress, challenges and the possible investment opportunity. We have also highlighted companies that would potentially benefit from the expansion of piped drinking water project.

### Sanitation coverage jumped from 40% in 2014 to 99% by 2019

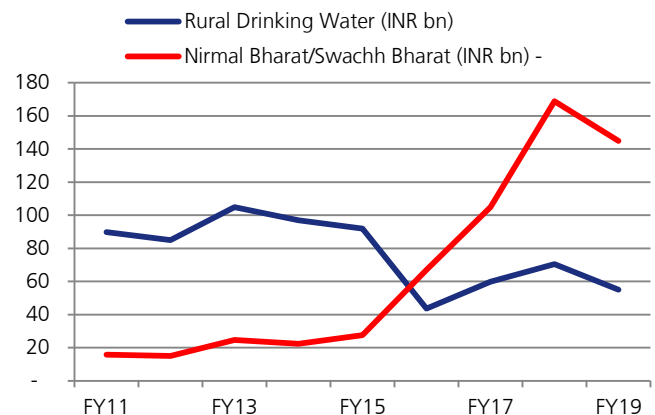
Over the past few years (2014-19), India has seen a significant jump in sanitation coverage (provision of toilets) through the Swachh Bharat Abhiyaan (SBA). Rural Sanitation coverage jumped from c.40% levels in Mar'14 to 76% by Mar'18 and 99% by Mar'19. This quantum jump in a relatively short period was driven by the government's focus led by prime minister to undertake this as a massive mission with community participation. The allocation for SBA (exhibit below) also recorded a steep jump from FY16, which enabled the achievement of sanitation coverage.

**Exhibit 7. Sanitation coverage saw a steep jump – SBA coverage at 90%+ from only 40% by FY14**



Source: SBA, JM Financial

**Exhibit 8. Government focus was also on sanitation coverage – Annual allocation trend for drinking water vs sanitation over the past few years**

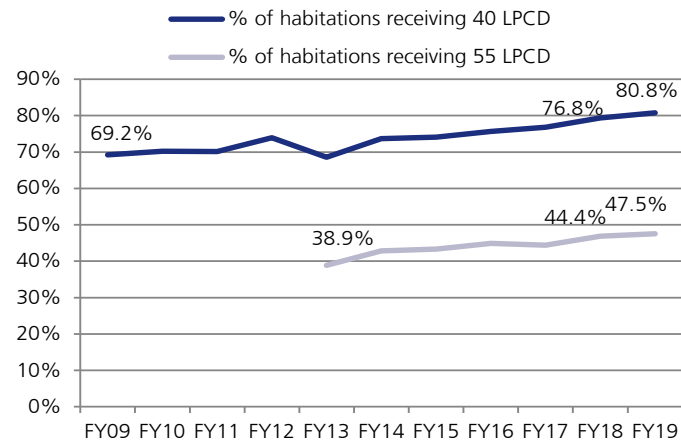


Source: Union budget, JM Financial

### Rural drinking water project execution below target in past

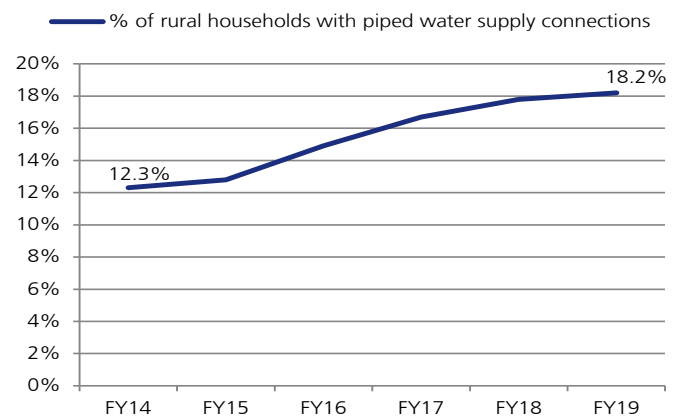
The erstwhile ministry of drinking water and sanitation had embarked on a large programme, NRDWP (National Rural Drinking Water Project) from 2009. As compared to the progress seen in SBA, the performance of NRDWP has been far below expectations, as highlighted below. The programme targeted providing potable water to 50% of rural households and 35% households to get piped water connections (by 2017). However, as of 2017, the project had under-performed significantly and only 18%/17% of rural house-holds received potable water / piped water connection.

**Exhibit 9. 81% of rural habitations had access to 40LPCD by FY19, up from 69% a decade earlier**



Source: NRDWP, Media, JM Financial, Note: LPCD: Litres per capita per day

**Exhibit 10. ..however progress in rural piped drinking expansion has been low – 18% of rural HHs with piped water connection at present, up only 6% points from FY14**



Source: NRDWP, Media, JM Financial

**Exhibit 11. NRDWP project lagged its performance targets by a substantial margins**

Target – 2017	Actuals - 2017
All rural habitations, government schools and anganwadis to have access to safe drinking water	Only 44 per cent of rural habitations and 85 per cent of government schools and anganwadis provided access to safe drinking water
50 per cent of rural population to be provided potable drinking water (55 lpcd1) by piped water supply	Only 18 per cent of rural population provided potable drinking water (55 lpcd) by piped water supply
35 per cent of rural households to be provided household connections	Only 17 per cent of rural households provided household connections

Source: CAG, JM Financial, Performance over 2012-17

The CAG report (released in 2018, for the period 2012-17) highlighted multiple challenges in the execution of the programme including ineffective monitoring, lack of planning of water sources, lack of community participation etc. In addition, the allocation on NRDWP declined from FY16 as the government’s focus was on increasing sanitation coverage. These factors resulted in multiple instances of incomplete and abandoned work; while a lack of operation and management plans in many states also resulted in rural drinking projects turning out to be ineffective.

**Piped drinking water programme - A complex task to execute**

As discussed in the previous section, the expansion of piped drinking water across states is a complex challenge and needs close co-ordination among the centre, states and local government bodies, It needs to be accorded high priority at the highest level. In addition, the water supply projects also need to become a community initiative for it to sustain in the longer term. In our view, as the water related programmes were part of the manifesto of BJP, it could see a wider push by the current government in the coming years. The key highlights from the BJP manifesto around water was-

- (a) Water is a critical resource but its management is spread across various departments, even at the central level. **A new ministry of water will be formed unifying the water management functions.** The ministry will take forward the program of linking rivers from various parts of the country and ensure a solution to the problems of drinking water and irrigation.
- (b) Launch of “Jal Jivan Mission” under which a programme **“Nal Se Jal”** will be introduced **to ensure piped water for every house-hold by 2024.**
- (c) Ensure sustainability of water supply through special focus on conservation of rural water bodies and ground water recharge

## Initial policy action indicate reforms around water and aggressive rollout of piped drinking water scheme

Post the general elections and formation of the new government new steps have been taken indicating high priority for the government around the reforms in the water-related areas and also to provide every house-hold with piped water.

### (a) Merging of the ministry around water in “Jal Shakti”

After the NDA government came back to power, in May'19, the erstwhile ministries of water resources and drinking water and sanitation have been merged in the ministry of Jal Shakti in May'19 itself. As a result, all the water related departments – surface water, ground water, river rejuvenation, irrigation etc. and departments looking at the use of water have come under a single ministry, **which could significantly ease the implementation of large programmes by easing the process and timelines of sharing data / resources within the government.**

#### Exhibit 12. Jal Shakti ministry combines major water/river related activities across prior two ministries

Ministry of Drinking water and sanitation				
Allocation (INR bn)	FY18	FY19BE	FY19RE	FY20BE
National Rural Drinking Water Mission	70.4	70.0	55.0	82.0
SWM - Rural	168.9	153.4	144.8	100.0
<b>Net Allocation</b>	<b>239.4</b>	<b>223.6</b>	<b>199.9</b>	<b>182.2</b>
Ministry of Water Resources, River Development and Ganga Rejuvenation				
Allocation (INR bn)	FY18	FY19BE	FY19RE	FY20BE
PMKSY - transfer to states	21.2	31.8	34.6	39.5
Namami Gange	7.0	23.0	7.5	7.5
National River Conservation Programme	7.2	7.7	16.2	12.2
Water Resources Management	6.1	11.6	6.0	7.8
Central Water Commission	3.3	4.5	3.8	4.3
Major Irrigation Projects	2.0	3.2	1.8	2.4
Central Ground Water Board	2.1	2.4	2.3	2.3
River Basin Management	2.3	2.3	2.0	2.3
Others	1.2	1.4	1.3	1.5
Central Water and Power Research Station	0.6	0.8	0.6	0.7
<b>Net Allocation</b>	<b>53.1</b>	<b>88.6</b>	<b>76.1</b>	<b>80.4</b>
<b>Combined</b>	<b>293</b>	<b>312</b>	<b>276</b>	<b>263</b>
IEBR				
Ministry of Drinking Water and Sanitation			<b>150</b>	
Ministry of Water Resources, River Development and Ganga Rejuvenation	31	60	81	67

Source: Union budgets, JM Financial

### (b) Launch of Jal Shakti Abhiyaan

The Government has initiated the Jal Shakti Abhiyan to stimulate rainwater harvesting and water conservation efforts in 255 water stressed districts of the country. The campaign would run from 1Jul'19 to 15Sept'19 in states receiving rainfall during the south-west monsoon, while States receiving rainfall in the retreating or north-east monsoon would be covered from 1Oct'19 to 30Nov'19. Overall, 313 blocks with critical groundwater levels would be covered, along with 1,186 blocks with over-exploited groundwater and 94 blocks with low groundwater availability.

In this campaign, teams of officers from the central government will visit and work with district administration in 1592 water stressed blocks in 256 districts, to ensure five important water conservation interventions. These will be **(a)** water conservation and rainwater harvesting, **(b)** renovation of traditional and other water bodies / tanks, **(c)** reuse and bore well recharge structures, **(d)** watershed development and **(d)** intensive afforestation.

These campaigns and the personal involvement of the PM through address to nation clearly indicated the importance of water conservation and prudent usage as a key development agenda for the next five years.

**(c) Declaration by government to provide tapped water access to all by 2024**

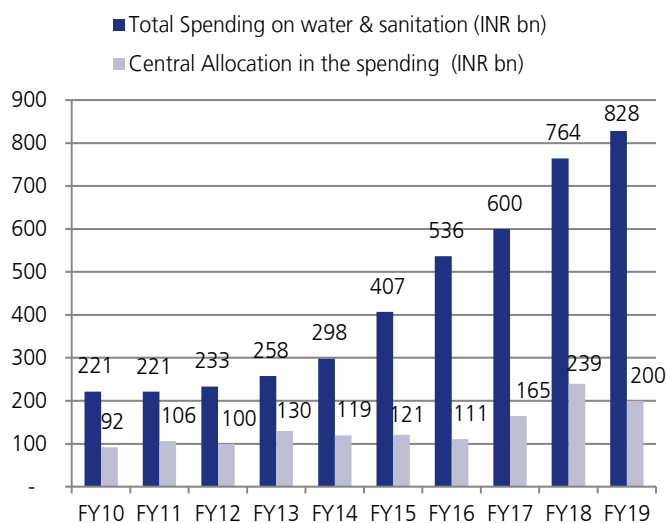
The government, through its various announcements, has made providing piped water to all by 2024 as a key priority. Though the finer details of the allocation on the project will take some more time to be rolled out, interactions with policy makers to announcements by the PM clearly indicate that as the rural sanitation targets are nearly complete, the full focus of the department would be towards the implementation of piped drinking water to all, or the Nal se Jal scheme.

We would look at the details of rural drinking water projects in later section, initial releases by government indicate that Jal Jeevan Mission would be launched to cover 140mn (14 crore) house-holds. Under the mission, both ground water and surface water will be used to meet the requirements. **Villages with good quality of water** – there water will be sourced and supplied at village level. Wherever the water quality is poor – Trunk water supply system for a cluster of villages and piped water will be sourced from other villages or locality. The communities such as village panchayat would manage the operation and maintenance of the facilities wherever feasible.

**“Nal Se Jal” scheme – implies almost doubling of spending on water and sanitation in next five years**

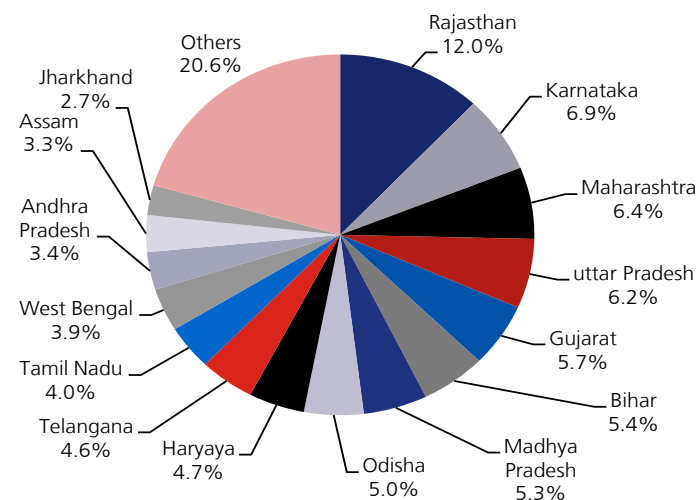
The new scheme for piped water connection, Nal Se Jal, would likely lead to massive jump in the investment in water and sanitation. Earlier, the total spending on water and sanitation (centre + states) recorded a step up from FY14-19, as compared to FY10-14, and was driven by investments in SBA mission.

**Exhibit 13. Total spending on water and sanitation (state + centre) over the past few years**



Source: RBI, Union budget, JM Financial

**Exhibit 14. Share of spending by states over FY15-19: Rajasthan, Karnataka, Maharashtra top 3 states in spending on water and sanitation**



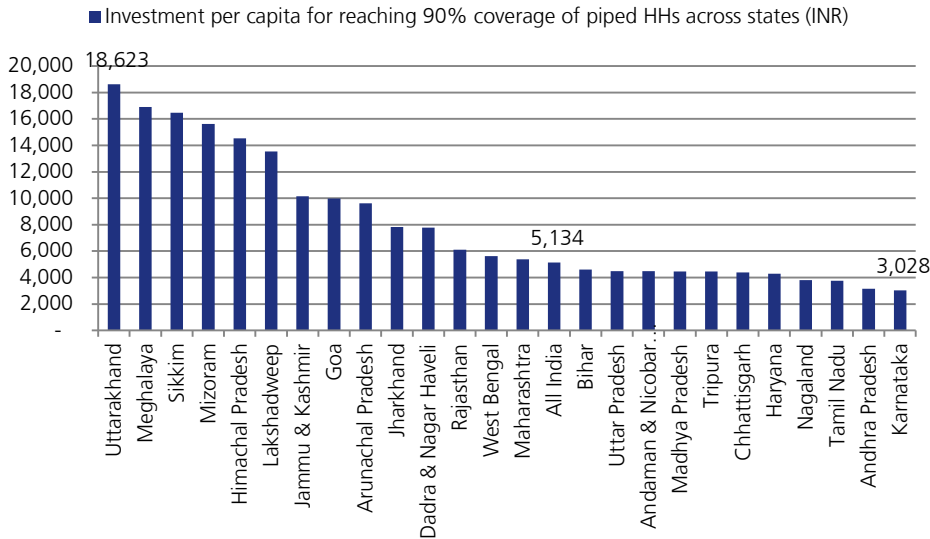
Source: RBI, Union budget, JM Financial, FY20-24E are expectations

In the next five years, the priority for the government is to implement “Nal Se Jal” and we estimate the expected outlay taking into consideration the following:

- (a) The government had come out with a strategic review to reach 90% of the rural population with piped water and had estimated a cost of INR 3.1tn at 2011 prices. In terms of per capita investment, this amounts to INR 5,134. (Appendix 1). Adjusting for WPI inflation over 2011-19, this number could average to INR 6,150 per capita.

- (b) There are wide variations in the estimated investments across states and would depend on the quantity of available drinking water, quality of water for drinking purposes, geography and terrain. The cost varied from **INR 18,000+** in hilly state of **Uttarakhand** to **INR 3,000** in **Karnataka**.

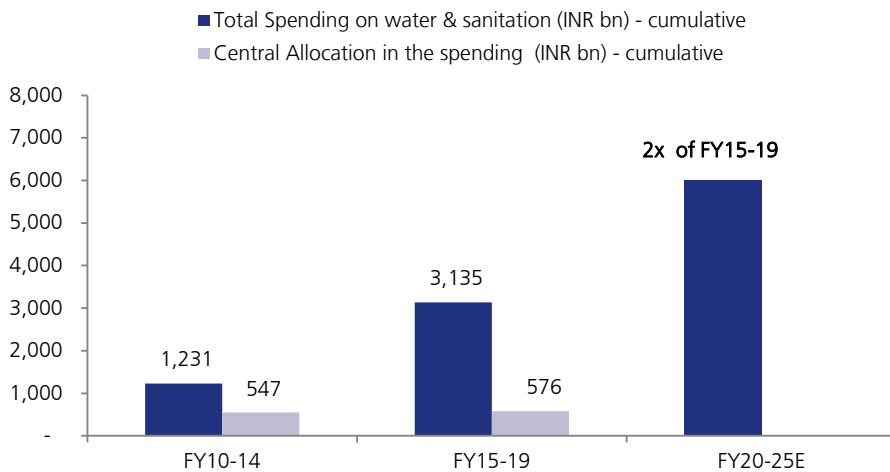
**Exhibit 15. Government’s earlier estimate of investment per capita (2011-2022) for providing piped drinking water to 90% of rural house-hold (based on 2011 prices)**



Source: NRDWP, JM Financial, Based on 2011 prices

- (c) In recent times, Telangana government has launched Mission Bhagiratha for providing tapped drinking water connection to all. The scheme had an outlay of INR 438bn, benefiting 27.2mn (rural+urban) population and the per capita outlay comes out to be **INR 16,100**.
- (d) Our study of sample projects in water and sanitation (for example in box 2 ahead) and interactions with water related policy experts indicate per capita investment spending could range around **INR8,000-9,000** for providing piped water access. **This would amount to a spending of at least INR5.6tn-6.3tn over FY20-25E, and would be almost double of the spending on water and sanitation over FY14-19.**

**Exhibit 16. Spending on water related projects could be 2x over FY20-25E from the past 5 years**



Source: RBI, Union budget, JM Financial



**Box 1: Mission Bhagiratha - Telangana – A template for rural water drinking project?**

- The project spans 26 segments in 30 districts. Mission Bhagiratha is declared as flagship programme and the state also passed Right of User (RoU) Act for laying of pipelines in Private Land. The project management process was made effective and improved feedback from earlier projects. This project was scheduled for 3 years and to cover 27.2mn people of the state.
- The aim of the project has been to ensure safe and sustainable piped drinking water supply from surface water sources at:
  - 100 LPCD ( litres per capita per day) for rural areas,
  - 135 LPCD for municipalities
  - 150 LPCD for municipal corporations
  - 10% Quantity allocated to Industrial requirements
- The project also aimed to provide each household with a tap connection and 10% of water in all Irrigation sources have been reserved for drinking Water.

**Exhibit 17. Project details - Mission Bhagirathi**

Parameter	Value
Geographical area covered (mn square km)	0.11
<b>House-hold coverage (mn)</b>	
Rural	5.2
Urban	1.3
Population to benefit (mn)	27.2
Total Pipeline network (mn km)	0.17
Total project outlay (INR bn)	438
Power requirement (MW)	235
<b>Per capita outlay (INR)</b>	<b>16,100</b>
<b>Per capita pipeline (m)</b>	<b>6.2</b>

Source: Mission Bhagiratha, JM Financial

- Water is sourced from Krishna River (and its tributaries, 32.4TMC) and Godavari River (and its tributaries, 53.6TMC). The project entailed construction of Intake structure (67 including 48 existing), Water Treatment Plants (153 incl. 103 existing), Major structures (1,674 incl 505 existing) and Over-head Service Reservoirs (OHSRs) (35,514 incl. 17078).

**Exhibit 18. Key project activity for the drinking water project**

Project Activity	Details
<b>Sourcing</b>	Water from major rivers or reservoirs fed by these rivers
<b>Purification</b>	The raw water in nearby water treatment plant
<b>Pumping</b>	Treated water to the major OHSRs and sumps at the highest points
<b>Transmission</b>	From the highest point through secondary pipeline network to all the habitations by gravity (98%)
<b>Distribution</b>	To each house hold through a modern, rationalised intra village network by providing tap connections to each household

Source: Mission Bhagiratha, JM Financial

- Our interactions with various industry experts indicate that the major cost incurred in the program would be on pipelines (c.60-70%), 20-25% on the civil work (excavation, civil structure, water treatment) and the rest on pumps. Among pipes, DI, MS and HDPE pipes (major expense) are used for the distribution and for reaching out to the house-holds.

### Box 2: Cost break-up of a piped drinking water project in Assam

- This project is in the state of Assam with a target to provide piped drinking water to households in 42 zones of the chosen district. There are on an average 10 village per zone totalling 420 villages and covering c.0.3mn of population. The target quantity of water to provide is 100 litres per person per day.
- The drinking water source is “Brahmaputra” river and water is stored in an underground reservoir (2,500 cubic metres). A treatment plant (28 MLD) has been set up for water treatment and purification.
- The total cost of project which is to provide water till the villages (excluding last mile distribution) is INR2.6bn and translates to **INR8,067 per capita**.
- Cost break-up, in a INR2.6bn project
  - Civil work (INR500mn, c.20% of total) –Construction of tanks, underground tanks, all the infrastructure work.
  - Water treatment plant & pumps (minor) (overall 23% or INR600mn)
  - Distribution (chiefly pipes, minor pumps, labor etc) – INR1.5bn (60% of cost) - The benchmark is INR0.1mn/km cost in distribution.

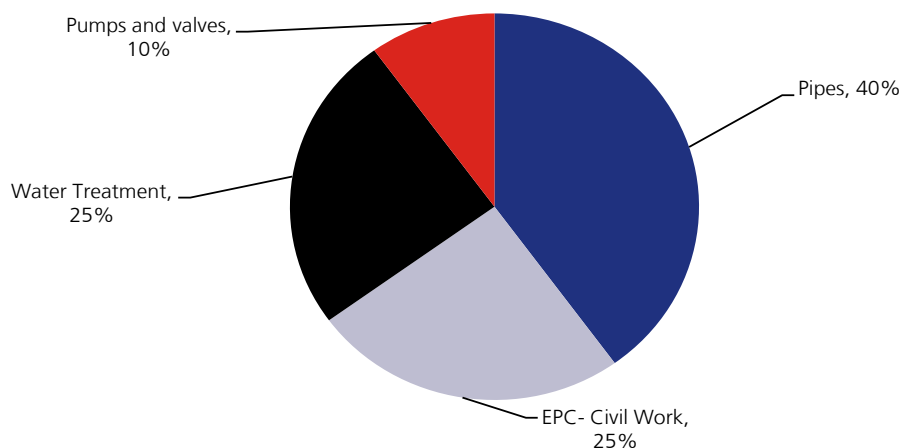
### Beneficiaries from expansion of piped drinking water project

Our study of the piped drinking water projects indicate key components (detailed in Appendix C) in a piped drinking water project are -

- (a) **EPC or the civil work related activities** – Construction of reservoirs, other civil structures etc.
- (b) **Water treatment** – Based on the quality of water in the area, water is treated and then sent across for drinking purposes
- (c) **Pumps / valves** – Used for transferring water from source to reservoirs and also in the distribution network
- (d) **Distribution** – From the mains to village level and then to the house-holds through the pipes

The overall cost across segments would vary based on the projects (access to drinking water, quality of water, terrain etc.), but on aggregate, the major cost would be on distribution pipes (40%), followed by on EPC-Civil work (25%), Water treatment (25%) and Pumps and valves (10%). Some of the companies in these areas are listed in exhibit below.

### Exhibit 19. Key beneficiaries from the expansion of piped drinking water project – Distribution pipes to be the largest beneficiary



Source: Industry, JM Financial

**Exhibit 20. Companies involved across the water supply value chain**

EPC/Civil Work, Water Treatment	Pipes	Pumps/Motors	Cement
Larsen & Toubro	Astral Poly Technik	Crompton Greaves Consumer	
Thermax	Supreme Industries	V-Guard Industries	
Dilip Buildcon	Finolex Industries	Ksb	
Ncc	Jindal Saw	Kirloskar Brothers	
Knr Constructions	Tata Metaliks	Dynamatic Technologies	
Gayatri Projects	Surya Roshni	Wpil	Higher benefit to East and Central Indian players
Hg Infra Engineering	Srikalahasthi Pipes	Shakti Pumps	
Va Tech Wabag			
Indian Hume Pipe Co			
Shriram Epc			
Ion Exchange (India)			
Chembond Chemicals			

Source: JM Financial

**East and central Indian states to account for bulk of investment in piped drinking water project**

While the average cover of rural piped water connection across India is 18%, there is a wide variation across states. States such as Gujarat (78.5% coverage), Haryana (53.5%), Punjab (52.8%) have coverage above 50% levels, while the North and East Indian states such as Uttar Pradesh, Bihar, West Bengal have coverage of sub-5%, for example (exhibit below).

Therefore in terms of the sheer volume of work, major efforts have to be based in these East and Central Indian states and only top 5 states would account for 55% of the targeted households to be provided tap drinking water connection.

**Exhibit 21. Nal Se Jal – Five states (UP, Bihar, West Bengal, Madhya Pradesh, Rajasthan) to account for 55% of the targeted HHS**

S.No.	State	% HH with piped water connection	Rural HHS to be connected (mn)	Target - % of HHS to be connected
1	Uttar Pradesh	1.0%	28.2	20%
2	Bihar	1.9%	17.6	12%
3	West Bengal	1.0%	15.0	10%
4	Madhya Pradesh	12.0%	9.7	7%
5	Rajasthan	12.3%	8.6	6%
6	Maharashtra	38.3%	8.0	6%
7	Odisha	3.9%	7.9	5%
8	Tamil Nadu	29.7%	6.9	5%
9	Andhra Pradesh	33.5%	6.2	4%
10	Assam	2.2%	5.4	4%
11	Jharkhand	5.8%	4.8	3%
12	Karnataka	43.5%	4.7	3%
13	Chhattisgarh	8.7%	4.1	3%
14	Telangana	33.3%	3.6	2%
15	Kerala	16.8%	3.6	2%
16	Punjab	52.8%	1.6	1%
17	Haryana	53.5%	1.6	1%
18	Gujarat	78.5%	1.4	1%
19	Uttarakhand	14.3%	1.3	1%
20	Jammu & Kashmir	29.9%	1.2	1%
	<b>Total (Top 20 states)</b>		134.2	93%
	<b>All India</b>	<b>18.0%</b>	<b>144.0</b>	<b>100%</b>

Source: NRWDM, Media, JM Financial

## India's water Scenario – Do we have enough water for expansion in drinking water

India has usable water of 1,101 BCM (billion cubic metres), with 63% sourced from surface water and 40% from the ground-water sources. The country generates c.410BCM of ground-water annually. In India, though the availability of surface water is greater than ground water. owing to the decentralised availability of groundwater, it is easily accessible and forms the largest share of India's agriculture and drinking water supply.

Ground water is used for 85% of rural domestic water requirements and for almost 50% of urban requirements, indicating its importance.

### Exhibit 22. The water supply in India

Parameter	BCM
Annual water availability	1,869
<b>Usable water</b>	<b>1,101</b>
Surface water	690
Annual ground water availability for country	411
Reservoir capacity created - BCM	258
Reservoir capacity of 91 reservoirs monitored regularly - BCM	162

Source: CGWB, PRS, JM Financial

### Exhibit 23. India's ground water – Supply and demand trend over the years

(in BCM)	Mar'04	Mar'09	Mar'11	Mar'13
% Rainfall deficit in preceding year	1.3%	-6.6%	0.9%	-9.0%
<b>Recharge from rainfall - Monsoon</b>	<b>248</b>	<b>246</b>	<b>252</b>	<b>259</b>
Recharge from other sources - Monsoon	70	67	69	72
Recharge from rainfall - Non Monsoon	42	46	41	41
Recharge from other source -Non Monsoon	73	71	70	74
<b>Total</b>	<b>432</b>	<b>430</b>	<b>432</b>	<b>446</b>
Natural Discharge during no monsoon season	(34)	(35)	(35)	(35)
<b>Available ground water</b>	<b>399</b>	<b>395</b>	<b>398</b>	<b>411</b>
Usage				
<b>Irrigation</b>	(212)	(221)	(222)	(228)
Domestic and industrial users	(18)	(22)	(23)	(25)
<b>Annual ground water draft</b>	(230)	(243)	(245)	(253)
Usage as % of available	58%	61%	62%	62%
<b>Ground water available for future use</b>	<b>162</b>	<b>153</b>	<b>154</b>	<b>162</b>
<b>Water requirement in case of expansion of piped drinking water (BCM)</b>				
<b>Total water demand in India if every house-hold gets 70LPCD in</b>				<b>31</b>
<b>Total water demand if every house-hold gets 150LPCD in India</b>				<b>66</b>

Source: CGWB, JM Financial, Note: Report published from CWGB in 2017, LPCD: Litre per capita per day

The key source for India's ground water (2/3<sup>rd</sup>) is annual rainfall, while other sources such as Canal seepage, return flow from irrigation, recharge from tanks, ponds and water conservation structures provide the rest of ground water to the country. **At an aggregate level, the country has higher ground water than the demand, but there is a large variation across the usage of ground-water between the states and regions.**

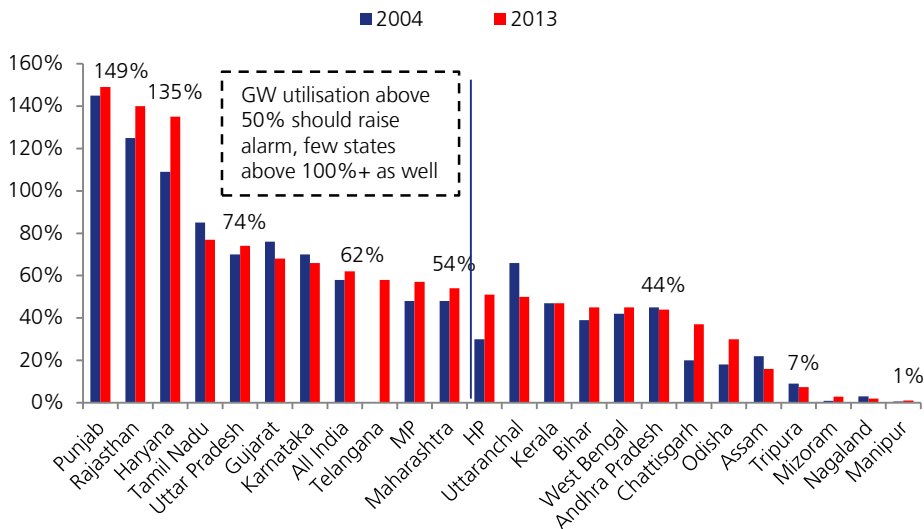
At an aggregate level, even if every house-hold gets 70LPCD drinking water, the total demand would be 31 BCM, much lower than the available 162BCM ground water. This essentially indicates that there is no lack of supply for fulfilling water demand with the expansion of piped water coverage.

High ground water usage in west and north Indian states

In terms of usage of ground water as a percentage of annual supply, the north western states of Punjab, Haryana and Rajasthan clearly indicate very high usage leading to continued decline in the water levels. **Even across other states, the usage of ground water continues to increase leading to steady depletion in the ground-water level.**

As per data from CGWB, at an aggregate level, the usage of ground-water (use/supply) increased to 62% in 2013 from 58% over a decade ago.

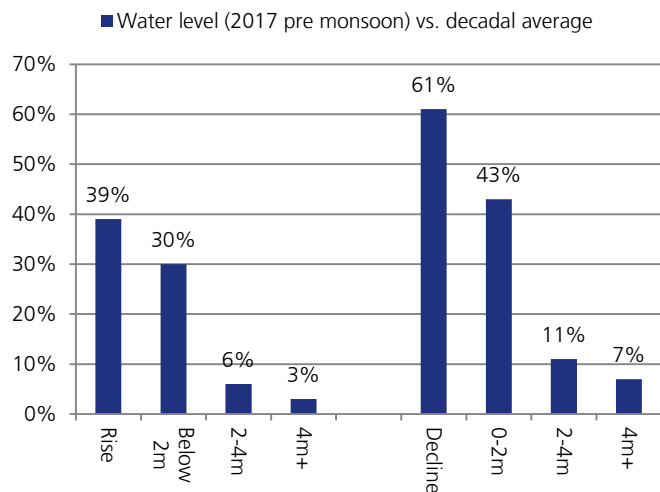
Exhibit 24. Ground water extraction as % of availability – Punjab, Rajasthan and Haryana above 100%+ for more than a decade



Source: CGWB, JM Financial, Note: Data for 2013 measurement released in 2017 report

Major usage of ground-water is towards irrigation (c.90%), while domestic and industrial use constitute only 10% of the ground water usage. The ground water levels have shown decline and as in Jun'17 pre-monsoon data, 61% of the measured wells reported decline in water levels (as compared to decadal averages), while 39% showed, largely marginal increases.

Exhibit 25. Water levels have been steadily going down



Source: CGWB, JM Financial, Data from 13,423 wells across country, in mngl (metres below ground level)

Exhibit 26. Drinking water supply through tanks – a common feature in rural India in Jun'19



Source: JM Financial

At an aggregate level, there is higher supply of ground water in the country than demand, but there are high variations among the region leading to stress in water levels.

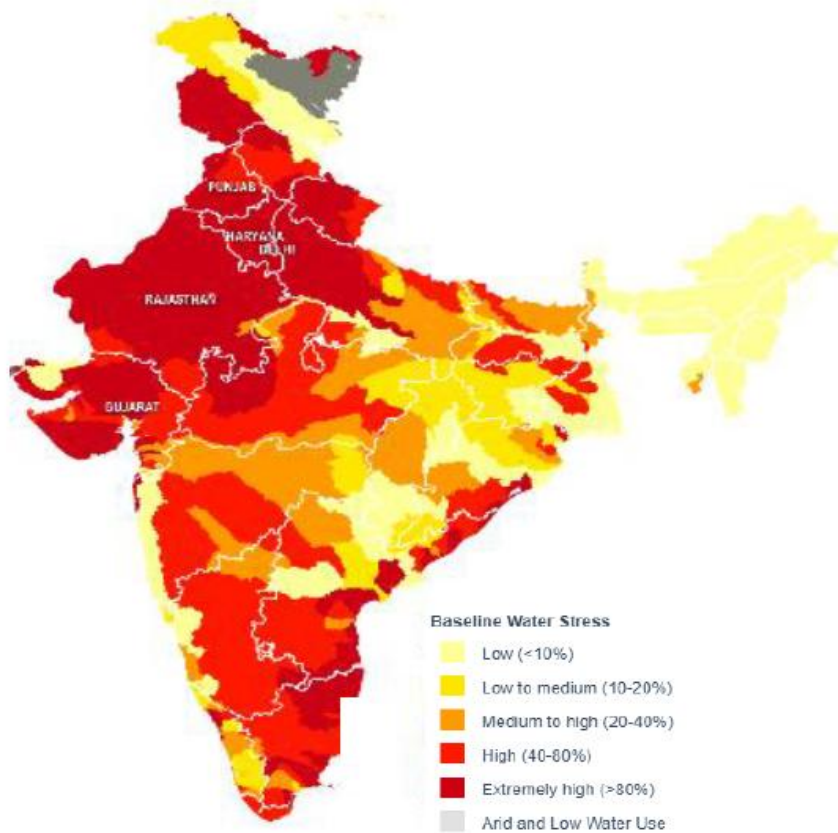
**Exhibit 27. Regional variation in water usage and the potential stress**

Region	Population share (%)	Share of water demand of country (%)	Average annual rainfall (mm)	Per capita water availability (cubic metre)	Annual demand as % of annual availability	Water Stress level
North	25%	38%	1,074	738	70%	High
West	20%	17%	776	736	41%	High
South	21%	17%	1,105	844	30%	Medium to High
East	22%	16%	1,470	794	30%	Medium to High
Central	8%	12%	1,100	1,826	23%	Low to medium
North East	4%	1%	2,360	1,600	2%	Low to No Stress
<b>All India - Combined</b>	<b>100%</b>	<b>100%</b>	<b>1,588</b>	<b>1,187</b>	<b>35%</b>	<b>Medium to High</b>

Source: TERI, JM Financial, Note: Annual availability of combined surface and ground water

Given the variation in rainfall, usage and availability of water resources, the north western region of the country and also various regions in south India face situation of water stress (when annual water demand reaches near available supply levels).

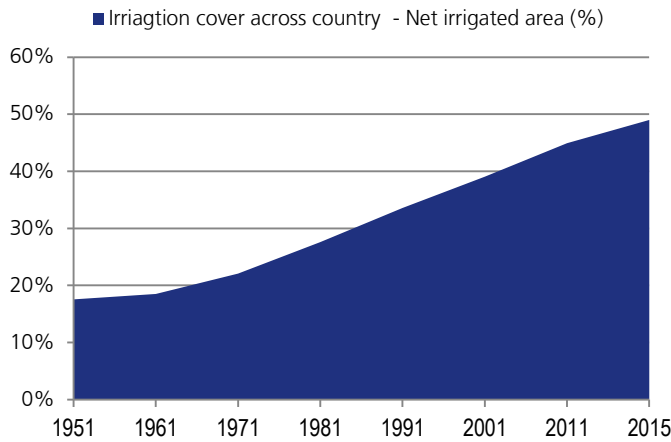
**Exhibit 28. Wide variation in water stress across regions in the country**



Source: Niti Aayog, JM Financial

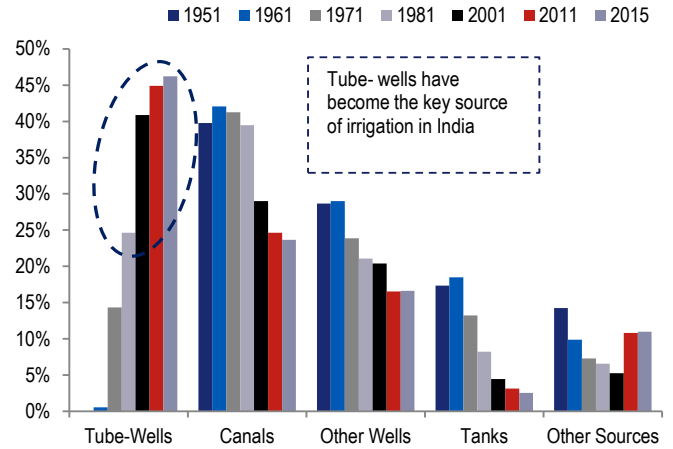
Increase in irrigation coverage through tube wells prime driver of high ground water usage

Exhibit 29. Irrigation cover has increased to c.50% now, from 22% in FY71



Source: CMIE, JM Financial

Exhibit 30. Share of tube wells in irrigation has gone up from 14% in FY71 to 46%+ now; 2/3<sup>rd</sup>s of incremental irrigated area because of tube-wells

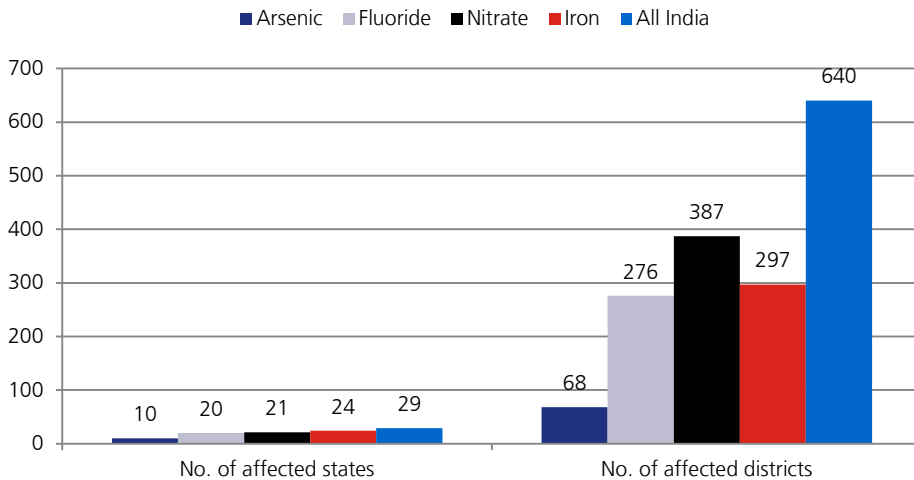


Source: CMIE, JM Financial

Over the past five decades, 3/4<sup>th</sup> of incremental area added under irrigation has been due to expansion of tube wells and a decline in areas under traditional mode of irrigation such as wells, tanks etc. which also used to conserve water and ensured no decline of ground water levels. Incentives such as credit for irrigation equipment and subsidies for electricity supply have enabled higher usage of pumps for irrigation and thereby increased the usage of ground water for irrigation.

High ground-water usage, low urban sewage treatment (1/3<sup>rd</sup>) continues to increase contamination

Exhibit 31. Water quality is a big concern – 70% of available water has contamination – No. of states and districts affected by various contaminations



Source: Niti Aayog, JM Financial, Note: 640 districts (census 2011), at present it would be 725 JM Financial

In addition to issues of water demand, the quality of water also remains a concern due to various contaminations. Overall 70% of the fresh water sources in the country are contaminated and as per Niti Aayog, India ranks 120 out of 122 countries in terms of water quality. The sources of contamination include pollution by landfills, septic tanks, leaky underground gas tanks, and from overuse of fertilizers and pesticides. **It has been pointed**

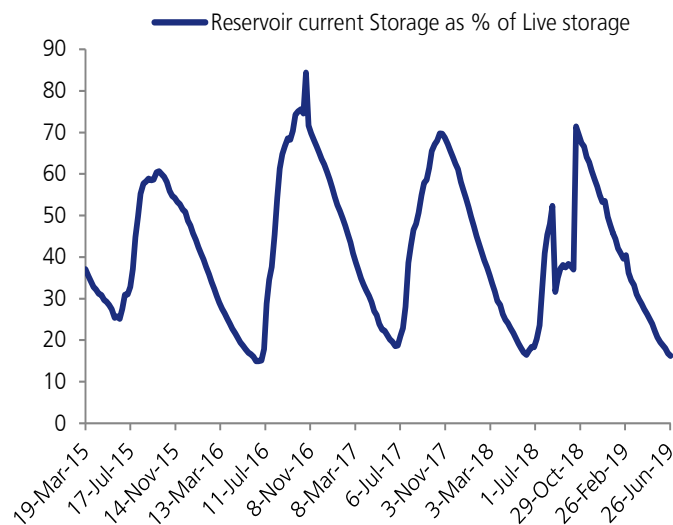
out that nearly 60% of all districts in the country have issues related to either availability of ground water, or quality of ground water, or both.

According to government data, an estimated 62 MLD of sewage is generated per day in urban areas, while the treatment capacity across the country is only 23 MLD (i.e. 37%). Out of 816 municipal sewage treatment plants (STPs) listed across India, only 522 are functional, which means that only c.19 MLD of sewage actually gets treated, implying that 70% of the sewage generated in urban India goes untreated. An estimated 75% to 80% of water pollution is from domestic sewage, discharged untreated into local water bodies, as per annual report from Srikalahasthi pipes.

**Lower and delayed rainfall in Jun'19 exacerbated the availability of water**

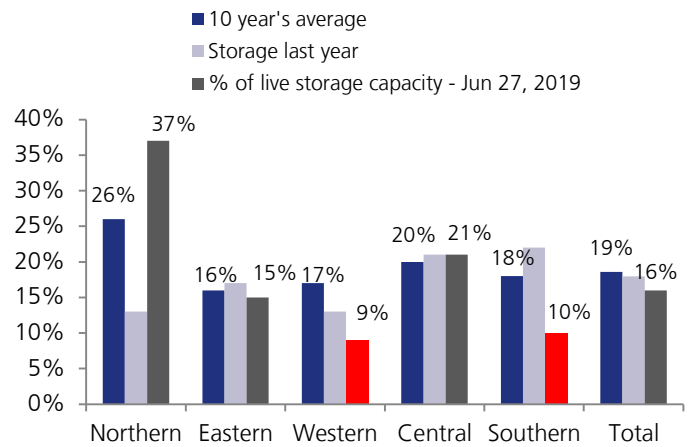
Overall, the spatial and temporal distribution of water also adds to the water stress. A vast majority of water (70%+) in India is received in the four months of monsoon (Jun-Sep) and any deficit in rainfall does impact and aggravates the ground-water situation. In 2019, rainfall in Jun'19 has been 30% below normal, and has added to the lowering of water levels, particularly in the western and southern regions.

**Exhibit 32. Spatial variation in rainfall in India – 70%+ of annual rainfall happens between Jun-Sep, and reflects in reservoir levels**



Source: CMIE, JM Financial

**Exhibit 33. The water levels in western and southern reservoirs have gone much below last ten year averages, leading to current water challenge**



Source: CMIE, JM Financial



## Are there efforts to ease water stress levels?

### Expansion in micro-irrigation could improve water usage, though area under coverage still low

Apart from the investments made in traditional irrigation areas (canals, tanks, tube-wells), the coverage area under micro-irrigation (drip, sprinkler) has seen a healthy expansion of 45% over the period FY16-19. **Among states, Andhra Pradesh (AP), Karnataka and Gujarat have led in expansion of micro-irrigation coverage.**

#### Exhibit 34. Area under micro-irrigation (MI) up by 3.5mn hectares over FY16-19 (45% expansion of the area in the past three years)

State	Area under MI till FY15 (mn ha)	FY16-19 addition to MI (mn ha)	Total area under MI (mn ha)	Share in addition during FY16-19	Share in MI area of the country
Andhra Pradesh	1.2	0.6	1.8	17.8%	15.8%
Karnataka	0.8	0.6	1.5	17.5%	12.9%
Gujarat	0.8	0.6	1.4	17.0%	12.6%
Maharashtra	1.3	0.4	1.7	11.9%	15.0%
Tamil Nadu	0.3	0.4	0.7	10.2%	6.0%
Telangana	0.0	0.2	0.3	6.6%	2.3%
Rajasthan	1.7	0.2	1.9	5.6%	16.7%
Madhya Pradesh	0.4	0.2	0.5	5.2%	4.7%
Uttar Pradesh	0.0	0.1	0.1	3.2%	1.3%
Rest of country	0.4	0.1	0.5	2.8%	4.2%
Haryana	0.6	0.0	0.6	0.8%	5.3%
Odisha	0.1	0.0	0.1	0.5%	1.1%
West Bengal	0.1	0.0	0.1	0.4%	0.6%
Bihar	0.1	0.0	0.1	0.2%	1.0%
Punjab	0.0	0.0	0.0	0.1%	0.4%
<b>Total</b>	<b>7.8</b>	<b>3.5</b>	<b>11.3</b>	<b>100.0%</b>	<b>100.0%</b>

Source: PMKSY, JM Financial

However, the coverage of MI remains low at 11.5% of the aggregate gross sown area. Usage of MI systems saves c.30-50% of the water requirement and enhances yields by 15-50% on an average, compared to a traditional irrigated system. **Hence, expansion of MI coverage is beneficial for water usage and also for a significant hike in crop yields.**

#### Exhibit 35. Usage of micro-irrigation saves water usage by almost half and significantly improves yield (15-50%), in comparison with traditional irrigation systems

Crop	Lower water requirement under MI			Yield improvement under MI		
	Water requirement (mm)- Traditional	Water requirement (mm) – Drip irrigation	% saving in water	Yield - ton/hectare – Traditional irrigation	Yield - ton/hectare, Drip irrigation	% increase in yield
Banana	1,760	970	45	58	88	52
Grapes	532	278	48	26	33	23
Citrus	1,660	640	61	100	150	50
Tomato	300	180	39	32	48	50
Brinjal	90	42	53	28	32	14
Chilli	100	42	62	4	6	44
Sugarcane	2,150	940	56	128	170	33
Cotton	90	42	53	2	3	27

Source: Horticulture statistics, JM Financial, Note: Under drip irrigation

### River water clean-up efforts – Namami Gange

NGP is an integrated conservation mission, approved as 'flagship programme' by the Union government in June 2014 with budget outlay of INR 280bn to accomplish the twin objectives of effective abatement of pollution, conservation and rejuvenation of National River Ganga.

Main Pillars of the Namami Gange Programme are:

- Sewerage Treatment Infrastructure
- River-Surface Cleaning
- Afforestation
- Industrial Effluent Monitoring
- River-Front Development
- Bio-Diversity
- Public Awareness

Its implementation has been divided into entry level activities (for immediate visible impact), medium-term activities (to be implemented within 5 years of time frame) and Long-Term Activities (to be implemented within 10 years).

#### Current status

About 24.4% of the allocated budget have been utilised as of May'19 which amounts to about INR 70bn. Out of the total 298 projects, 99 are completed and 134 are under progress.

#### Exhibit 36. Status of projects under Namami Gange

Project Type	Average project size (INR mn)	Sanctioned	No. of projects			AA&ES issued	Cost of projects		Cost incurred as % of total cost
			Completed	Under Progress	Under tendering		Sanctioned INR bn	- Cost incurred - INR bn	
Sewage infrastructure	1,559	151	42	61	48	-	235	46	20%
Entry level activities	195	77	40	29	3	5	15	9	61%
Institutional Development (Non - Infrastructure)	639	18	1	16	1	-	11	1	6%
Project implementation support and research	153	10	4	5	-	1	2	1	58%
Others	501	42	12	23	4	3	21	12	59%
<b>Total Plan</b>	<b>955</b>	<b>298</b>	<b>99</b>	<b>134</b>	<b>56</b>	<b>9</b>	<b>285</b>	<b>70</b>	<b>24%</b>

Source: Namami Gange, JM Financial, As on May'19

### Ground water recharging efforts

Some of the states such as Andhra Pradesh and Gujarat have built in structures to recharge the ground water levels, however overall performance across the country remains inadequate (as per Niti aayog report).

#### Box 3: Example of a water recharging project in Andhra Pradesh

- Central Ground Water Board (CGWB) constructed 27 artificial structures the project, 27 artificial recharge structures were constructed out of which 26 were check dams and one percolation tank.
- Check dams are small barriers built across the direction of water flow to reduce its velocity. Check dams are built on shallow rivers and streams for the purpose of water harvesting. The small dams retain excess water flow during the monsoon rains in a small catchment area behind the structure.
- Pressure created in the catchment area helps force the impounded water into the ground which leads to replenishment of nearby groundwater reserves and wells. The water then could be used for irrigation and domestic needs. Percolation tank was constructed to store excess flowing water. It is an artificial surface body to entrap the surface run-offs for recharge of groundwater.

## Appendix A: Government cost estimate for piped drinking water project by states

**Exhibit 37. Estimated investment required to provide piped drinking water to 90% of rural house-holds, as per strategic review -2011-2022**

State	Total Rural Population (mn)	Population to cover for 90% coverage at 70 LPCD (mn)	Allocation (INR bn)	Cost per person (INR)
Uttar Pradesh	157	152	682	4,488
Bihar	90	88	405	4,605
West Bengal	75	65	363	5,612
Madhya Pradesh	53	49	218	4,465
Rajasthan	52	40	242	6,095
Maharashtra	65	32	172	5,390
Odisha	35	26	121	4,690
Jharkhand	25	24	184	7,816
Assam	26	21	137	6,563
Andhra Pradesh	61	17	52	3,154
Chhattisgarh	18	15	66	4,395
Tamil Nadu	35	14	53	3,752
Karnataka	38	10	29	3,028
Gujarat	36	8	27	3,190
Kerala	25	6	19	3,061
Jammu & Kashmir	10	6	59	10,161
Uttarakhand	7	6	106	18,623
Haryana	18	4	16	4,289
Himachal Pradesh	6	2	32	14,532
Punjab	18	2	1	624
Tripura	3	2	8	4,450
Meghalaya	2	1	13	16,919
Manipur	2	1	2	3,340
Nagaland	2	1	3	3,809
Goa	1	0	5	9,988
Sikkim	1	0	7	16,467
Andaman & Nicobar Island	0	0	1	4,480
Mizoram	1	0	4	15,623
Arunachal Pradesh	1	0	2	9,617
Dadra & Nagar Haveli	0	0	1	7,767
Daman & Diu	0	0	1	7,799
Puducherry	0	0	0	1,913
Lakshadweep	0	0	1	13,543
<b>All India</b>	<b>863</b>	<b>591</b>	<b>3,035</b>	<b>5,134</b>

Source: NRDWP, JM Financial, Strategic review, 2011-22

## Appendix B: Distribution and movement ground water by states

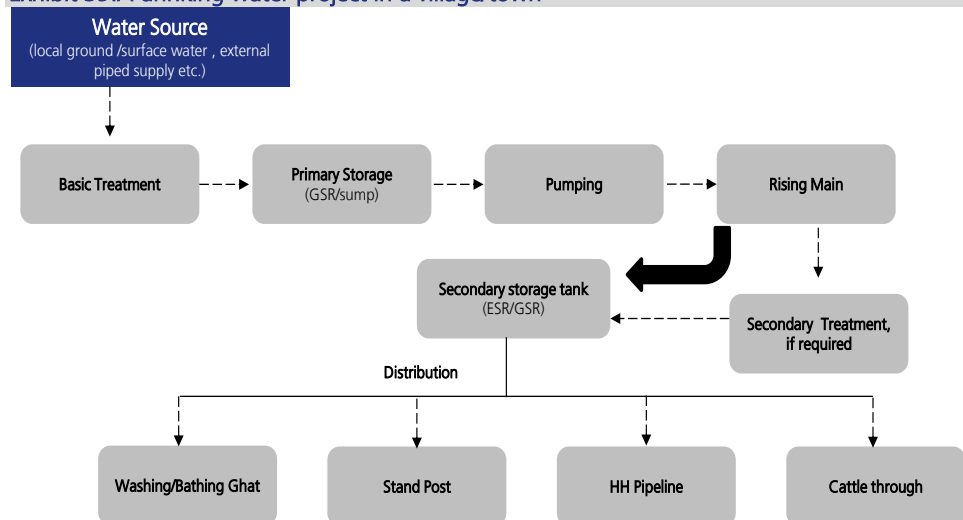
Exhibit 38. Ground-water details in India

State	Ground water (BCM)		Share of ground water in India (%)		Utilisation of Ground-water (%)	
	Mar'04	Mar'13	Mar'04	Mar'13	Mar'04	Mar'13
Uttar Pradesh	70.2	71.6	17.6%	17.4%	70%	74%
Madhya Pradesh	35.3	34.2	8.9%	8.3%	48%	57%
Andhra Pradesh	33.0	31.9	8.3%	7.8%	45%	44%
Maharashtra	31.2	31.5	7.8%	7.7%	48%	54%
Assam	24.9	28.9	6.2%	7.0%	22%	16%
Bihar	27.4	28.5	6.9%	6.9%	39%	45%
West Bengal	27.5	26.6	6.9%	6.5%	42%	45%
Punjab	21.4	23.4	5.4%	5.7%	145%	149%
Gujarat	15.0	19.8	3.8%	4.8%	76%	68%
Tamil Nadu	20.8	18.6	5.2%	4.5%	85%	77%
Odisha	21.0	16.7	5.3%	4.1%	18%	30%
Karnataka	15.3	14.8	3.8%	3.6%	70%	66%
Chhattisgarh	13.7	11.9	3.4%	2.9%	20%	37%
Rajasthan	10.4	11.3	2.6%	2.7%	125%	140%
Haryana	8.6	10.3	2.2%	2.5%	109%	135%
Jharkhand	5.3	6.0	1.3%	1.5%	21%	23%
Kerala	6.2	5.7	1.6%	1.4%	47%	47%
Jammu & Kashmir	2.4	4.8	0.6%	1.2%	14%	24%
Arunachal Pradesh	2.3	4.0	0.6%	1.0%	0%	0%
Others	6.8	10.4	1.7%	2.5%		
<b>Total States</b>	<b>398.7</b>	<b>410.7</b>	<b>100.0%</b>	<b>100.0%</b>	<b>58%</b>	<b>62%</b>

Source: CWGB, JM Financial

## Appendix C: Components of a typical drinking supply project

Exhibit 39.A drinking water project in a village/town



Source: Industry, JM Financial

Exhibit 40. Sources of water – Ground water is the most used source in drinking water projects

Source	Details
Ground water:	Open well, tube well/bore well, hand pump are sources which make water available from ground.
Open Well:	Where ground water is available at low depth (less than 15 meters - and water is available all year round, open well is used.
Hand Pump:	Where safe ground water is available up to 60 m depth, hand pump is ideal choice for a cluster or habitation.
Bore Well/Tube Well:	Where ground water is at greater depth and open wells or hand pumps are not viable, bore well or tube well is installed.
Surface Water:	River, pond, dam site are sources where surface water is available. Moreover, rain water can be harvested and stored directly in storage tanks. This water is potable after first rain and can be used for drinking purpose also.

Source: Industry, JM Financial

Storage capacity of the service reservoirs is estimated based on pumping hours, demand and hours of supply, electricity available for pumping. Systems with higher pumping hours require less storage capacity. Normally, such reservoirs are calculated to store half to one day daily water requirement.

Exhibit 41. Key components in a water supply system

Key Terms	Details
Pump house and pumping machinery:	Pump is used to fetch water from source like bore well, open well, sump or ground water storage and supply it to pipelines or elevated storage. There are three main components: <b>a)</b> pump, <b>b)</b> electrical or oil engine, <b>c)</b> panel board. Pump house is constructed for security and safety of machineries.
Rising main	The delivery line carrying water from pump to storage tank (elevated or ground) is called rising main.
Elevated surface reservoir (ESR)	Elevated storage tank: ESR is constructed, where water is to be supplied at elevated height (less than the level of ESR) or where the distance is large and topography is undulating. <b>Generally, ESR is at height more than 15 m. Water can be distributed directly from this storage tank by gravity or pump.</b>
Ground service reservoir (GSR):	GSR is ground level or plinth level storage tank. The plinth level is generally not more than 3 m.
Sump:	Sump is used as additional storage at village/town level or cluster level. It is not used for direct distribution of water. Rather, it is used as intermediate or contingency storage, to store water before it is pumped to ESR/GSR. The underground storage tank in circular shape with dome line covering is called sump. Generally, the capacity of sump is more (one and half to two times) than ESR or GSR or two to five days water requirement, so that if the supply is disturbed for that time, the water is available for the people

Source: Industry, JM Financial

## Distribution pipes to be a key beneficiary from providing tap drinking water to all

For efficient distribution, it is required that water should reach its end use with required flow rate with needed pressure in the piping system. There are three main types of distribution systems that can be adopted in villages / towns:

**Gravity-fed distribution:** When the ground level of water source / storage is sufficiently raised than the core village/town area, such system can be utilised for distribution. The water in the distribution pipeline flow due to gravity and no pumping is required. Such system is highly reliable and economical.

**Pumping system:** In such a system, water is supplied by continuous pumping. Treated water is directly pumped into the distribution main with constant pressure without intermediate storing. Supply can be affected during power failure and breakdown of pumps. Hence, diesel pumps also in addition to electrical pumps as stand by to be maintained. Such system works only in condition where there is continuous power supply, reliable water source and where intermediate storage system cannot be installed.

**Dual / combination:** In such a system, both gravity as well pumping systems are used. Such systems are used where there are variations in topography in town / village.

**Distribution pipelines:** The lines carrying water from storage to its end use (stand post/ household tap etc.) are called distribution lines. Distribution pipelines consist of main pipeline connected from secondary storage; sub-main pipes connected from main pipeline and service/branch pipes connected from sub-main for distribution to households. Generally, **mild steel (MS), galvanised iron (GI), high density polyethylene (HDPE) / poly vinyl chloride (PVC) pipes, ductile iron (DI) pipe with 15-200 mm diameter are used in distribution.** These lines are generally underground (1-3 feet below ground). Valves are used to control the distribution.

For water mains, mainly GI and MS pipes or even large HDPE pipes are used, while for branch/service pipes, most commonly used are galvanised iron and HDPE / PVC pipes. DI pipes are used for both purposes.

## APPENDIX I

## JM Financial Institutional Securities Limited

(formerly known as JM Financial Securities Limited)

Corporate Identity Number: U67100MH2017PLC296081

Member of BSE Ltd., National Stock Exchange of India Ltd. and Metropolitan Stock Exchange of India Ltd.

SEBI Registration Nos.: Stock Broker - INZ000163434, Research Analyst – INH000000610

Registered Office: 7th Floor, Cnergy, Appasaheb Marathe Marg, Prabhadevi, Mumbai 400 025, India.

Board: +9122 6630 3030 | Fax: +91 22 6630 3488 | Email: jmfinancial.research@jmfl.com | www.jmfl.com

Compliance Officer: Mr. Sunny Shah | Tel: +91 22 6630 3383 | Email: sunny.shah@jmfl.com

Definition of ratings	
Rating	Meaning
Buy	Total expected returns of more than 15%. Total expected return includes dividend yields.
Hold	Price expected to move in the range of 10% downside to 15% upside from the current market price.
Sell	Price expected to move downwards by more than 10%

**Research Analyst(s) Certification**

The Research Analyst(s), with respect to each issuer and its securities covered by them in this research report, certify that:

All of the views expressed in this research report accurately reflect his or her or their personal views about all of the issuers and their securities; and

No part of his or her or their compensation was, is, or will be directly or indirectly related to the specific recommendations or views expressed in this research report.

**Important Disclosures**

This research report has been prepared by JM Financial Institutional Securities Limited (JM Financial Institutional Securities) to provide information about the company (ies) and sector(s), if any, covered in the report and may be distributed by it and/or its associates solely for the purpose of information of the select recipient of this report. This report and/or any part thereof, may not be duplicated in any form and/or reproduced or redistributed without the prior written consent of JM Financial Institutional Securities. This report has been prepared independent of the companies covered herein.

JM Financial Institutional Securities is registered with the Securities and Exchange Board of India (SEBI) as a Research Analyst and a Stock Broker having trading memberships of the BSE Ltd. (BSE), National Stock Exchange of India Ltd. (NSE) and Metropolitan Stock Exchange of India Ltd. (MSEI). No material disciplinary action has been taken by SEBI against JM Financial Institutional Securities in the past two financial years which may impact the investment decision making of the investor.

JM Financial Institutional Securities renders stock broking services primarily to institutional investors and provides the research services to its institutional clients/investors. JM Financial Institutional Securities and its associates are part of a multi-service, integrated investment banking, investment management, brokerage and financing group. JM Financial Institutional Securities and/or its associates might have provided or may provide services in respect of managing offerings of securities, corporate finance, investment banking, mergers & acquisitions, broking, financing or any other advisory services to the company(ies) covered herein. JM Financial Institutional Securities and/or its associates might have received during the past twelve months or may receive compensation from the company(ies) mentioned in this report for rendering any of the above services.

JM Financial Institutional Securities and/or its associates, their directors and employees may; (a) from time to time, have a long or short position in, and buy or sell the securities of the company(ies) mentioned herein or (b) be engaged in any other transaction involving such securities and earn brokerage or other compensation or act as a market maker in the financial instruments of the company(ies) covered under this report or (c) act as an advisor or lender/borrower to, or may have any financial interest in, such company(ies) or (d) considering the nature of business/activities that JM Financial Institutional Securities is engaged in, it may have potential conflict of interest at the time of publication of this report on the subject company(ies).

Neither JM Financial Institutional Securities nor its associates or the Research Analyst(s) named in this report or his/her relatives individually own one per cent or more securities of the company(ies) covered under this report, at the relevant date as specified in the SEBI (Research Analysts) Regulations, 2014.

The Research Analyst(s) principally responsible for the preparation of this research report and members of their household are prohibited from buying or selling debt or equity securities, including but not limited to any option, right, warrant, future, long or short position issued by company(ies) covered under this report. The Research Analyst(s) principally responsible for the preparation of this research report or their relatives (as defined under SEBI (Research Analysts) Regulations, 2014); (a) do not have any financial interest in the company(ies) covered under this report or (b) did not receive any compensation from the company(ies) covered under this report, or from any third party, in connection with this report or (c) do not have any other material conflict of interest at the time of publication of this report. Research Analyst(s) are not serving as an officer, director or employee of the company(ies) covered under this report.

While reasonable care has been taken in the preparation of this report, it does not purport to be a complete description of the securities, markets or developments referred to herein, and JM Financial Institutional Securities does not warrant its accuracy or completeness. JM Financial Institutional Securities may not be in any way responsible for any loss or damage that may arise to any person from any inadvertent error in the information contained in this report. This report is provided for information only and is not an investment advice and must not alone be taken as the basis for an investment decision.

The investment discussed or views expressed or recommendations/opinions given herein may not be suitable for all investors. The user assumes the entire risk of any use made of this information. The information contained herein may be changed without notice and JM Financial Institutional Securities reserves the right to make modifications and alterations to this statement as they may deem fit from time to time.

This report is neither an offer nor solicitation of an offer to buy and/or sell any securities mentioned herein and/or not an official confirmation of any transaction.

This report is not directed or intended for distribution to, or use by any person or entity who is a citizen or resident of or located in any locality, state, country or other jurisdiction, where such distribution, publication, availability or use would be contrary to law, regulation or which would subject JM Financial Institutional Securities and/or its affiliated company(ies) to any registration or licensing requirement within such jurisdiction. The securities described herein may or may not be eligible for sale in all jurisdictions or to a certain category of investors. Persons in whose possession this report may come, are required to inform themselves of and to observe such restrictions.

Persons who receive this report from JM Financial Singapore Pte Ltd may contact Mr. Ruchir Jhunjhunwala (ruchir.jhunjhunwala@jmfl.com) on +65 6422 1888 in respect of any matters arising from, or in connection with, this report.

**Additional disclosure only for U.S. persons:** JM Financial Institutional Securities has entered into an agreement with JM Financial Securities, Inc. ("JM Financial Securities"), a U.S. registered broker-dealer and member of the Financial Industry Regulatory Authority ("FINRA") in order to conduct certain business in the United States in reliance on the exemption from U.S. broker-dealer registration provided by Rule 15a-6, promulgated under the U.S. Securities Exchange Act of 1934 (the "Exchange Act"), as amended, and as interpreted by the staff of the U.S. Securities and Exchange Commission ("SEC") (together "Rule 15a-6").

This research report is distributed in the United States by JM Financial Securities in compliance with Rule 15a-6, and as a "third party research report" for purposes of FINRA Rule 2241. In compliance with Rule 15a-6(a)(3) this research report is distributed only to "major U.S. institutional investors" as defined in Rule 15a-6 and is not intended for use by any person or entity that is not a major U.S. institutional investor. If you have received a copy of this research report and are not a major U.S. institutional investor, you are instructed not to read, rely on, or reproduce the contents hereof, and to destroy this research or return it to JM Financial Institutional Securities or to JM Financial Securities.

This research report is a product of JM Financial Institutional Securities, which is the employer of the research analyst(s) solely responsible for its content. The research analyst(s) preparing this research report is/are resident outside the United States and are not associated persons or employees of any U.S. registered broker-dealer. Therefore, the analyst(s) are not subject to supervision by a U.S. broker-dealer, or otherwise required to satisfy the regulatory licensing requirements of FINRA and may not be subject to the Rule 2241 restrictions on communications with a subject company, public appearances and trading securities held by a research analyst account.

JM Financial Institutional Securities only accepts orders from major U.S. institutional investors. Pursuant to its agreement with JM Financial Institutional Securities, JM Financial Securities effects the transactions for major U.S. institutional investors. Major U.S. institutional investors may place orders with JM Financial Institutional Securities directly, or through JM Financial Securities, in the securities discussed in this research report.

**Additional disclosure only for U.K. persons:** Neither JM Financial Institutional Securities nor any of its affiliates is authorised in the United Kingdom (U.K.) by the Financial Conduct Authority. As a result, this report is for distribution only to persons who (i) have professional experience in matters relating to investments falling within Article 19(5) of the Financial Services and Markets Act 2000 (Financial Promotion) Order 2005 (as amended, the "Financial Promotion Order"), (ii) are persons falling within Article 49(2)(a) to (d) ("high net worth companies, unincorporated associations etc.") of the Financial Promotion Order, (iii) are outside the United Kingdom, or (iv) are persons to whom an invitation or inducement to engage in investment activity (within the meaning of section 21 of the Financial Services and Markets Act 2000) in connection with the matters to which this report relates may otherwise lawfully be communicated or caused to be communicated (all such persons together being referred to as "relevant persons"). This report is directed only at relevant persons and must not be acted on or relied on by persons who are not relevant persons. Any investment or investment activity to which this report relates is available only to relevant persons and will be engaged in only with relevant persons.

**Additional disclosure only for Canadian persons:** This report is not, and under no circumstances is to be construed as, an advertisement or a public offering of the securities described herein in Canada or any province or territory thereof. Under no circumstances is this report to be construed as an offer to sell securities or as a solicitation of an offer to buy securities in any jurisdiction of Canada. Any offer or sale of the securities described herein in Canada will be made only under an exemption from the requirements to file a prospectus with the relevant Canadian securities regulators and only by a dealer properly registered under applicable securities laws or, alternatively, pursuant to an exemption from the registration requirement in the relevant province or territory of Canada in which such offer or sale is made. This report is not, and under no circumstances is it to be construed as, a prospectus or an offering memorandum. No securities commission or similar regulatory authority in Canada has reviewed or in any way passed upon these materials, the information contained herein or the merits of the securities described herein and any representation to the contrary is an offence. If you are located in Canada, this report has been made available to you based on your representation that you are an "accredited investor" as such term is defined in National Instrument 45-106 Prospectus Exemptions and a "permitted client" as such term is defined in National Instrument 31-103 Registration Requirements, Exemptions and Ongoing Registrant Obligations. Under no circumstances is the information contained herein to be construed as investment advice in any province or territory of Canada nor should it be construed as being tailored to the needs of the recipient. Canadian recipients are advised that JM Financial Securities, Inc., JM Financial Institutional Securities Limited, their affiliates and authorized agents are not responsible for, nor do they accept, any liability whatsoever for any direct or consequential loss arising from any use of this research report or the information contained herein.