

# Achieving Sustainable and Healthy Water Through Efficient Systems

10<sup>th</sup> October 2020

## ORCHHA CITY WORKSHOP A REPORT



## ACKNOWLEDGEMENT

The DA team is deeply thankful to Shri Balram Yadav and Shri Pratap Singh Khengar from the city of Orchha for giving us an opportunity to contribute to achieving the developmental goals of the city in the area of water and wastewater management and for co-developing the agenda of the Orchha city workshop.

We extend our heartfelt gratitude towards Shri. Depinder S Kapur and his team members Shri. Parth V Kamath, Shri. B Ashwin Kumar, and Shri. Victor R Shinde from NIUA for supporting and being a torchbearer for our initiative.

We are also thankful to Mr. Piyush Dhawan, Mr. Andrews Jacob, Ms Smita Singhal, Mr. Tharun Kumar, Mr. Abhijit, and Mr. Divanshu for being part of this workshop and contributing towards the agenda of this round table discussion for sharing knowledge about the new-age solutions and systems thinking approach and creating possible opportunities for all stakeholders in achieving the efficiency and circularity of urban water systems.

We feel immense pleasure in forwarding our thankfulness towards all the stakeholders and participants who supported us in successfully conducting this workshop for the city of Orchha.

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## Executive Summary

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Indian cities face extreme water stress which stands at more than 54% on an average. Most of the cities face acute water loss in the system caused by ancient and dilapidated infrastructure, illegal connection, pipe and joint leakages, and lack of metering system. The cities are also not equipped with new technologies which can help them achieve resource circularity. 80% of the drinking water in Indian cities is still extracted from groundwater sources which makes it an energy intensive sector.

This report discusses the workshop conducted by Development Alternatives Group for the city of Orchha supported by the National Institute of Urban Affairs (NIUA) and Heinrich Boell Stiftung aimed at understanding innovative technologies in the wastewater treatment space. Orchha is a culturally rich and historic tourist place in the state of Madhya Pradesh. It faces numerous challenges in achieving safe and adequate water system management. Orchha faces acute water shortage with water supply limited to an hour a day and alternate days in summer. Only few wards are distributed through water lines and remaining wards are provided water through tankers by Nagar Panchayat. Only 25 % HHs are equipped with toilet facilities with no existing sewer infrastructure. The municipality of Orchha have initiated various interventions to address the identified problems. However, these issues require integration of innovative solutions into the system for efficient operation.

During the discussion, the pain points of the city were discussed in detail which were found to be wastewater treatment and reuse, and capacity building and stakeholder participation. Once the difficulties faced by the city were made clear, subject matter experts and solution providers put forth their recommendations and solutions which can be feasibly integrated to the city systems to achieve its aspiration. Several new age technologies, nature based solutions, business models, best municipal practices, and resource circularity interventions were discussed.

## Background

### 1.1 Context

With an increasing population in cities, estimated to reach 590 million by 2030, the demand for water is ever increasing. According to a report by the World Resources Institute (WRI, 2015) more than 54% of India is under high or extreme water stress. Non-revenue water in cities is estimated to be around 32% and with 70% installed capacity of sewage treatment, only 35% is treated. According to the NITI Aayog (Composite Water Management Index-2019), about 2 lakh people die every year due to inadequate water, sanitation & hygiene; 820 million people (58%) have less than 1000 m<sup>3</sup>/ capita water availability; and 70% of our water is contaminated. Traces of the Novel Coronavirus found in sewage water of infected population have brought to the fore the risks of diseases spread through water systems. Untreated or inadequately treated sewage water entering water bodies poses high risk to human health through potable and non-potable consumption. The humongous quantity of wastewater generated creates significant potential for treatment and reuse. Researchers tested the treated wastewater from the municipal WWTPs from where the virus was found in an untreated sample, and found no viral genome, thereby validating the efficacy of wastewater treatment systems. The integrated management of water systems that addresses safe water supply, safe management of sewage and water security must therefore be a priority agenda of local governments.

### 1.2 Need for an Integrated Systemic Approach

It is important to understand that the challenges of each city differ with the context and a universal solution cannot be applied. The key challenges in urban water supply include ; 1) Rapid urbanisation, 2) Non-circularity of treated waste water or not treating waste water, 3) Inefficient water distribution system with plagued distribution losses, 4) limited metering leading to NRW, 5) Low household connection coverage, 6) Poor pricing strategies, 7) challenges related to existing institutional arrangements, and 8) challenges related to institutional capacities. The existing water supply priority follows the order Engineering, water science, social mobilisation, ecological factors. Whereas, it is to be noted that to achieve a sustainable water system, it is important to prioritise the ecological factors and provide suitable and efficient engineering solutions after considering all other related parameters.

A systemic approach to look at the issues will bring in a value addition to the urban water and wastewater system management. It will help in comprehensive understanding of the functioning of the interconnected elements of the system, enhance capacity to integrate designed to fit smart and efficient solutions, enhance streamlined coordination among actors of the value chain, and enhance tracking and monitoring mechanisms for continuous system improvement. Resource equity can be maintained through participatory, transparent and accountable governance system. Achieving an integrated system allows city to efficiently identify pain points, areas of interventions, required customized solutions and opportunities for stakeholder engagement.

## Orchha City Workshop

A virtual round table discussion was organised by Development Alternatives Group on 10 October 2020 for the city of Orchha, a culturally rich and historic tourist place in the state of Madhya Pradesh. This dialogue was supported by the National Institute of Urban Affairs (NIUA) and Heinrich Boell Stiftung aimed at understanding innovative technologies in the waste water treatment space. It also focused on how collaborations can be leveraged to complement each other's aspirations and provide support to meet the challenges in achieving sustainability through efficient water systems.

### 2.1 Key Issues of Orchha City

The city of Orchha faces numerous challenges in providing a safe and adequate water supply, managing wastewater generated and checking non-revenue water. Currently, the city faces acute water shortage. The supply duration is limited to an hour per day and alternative days in summer. The water intake system is poor. Water is being pumped from the submersible pumps fitted in the river Betwa and stored in underground tank for distribution limited to few wards. The remaining area is covered through water tankers provided by Nagar Panchayat. Only 1 out of 4 houses have toilet facilities in the city. Most of the town has no roadside storm water drain and situation worsens when solid waste is dumped into these drains. There is no sewerage system laid and the sewage generated is released into storm water drains without any treatment. Based on CPHEEO norms, water demand and wastewater generation has been estimated as 2.81 MLD and 2.25 MLD respectively for the year 2035. The stormwater drains in the city is inefficient and situation worsens when solid waste is dumped into these drains.

The municipality of Orchha have initiated various interventions to address the identified problems. However, these issues require integration of innovative solutions into the system for efficient operation. The challenges of dilapidated infrastructure, economics of traditional solutions, ULB staff capacities, procurement systems must be dealt with. Integration of new age technologies with real time data tracking, awareness on WASH practices, and knowledge on the entire water system value chain - water conservation, storage, supply and waste water treatment and re-use can help city to overcome its current situation. Orchha Nagar Palika has also introduced water tax as user charges for water supply and drainage provided in few slums in 2010-2011 under JnNURM. The 2011 City Development Plan of Orchha aims at augmenting the water supply system to cover 100% households with continuous piped water supply, 100% coverage of sewer lines, toilet facilities, 100% coverage of storm water drainage for safe and hygienic disposal of rain water.

### 2.2 Priority Issues Discussed

#### 1. Wastewater Treatment and Reuse

- a) Sewage and Faecal Sludge Management (centralized or decentralized treatment, monitoring, smart metering, data collection and analysis, reuse of treated water)
- b) Septic Tanks and Management (on-site treatment, septic tank cleaning and management services, collection & transportation solutions for faecal sludge, reuse of sludge and wastewater)

#### 2. Capacity Building and Stakeholder Participation

- a) Capacity building of ULB and line department officers
- b) Awareness generation and participation of citizens and other stakeholders

## 2.3 Enabling Response to Challenges

Through the workshop conducted for the city of Orchha, we were focused on bringing forth the challenges faced by the city to the solution providers and subject matter experts. It is important to understand the ground reality and issues in water system prevailing in the city to adopt a feasible solution. Our endeavour was to identify key domains where support to the city is most pressing to enable acceleration of integration of a new generation of solutions to address the selected priority issues such as;

- a. Identifying more resilient, agile, sustainable, and affordable solutions.
- b. Support in accessing information, comparing and selecting solution providers, including national and international start-ups, SMEs and corporates.
- c. Support in preparing and piloting projects.
- d. Support in accessing finance.
- e. Support in implementing PPP models.

During the discussion, it was understood that, currently, the city is running on a 2 MLD treatment plant and supplies 10 lakh litres of water per day. The wastewater collection is through an ancient system in which water is conveyed through walled structures into drains. During monsoon, these drains overflows making it a hot bed for various disease transmission. The city is in dire need of an efficient and sustainable treatment system to serve its fixed as well as the floating population. The city also faces financial constraints and is thereby hoping to receive investment aid from various central and state initiatives.

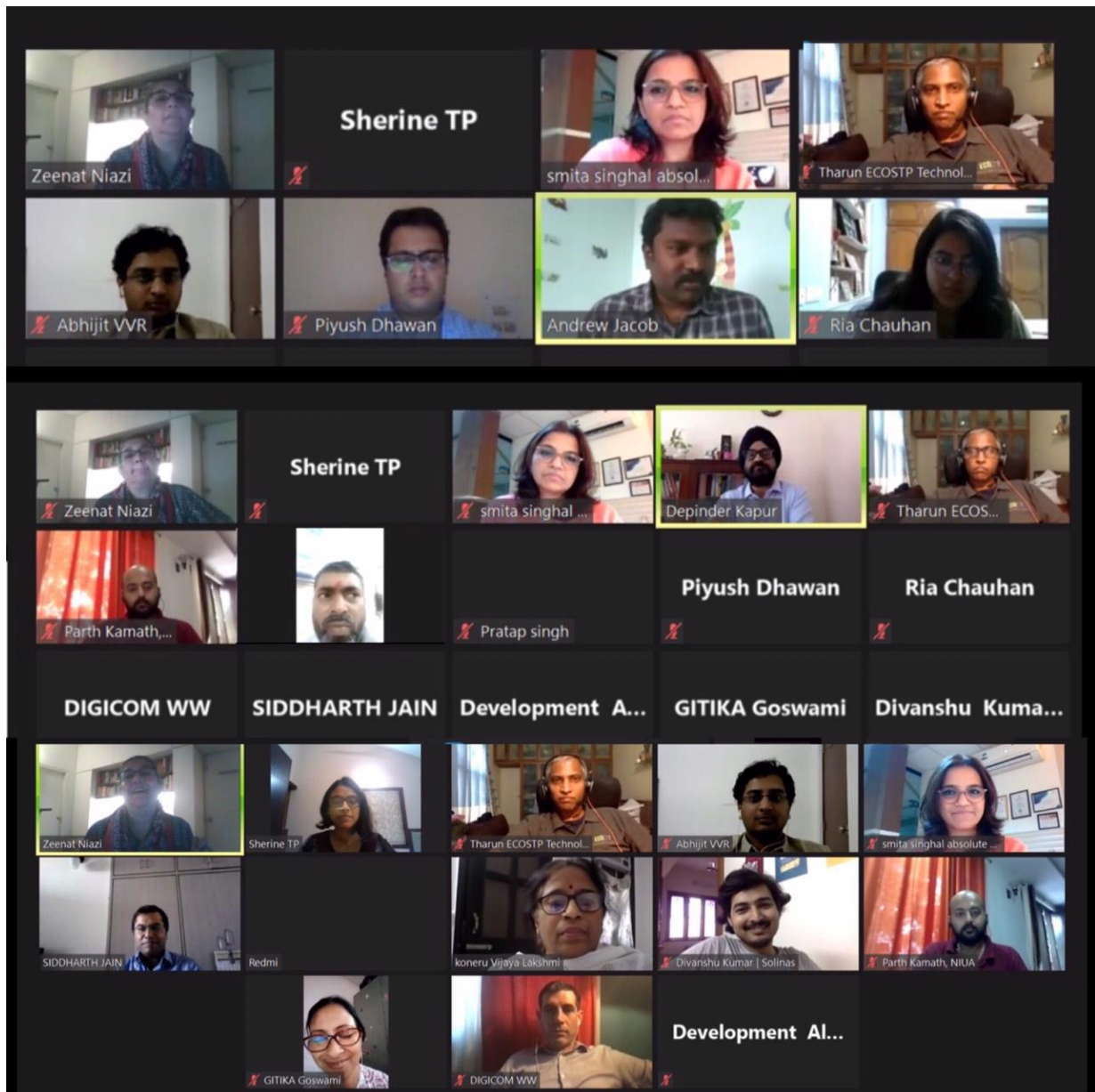
Considering the ground conditions, various solutions were discussed for issues identified such as energy efficient and compact systems addressing land scarcity, resource circularity, leakage and online monitoring systems, resource resilience and capacity building. The city has to adopt a holistic and participatory approach with all stakeholders involved in every stage from conceptualization of a project through implementation, operation and maintenance.

## 2.4 Summary of Solutions Discussed

Once the challenges were clearly laid down by the city, innovative and cost-effective technologies were discussed which could enable the city to have an efficient water management system. Orchha being a small town facing immense land scarcity most of the technologies discussed were decentralised, compact, containerised/mobile, and plug and play systems. The solutions discussed used various technologies such as vermiculture, electro-coagulation, electro-oxidation, biomimicry, and tethered sensors, etc. The systems had minimum energy consumption as they run on solar power, gravitational flow, etc. The capital and operational cost for these systems stood at minimum compared to conventional systems and had faster ROIs. Solution providers also wish to introduce a new business model of “use an pay” where in the city could pay per litres of water treated. Such models could go a long way for cities like Orchha which faces financial constraints. Orchha being a touristic city with utmost importance given to aesthetics, solutions that enables landscaping over the treatment system were also discussed. The importance of adopting circular consumption model and capacity building of the municipal officials were also emphasized during the discussion.

Read more about the technologies discussed [here](#).





Picture 1: Online workshop conducted for Orchha city

## 2.5 Way Forward

The workshop conducted for Orchha city was a knowledge enriching session for all the entities participated. Along with smart and sustainable technologies, innovative business models and interventions were discussed. In order to help the city to adopt a feasible solution and achieve its goals and aspirations as laid out in the City Development Plan we are looking forward to having;

- Continued dialogue with city officials to facilitate integration of efficient solutions to their system
- Workshops and training for municipal capacity development for material flow and life cycle analysis of the resource
- Social media campaigns and awareness programmes through various platforms
- Continued engagement with solution providers
- Documentation and publication of the learnings, findings and best practices with relevant communities and stakeholders.



# Annexures

## Annexure 1 - Agenda

Date: 10th October 2020

Venue: Virtual Meeting

Time: 3pm – 4:30pm

3:00 PM – 3:05 PM	<b>Introduction to the Webinar and Welcome</b> – Ms Zeenat Niazi, Vice-President, Development Alternatives (DA)
3:05 PM – 3:10 PM	<b>Inaugural address</b> - Mr Balram Yadav, Chairman, Nagar Palika Orchha
3:10 PM – 3:15 PM	<b>Special keynote Address by</b> - Mr. Depinder Kapur Senior Domain Expert and Team Lead (SCBP) NIUA
3:15 PM – 3:20 PM	<b>Orchha city challenges and issues</b> – Mr Pratap Singh Khengar, Chief Municipal Officer, Nagar Parishad Orchha
3:20 PM – 3:30 PM	<b>Opening Presentation by</b> Mr Siddharth Jain, Deputy Manager, DA
3:30 PM – 4:20 PM	<b>Round Table Panel Discussion: Decentralized Solutions for Wastewater and Sewage Management</b> – Ms Smita Singhal, Director, Absolute water Pvt. Ltd. Mr Piyush Dhawan, Cofounder, The Circular Collective Mr Tharun Kumar, Cofounder, ECOSTP Mr Andrews Jacob, Project Manager, Consortium for DEWATS Dissemination Society Mr Divanshu Kumar, CEO, Solinas Integrity Mr Abhijit VVR, Cofounder, INDRA Water Mr Parth V Kamath, Program Officer-Technical (SCBP), NIUA Mr B Ashwin Kumar, Programme Officer (SCBP), NIUA Mr Pratap Singh Khengar, Chief Municipal Officer, Orchha
4:20 PM - 4:25 PM	<b>Key respondent:</b> Dr, Victor Rana Shinde, Sector Coordinator, Water and Environment, NIUA: <b>Responding to urban challenges in the SDG frame</b>
4:25 PM - 4:30 PM	<b>Thanks, and Concluding Remarks</b> - Ms Zeenat Niazi, Vice-President, Development

# Annexure 2–Solution Providers and Technologies

## I. Inphlox Water Systems Pvt. Ltd.

INDRA Water makes economical, compact & smart water treatment systems for recycling domestic & industrial wastewater for non-potable reuse applications. Founded in 2017, INDRA water is already recipient of several accolades including Winner of Urban Works Innovation Challenge 2018 by Columbia University & RMZ Corp, winner of global 2019 urban water challenge at world water week, and recently the Millennium Alliance Award 2020 under WASH sector.

### Products

#### a. INDRA Flow series

Indra Flow Series is an Electro-Coagulation (EC) based system designed to remove pollutants from residential, commercial, municipal or industrial wastewater. Flow Series provides a low energy, chemical free alternative to chemical coagulation and other membrane or biological enzyme based processes.

#### b. INDRA Activated Flow series

Indra Activated Flow Series is a treatment system which combines our pioneering 'Sludge Activated Flocculation' (SAF) technology and 'Activated Treatment' process with the Flow Series system to treat effluents with very high content of COD, BOD, TDS, turbidity, coloration and harmful chemicals from industrial wastewater streams.

#### c. INDRA Electrox series

The 'Electrox Series' is our most advanced industrial wastewater treatment system. It combines Activated Flow Series with Electro oxidation technology to achieve multi-stage controlled wastewater treatment. The Electrox Series is extremely effective in treating wastewater with very high content of organic carbon and oxygen demanding substances. It also effectively deals with a host of other pollutants present in the industrial wastewater effluent stream.

### Features

1. Less sludge production
2. Electro-coagulation, electro-oxidation technology
3. Less footprint
4. Plug and play
5. Module capacity 5-200 KLD
6. 40% savings on operational costs, 35% savings on lifecycle cost
7. 95% water recovery with zero chemical
8. Meets CPCB and state norms

### Highlights

1. **Reduced sludge production:** Produces 60% less sludge compared to conventional system. The sludge produced is stored in a separate storage unit after disinfection which can later be used as manure/fertilizers.
2. **Pay as you use business model:** INDRA water is coming up with a new business model where in the client has no capex but paid in form of water treatment bill in terms of the amount of water treated.
3. **Decentralised approach:** Containerised and compact solution with standardised plant capacity specially designed for regions facing land scarcity or difficult geographical terrains.

## II. Absolute Water Pvt Ltd



Absolute Water Pvt. Ltd. provides green water recovery system that converts raw sewage into drinking water quality as per WHO standard. We provide organic waste water solutions for Institutions, Industry, Municipal Authorities, and Commercial properties. Founded in 2013, Absolute Water has received several accolades including Aqua Foundation's Excellence award 2019, Action for India- Best Indian Social Enterprise Award, 2019. We were selected by the Prince Charles Sustainability Markets Initiative in collaboration with the World Economic Forum, as the top 100 in the World for treating water pollution in a green manner.

### Products

#### a. Bio-Filter Green STP

Specially bred worms are introduced in this technology. Once the worms have broken down the micro-pollutants present, the filtration system additionally uses completely organic and inorganic media, such as woodchips, pebbles and sand. The resultant water is suitable for agricultural, ground water rejuvenation, river replenishment and horticultural use. On advanced treatment, the treated water can be used for toilet flushing, laundry, washing maintenance, AC tower cooling, etc.

#### b. Water Recovery System

Water Recovery System is a further advanced treatment to the above, with a very high recovery (> 85 %) of water. The specially designed Membrane not only filters out various contaminants but also the harmful bacteria, Viruses & other Pathogens without any sludge generation. Treated potable water quality is WHO and BIS standard.

### Features

1. No sludge generation, the product is nutrient rich humus
2. No reject for non-potable treated water, 15% reject for drinking water, but the reject is converted into nutrient rich liquid fertiliser.
3. Minimal electricity consumption and works on solar power as well.
4. Low operation and maintenance cost and unskilled labour can operate
5. Smart footprint, civil or modular space according to space availability
6. No odour and noise
7. No chemicals
8. High ROI and shortest stabilization period

### Highlights

1. Reduced Sludge production: Produces no sludge. The treatment by-product on replenishment is converted into rich humus fertiliser
2. Decentralised model: Containerised and compact solution for regions with land scarcity or difficult terrain. Also provides mobile bio-filter STP system to fulfil urgent wastewater treatment. Civil based units are also designed where space is no constraint and where larger communities water needs are fulfilled

### III. ECOSTP Technologies Pvt Ltd

ECOSTP's unique patented technology treats sewage in a decentralised, self-sustainable way in underground chambers without power, chemicals or human intervention. Using Biomimicry, regenerative innovation inspired by nature, the ECOSTP utilises functional principles and strategies of microorganisms and ecosystem found in a cow's stomach. ECOSTP Technology was discussed in the 8th World Water Forum (Brasilia, 2018) and subsequently selected as a Best Practice case study for United Nations SDG Sustainability Asia Pac report.

#### Product

##### a. Cow's Stomach Engineering STP

The technology is a 4-staged process in which cow's stomach bio-mimicry is adopted. Just like how the ruminant stomach in a cow turns grass into milk. We biologized the same method to convert "bad" water to "good" water using exactly the same ruminant stomach process. The 4 stages are primary sedimentation chamber, up flow baffled reactor chamber, attached growth biological filter with high surface area, and plant bio-filter.

#### Features

1. No power required
2. No moving parts
3. No chemicals, odours, noise
4. One unit treats 8 KLD-1 MLD
5. No operation and maintenance cost
6. Less sludge production, byproduct is digestate used as a manure

#### Highlights

1. **Less or no maintenance & reduced sludge production:** The technology works on gravitational infiltration and hence requires no maintenance or operational skill and cost. The sludge produced is so low that it has to be emptied only once in two years.
2. **Promotes usage of local resources:** ECOSTP provides design, consultation and other technical assistance. The STP is constructed with local resources and labour, reducing the construction cost.
3. **Aesthetics:** The land used for underground STP could be landscaped into a garden, playground, etc., in accordance with the client's interest.

## IV. Solinas Integrity Private Limited



Solinas build inline inspection robotic technologies for critical pipeline infrastructure to detect existing defects and also prevent failures, maximising the lifespan of assets. Solinas serve O&G, Petrochemical, Power plants, Water, Sanitation and Process Industries. Solinas won National Bio Entrepreneurship Award 2019 and was also featured in widely respected outlets such as Forbes, LinkedIn, Yourstory, Singapore International Foundation & other media houses.

### Products

#### a. Endobot

Endobot helps water utilities to identify leaks and defects in underground water pipelines and reduce non-revenue water. It helps in preventing undesirable excavations and costly pipeline replacements.

#### b. HomoSEP

Septic tank inspection and cleaning robot to prevent manual scavenging.

### Features

1. Visual inspection
2. Leak detection
3. Corrosion estimation
4. In-pipe cleaning
5. GIS mapping
6. Septic tank inspection and cleaning

### Highlights

1. Reduced Manual intervention: The technology is a tethered robot aimed at inspection, maintenance of water pipelines and cleaning septic tank. It carries multiple sensor payloads for detection of leakages, estimate the corrosion, GIS mapping and sedimentation at an early stage thereby reducing NRW and increasing revenue

# Annexure 3 – Subject Matter Expert Organisations

## I. Consortium for DEWATS Dissemination Society

CDD Society is a non-profit organisation dedicated to innovate, demonstrate and disseminate decentralized nature-based solutions for the conservation, collection, treatment and reuse of water resources and management of sanitation facilities. CDD's works are widely appreciated through-out the country in wastewater treatment, faecal sludge management, waterbody rejuvenation, and solid waste management. It has already installed more than 400 plants in residential, institutional as well as industrial sectors. It is a pioneer in nature based wastewater treatment having implemented in 8 unique designs. CDD is key technical partner in the National Faecal Sludge and Septage Management alliance and various State Governments.

### Services

#### a. Technical solutions

1. Feasibility studies
2. Planning, design and engineering
3. Tendering and implementation support
4. Operation and maintenance support
5. Monitoring and evaluation of the system
6. Post implementation trouble shooting of treatment plants

#### b. Capacity Building

1. Flagship training programmes for DEWATS, FSM, WBR covering Design, Planning, Implementation & O&M Support for WATSAN systems
2. CDD Professionals are sought after as Subject Matter Experts in the WATSAN Ecosystem
3. Customized training programmes to suit the needs of different stakeholders
4. Participatory approach that encourages learning and knowledge sharing
5. World class training materials for practitioners

#### c. Applied Research

1. Research targeted at improving efficiency and upgradation of water and sanitation systems.
2. Continuous monitoring of implemented DEWATS/FSTPs and their performance.

#### d. Knowledge Publications & Dissemination

1. Curating content aimed at informing practitioners about sustainable ways of problem solving.
2. Capturing on ground implementation and innovation experience



## II. The Circular Collective

The circular collective is a knowledge platform aimed at facilitating, activating and enabling discussions for circular economy in India. It emphasizes on the importance of shifting from linear consumption to circular consumption model and thus drawing the maximum potential of all the resources.

### Activities

1. Academic and corporate linkages
2. Case studies
3. Circular cities research
4. Material flow analysis

### Principles of circular economy in water

1. **Regenerate natural capital:** Ensure functional environmental flows and stocks, by reducing the anthropogenic water uses, preserving and enhancing ecosystems, and ensuring minimum disruptions from human interactions and use.
2. **Keep resources in use:** Close the water and water-related materials and energy loops within the system. It can be achieved by optimizing resource yields, optimizing energy and resource extraction, and by maximizing recycling and reuse.
3. **Design out waste externalities:** Focus on both the reduction of waste and the economic efficiency of the system, The costs of reducing waste by one unit is equal to the economic and environmental benefits of having one less unit of waste.

### 4 step approach for circularity of water resource

1. Paradigm shift from 'use and throw' to 'use, treat and reuse'
2. Principles of circular economy
3. Nature based solutions
4. Circular economy model framework for Indian cities

## Annexure 4 – Speakers Contact List

Speaker	Name of the organisation	Address and Contact
Mr. Depinder Kapur Senior Domain Expert and Team Lead (SCBP)	NIUA	1st and 2nd Floor, Core 4B, India Habitat Centre, Lodhi Road, New Delhi, Delhi 110003, Email: dkapur@niua.org
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Mr B Ashwin Kumar Programme Officer (SCBP)	NIUA	1st and 2nd Floor, Core 4B, India Habitat Centre, Lodhi Road, New Delhi, Delhi 110003, Email: bashwin@niua.org
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Mr Balram Yadav Chairman, Nagar Palika Orchha	Orchha Nagar Palika	cmoorcha@mpurban.gov.in
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Mr Divanshu Kumar CEO	Solinas Integrity Pvt Ltd	Solinas Integrity Pvt. Ltd. IITM Incubation Cell, Module 2, D Block, Third Floor Phase II, IIT Madras Research Park, Kanagam Road, Taramani, Chennai - 600113, Tamil Nadu, India. Ph: +91 89395 75963, Email: divanshu@solinas.in
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## About Development Alternatives

*Delivering eco-solutions for people and the planet*

Development Alternatives (DA) is a premier social enterprise with a global presence in the fields of green economic development, social empowerment and environmental management. It is credited with numerous innovations in clean technology and delivery systems that help create sustainable livelihoods in the developing world. DA focuses on empowering communities through strengthening people's institutions and facilitating their access to basic needs; enabling economic opportunities through skill development for green jobs and enterprise creation; and promoting low carbon pathways for development through natural resource management models and clean technology solutions.



## About Heinrich Böll Stiftung

The Heinrich Böll Stiftung is a German foundation and part of the Green movement that has developed worldwide as a response to the traditional politics of socialism, liberalism, and conservatism. We are a green think-tank and an international policy network, our main tenets are ecology and sustainability, democracy and human rights, self-determination and justice. We place particular emphasis on gender democracy, meaning social emancipation and equal rights for women and men. We are also committed to equal rights for cultural and ethnic minorities. Finally, we promote non-violence and proactive peace policies. To achieve our goals, we seek strategic partnerships with others who share our values.

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