



**Potential and Validation  
of Sustainable Natural & Advance Technologies  
for Water & Wastewater Treatment,  
Monitoring and Safe Water Reuse  
in India**

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**Deliverable D7.11**  
**Short report of 1<sup>st</sup> India-EU Practitioners  
Exchange Programme**

Version 1.0

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## 1. Executive Summary

The exchange programme is a task that presents the transference of knowledge between professionals in the water sector. The present report collects the activities carried out from the beginning of the project to December 2022. The exchanges accomplished in the period presented the knowledge and experience exchange between professionals, including technology and manager discussions, technical visits to pilot or demo plants working on wastewater treatment, and technical demonstrations and operations. The situation derived from the pandemic leads to analysing the way to face this practitioner exchange and to reformulate the next event for the near future.

## 2. Introduction and objectives

The deliverable D7.11 is to compile all the activities related to the Exchange of India-EU practitioners in the project so far. The activities indicated in this report were performed to allow the partners to learn how the problems are overcome in other regions to promote potential solutions for their situations. Moreover, this report collected the activities that took place with a summary and details about the work carried out. Finally, due to the worldwide situation derived from the pandemic, the changes done to adapt to the situation to deal with the objectives of the task will be explained.

## 3. Indian-EUR Practitioner Exchange

Three exchanges have been programmed so far in the project. In the first year of the project, two exchanges implied partner's trips during 2019. Recently, one workshop was carried out to complete the practitioner exchange by the moment.

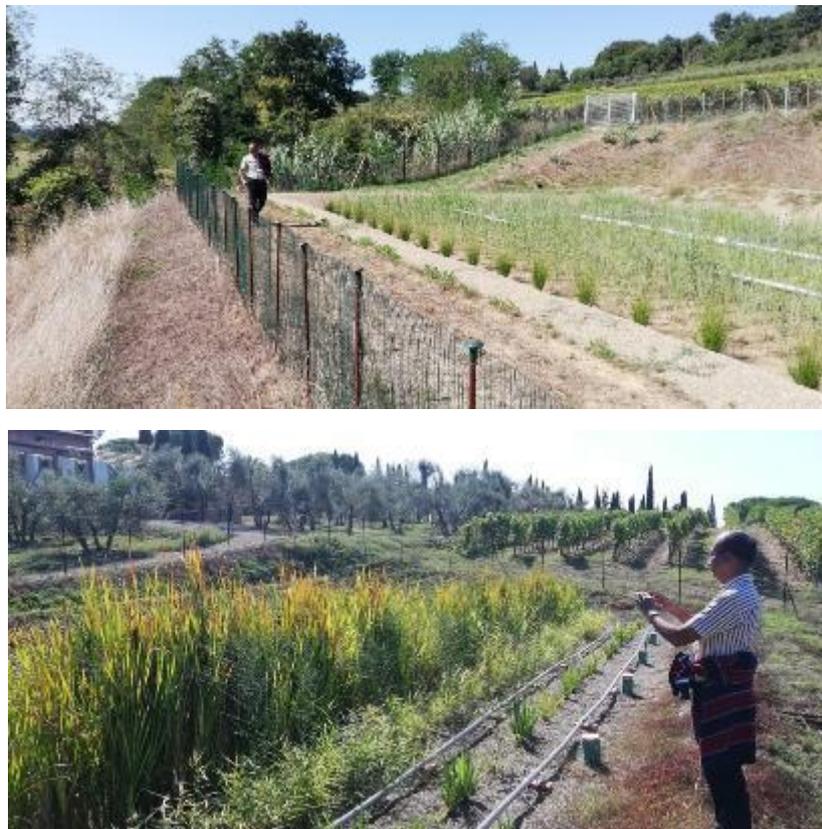
### 3.1. Exchange NEERI - European partners: UPC, IRIDRA, and BIOAZUL (September 2019)

In September 2019, Prof. Dr. Girish Pophali from Indian National Environmental Engineering Research Institute (NEERI) visited different partners in Europe in order to study different constructed wetland full scale. The exchange was organized to know a different way to apply nature-based solutions from 3 different perspectives from the private companies to the university. In all the exchanges, it was organized different meetings to discuss the technology and technical visits to full-scale wastewater treatment plants based on natural solutions were done.

#### Visit IRIDRA

In the visit, Dr. Girish visited the IRIDRA in Florence (Italy). The interest of the Indian partner was to check the working of the constructed wetland working with real water, collecting information relative to their operation and maintenance in a real scenario. IRIDRA is an engineering company that works in the planning and design of sustainable wastewater treatment systems. Professor Girish visited 3 constructed wetlands designed by IRIDRA:

- Villa Cerna (Castellina in Chianti, Siena): A constructed wetland that comprises a French Reed Bed followed by a horizontal flow wetland. This unit is designed to treat wastewater from a winery industry and the size was designed to 1300 PE
- La Solatia (Monteriggioni, Siena): These facilities present a combination of horizontal and vertical constructed wetlands to treat wastewater from a winery equivalent to 280 PE.
- Gretole (Castellina in Chian, Siena): a combination of an anaerobic pond combined with an aerated constructed wetland for treating the winery wastewater equivalent to 800 PE.



*Figure 1: Prof. Girish in the visit to IRIDRA facilities*

### Visit UPC

Dr. Girish visited the UPC partners after the visit to IRIDRA. The idea of this next step of the exchange was to comment with the researcher another perspective about wastewater treatments. In this case, the UPC is a university/research center working on nature-based solutions as a system to face the wastewater challenge. This approach is closer to the NEERI ones and the visit to UPC is useful to observe an analogous way to work.

The UPC researchers who visited Dr. Girish belong to the Group of Environmental Engineering and Microbiology (GEMMA), one of the most important in Europe in the field of natural systems for wastewater and sludge treatment systems working at a real scale in industries different. The main

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objective of this visit was to comment on various aspects of the High rate Algae Pond (HRAP) an innovative technology promoted by the GEMMA group which we will be developing in Indian during the PAVITR project. The visit included several meetings with the personnel responsible for the design and operation of the HRAP and a technical visit to the wastewater treatment plant and water reuse facility in Granollers (Barcelona) for checking the HRAP system working on a real scenario.

### Visit BIOAZUL

The exchange of Prof Girish with European partners was completed with the visit to BIOAZUL. BIOAZUL is a private company that works in wastewater treatment in small communities. It is focused on the development of eco-innovative and sustainable solutions for the treatment and reuse of water resources. In this visit, Prof. Girish focused on going into more detail about the updated SBR systems and the reuse of water in agriculture.

BIOAZUL and Professor Girish commented on different aspects about the upgraded SBR in which BIOAZUL is working, the RichWater system. Afterward, a visit to the project demonstration site at Algarrobo municipality (Málaga) was carried out, including the visit to a center belonging to the Spanish National Research Council (CSIC), the Institute for the Mediterranean and Subtropical Horticulture "La Mayora", in Algarrobo (Málaga), where the RichWater SBR is applied to reuse of water in agriculture. The visit included meetings with workers from La Mayora to learn more about the agronomic results of RichWater SBR.



Figure 2: Photos taken during the visit of Prof. Girish to the BIOAZUL company. Meetings with manager and technician in BIOAZUL and La Mayora and technical revision of RichWater SBR.

### 3.2. Exchange EU partners in Aligarh Muslim University (November 2019)

Into the first meeting project in Aligarh different European partners organised an exchange for visiting the installations of a previous project developed at AMU facilities. This exchange was carried out for checking and discussing the development of a previous EU-India project, thus, PAVITR could have previous experience knowledge about the development of similar projects in order to take advantage of the strong/weak points detected in previous experience.

Thus, in November 2019, a European partner visited the facilities of the SWING project in AMU installation. In the next table is summarized the European partners involved in this technical exchange:

*Table 1: Participants in the Exchange EU partners in Aligarh Muslim University*

<b>PARTICIPANTS</b>	<b>CENTRE</b>	<b>COUNTRY</b>
Mirko Hänel and Andrés Acosta	TTZ	GERMANY
Carlos A. Arias and Dennis Konnerup	AU	DENMARK
Khaja Zillur Rahman	UFZ	GERMANY
María Jesús García Galán and Antonio Ortiz Ruiz	UPC	SPAIN
Günter Langergraber and Sandra Nicolics	BOKU	AUSTRIA
Antonia M. Lorenzo López and Pilar Zapata Aranda	BIOAZUL	SPAIN
Fabio Masi and Riccardo Bresciani,	IRIDRA	ITALY
Philipp Otter,	AUTARCON	GERMANY
Max Odenthal	KRETA	GERMANY
Simon Joncourt	SEECON	SWITZERLAND
Michael Parth	PESSL	AUSTRIA

The technical visit included the discussion of the systems and a visit of the units developed in Aligarh in the framework of the previous project. The visit of the pilot plant included the review and discussion about technologies already implemented (such as SBR and UASB), as well as those potential systems which will be installed in the PAVITR development, which included a High Rate algae Pond, a Short Retention Plantation, and a French Reed Bed.

Moreover, it was discussed potential demonstration capacities and the potential uses of the by-products and treated effluents obtained, as the treated water of SBR employed for irrigation, considering the necessities of the Indian market. In the next photos, it is shown the visit of the partners to the facilities of AMU.



Figure 3: Exchange Europe partners in Indian in Aligarh

### 3.3. International Training Workshop on GIS-based Regional Planning, Water & Wastewater Management in India (July 2021)

During the year 2021, an exchange activity was performed. After the global exceptional situation lived in 2020 derived from the pandemic situation, the practitioners' exchanges concept was to be reformulated to face the situation of restriction and uncertainty which is been living currently. In this sense, it was organized an online exchange of local Indian partners/stakeholders. It was a *GIS-based ALLOWS tool/methodology training workshop* for discussing the use of the geographic information system tools in water management. This online event was organized by the Helmholtz Center for Environmental Research (UFZ – Germany) and the Aligarh Muslim University (AMU- India) and it was arranged for 14<sup>th</sup> and 15<sup>th</sup> of July 2021.

The objective of this exchange was to train the Indian partners/stakeholders to use the newly developed ALLOWS methodology for planning regional water and wastewater management. The idea was to present the potential uses of this tool widely used in Europe, to professionals in the field of water supply and sanitation and responsible for environment and sewage management in India. Moreover, European participants were invited since the interest in a global collaboration will favour the exchange of experience and knowledge in the topic. The workshop was jointly moderated by Dr. Khaja Rahman from the UFZ (Germany) and Prof. Dr. Nadeem Khalil from AMU (India).

Around 40 participants took part in the event as it is shown in Table 3 in Annex. The attenders were university representatives, researchers, consultants, and graduate/post-graduate students from India.

The exchange included different sessions along the two days of the event. The participants could share their experience and discuss the uses of the GIS-based tools from the Data processing, Risk analysis to the economic assessment and the design of networks. On the second day, it was more focused on the Indian perspective about sewage and sanitation management and the potential manners to evaluate this management. A final session where different perspectives were exchanged as the conclusion of the event. The participants gave their feedback about the exchange workshop at the end of the event. In general, they found the workshop especially useful and interesting, especially the way to face the tools in a comprehensive approach for the development and implementation of sustainable sanitation management policies and practices.

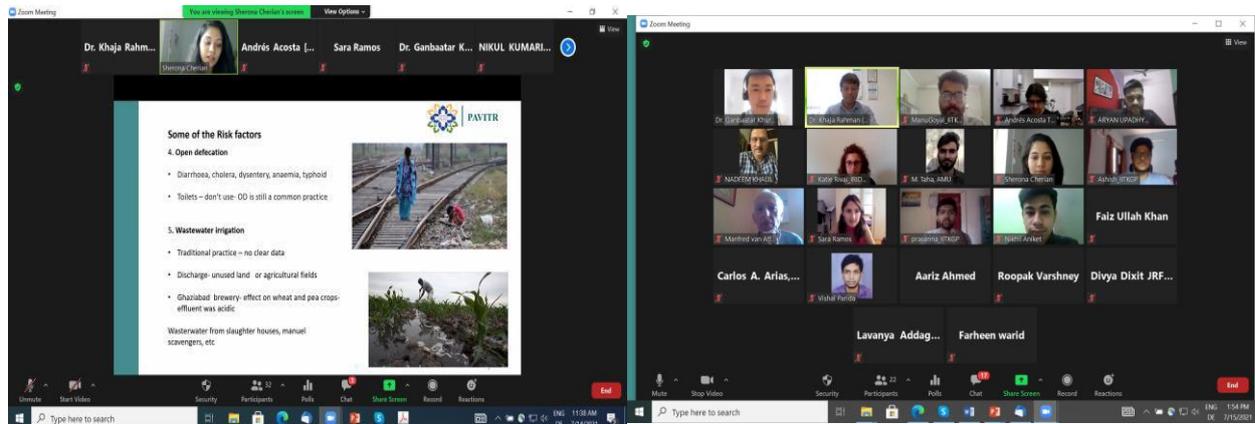


Figure 4: Screenshots of the online workshop exchange.

### 3.4. PAVITR Workshops in international conferences (September 2021)

In the year 2021, it was organized two specific workshops in international congresses with the objective of presenting the project and the technologies to a wide range of audience. The congresses selected were:

- 13th International Conference on Environmental Engineering and Management–ICEEM11, 8-10 September 2021, Muttenz, Switzerland and online via Zoom from 8-10 September 2021. In it was created a special session on PAVITR Project. The PAVITR session took place the 9th September from 16.30 to 17.45 and it was followed by 36 participants (13 online and 13 onsite). In this workshop participated partners from IRIDRA, AIMEN, AU, TTZ, AMU, UPC and BIOAZUL.
- 9th International Symposium on Wetland Pollution Dynamics and Control -WETPOL 2021 venue on-line from 13-17 September 2021. In this congress also was established a parallel PAVITR workshop where the technologies developed in India were showed and discussed. A total of 17 participants took part in this workshop.

More information about this workshops and congress participation could be found in the deliverable D 8.11 already submitted.



Figure 5: Screenshot taken during the PAVITR workshops during the ICEEM (left) and the Wetpol (Right).

### 3.5. Technology training in India by European partners (November – December 2021)

In the last months of the year and taking advantage of the improvement of the global health situation (relative to COVID) and the reduction of the restrictions regarding the international travels, some European partners decided to visit India to check the facilities of the project. In these technical visits, they prepared a trainings workshop to the Indian professionals who are going to work in technologies in order to transfer the knowledge of the start-up, operation and management of each technology to the Indian partners. Thus, UPC and Autarcon were the partners involved in the trainings in Aligarh and Pune, respectively.

#### High Rate Algae Ponds - training by UPC at AMU

The partners from UPC visited the High Rate Algae Pond installation in Aligarh to discuss with works from India various aspects of the technology. In this exchange, UPC members, Enrica Uggeti and Antonio Ortiz Ruiz arranged a training session with the team of Prof Dr. Nadeem Khalil, from AMU, in which it was handled different design aspects, modifications of the unit according to the necessities of the Indian scenario, recommended steps to ensure a solid start-up of the process and the definition of the initial operation of the unit to achieve the higher efficiencies and ensure the correct working in the near future. This training activity took 3 days and was successful for both parties.



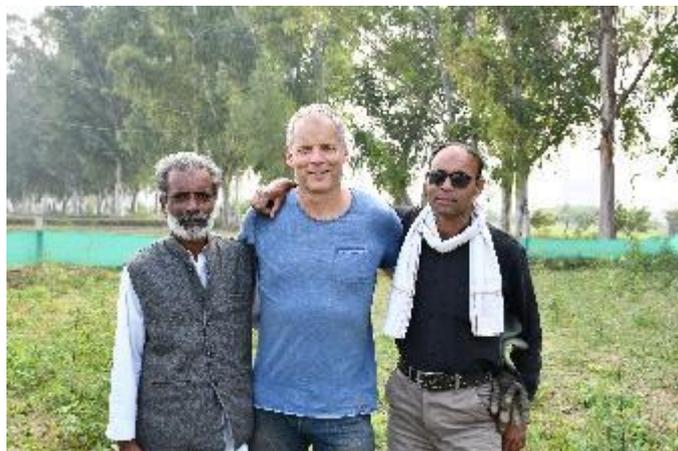
Figure 6: Photos of the training of the HRAP technology performed by UPC in Aligarh

**Sensor Installation and SRP Operation - Training by PESSL, AU, and TTZ, at AMU**

Our colleagues Michael Parth (PESSL), Mirko Hänel (TTZ), and Claudia Rojas (TTZ) trained the AMU personal in the installation of sensors and in the procedures for the SRP system operation.



*Figure 7: Photos of the training for water reclamation and sensors using natural base solutions*



*Figure 8: Photos of the training for Installation and maintenance of SRP System*

### Water Reclamation training by TTZ, UPC, AU, AMU, PESSL

A workshop with English speaking school students was undertaken to raise the awareness of water reclamation. In this exchange, technical partners from TTZ, PESSL, and UPC performed a workshop introducing the importance of wastewater treatment for avoiding health problems and protecting environmental resources. Moreover, it was carried out a training in a real constructed wetland operating with urban wastewater sited in Aligarh, in which the process was explained, as well as the operational requirements and the advantages against intensive treatments. In the next figures is observed the visit performed by the partners.



Figure 9: Photos taken during the workshop and training performed by TTZ, PESSL and UPC to school students from Aligarh (India).

### Electro-chlorination system training by AUTARCON

Autarcon carried out a training activity related to the technology of the Electro-chlorination system for decentralized water disinfection. After the installation and testing of the system implemented in Pune which is going to supply disinfected water to 6000 PE, Philip Otter was the responsible of the training to the SIU team for the operation of the unit. This training was focused on providing knowledge to the SIU team to keep the unit working properly, as well as to establish the most important parameters to monitor, the correct way to collect data and the operational conditions to adjust in the different scenarios of disinfection. The objective of this training was to ensure the SIU team could deal with the system and keep it working under the different expected conditions and also to collect the higher amount of data to calibrate the system and improve it in the upcoming months. In the next figure it could be seen some photos of the training days:



Figure 10: Photos of the training activities to SIU performed by Autarcon in Pune.

## 4. Contingency plan

The global health problem due to the coronavirus pandemic from March 2020 has provoked the necessity to adapt the EU-Indian exchange to keep working on this task and preserve the practitioners' safety. Virtual, hybrid (virtual& in-person) events were combined with the in-person meetings when the situation was less risky and the project required close monitoring. Our EU-India exchanges have been adapted to the global health situation, and the governmental regulations and restrictions in travel, e.g. the international workshop carried out in July 2021 with successful participation and valorisation by the attendees.

Currently, we keep on living uncertain months due to some restrictions periods associated with the evolution of the pandemic in several countries of Europe and India. Therefore, task D7.4 is currently focused on working on adapting the exchange to ensure the knowledge and experience transmission among the participants who take part in each exchange. Thus, the organization of hybrid events combining attendance and online participation will be maintained for these exchanges, ensuring the transfer of knowledge between practitioners and allowing to take part any practitioner independently the situation in his/her region. PAVITR is under the organization of workshops, meetings and conferences in which the approach is to allow the participation of stakeholders remotely and in-person depending on the governmental instructions given to control the pandemic.

## 5. Conclusion

The present report gathers the practitioner's exchanges in the PAVITR project from 2019 to December 2021. The exchanges performed consisted of a series of technical visits with meetings and practical training sessions where the exchange of knowledge and experience of different wastewater technology was carried out. Knowledge and experience about the general issue of the wastewater in India, the use of NBS as water treatment, the management tools for better water sector planning, and the use of disinfection units for providing clean water are some of the topics in which it has been working in the framework of this task. The hybrid exchange model (combination of online and face-to-face practitioners) is our strategy to further advance in the know-how exchange. Our PAVITR experts will travel to India as long as it is safe and the regulations at the time allow it; as an example, our experts travelled to India in November 2021 to follow up the project, undertake training activities, help in the installation of the systems & sensors, and to collect data for the LCA - WP5.

## **6. ANNEX**

- Table 2 Fehler! Verweisquelle konnte nicht gefunden werden. is shown the agenda prepared for BIOAZUL for the exchange of Prof. Girish.
- Table 3 is presented a completed list of attendees to the GIS training workshop.

Table 2: Agenda prepared for the Prof. Girish exchange at BIOAZUL in September 2019

<p><b>Meeting</b>  <b>India-EU Water Projects on Research and Innovation</b>                  Organised by  <b>BIOAZUL S.L.</b>                  Venue: <b>BIOAZUL S.L. office</b>  <b>Avenida Manuel Agustin Heredia, 18, 1<sup>ª</sup>4, 29001 Malaga, Spain</b></p>	
<p><b>Malaga, 23-24 September 2019</b></p>	
Organisation	Attendee
CSIR-NEERI	Prof. Girish R. Pophali
BIOAZUL	Ms. Pilar Zapata Aranda
	Mr. Alejandro Caballero Hernández
	Ms. Antonia M. Lorenzo López

PROGRAMME	
09:30 - 10:00	Session I: PAVITR project review
10:00 - 11:00	Session II: overview of the common work to be performed under WP3: design, adaptation and development of PAVITR technologies (I) <ul style="list-style-type: none"> <li>• Upgrade of a Sequential Batch Reactor (SBR).</li> <li>• Design and implementation of a RichWater – SBR.</li> <li>• Design and implementation of a Moving Bed Biofilm Reactor (MBBR).</li> <li>• Design and implementation of a Submerged Aerobic Fixed Film Reactor (SAFF).</li> </ul>
<b>11:00 - 11:30</b>	<b>Coffee Break</b>
11:30 - 12:30	Session III: overview of the common work to be performed under WP3: design, adaptation and development of PAVITR technologies (II) <ul style="list-style-type: none"> <li>• Upgrade of a Sequential Batch Reactor (SBR).</li> <li>• Design and implementation of a RichWater – SBR.</li> <li>• Design and implementation of a Moving Bed Biofilm Reactor (MBBR).</li> </ul>

	<ul style="list-style-type: none"> <li>Design and implementation of a Submerged Aerobic Fixed Film Reactor (SAFF).</li> </ul>
12:30 - 13:00	Session IV: introduction to the RichWater project.
13:00 - 13:30	Session V: interview recording for dissemination purposes.
<b>13:30 - 15:00</b>	<b>Lunch</b>

**Tuesday, 24 September 2019**

**ATTENDEES**

<b>Organisation</b>	<b>Attendee</b>
CSIR-NEERI	Prof. Girish R. Pophali
BIOAZUL	Ms. Pilar Zapata Aranda
	Mr. Alejandro Caballero Hernández
	Mr. David Frías Gil
IHSM La Mayora	Dr. M. Remedios Romero Aranda

**PROGRAMME**

09:30 - 11:00	Visit to the RichWater project demonstration site at Algarrobo municipality
<b>11:00 - 11:30</b>	<b>Coffee Break</b>
11:30 - 13:00	Visit to IHSM La Mayora to learn about the agronomic results of RichWater project

Table 3: List of the Training Workshop Attendees/Participants (provided voluntarily during the workshop)

NAME OF ATTENDEES	ORGANIZATION / COUNTRY	POSITION / JOB TITLE
Abdul Sami	AMU Aligarh, India	Research Student, M.Tech, Environmental Engineering, AMU
Abhradeep Majumder	IIT, Kharagpur, India	School of Environmental Science and Engineering, IIT, Kharagpur
Addagada Lavanya	CSIR – NEERI, India	Research Associate -1
Afreen Haidery	AMU Aligarh, India	Research Scholar, Dept. of Geology, Aligarh Muslim University
Anurag Yadav	AMU Aligarh, India	Research Scholar, Dept. of Civil Engineering, AMU
Aryan Upadhyay	AMU Aligarh, India	Civil Engineering Dept., AMU
Ashish	IIT Kharagpur, India	
Ashish Srivastava	IIT, Kharagpur, India	Research Scholar, School of Environment Science and Engineering, IIT Kharagpur
Aslam Khan	Aligarh, UP, India	Senior Professional, water and wastewater (consultant)
Carlos A. Arias, Ph.D.	Aarhus University, Denmark	Senior Researcher, Department of Biology, AU
Divya Dixit	CSIR-NEERI, NAGPUR	JRF, NEERI
Divya Dixit	CSIR – NEERI, Nagpur, India	JRF
Divyanshu Sikarwar	School of Environmental Science and Engineering,	M.Tech Student
Dr. Ganbaatar Khurelbaatar	UFZ, Germany	Senior Researcher
Dr. Khaja Rahman	UFZ, Germany	Senior Researcher
Dr. Manfred van Afferden	UFZ, Germany	Leader of the working group “Decentralized Wastewater Management”,
Dr. Pervez Alam	BGSB University, Rajouri, J & K, India	Assistant Professor
Duduku Saidulu	IIT Kharagpur, India	PhD, Environmental Engineering
Fahim Un Nisa	AMU Aligarh, India	Research student, Department of Geology, AMU
Farheen Warid	AMU Aligarh, India	Ph.D Geography
Juan A Alvarez	AIMEN Technology Centre, Spain	Research Strategy Manager

Kathryn Rivai	IRIDRA Srl, Italy	
M.Sc.- Ing. Andrés Acosta	ttz Bremerhaven, Germany	Project Leader of the PAVITR project
Manoj Kumar Yadav	IIT, Kharagpur, India	Research Scholar
Manu Goyal	IIT, Kharagpur (dept. of civil engineering)	M.Tech,
Mohammad Bilal	Politecnico di Milano, Italy	M.Tech ,
Mr. Pranav Sankapal	SIU, Pune, India	JRF
Ms. Radhika Boargaonkar	Ecosan Services Foundation, Pune, India	Project Manager
Ms. Sara Ramos	UFZ and TUD, Germany	M.Sc. in Hydrosiences and Engineering
Ms. Sherona Cherian	UFZ and TUD, Germany	M.Sc. in Hydrosiences and Engineering
Muddassar Taha	AMU Aligarh, India	JRF, Department of Civil Engineering, AMU, Aligarh
Nikhil Aniket	Dr. B.R. Ambedkar National Law University Sonipat, India	Research Intern
Nikul Kumari Sharma	Dr. A.P.J. Abdul Kalam Technical University (APJAKTU)	M.Tech., AKTU
Prasanna Katte, M.Tech.	IIT Kharagpur, India	Water Management
Prof. Dr. Nadeem Khalil	AMU, Aligarh, India	Professor, Dept. of Civil Engineering, AMU Aligarh
Salman Husain	AMU Aligarh, India	M.Tech Student, environmental Engineering
Santiago Gómez Cuervo	AIMEN Technology Centre, Spain	Research & Development
Satya Pallagani	Worked for Rural WatSan Project funded by World Bank, UP, India	Freelance Consultant,
Vishal Kumar Parida	IIT, Kharagpur, India	Research Scholar