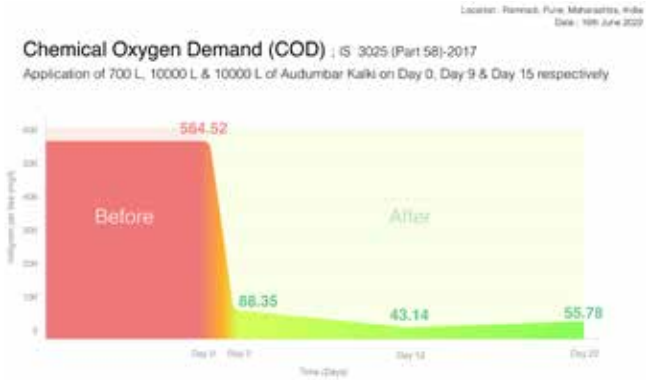
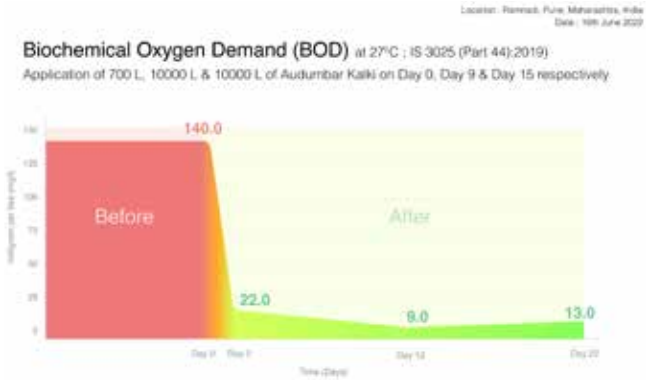
Restoring Ram Nadi Through 'Kalki' Application A Collaborative Pilot Project

Through Improvements in Air, Water and Soil





Principle Sponsor

Persistent Foundation
Let us be the 'Agents of Change'

Supporting Sponsor

Neeraja Foundation

- Kalki Inventor -
Shri Ajitkumar Parab, Vengurla
- Kalki Application -
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Report By

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Executive Summary

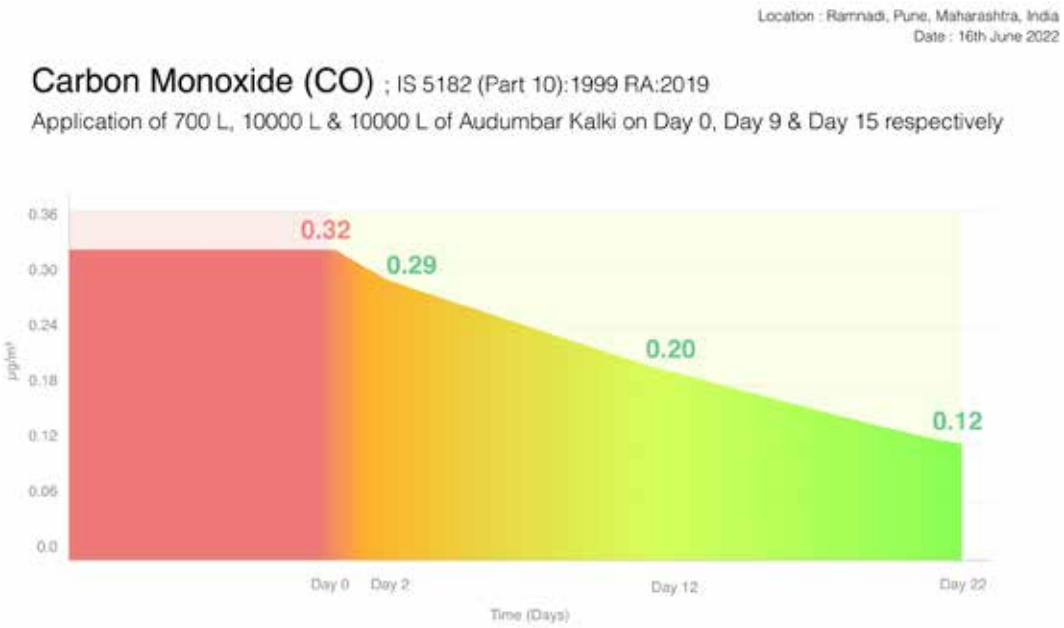
'Kalki' a 100% natural formulation developed over last few years, by Shri Ajitkumar Parab from Vengurla, appeared to be effective in situ treatment of water pollution. The results were quite impressive. It was successfully used for treatment of air, sewage and soil in other places including the Pune office of **Persistent Systems Limited.** Hence, **Persistent Foundation** and we decided to try and apply the same as a **pilot project**, on a small but highly polluted stretch of one of the typical urban rivers, Ramnadi.

Ramnadi is a 20 km long river. It originates from hills near Bhukum. It meets Mula River near Aundh. During summer season, 'S' bend part of the Ramnadi in Bavdhan before it crosses the Mumbai – Bengaluru Highway. This part onwards, the river practically carries only sewage mixed with water discharged from vehicle washing stations. It was found that the flow in this stretch is about 1.6 MLD at dosing point and at sampling point it was 2.5 to 3.0 MLD.

The pilot project was carried out in May 2022, with due permission from **Pune Municipal Corporation**. The 'S' bend part of the Ramnadi in Bavdhan before it crosses the Mumbai – Bengaluru Highway was chosen for this Pilot project. Careful physico-chemical and biological analysis of air, water, sludge and soil samples was done through an independent NABL accredited laboratory. Sludge accumulated at the sampling point, before and after the dosing was also studied. To add better accuracy and validation of quality of data, independent parallel water samples were sent to another laboratory also.

The original inventor **Shri Ajitkumar Parab** did not charge anything for this study. The Applicator too contributed considerably from his end. Major funding came from **Persistent Foundation**, with some part coming from **Neeraja Foundation**. Overall, it was a **collaborative participatory Project, without any commercial interest**.

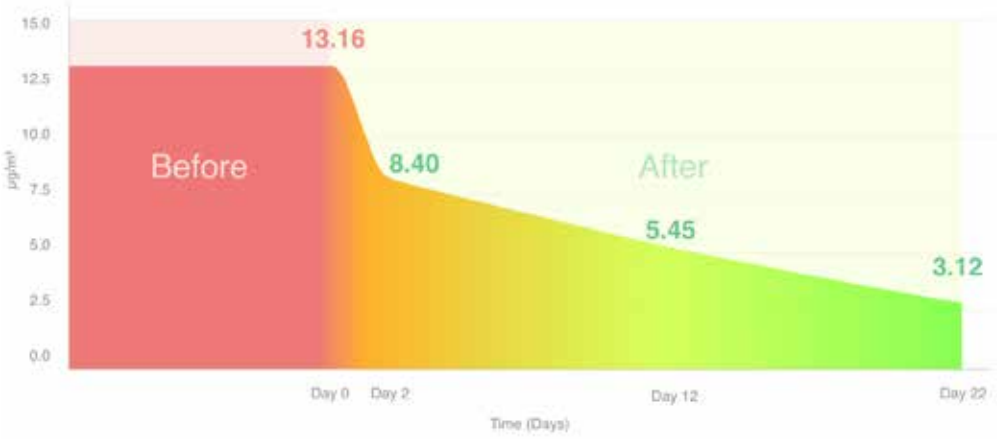
The results of the experiment show that Kalki has been quite effective in treating air, water and soil in the vicinity of the dosing point and downstream also. Percentage reduction/ improvements in the key characteristics are listed below. **Carcinogens in air like Benzene and Benzopyrene** (which are essentially air pollutants) **reduced and remained below detectable limit**.



Location : Ramnadi, Pune, Maharashtra, India
Date : 16th June 2022

Ammonia (NH_3) ; IS 5182 (Part 25):2018

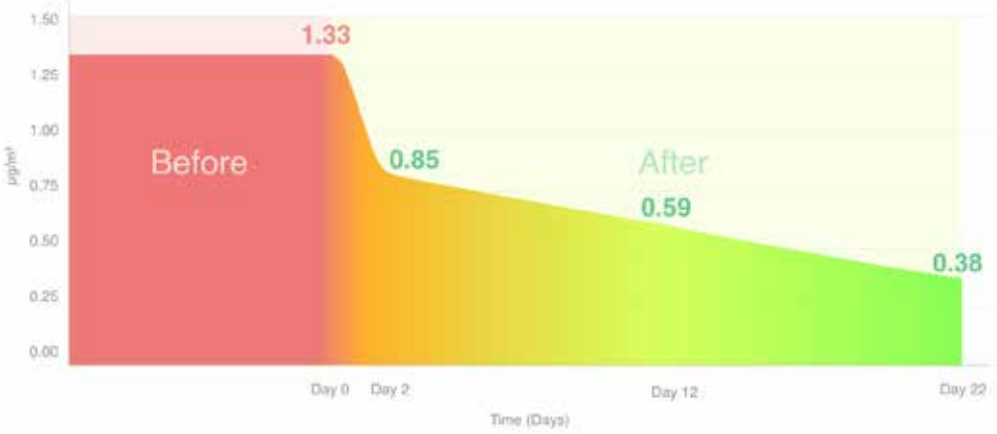
Application of 700 L, 10000 L & 10000 L of Audumbar Kalki on Day 0, Day 9 & Day 15 respectively



Location : Ramnadi, Pune, Maharashtra, India
Date : 16th June 2022

Hydrogen Sulphide (H_2S) ; IS 5182 (Part 7) 2021

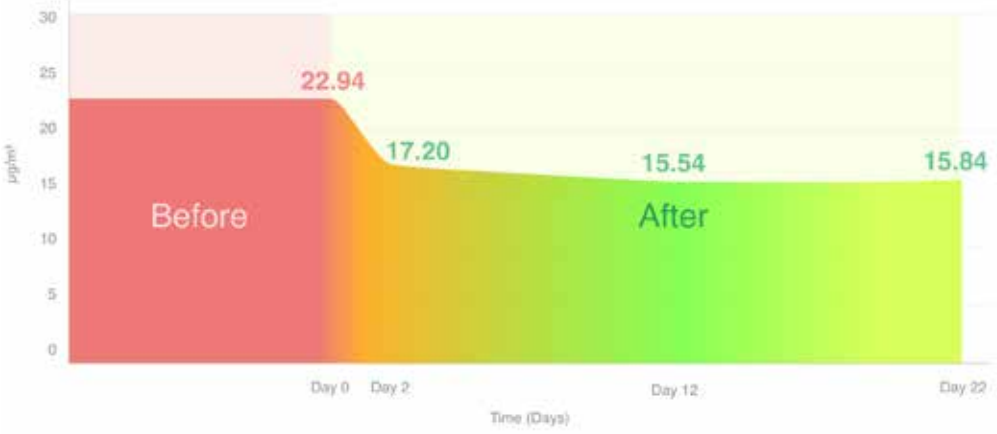
Application of 700 L, 10000 L & 10000 L of Audumbar Kalki on Day 0, Day 9 & Day 15 respectively



Location : Ramnadi, Pune, Maharashtra, India
Date : 16th June 2022

Nitrogen Dioxide (NO_2) ; IS 5182 (Part 6):2006 RA:2017

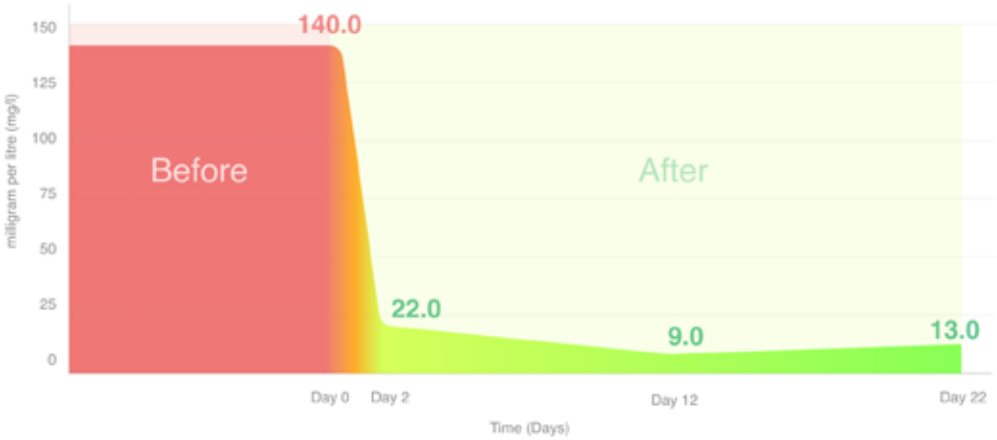
Application of 700 L, 10000 L & 10000 L of Audumbar Kalki on Day 0, Day 9 & Day 15 respectively



Location : Ramnadi, Pune, Maharashtra, India
Date : 16th June 2022

Biochemical Oxygen Demand (BOD) at 27°C ; IS 3025 (Part 44):2019)

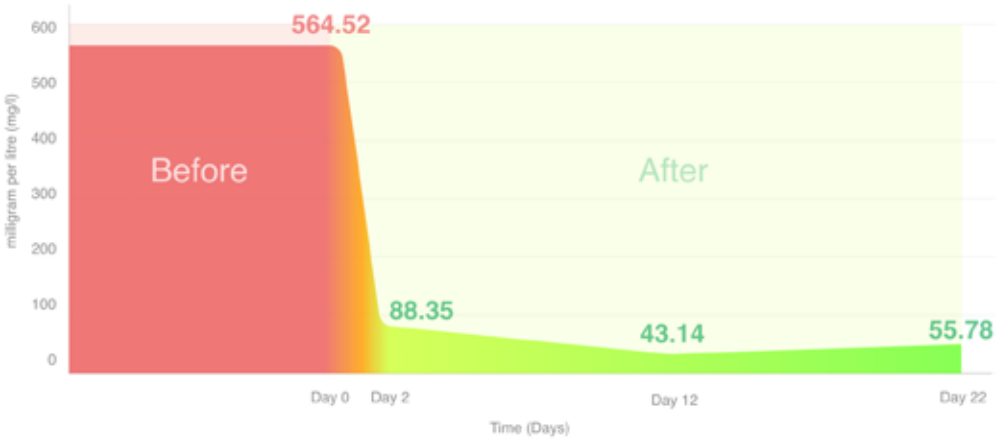
Application of 700 L, 10000 L & 10000 L of Audumbar Kalki on Day 0, Day 9 & Day 15 respectively



Location : Ramnadi, Pune, Maharashtra, India
Date : 16th June 2022

Chemical Oxygen Demand (COD) ; IS 3025 (Part 58)-2017

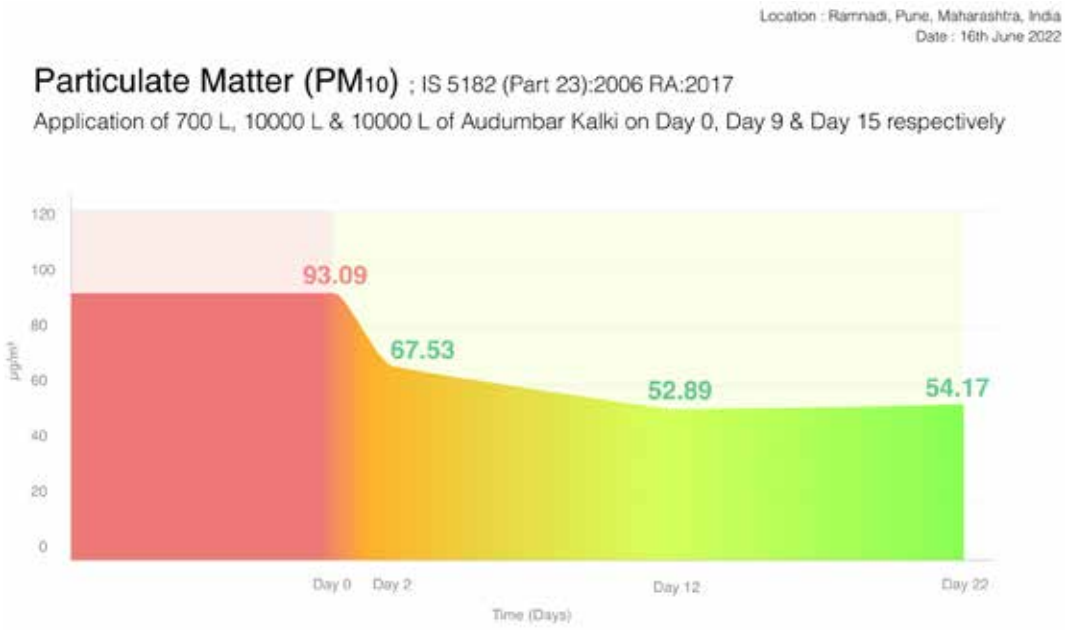
Application of 700 L, 10000 L & 10000 L of Audumbar Kalki on Day 0, Day 9 & Day 15 respectively



Location : Ramnadi, Pune, Maharashtra, India
Date : 16th June 2022

Particulate Matter ($PM_{2.5}$) ; IS 5182 (Part 24):2019

Application of 700 L, 10000 L & 10000 L of Audumbar Kalki on Day 0, Day 9 & Day 15 respectively



The Application of Kalki has resulted in considerable and astonishing positive changes in Air, Water, Soil, and Sludge at the sampling location in Ramnadi.

The result from MITCON sampling on the 2nd June by PMC is also astonishing. It's actually showing 4.9 DO in what otherwise is practically untreated sewage water.

Another striking result is 420,900 kg Organic matter (contributed by reduction in sludge & COD) **reduction and was treated in 20 days' time. Major part of it came from the sediment-sludge liquification.**

As is evident from above, Kalki has not only substantially improved the water quality, but has also reduced air pollution and improved available nutrient contents in the soil. Further it also processed the sludge 396,000 kg of sludge got liquified in just 3 weeks.

It is certain that the formulation has worked and given significant, substantial and sustainable results without any adverse impact.

Encouraged by the above results, we recommend a **full-scale project** to be developed with **use of Kalki** starting **from** the river **origin** (Khatpewadi) & surroundings to the point **where it meets** Mula river **all along its length**, with other physical and biological features so that the River Ramnadi can be restored to pristine condition. **PMC along with ZP Pune** can help in getting like-minded people and organisations together to make this happen. The tentative outline of the future project would include dosing of Kalki, and then sampling, air, water & soil testing, analysis and documentation. All together this will cost about ₹ 45-50 Lacs.

The **overall cost can be reduced further**, if the residential societies around use Kalki in their STPs/ drainage on a regular basis, for which **PMC can issue an advisory** or incentivise it.

We can further take it ahead with **other aspects aiding and complementing** the results of Kalki, like creating removable structures at strategic points for creating pools in river (where Kalki can interact with water, more), plantation of specific species at strategic points for improving efficiency of treatment. This can bring all like-minded people and organisations together in the Mission.

The result will be clean air, truly clean & healthy water and good greenery along the Ramnadi up to Pashan lake and beyond up to the confluence with Mula River. And it will be a Proof of Reproducible River Rejuvenation Project for Every River in the Vicinity. The fall out of the applied Kalki will eventually reach downstream in Mula and treat her, too.

Acknowledgements

We thankfully acknowledge the unique and most important contribution of **Shri Ajitkumar Parab** in conceptualizing and making the formulation (with years of painstaking research almost anonymously & at a huge personal cost of tens of lacs of rupees) that he has named 'Audumbar Kalki' *('Kalki' for general usage)* which he has made available absolutely free of any IPR or other charges.

We also thankfully acknowledge the support and contribution of the following to make this Pilot Project possible and help in preparation of this report :

1. Persistent Foundation, Pune.
2. Persistent Systems Limited, Pune.
3. Neeraja Foundation, Mumbai.
4. Shri Dilip Vede-Patil the Municipal Corporator from Bavdhan, Pune
5. Mr Anand Tatooskar and his team from Sunrise Engitech Pvt Ltd, the applicator of Kalki
6. Mr Siddharth Menon for converting data to graphics
7. People living near the Ramnadi

We specially thank **Pune Municipal Corporation** and its following officers for permitting this pilot project :

1. Dr. Shri. Kunal Khemnar,
   Addl Municipal Commissioner
2. Shri Santosh Tandale,
   Superintending Engineer
   (Sewerage, Maintenance and
   Repair Department)
3. Shri. Mangesh Dighe,
   Environmental Conservation Officer
4. Shri. Kedar Vaze,
   Assistant Municipal Commissioner
   (Kothrud Bavdhan Ward)
5. Shri Ashish Agarwal,
   Coordinator PIU

Index

1 Introduction to 'Kalki'

'Kalki' is a 100% Natural, Biological Formulation invented by erstwhile Shri Ajitkumar Parab based in Vengurla, Maharashtra. It is a progressively improving composition which is being improved by the inventor, practically every month.

It is a product which is pending patent and has potentized extracts of some 3000 plants and microbes like bacteria, algae and yeasts. It is developed in the pristine environment of western coastal town of Vengurla, after years of research and tens of lacs of rupees of own expense by him, completely selflessly.

Before developing this formulation, Mr Ajitkumar Parab had successfully made some of the sewage gutters and public toilets of Vengurla town odour free. This he had achieved by applying 'Jeevamrut' the desi cow dung preparation formulated by Padmashree Shri Subhash Palekar.

However, he found that the same cannot be applied in urban conditions. It does not give the desired results. The reason behind it, according to him is that the urban air, and soil also is polluted alongside the urban sewage. And, unless all the three are purified sufficiently and simultaneously the results would not be as desired.

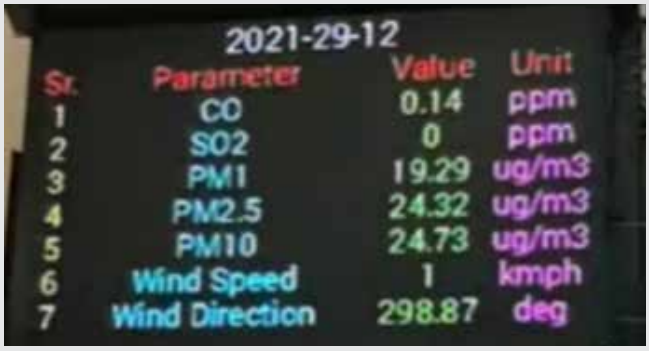
Hence, Mr Ajitkumar Parab contemplated further on the intricacies involved in treating and detoxifying the urban sewage in urban setting. As a result, he could put together a very potent combination of extracts of some 3000 plants and microbes like bacteria, algae and yeasts. This naturally harmonious combination he tried in various places including the main market road of Vengurla. Here he could get a phenomenal success of reducing the air pollution and also removing odour form the surroundings.

Application of Kalki in market area

Google Location 15°51'46.1"N 73°38'05.4"E

Kalki was tested here on the busy public road for the first time and its efficacy was tested on the online air quality monitor placed on the wall of the same office.

Before Application of Kalki on the 29th Dec 2021



Immediately after Application of Kalki on the 29th Dec 2021

A few minutes after Application of Kalki on the 29th Dec 2021
Note that the CO and SO2 have become 0 PPM

These were quite satisfying and dramatic results. The government officials from Vengurla Municipal Corporation expressed their satisfaction on the usefulness of Kalki and endorsed that it improved air quality.

Mr Amit Kumar Sondge
The Chief Officer
Vengurla Municipality

"Total Elimination of Carbon Monoxide and Sulphur Dioxide is a Unique Achievement, to the best of my knowledge this has happened for the first time in Human History."

Mr Sushmit Chavan
Town Coordinator
Swachh Bharat Mission of Vengurla Municipality,

"This application should be done everywhere. Air purification should be our sole mission".

Shri Ajitkumar Kumar Parab could repeat it in the busy market square of Vengurla and garbage depot of Savant Wadi. While experiencing this, he found that as the air got purified, mosquitoes did not feel like staying in that area. The mosquitoes chose to stay away from the area which was thus purified.

He also employed it on the agricultural fields of a few famers and found that Kalki gives good improvement in the upkeep and yield of crops

Mr Jeevan Parab
Agriculture Assistant

"Use of Kalki has saved the farmer one lakh rupees and the orchard is in very fine health and giving bumper yield"

Mr Shashikant Gawade
a Farmer giving testimonial for use of Kalki

"My crops are disease free and yielding much longer than usual"

Farmer Mr Ajay Tandel
also used and gave testimonial for Kalki use in his mango orchard

"My mango crops have become free from troublesome pests like thrips and jassids. My farm has become poison free, my health, my trees' health and yield has improved beyond imagination".

Encouraged by these results he happened to share them with Mr Anand Tatooskar and Commander Jayant Konde, both form Pune. Commander Konde invited him to his residential society Sharmad Residency, Sheela Vihar Colony, Karve Road, Pune; where they had a severe issue of mosquito breeding, particularly in the basement parking which was having storm drains contaminated by the carwash and on top of that some sewage overflow from neighbouring society also was mixing in the storm drain. No wonder the place became a paradise for the Mosquitoes which bred freely and were in such a high density that it was difficult to be in the area without ingesting several of them.

Kalki application proved to be useful in this case too. When Kalki was applied only once in the said storm drains. It improved the accumulated water and air in the area. With improved air, mosquitoes left the place and their breeding in treated water in the drains, stopped. The drivers and attendants too confirmed that they found great relief after application of Kalki. The effect lasted over a month. Later, it needed to be re-dosed. After about three doses the mosquito density remained so low that further dosing was not needed.

Encouraged by these results Commander Konde thought of using Kalki in the STP of Persistent Systems office at Erandawane, Pune. Over there the formulation was used in STP, toilet blocks as well as on the garden soil. The effects of application of Kalki were experientially observed as well as analytically studied through before and after sampling and tests through an NABL accredited laboratory. The results are tabulated below.

Outdoor Air Quality at STP Exhaust - Persistent Systems Ltd, Erandawane, Pune

Sr	Parameter	Unit	Before Kalki* 21st March 22	After Kalki* 4th April 22	% Difference
1	Sulphur Dioxide SO2	µg/m3	48.97	12.4	- 75%
2	Nitrogen Dioxide NOx	µg/m3	25.18	15.4	- 39%
3	Hydrogen Sulphide H2S	µg/m3	8.41	3.28	- 61 %
4	Ammonia NH3	µg/m3	23.13	11.81	- 49%
5	Methane CH4	µg/m3	2.09	1.02	- 51%
6	Carbon Monoxide CO	µg/m3	0.32	0.11	- 65%

Indoor Air Quality in Gents Washroom at Persistent Systems Ltd, Erandawane, Pune

Sr	Parameter	Unit	Before Kalki* 21st March 22	After Kalki* 4th April 22	% Difference
1	Sulphur Dioxide SO2	µg/m3	71.02	11	- 84%
2	Nitrogen Dioxide NO2	µg/m3	48.18	24.94	- 48%
3	Hydrogen Sulphide H2S	µg/m3	7.72	1.98	- 74%
4	Ammonia NH3	µg/m3	33.18	7.97	- 75%
5	Methane CH4	µg/m3	1.11	0.82	- 26%
6	Carbon Monoxide CO	µg/m3	0.18	0.13	- 27%

Garden Soil Analysis of Nutrients at Persistent Systems Ltd, Erandawane, Pune

Sr	Parameter	Unit	Before Kalki* 21st March 22	After Kalki* 14th April 22	% Difference
1	pH	--	8.44	7.93	0.51 Units
2	Nitrogen	mg /kg	0.77	3708.82	481600 %
3	Phosphorous	mg /kg	260.61	1056.79	405%
4	Potassium	mg /kg	1086.38	2074.79	190%
5	Calcium	mg /kg	13499.01	20815.33	154%
6	Magnesium	mg /kg	3100.69	5278.39	170%
7	Zinc	mg /kg	74.53	110.34	135%
8	Manganese	mg /kg	915.16	1020.78	111%

It us to be noted here that changing pH of soil is far more difficult than changing pH of water. Here we saw O.51 units change in pH. Nitrogen showed extremely dramatic rise. Other nutrients too showed remarkable rise.

Gardener Mr Kamble
who who gave testimonial for the use of Kalki in garden STP of Persistent Systems, Pune

Satisfied STP operator.
He experienced the benefits of Kalki in STP of Persistent Systems, Pune

Kalki Production at Persistent Systems Pune.

Commander Konde, the user rep and Mr Tatooskar, the applicator of Kalki in front of the Kalki Production Unit

Similarly, STP performance improvement was observed at of Splendour County (residential Society), Wagholi, Pune.

STP water pre and post kalki application parameters reports at Persistent Systems Ltd, Erandawane, Pune

Sr	Name of Parameter checked	Unit	Sample 1 (before appliying Kalki Bio Culture)	Sample 2 after applying Kalki Bio culture ist does, Date of testing	Remark
1	PH	N.S.	7.9	8	
2	Total Desolved Solid	mg/l	805	865	
3	Total Hardness	mg/l	492	527	
4	Sulphets	mg/l	170	141	
5	Alkalinity	mg/l	315	384	
6	Chlorides	mg/l	210	210	
7	Total Bacterial Count	cfu/ml	>300	>300	
8	Caliform	MPN/100ml	2	2	
9	E Coil	Per/100ml	Absent	Absent	
10	Odour	N.S	Agrreable	Agrreable	
11	Tubidity	NTU	1.4	1.2	
12	Calcium	mg/l	103	109	
13	Magneshium	mg/l	55	59	
14	Chemical Oxygen Demand (COD)	mg/l	35.86	19.92	44% reduction
15	Biological Oxygen Demand (BOD)	mg/l	12	6	50% reduction

Kalki was also tested in an industrial STP in Nasik. And was found useful in improving air and water parameters.

2 Why We Selected to Work on Ramnadi

Encouraged by the results described in Chapter 1, with inspiration and active guidance from Shri Ajitkumar Parab, Commander Jayant Konde of Persistent Systems thought of carrying out a pilot project on a small open part of a river polluted by sewage, in collaboration with Dr Ajit Gokhale of Natural Solutions and Kalki applicator Shri Anand Tatooskar

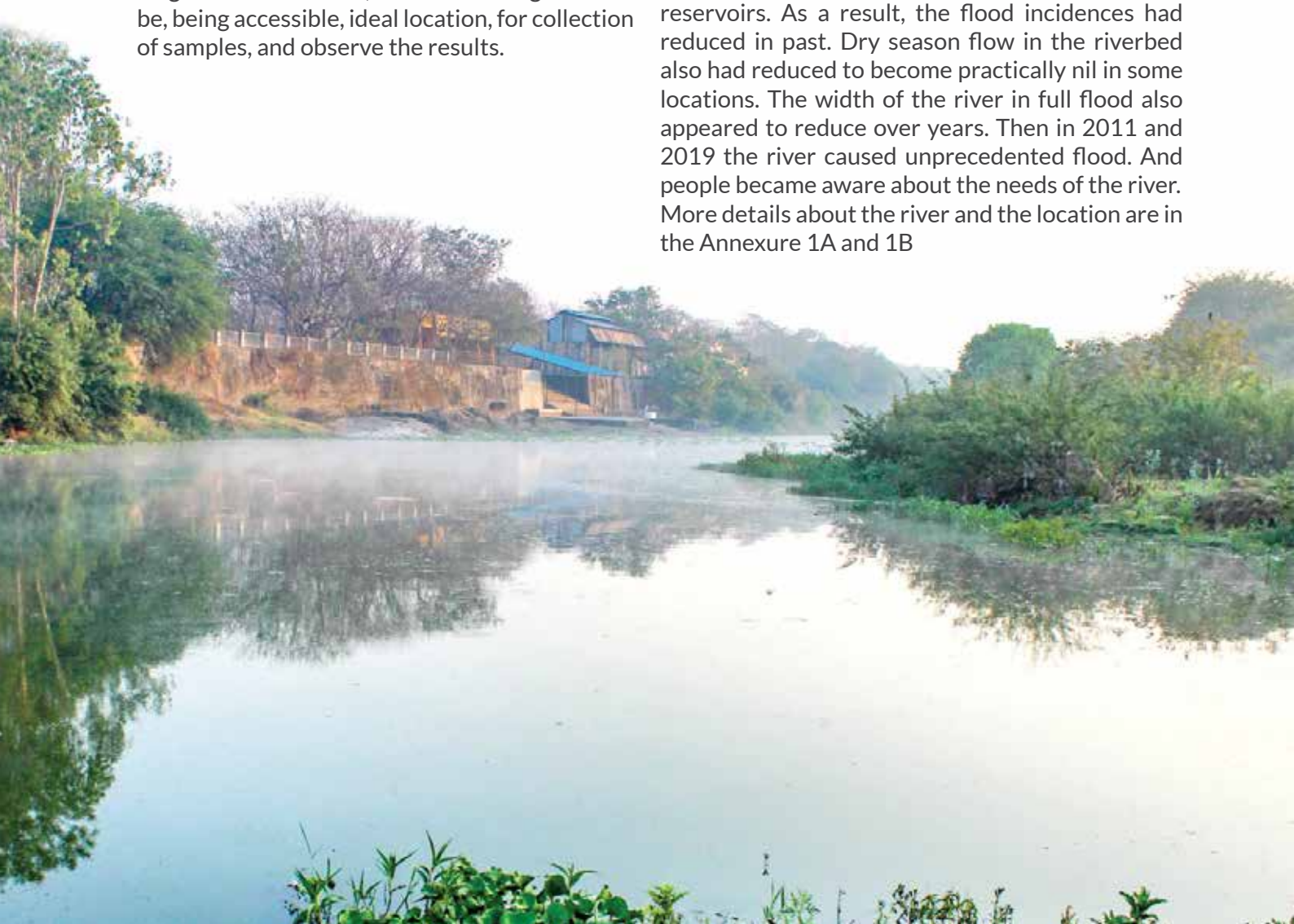
They found Ramnadi as the most suitable and ready candidate for the same, since

- It is a short length rivulet with accessible banks within the PMC limits
- The stretch offers more or less stable flow and composition especially in summer months. Offering conditions like an open laboratory, with as less variations as possible.
- It has only sewage in the summer months.
- The 'S' bend part of the Ramnadi in Bavdhan before it crosses the Mumbai – Bengaluru Highway with a small bund creates some stagnation of the flow, which we thought would be, being accessible, ideal location, for collection of samples, and observe the results.
- This part onwards, the river practically carries only sewage mixed with water discharged from vehicle washing stations. It was found that the flow in this stretch is about 1.6 MLD at dosing point and at sampling point it was 2.5 to 3.0 MLD. Which is a fairly large volume for pilot study.
- The logistics and convenience of testing – especially air testing from a reputed NABL laboratory was best achieved at this location

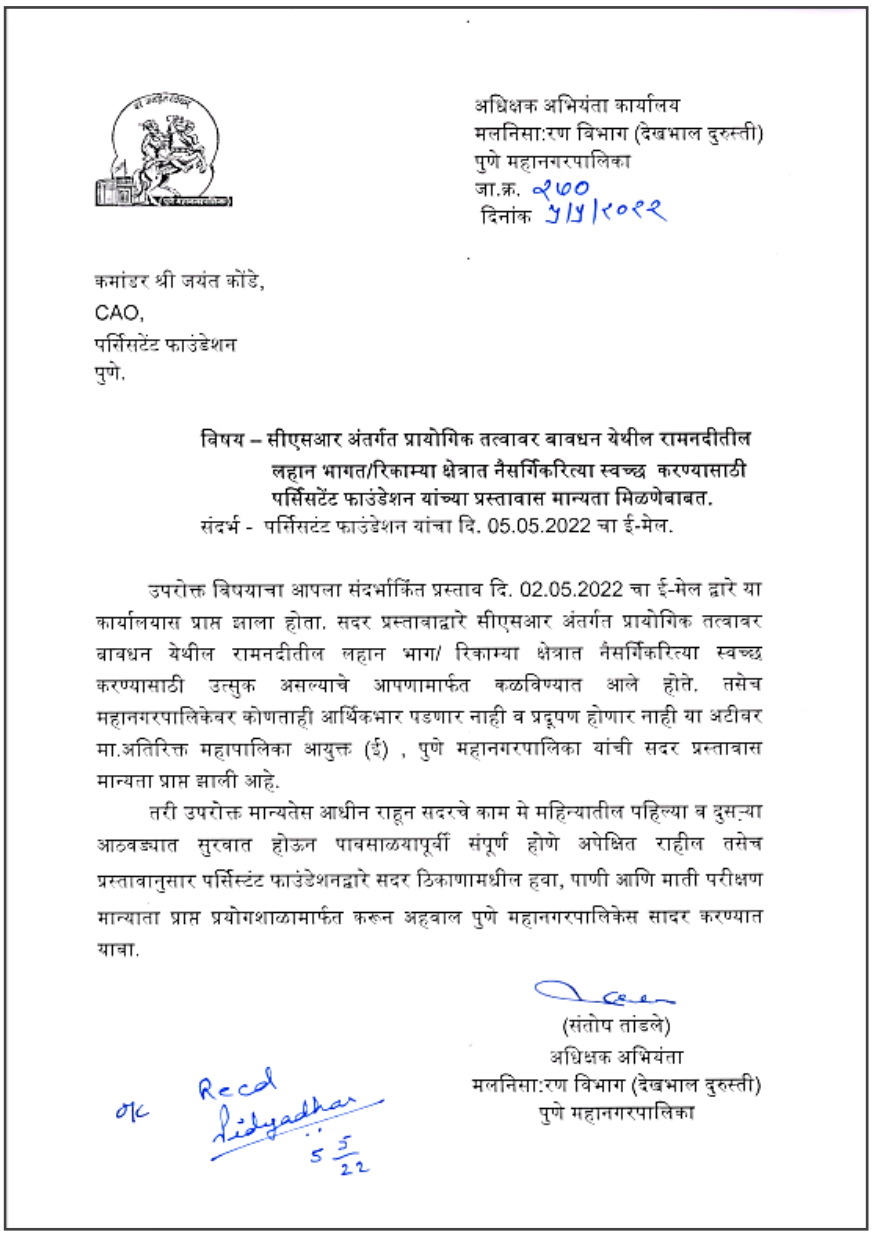
About Ramnadi

Ramnadi is about 20 Km long sweet water flow starting from Khatpewadi and has confluence with Mula River near Aundh. This river now has three fairly large reservoirs on it. The Upper most is a percolation tank at Khatpewadi, next is Manas Lake at Bhugaon and the third is Pashan Lake near Pashan.

A large volume of water is getting trapped in these reservoirs. As a result, the flood incidences had reduced in past. Dry season flow in the riverbed also had reduced to become practically nil in some locations. The width of the river in full flood also appeared to reduce over years. Then in 2011 and 2019 the river caused unprecedented flood. And people became aware about the needs of the river. More details about the river and the location are in the Annexure 1A and 1B



3 Preparations for the Pilot Project



अधिक्षक अभियंता कार्यालय
मलनिसा:रण विभाग (देखभाल दुरुस्ती)
पुणे महानगरपालिका
जा.क्र. २१००
दिनांक ५/५/२०२२

कमांडर श्री जयंत कोंडे,
CAO,
पर्सिसटेंट फाउंडेशन
पुणे.

विषय – सीएसआर अंतर्गत प्रायोगिक तत्वावर बावधन येथील रामनदीतील लहान भागत/रिकाम्या क्षेत्रात नैसर्गिकरित्या स्वच्छ करण्यासाठी पर्सिसटेंट फाउंडेशन यांच्या प्रस्तावास मान्यता मिळणेबाबत.
संदर्भ - पर्सिसटेंट फाउंडेशन यांचा दि. 05.05.2022 चा ई-मेल.

उपरोक्त विषयाचा आपला संदर्भाकित प्रस्ताव दि. 02.05.2022 चा ई-मेल द्वारे या कार्यालयास प्राप्त झाला होता. सदर प्रस्तावाद्वारे सीएसआर अंतर्गत प्रायोगिक तत्वावर बावधन येथील रामनदीतील लहान भाग/ रिकाम्या क्षेत्रात नैसर्गिकरित्या स्वच्छ करण्यासाठी उत्सुक असल्याचे आपणामार्फत कळविण्यात आले होते. तसेच महानगरपालिकेवर कोणताही आर्थिकभार पडणार नाही व प्रदूषण होणार नाही या अटीवर मा.अतिरिक्त महापालिका आयुक्त (ई) , पुणे महानगरपालिका यांची सदर प्रस्तावास मान्यता प्राप्त झाली आहे.

तरी उपरोक्त मान्यतेस आधीन राहून सदरचे काम मे महिन्यातील पहिल्या व दुसऱ्या आठवड्यात सुरवात होऊन पावसाळ्यापूर्वी संपूर्ण होणे अपेक्षित राहील तसेच प्रस्तावानुसार पर्सिस्टंट फाउंडेशनद्वारे सदर ठिकाणामधील हवा, पाणी आणि माती परीक्षण मान्यताप्राप्त प्रयोगशाळामार्फत करून अहवाल पुणे महानगरपालिकेस सादर करण्यात यावा.

(संतोष तांडले)
अधिक्षक अभियंता
मलनिसा:रण विभाग (देखभाल दुरुस्ती)
पुणे महानगरपालिका

Recd Vidyadhar 5/5/22

PMC Permission

On a special request from Persistent Systems Ltd. supported by test results of Kalki application in their Erandawane premises, Pune municipal Corporation graciously granted a permission to carry out the pilot study. Their letter of approval is given beside;

After this a lot of efforts were taken by the applicators and staff of Persistent, as volunteers, for preparing, arranging Funds, transport, sampling, testing/lab analysis and dosing adequate quantity of Kalki in Ramnadi along with Dr Ajit Gokhale of Natural Solutions. Here it is important to mention special and rigorous efforts out in by Shri Sanjay Chaudhary DGM, Vidyadhar Purandare Sr Manager and Sagar Gavade of Persistent Systems for site coordination, logistics and testing arrangements/ logistics which were quite challenging.

4 Execution of the Pilot Project

'Kalki' Bioculture was dosed three times on this stretch and the quantity of each dose were as follows;

Sr	Location and Latitude Longitude	Date	Kalki Quantity
1	From the Windmill Complex Bridge 18°30'21.4"N 73°45'51.6"E	18th May 2022	2000 Litres
2	Open Rocky banks Opposite Ryan Highschool 18°30'35.1"N 73°46'00.2"E	18th May 2022 24th May 2022	8000 Litres 8000 Litres
3	Ghat Near Nissan Showroom 18°30'46.6"N 73°46'10.3"E	9th May 2022 24th May 2022	700 Litres 2000 Litres

Dosing Points are shown in the image.

Seen here are dosing points of 9th 18th and 24th May

Locations of sampling points and the analyses carried out are given below

Sampling Points are shown on the Google earth images above.

Application Site Photographs

1	Sampling point 1 18°30’46.6”N 73°46’10.8”E	9th May – Before 11th May After 1st 21st May After 2nd 31st May After 3rd	Air water Soil Sediment Air water Soil Sediment Water Air water Soil Sediment
2	Sampling Point 2 18°30’47.8”N 73°46’13.4”E	9th May – Before 11th May After 1st 31st May After 3rd	Water
3	Sampling Point 3 18°30’47.8”N 73°46’13.4”E	9th May – Before 11th May After 1st 21st May After 2nd	Air water Soil Sediment Air water Soil Sediment Air water Soil Sediment
4	Sampling Point 3’ 18°30’47.8”N 73°46’13.4”E	31st May After 2nd	Water

Given on the next pages is short photo documentation of the dosing and sampling process.

Site Selection for Dosing on Ghat Near Nissan Showroom

Actual Dosing of 700 Litres of Kalki manually on the 9th May 2022+ Mr. Ajitkumar Parab seen in yellow shirt

After Sampling of Air, Water, Soil and Sediments On the 11th May 2022. From Left Tushar, Ganesh and Ms Prajakta of Umwelt Laboratory. Innovator of Kalki Shri Ajitkumar Parab, Mr Sagar Gavade of Persistent Systems and Mr Anand Tatooskar the applicator of Kalki

River After Sampling On the 11th May 2022

Umwelt Laboratories Staff Ganesh and Tushar doing Sampling of Air On the 9th May 2022 (Before Kalki Application)

Measuring Sediment Depth Sampling On the 9th May 2022 (Before Kalki Application)

Video Documentation of the Dosing Process. Commander Konde explaining background of the project 18th May 2022. Vehicles used and Tanks in which Kalki was brought in are seen in the background.

Dosing of 8000 Litres of Kalki manually on the 18th May 2022

Difficulty in Reaching Sampling Site

Water Sampling Mr Ganesh Choudhari of Umwelt Lab sampling the water

Distinct Visual Difference in Water Clarity … Upstream of dosing and at Sampling Point

Happy face of Mr Akash Mohite on smelling the River Water on the 31st May 22

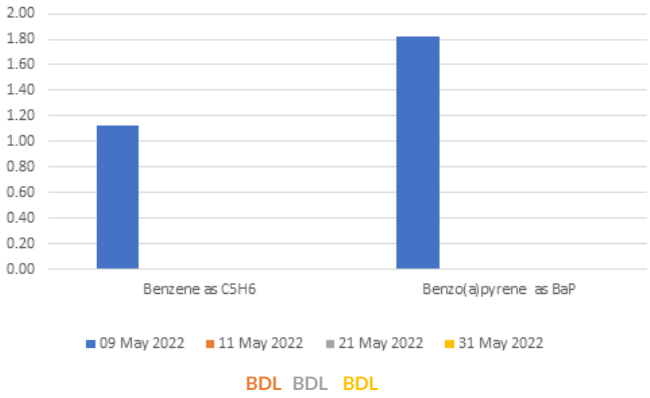
5 Analysis of Laboratory Reports

Following are the graphical representations of the findings for ease of understanding. Lab Test Reports are placed at Appendix 1.

5.1 Ambient Air Analysis

Most important and welcome change in Air Quality was in Benzene and Benzopyrene. Immediately after the first dosing its levels went down and have remained down to below detectable limit (BDL).

Benzene and Benzopyrene

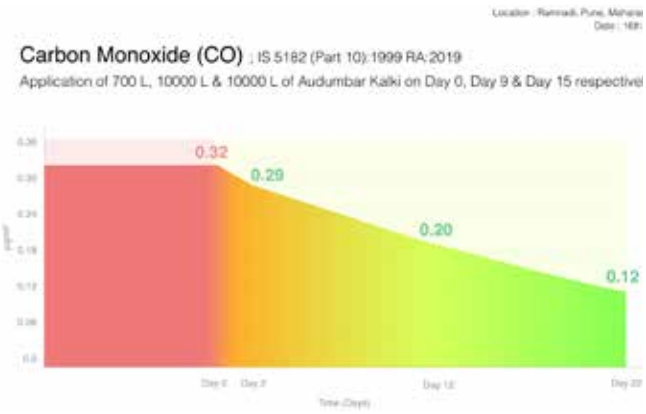


Benzene A chemical that is used widely by the chemical industry, and is also found in tobacco smoke, vehicle emissions, and gasoline fumes. Exposure to benzene may increase the risk of developing Leukaemia (i.e. Blood Cancer).
For more information
https://www.cancer.gov/about-cancer/causes-prevention/risk/substances/benzene

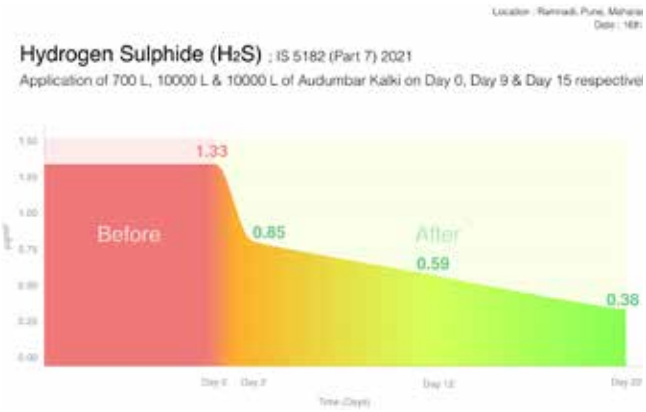
Benzopyrene A chemical that comes from certain substances when they are not burned completely. It is found in car exhaust, smoke from wood fires, tobacco, oil and gas products, charred or grilled foods, and other sources. It may also be found in water and soil. Benzo(a)pyrene can cause a skin rash, a burning feeling, skin colour changes, warts, and bronchitis. It may also cause cancer. It is a type of polycyclic aromatic hydrocarbon. Also called 3,4-benzpyrene.

Benzopyrene is listed as a Group 1 carcinogen by the IARC (International Agency for Research on Cancer). In the 18th century a scrotal cancer of chimney sweepers, the chimney sweeps' carcinoma, was already known to be connected to soot.

Both are air pollutants coming from vehicle emissions. Their reduction to Below Detectable level (BDL) is a very significant, important and surprising outcome when Kalki has been applied in water. What is more remarkable here is that both pollutants remained BDL to sustain through the three testing over 3 weeks. This Kalki acting to reduce / eliminate air pollution is well demonstrated here



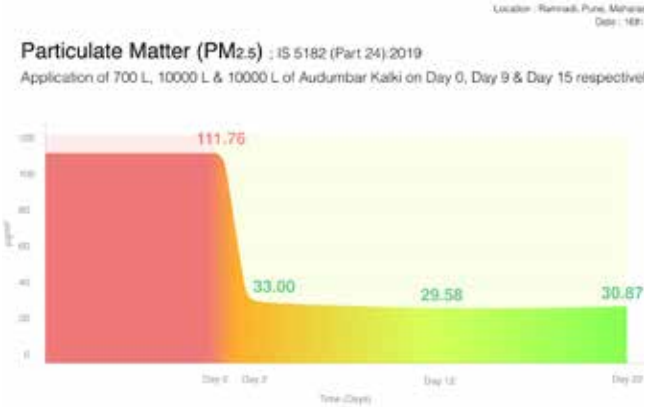
Carbon Monoxide CO Breathing air with a high concentration of CO reduces the amount of oxygen that can be transported in the blood stream to critical organs like the heart and brain. At very high levels, which are possible indoors or in other enclosed environments, CO can cause dizziness, confusion, unconsciousness, and death.



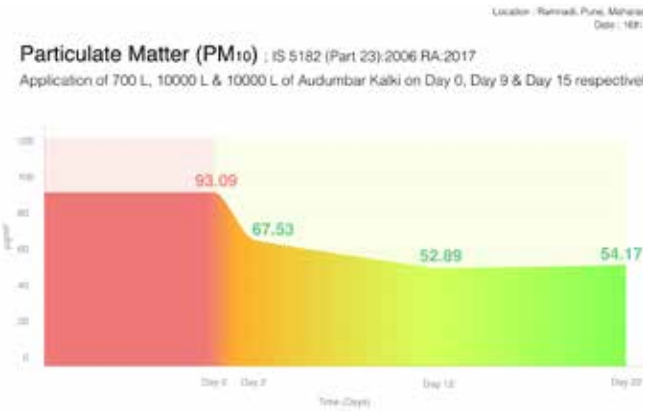
Hydrogen Sulphide H2S The health effects of H2S increase sharply with dose, ranging from a rotten egg smell (0.13–0.15 ppm), to respiratory, eye, and throat irritation (100 ppm), to olfactory nerve paralysis (150 ppm), and coma (1000 ppm). Exposure to high concentrations can be extremely hazardous and lead to immediate collapse or death.

Ammonia NH3 Exposure to high concentrations of ammonia in air causes immediate burning of the eyes, nose, throat and respiratory tract and can result in blindness, lung damage or death. Inhalation of lower concentrations can cause coughing, and nose and throat irritation.

Nitrogen Dioxide NO2: Elevated levels of nitrogen dioxide can cause damage to the human respiratory tract and increase a person's vulnerability to, and the severity of, respiratory infections and asthma. Long-term exposure to high levels of nitrogen dioxide can cause chronic lung disease.

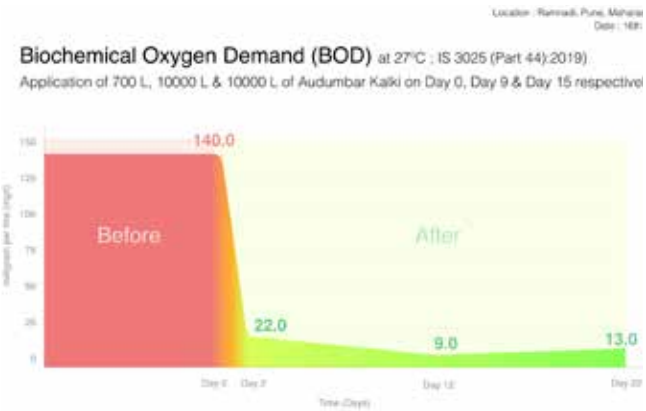


Particulate Matter PM 2.5: Particles in the PM2.5 size range are able to travel deeply into the respiratory tract, reaching the lungs. Exposure to fine particles can cause short-term health effects such as eye, nose, throat and lung irritation, coughing, sneezing, runny nose and shortness of breath. A prolonged exposure to PM2. 5 can cause permanent respiratory problems such as asthma, chronic bronchitis and heart disease. While PM2. 5 impacts everyone, people with breathing and heart problems, children and the elderly are most sensitive to it.

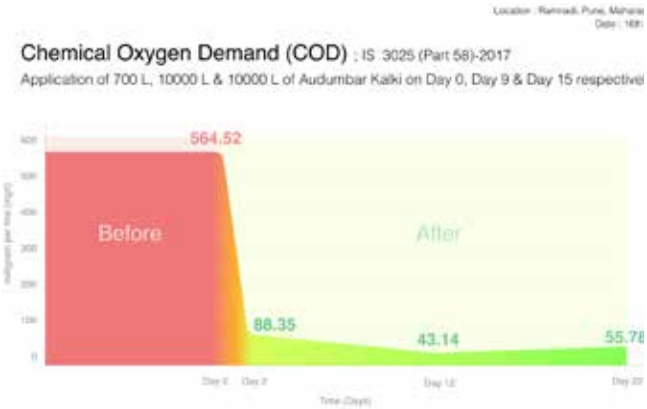


Particulate Matter PM10 : The abbreviation PM stands for particulate matter, and the number to the right indicates the particle size. So, PM10 refers to small particles of solid or liquid with an aerodynamic diameter smaller than 10 µm Exposure to high concentrations of PM10 can result in a number of health impacts ranging from coughing and wheezing to asthma attacks and bronchitis to high blood pressure, heart attack, strokes and premature death.

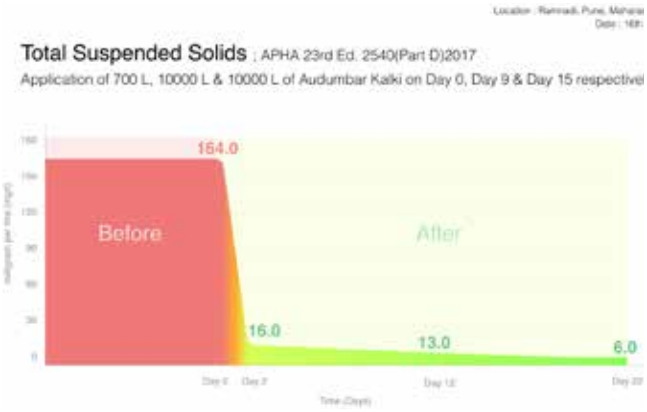
5.2 Water Analysis



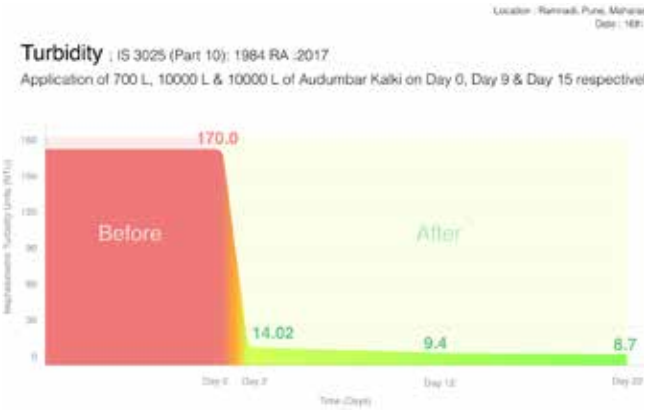
Biochemical Oxygen Demand: In any water stream the greater the BOD, the more rapidly oxygen is depleted in the stream. This means less oxygen is available to higher forms of aquatic life. The consequences of high BOD are the same as those for low dissolved oxygen: aquatic organisms become stressed, suffocate, and die.



Chemical Oxygen Demand (COD): In wastewater treatment, this is an important measurement for the amount of oxygen that is required to break down pollutants (organic substances) in water. the greater the COD, the more rapidly oxygen is depleted in the stream.



Suspended Solids: High total suspended solids in drinking water or wastewater can have both environmental effects and effects on human health. When it comes to water quality, high TSS may decrease water's natural dissolved oxygen levels and increase water temperature. Suspended solids can clog fish gills, either killing them or reducing their growth rate. They also reduce light penetration. This reduces the ability of algae to produce food and oxygen.



Turbidity: affects the growth rate of algae (micro-aquatic plants) and other aquatic plants in streams and lakes because increased turbidity causes a decrease in the amount of light for photosynthesis. Turbidity can also increase water temperature because suspended particles absorb more heat. Turbidity and dissolved oxygen are inversely related. The more turbidity, the less dissolved oxygen there is for living organisms to breath, negatively affecting animal population.

5.3 Organic Matter Reduction from water

BOD COD levels indicate the organic matter in water. Before the Kalki application these values were 140 and 560 mg/lit respectively. From the 11th May to 31st May the BOD and COD values were 15 and 62 respectively.

These values can be converted into total quantity of BOD and COD matter processed.

Considering 2.5 MLD flow at the sampling point,

For BOD

Total BOD Matter = (Initial BOD – Final BOD) x volume per day x no of days
Total BOD Matter = (140-15) * 2.5* 20 = 6,250 kg over the period of 20 days.

For COD

Total COD Matter = (Initial COD – Final COD) x volume per day x no of days
Total COD Matter = (560-62) * 2.5* 20 = 24,900 kg over the period of 20 days

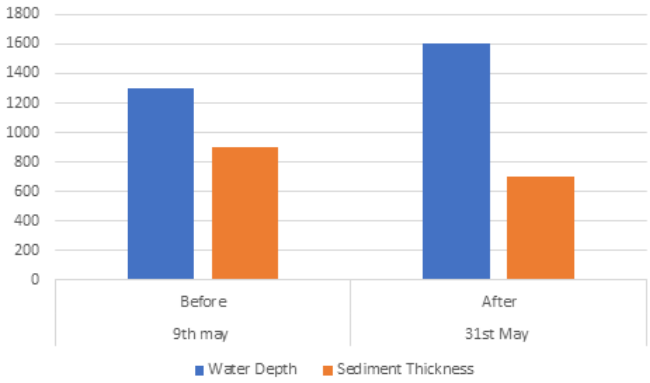
(Note : BOD is a subset of COD)

Organic matter reduction from water, 24,900 kg in 20 days time. ….. (A)

5.4 Sludge Analysis

Sludge was accumulated behind the check dam. The level of the sludge below water was measured. Before the dosing it was found that the water level above the sediments was 1300 mm when the stick was inserted with force it went inside to 2200 mm mark. That means the Sludge was about 900 mm deep.

Water Depth and Sediment Depth at Sampling Point Before and After



When the after test was carried out, at the same spot … the water level above the Sludge was 1600 mm when the stick was inserted with force it went inside to 2300 mm mark. That means the Sludge was about 700 mm deep.

Besides the change in Sludge thickness from 900 mm to 700 mm which is a 200 mm level reduction one more significant difference is the increase in water depth from 1300 mm to 1600 mm.

Increase in water depth is due to decrease in sludge depth and also further softening of the sludge could be seen. Thus 396,000 kg of sludge was found to have liquified/got naturally processed…..(B)
(detailed calculations are given in the Annexure 4)

Total Organic matter reduction from water is therefore,

(A) + (B) = 396,000 + 24,900 = 420,900 kg Organic matter which was treated in 20 days' time.

5.4 Microbes present in the sediments

In order to study the effect of Kalki on the microbial diversity, the sediments were analysed for microbial types also. Following are the findings.

Parameters Description	Before Use of Kalki	After Use of Kalki (700 L)	After Use of Kalki (10,000 L)	After Use of Kalki (10,000 L)
	09 May 2022	11 May 2022	21 May 2022	31 May 2022
Microscopic Bacterial Examination	Non-Motile Gram-Positive Cocci	Motile Gram-Positive short rods	Gram positive Cocci	Non-Motile Gram-Positive Cocci

Before application of Kalki they were Non-Motile Cocci. After the first dose they were Motile Rods. More detailed study can be done in the course of time to correlate this to the treatment that has been seen as the effect of Kalki Application.

5.5 River Bank –Sludge

Showed striking difference between 11th May and 31st may samples

Parameters Description		After Use of Kalki	After Use of Kalki	Remark
		11 May 2022	31 May 2022	
Colour	-	Black Colour	Black Colour	
Odour	-	Disagreeable	Disagreeable	
Appearance	-	Blackish semi solid sludge	Blackish semi solid sludge	
Specific Gravity	-	2.10	1.48	30% lighter material
Density	g/cc	1.83	1.42	23% less dense
Settle-Ability	-	Present	Present	
Organic Matter	%	1.60	1.81	13% richer in organic matter

These results too indicate good effect of Kalki on the sediments/sludge. And there is need for deeper study to understand the phenomenon.

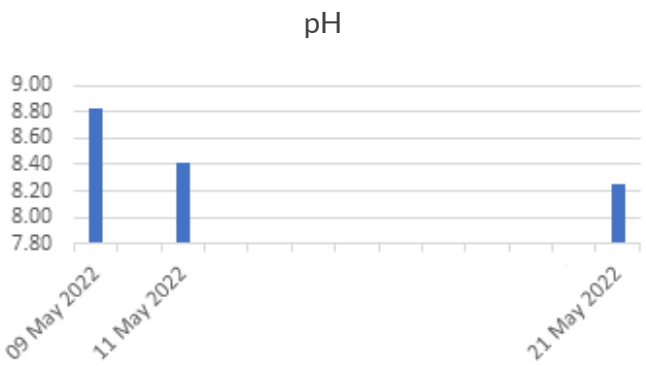
Microbiological Parameters		11 May 2022	31 May 2022	Remark
Microscopic Bacterial Examination	-	Motile Gram-Positive short rods	Motile Gram Positive short Coci	
Total plate count	cfu/g	4.5 x 106	5.9 x 106	30% increase in biomass
Aerobic Count	cfu/g	4.0 x 106	5.3 x 106	30% increase in biomass
Anaerobic Counts	per g	Present	Present	

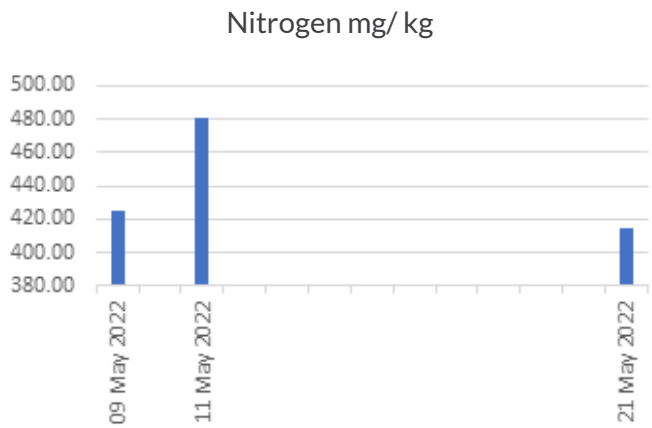
This too indicates improved condition of the water from treatment point of view.

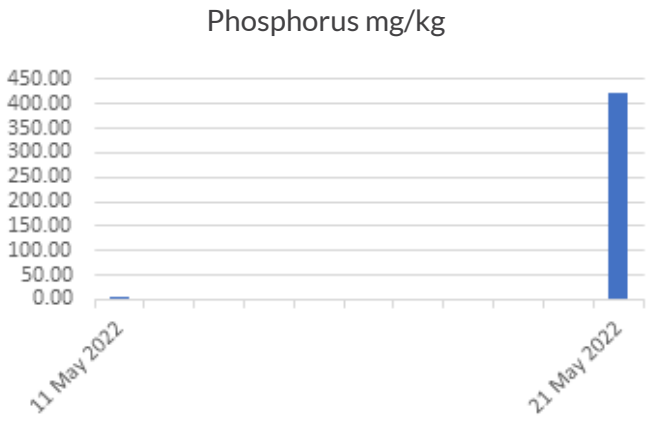
5.6 River Soil Analysis

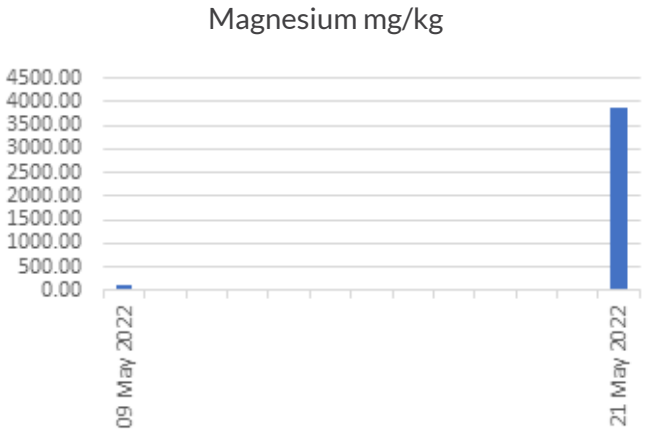
River soil was also sampled for various contents the results are given below.
(Just before the samples were taken on the 31st, May 22 a Poclain Excavator had 'cleaned' the area, hence we have not included the parameters of this date, being inconsistent and not relevant)

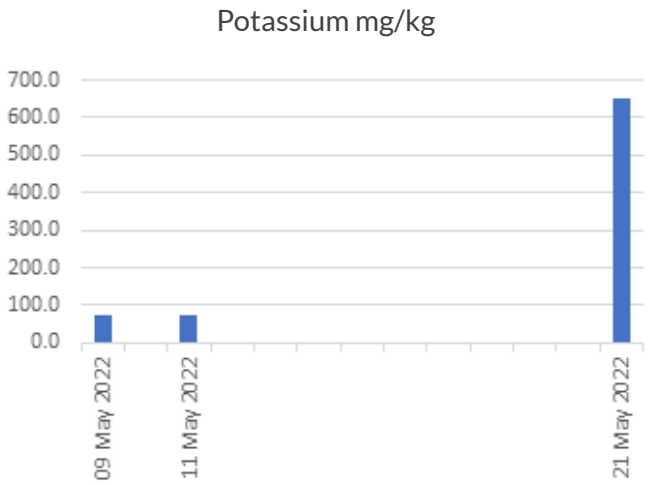
River Soil Test	Before Use of Kalki	After Use of Kalki (700 L)	After Use of Kalki (10,000 L)	Remark
	09 May 2022	11 May 2022	21 May 2022	
pH	8.83	8.42	8.26	Progress towards Neutral pH
Nitrogen	425.32	481.06	415.2	
Phosphorus	1.50	1.60	423.15	282 times rise
Potassium	72.1	74.13	653.24	9 times rise
Calcium	124.33	87.39	39236.11	316 times rise
Magnesium	100.71	50.52	3877.31	38 times rise
Zinc	BDL	BDL	47.69	Remarkable achievement. These nutrients were absent before and appeared after application of Kalki
Manganese	BDL	BDL	368.06	

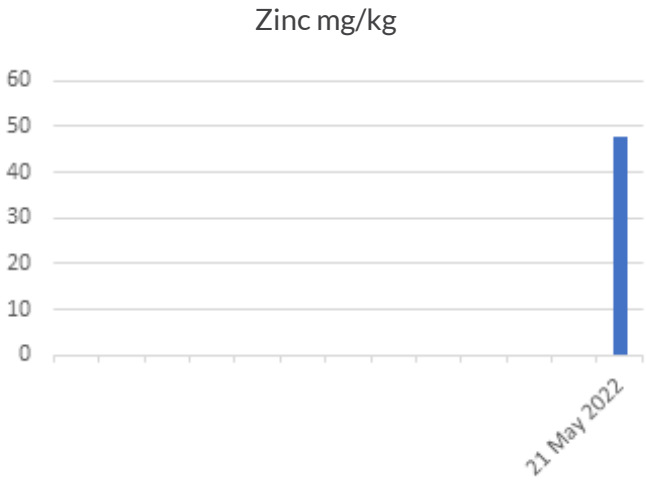


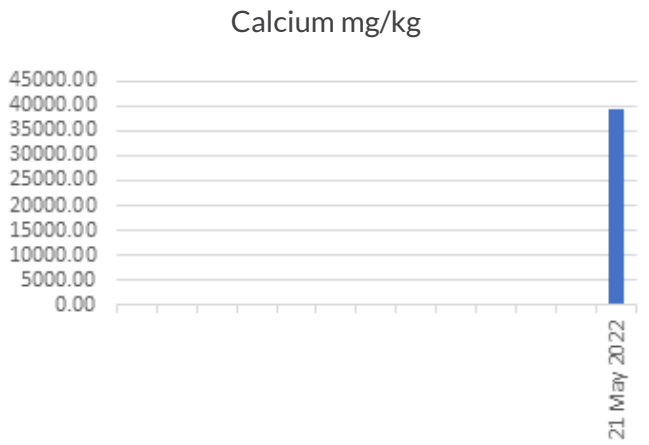


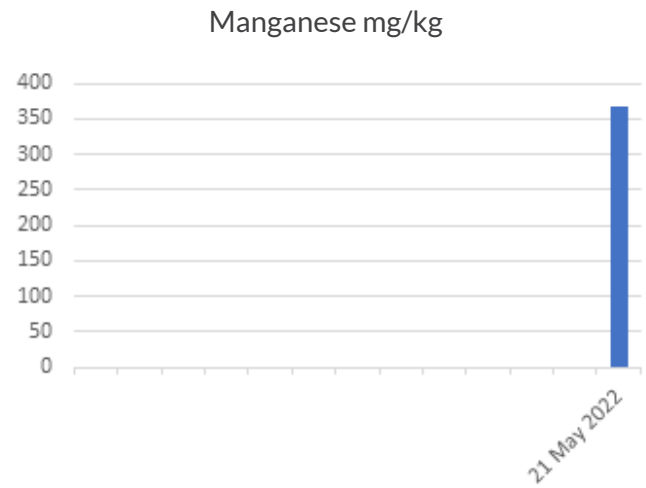












It is seen that those nutrients which were near or below detectable limits increased considerably, which is a very significant and positive effect. These results too need further study and corroboration with other factors.

5.7 Mosquitoes in the air and their larvae in water

Dr Ajit Gokhale was present for the second and the third dosing of Kalki at site. For the second dose (18th May) we had selected spot near Ryan International School and the application happened in the evening. There were plenty of mosquitoes in the area and was difficult to stand still for even a couple of minutes due to their bites.

At the time of the third dose on the 24th May and on the sampling day 31st May and on next follow up on the 8th June there were very few mosquitoes on the dosing spot. This is very peculiar. In the water too we found far too less mosquito larvae on the 31st and the 8th June as compared to the 18th May.

Similar experience was shared by Mr Sagar Gavade, of Persistent Systems. Who said, “on the 18th, while returning from the dosing, my car was full of mosquitoes. They had literally swarmed in just on opening the door. I was surprised on the 24th and the 31st when there were very few mosquitoes even at the dosing point itself”.

5.8 Additional Water Sampling and its Findings.

It is always good to do additional sampling of water and get it tested from different laboratories. That removes any bias in the procedure. Hence, we invited the drainage department of the PMC to take samples. Pune Municipal Corporation also sampled the water and tested it through their agency MITCON. This sampling was done on the 2nd Jun 22. Their report is still better than what we got on the 2 days earlier i.e. on 31st May 22. All along the trials there was not any rain event that could have affected the water quality. Following is their report.

MITCON Consultancy & Engineering Services Ltd.
Environment Management and Engineering Division
(Environment Laboratory)
Agriculture College Campus, Next to DIC office, Shivaji Nagar, Pune. 411 005,
Ph. No. 66289405/400, email: emelab@mitconindia.com
- ISO 45001:2018 (OHSAS)Certified Laboratory.
- Recognized by MoEF & CC

MITCON
Solutions for Sustainable Tomorrow

Format No. EME/LAB/Format 7.8/TR

Test Report

Report Number : MITCON/2022-23/June/246 **Issue Date:08/06/2022**

Client's Name & Address	Sample Details	
Drainage Department PMC Veer Sawarkar Bhawan Shivajinagar Pune Pin code :411005	Sample Code	MITCON/2022-23/June/246
	Name of Sample	water
	Sample Details	Ram Nadi Bawadhan
	Container Details	1 lit Plastic Can
	Sample Collected By	client
	Sample Collected On	02/06/2022
	Date of Sample Receipt	02/06/2022
	Analysis Start Date	02/06/2022
	End Date of Analysis	08/06/2022

ANALYSIS RESULTS

Sr. No.	Parameters	Results	Unit	Test Methods
01	pH at 25°C	7.43	-	APHA 4500 H+ , A, 4-95, 23rd Ed. 2017
02	Total Dissolved Solids	645	mg/l	APHA 2540 C, 2-69 to2-70 23rd Ed 2017
03	Turbidity	1.8	NTU	IS: 3025 Part – 10 (Rev.1,R.A:2012
04	Total Suspended Solid	07	mg/l	APHA 2540 D-2-70 to 2-71 23rd Ed 2017
05	Odour	Agreeable	-	IS: 3050 Part- 5 (Rev.1,R.A:2012)
06	Chemical Oxygen Demand	37	mg/l	APHA 5220 C,5-20 to 5-21 23rd Ed 2017
07	Nitrate as NO_3	4.89	mg/l	APHA 4500 NO3 B,4-127 23rd Ed 2017
08	Biological Oxygen Demand	14	mg/l	IS 3025 (Part 44) – 1993 (Rev.1,R.A:Ed 2017
09	Dissolved Oxygen	4.9	mg/l	IS 3025 (Part 38) – 1989 (RA 2014)
10	Aerobic Count	150	Cfu/ml	EME SOP
11	Anaerobic Count	60	Cfu/ml	EME SOP
12	Mictoscopic Exmination	Present		EME SOP
13	Specific Gravity	1.02	g/cm3	EMESOP
14	Organic Matter	0.24	%	EMESOP
15	Colour	Yellowish	-	APHA 2120B 2-6to 2-7 23rd Ed 2017

For MITCON Consultancy & Engineering Services Ltd.

Checked By
(Mrs. Kadambari Deshmukh)

MITCON CONSULTANCY & ENGINEERING SERVICES LTD. PUNE

Authorized Signatory
Dr. Sandeep Jadhav
(Senior Vice President)

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- *This Report should not be used for advertisement / judicial purpose.*
- *Customer complaint register is available in the laboratory.*

Page 1 of 1

6 Findings

From the above experiment following are our learnings/findings:

- Application of Kalki has resulted in considerable and astonishingly positive changes in all aspects - Air, Water, Soil and Sludge. It is to be noted that throughout the duration of this project, there has NOT been any rain or any such significant weather change which could have caused any change in water or air or soil quality.

- The result from MITCON sampling on the 2nd Jun 22 is astonishing. Its showing of 4.9 dissolved oxygen (DO) is remarkable, in what should be otherwise considered practically untreated sewage water.

- The effect on Benzene and Benzo(a)pyrene two known carcinogens in air, which are very difficult to remove, showed amazing results. Their levels went down to below detectable limits (BDL).

- Another striking result is 420,900 kg organic matter was treated in 20 days' time. Major part of it came from the sediment/sludge liquification or its elimination by natural processing.

- There was a clear and substantial reduction in mosquitoes observed along the river where Kalki was applied, including reduction in their breeding (larvae) in river water at and around the Kalki dosing points.

- The effect on air and water, is more pronounced just after the first application and then it appears to be consolidating, becoming gradually better and stabilising.

- All the air polluting gases measured (except CO and CH4) show a direct and substantial step wise decrease.

- The CO value shows slower but sustained decrease. While the CH4 value showed marginal rise, which could be explained by tremendous decrease in sludge volume/ weight and the rise is only marginal. If it was entirely methanogenetic reaction, this rise would have been enormous, which has not happened and hence is remarkable.

- The increase in water depth and concurrent decrease in sludge depth is one of the most significant achievement and it explains why the reduction in BOD/COD further, is not so substantial.

- When the sludge liquifies or gets oxidised, it converts solids into liquid this usually results in increase in BOD & COD of the liquid. The fact that this has not happened can be attributed to the effect of the second and the third dose, which treated it further to maintain BOD & COD to lower levels.

- It is certain that Kalki has worked and given significant, substantial and sustainable positive results, without any adverse impact.

7 Recommendations

1. We recommend a full-scale project to be developed with use of Kalki starting from the river origin (Khatpewadi) & surroundings to the point where it meets Mula river all along its length, with other physical and biological features so that the River Ramnadi can be restored to pristine condition.

2. PMC along with ZP Pune can help in getting likeminded people and organisations together to make this happen.

3. The tentative outline of the future project, would include dosing of Kalki, and then sampling, air, water & soil testing, analysis and documentation. All together this will cost about ₹ 45-50 Lacs.

4. The overall cost can be reduced further, if the residential societies around use Kalki in their STPs/ drainages on a regular basis, for which PMC can issue an advisory or incentivise it.

5. Other Recommendations:

   a. We can further take it ahead with other aspects aiding and complementing the results of Kalki, like creating suitable structures at strategic points for creating pools in river (where Kalki can interact with water, more), plantation of specific species at strategic points for improving efficiency of treatment, etc.

   b. This can bring all like-minded people and organisations, together with a common goal.

   c. There is urgent and acute need to get the river banks free from backfilling and further development. Actual need is to work like the road widening authorities, who, while widening the roads demolish whatever development that comes in the way. This would need concerted follow up and administrative/political will.

   d. If the above is not possible, we need to keep and secure for future, at least whatever is remaining as the river bank, as of now.

Annexure 1A Details about Ramnadi and Her Watershed

Transitions of Ramnadi and surrounding areas can be seen in the following Google Earth images

Ramnadi and her watershed in 2003 : Note Clear open fields and Hill slopes Khatpewadi lake is not there

Ramnadi and her watershed in 2014 : Note Construction in open fields and on Hill slopes

Ramnadi and her watershed in 2021 : Note increased Construction in open fields and on Hill slopes…
note so thick growth of water hyacinth in Pashan Lake

Ramnadi

The Ramnadi at Baner

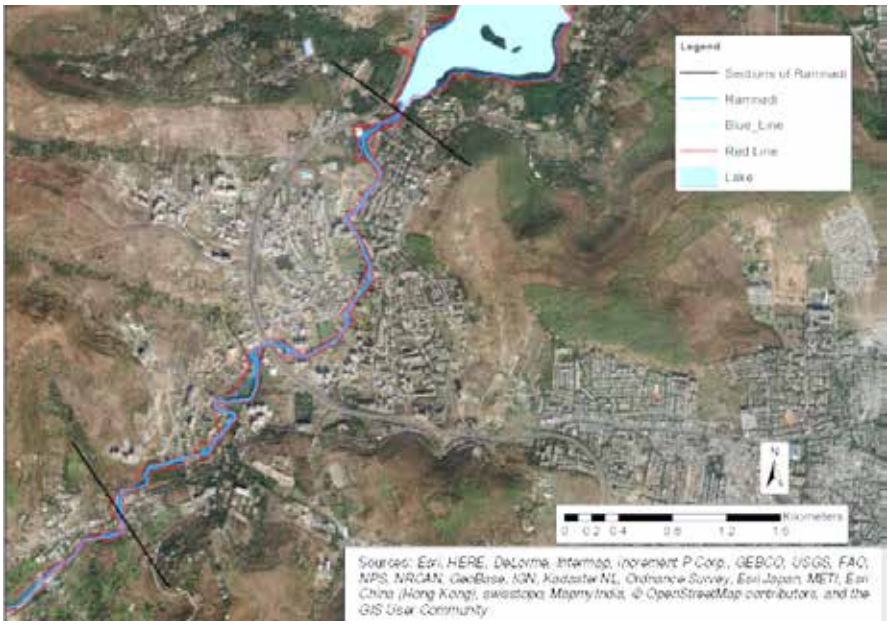
Location	
Country	India
State	Maharashtra
City	Pune
Physical characteristics	
Source	Sahyadri Range
• location	near Kathpewadi
• elevation	957 m
Mouth	Mula River
• elevation	550 m
Length	19.2 km
Basin size	181.65 km^2
Basin features	
Waterbodies	Pashan Lake, Manas lake

Many an activist NGOs and Researchers have worked on the issues related to Ram Nadi. They have also published their findings on various platforms journals conferences etc. The response they got was not very encouraging. Hence one of the leading researchers on rivers stated, "It has become evident that Pollution Control Boards or Municipal Treatment Plants have made no difference to the health or quality of water in our rivers. Let us hope that such citizen-led initiatives, which are born out of dire need and love for their rivers, will pave the way for a more participatory and sensitive approach to urban river management." *(https://www.indiawaterportal.org/articles/ram-nadi-citizens-pune-hunger-strike-save-their-river)*

As can be seen above the transition is fast and the development has resulted in only addition to sewage to the river. So much that in summers its almost only sewage that flows through the river. Study by citizen organizations have found following values of the dissolved oxygen at various locations on the river. Khatpewadi lake (7.5 ppm), Bhukum well (5.5 ppm), Manas Lake (5.5ppm), Windmill bridge (0 ppm), Graveyard (1.5 ppm), Pashan Lake (3.5 ppm), Someshwar Mandir (0 ppm), Confluence (1.5 ppm). Where the pollution is more, DO is less. When the DO drop below 4 ppm, fish begin to die.
(https://www.punekarnews.in/respect-rivers-and-nature-for-future-atul-kirloskar/)

Annexure 1B Ramnadi Pilot Project Location

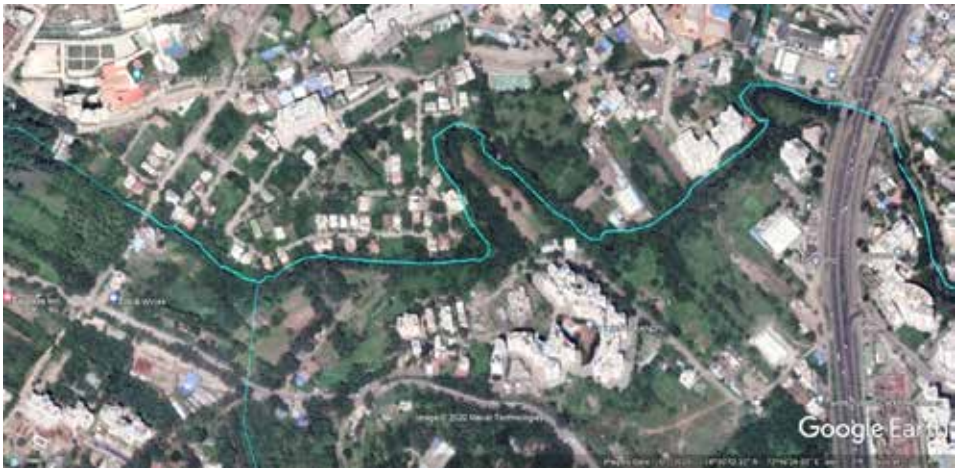
Now let's take look at the small stretch within Bavdhan area on which we got permission to work on for our pilot study. The place and its issues are known and well documented. Citizens of Pune had done lot of efforts to make people aware about the same.



The book cited above gives a very detailed review of the Causes and Effects of the floods caused by Ramnadi and peoples' initiatives. While it notes the pollution, it does not speak about simple workable solution.

Study Stretch and its surroundings in January 2003

Study Stretch and its surroundings in February 2014



Study Stretch and its surroundings in October 2021

Ramnadi Flow Section … schematic from Jeevitnadi website https://www.jeevitnadi.org/

Image from Jeevitnadi website *https://www.jeevitnadi.org/*

The city was expanding and needed as much space to build as it could get. Hence, it so happened that in many places the river bed was shrunk by developers in their hunger for space. All these developments are spewing their treated or partially treated sewage into the Ram Nadi. How to make that flow clean is a challenge which many NGOs and Individuals were trying to answer…

Such tall retaining walls have encroached on the flood plain of the river. Sewage from the buildings in the area spills into the river. River tries to clean it with its ecological processes. However modern chemical pollutants and their sheer quantity proves too much for the natural processes. Polluted water then starts leaching into the ground and spreads on more area on the other side. In rainy season such conditions cause upstream flooding. When this is repeated in many places the upstream floods become severe. They disperse the pollutants on larger areas in the flood plains.

People of Pune under the aegis of various NGOs have been trying to restore Ramnadi. A movement for restoration of Ramnadi also has been running for several years.

Annexure 2 About Giving Back the River Bed to the River.

Note the change …Incomplete / broken wall on the river on the 18th May 2022

The same is seen Completed in this image taken on 8th June2022

This wall, like many other walls on the bank of the river are actually encroachment on the riparian zones. They are often back filled and raised so that the flood waters do not get any chance of spreading horizontally.

One Observation: Such walls leave practically no place for the river bank vegetation, which plays a great part in cleaning of the river. In such case, river water rises between the opposite retaining walls and climbs up…making the flow deep, fast and turbulent. If this narrowing is too much it causes 'Upstream Flooding'. It may result in breakage of the retaining walls, water accumulation in lift shafts, basements, etc. Then people blame global warming and river for causing floods.

Need is to reclaim, through citizens' initiative, the riverbed land for river so that the air and water purification can happen naturally and the properties will remain protected from floods

Annexure 3

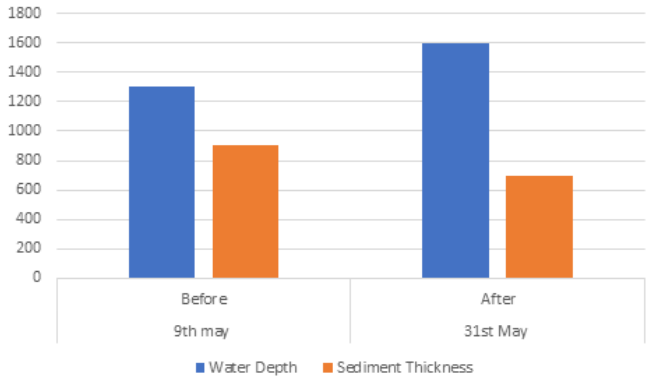
Calculation of the Sludge that Got Liquified

Sludge was accumulated behind the check dam. The level of the sludge below water was measured. Before the dosing it was found that the water level above the sediments was 1300 mm when the stick was inserted with force it went inside to 2200 mm mark. That means the Sludge was about 900 mm deep.

When the after test was carried out, at the same spot, the water level above the Sludge was 1600 mm when the stick was inserted with force it went inside to 2300 mm mark. That means the Sludge was about 700 mm deep.

Besides the change in Sludge thickness from 900 to 700 which is a 200 mm level reduction one more significant difference is the increase in water depth from 1300 to 1600

Water Depth and Sediment Depth at Sampling Point Before and After



Increase in water depth is due to decrease in sludge depth and also further softening of the sludge could be seen.

We can assume this to have happened over the entire reservoir formed by that mini check dam, since that check dam is in place for last over 16 Years. It is seen in 2006 image and not seen in 2003 image

2004 It appears like coffer dam... or Vanrai bandhara

2006 It appears like Cement Nala Bandh Complete checkdam

Till 2016 image it's a full length complete Bandh… No vent or dent in it

In 2018 It shows dent … through which we sampled the water.

So it is quite possible that the entire length of the reservoir i.e. about 274 m must have got more or less levelled deposition of the sludge…

However, even if we consider the minimal moderate straight path in the immediate vicinity of the check dam

difference in sediment level, it means 1100 x 0.2 = 220 cu m dissolution of the accumulated sludge … This is over and above the improvement in water and air quality parameters.

This must have been compacted old sludge most difficult to remove, digestion of it is a further difficult process.

The average sludge density was 1.8 g/cc i.e. 1.8 ton / cum.
That means the above mentioned 220 cu m would weigh 396 tonnes …

396,000 kg of sludge got liquified.