Bangalore's Toxic Legacy

Investigating Mavallipura's Illegal Landfills

A report by

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Dedicated to the memory of Akshay Kumar and Rajanna, both victims of Mavallipura's toxic legacy

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Section 1: Introduction

Unplanned urbanisation coupled with unprecedented increase in consumerism are causing extensive impacts on human health and the environment. As urban residents become more consumerist and cities become a locus of intense resource consumption, the capacity to generate waste is maximised. The weak impetus to minimise waste generation and poor management of the waste generated is resulting in a huge public health and environmental problem. The simple management question is what we should do with everything that we throw out.

Picture 1: Photograph of waste dumped on Bailappa's land

The neglect of such questions result in complex problems that are exacerbated by poor land use planning and waste management practices. There is little or no emphasis on community level solid waste management and this callousness has dire consequences for communities who become victims of large and poorly managed landfills. Forced to coexist with mountains of festering waste dumped in their backyards, these unfortunate people suffer unbearable stench, are forced to drink toxic water and end up with severe debilitating effects on their health and livelihoods.

Over 3000 tonnes of waste is generated in Bangalore every day, a good proportion is unhealthily dumped in the peri-urban areas of the city, with farmlands and wetlands becoming prime targets. Often times forest areas are also happy dumping grounds for waste disposal. A out of sight out of mind attitude pervades the administration and regulatory approach to solid waste management.

A case in point is what is claimed to be a designated municipal solid waste management landfill at Mavallipura, a village north of Bangalore near Yelahanka. Waste is being dumped here since 2003 in what was claimed to be farmer Bailappa's lands. Consistent process by local people succeeded in stopping this massice ileagal waste dump only for a similar landfill to recur abutting grazing pastures extending over 100 acres claimed to be designated scientific landfill managed by M/s Ramky Infrastructure Ltd.

The volume of mixed and untreated waste that has been dumped in both these landfills is unclear, but has ranged from 300 – 700 tonnes per day over the years. If we assume reasonably that 400 tonnes of waste was dumped daily in Mavallipura over the years, accumulated waste sitting in the landfills to a stupendous 10,22,000 tonnes of waste![1]

1 Calculated as 400 tonnes per day x 365 days x 7 years = 10,22,000 tonnes.

Picture 2: Absence of boundary wall giving easy access to waste dump

In this report we analyse the implications of the two landfills of Mavallipura and the impact it has on local communities and the environment. We examine the serious consequences of merely abandoning the landfill that Bailappa ran for over 3 years and the careless management of the new landfill of Ramky, which has been operational for at least 3 years. We also evaluate the implications of the location of these landfills in terms of the land use planning provisions, municipal solid waste management laws, the fact that they are in the watershed of the Arkavathy River (a major water source for Bangalore) and that they are in close proximity to a critical defense airport, Yelahanka Air Force Base, Bangalore International Airport and the Jakkur Flying School. The overarching concern is to draw attention to the serious environmental and social impacts these landfills are causing and explore what steps need to be taken to resolve this crisis.

Section 2: Landfills galore in Mavallipura

Section 2.1: Let's Begin with Bailappa's landfill

The garbage woes for the people of Mavallipura, approximately 20 kms. north of Bangalore centre, began in 2003, when a local landowner H. Bailappa agreed to lease his land to the erstwhile Bengaluru Mahanagara Palike (BMP) to dump solid waste from the city on what he claimed was his farmland. According to an agreement Bailappa concluded with BMP on 26 May 2003, it is claimed that the "Lessor is the owner of the Land (karab) vide Survey No. 70". In clause 8, it is stated that "Bangalore Mahanagara Palike will make its own arrangements for dumping of garbage" on Bailappa's land for a "mutually agreed lease amount of Rs. 12,000/- monthly". However, in the Schedule to this Agreement it is categorically stated that the land where waste would be dumped would be "All that piece and parcel of Dry Land (Karab) belongs to Lessor which bearing Sy, No. 72, measuring 34 Acres of Land out of which, 6 Acres only involing to this Agreement (72 Dry land on the Western portion of Dry land)".[2]
It is not clear the reference to land involved in the Agreement if the whole or part of the leased area would be the location for dumping waste. As for safety and prevention of pollution, all that the Agreement mandates Bailappa to do is that he "should put up protection wall of polythene sheets all round the leased land for preventing spread of communicable diseases" (Clause 4) and "(i)f any person residing near to land leased, (sic) complaints (sic) about spread of communicable diseases or nuisance of flies (sic). Smoke dogs vermins etc., due to dumping of garbage in the leased land the Lessor shall take all necessary steps to stop the nuisance without any liability to the **Lessor** at his own cost without resource (sic, possibly *recourse*) to the court law." It is shocking that in a legal agreement references between a Lessee and the Lessors have so carelessly been mixed up. Raising the issue if this were a 'deliberate' 'mistake'?

Picture 3: Lake polluted by leachate from dumped wastes

The way in which the Agreement is worded is also problematic in many other ways as well. First and foremost the question that arises is if BMP had the authority to enter into such an Agreement subsequent to the judgement of the Hon'ble Supreme Court in B. L. Wadhera and ors.[3] and the subsequent legislation of the Municipal Solid Waste Management Rules, 2000 enacted under the Environment Protection Act.[4] Read together, the dictum is that solid waste management which is an obligatory task of urban local bodies and has to be done in strict conformance with standards as laid down in the Rules and the Court verdict mandates that large metropolitan areas like Bangalore must have such landfills by December 2003. It is shocking that a city claimed to be India's IT capital has been so callous and irresponsible with the management of its solid waste. The Agreement concluded between BMP and Bailappa simply does not conform to any of the regulatory standards and is in patent violation of the applicable law and the judgement of the Supreme Court.

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2 Lease Agreement made on the 26th of May 2003 between H. Bylappa S/o Doddahanumaiah, and Deputy Commissioner (Health) Bangalore Mahanagar Palike, Bangalore

3 Dr.B.L. Wadehra vs. Union of India and others [(1996) 2 SCC 594 at 595], & Almitra Patel vs. Union of India

4 Municipal Solid Waste (Management & Handling) Rules, 1999; http://envfor.nic.in/legis/hsm/mswmhr.html; Last accessed December 22nd 2009

Section 2.2: Local people in the dark

Local communities knew very little about this Agreement. They were surprised when farmland and forest land was being converted into a massive waste dump. They started protesting against this "landfill", particularly the callous manner in which waste was dumped - without any safeguards whatsoever. Such dumping immediately and adversely affected them. Diseases and ailments became a constant companion to people of Mavallipura and surrounding villages, as their water and air became super-polluted.

The Foundation for Revitalisation of Local Health Tradition (FRLHT), which is located adjacent to Bailappa's dumpyard, was directly affected by such illegal waste dumping as well. It took up this issue with Ms. Latha Krishna Rao, then Secretary to the Karnataka Dept. of Ecology and Environment and requested her to "write an appropriate letter to Sh. K. Jyotilingam (sic, instead of Jyothirmalingam), the Commissioner, Bangalore Mahanagara Palikai (sic, instead of Palike) to please request BMP workers to stop dumping the garbage and burning plastic in Jarakabande Kaval, Rajankunte/ Ramagondanahalli/ Bettahalli Panchayat, Yelahanka".[5] Shri. Vittala Murthy, who succeeded Rao took up this matter in his letter of 7th July 2004 to the Commissioner of BMP in which he categorically stated that "as per Municipal Solid Waste (Management and Handling) Rules, 2000 dated 25.09.2000 the municipal solid waste shall be disposed of in a scientific manner in identified landfill sites only after obtaining authorisation from KSPCB. Indiscriminate dumping, burning of municipal solid waste are prohibited activities under the said Notification issued under Environment (Protection) Act, 1986 and any violation in this regard invites legal action. The transportation of municipal solid waste also requires mandatory authorisation from KSPCB as per the Government order No. FEE 67 EPC 2003 dated 19.01.2004 issued by the Department".[6]

This letter from Karnataka State's Environment Secretary should have served as a warning to BMP to immediately stop its illegal agreement with Bailappa and post haste take steps to comply with the laws and standards to develop a landfill in strictaccordance with applicable norms and rules. Instead it gave least importance to the Environment Secretary's warnings and proceeded to renew its Agreement with Bailappa for two more years. The Agreement is ambiguous about the monetary terms involved for leasing land and receiving waste. In the first Agreement there is a mention that the Lease Rent was Rs. 12,000/month, which could safely be assumed as the rate of leasing per acre. Considering that there were 34 acres claimed to be Bailappa's land leased out to dumping, big money was involved – estimated at Rs. 4,08,000/month.

There is then the other issue if the land so leased belonged to Bailappa at all. In the Agreement renewed with Bailappa in 2004, the Survey No. shown is 70. However, in the first Agreement of 2003 the Survey No. is listed as 72. This might seem like a typographical error, oversight or a case of poor drafting. But the problem appears to be much deeper when we actually verify the ground situation.

Section 2.3: BMP dumped waste on Forest Land

A review of the village map reveals that Survey No. 59 is actually Forest land which is protected under the stringent Forest Conservation Act and the directions of the supreme court in the Godavarma case. (FOOTNOTE) It turns out that Bailappa liberally used this probably deliberate confusion introduced into the Agreement about the land involved, to expand the scope of dump solid waste on both his land and the abutting forest land. Curiously, no one in authority ever thought it fit to conduct a land survey – not even the Forest Department, prior to entering into these Agreements. It was not until much later when local people blockaded hundreds of trucks rolling into the waste dump that the matter reached the higher echelons of BMP officialdom. Their response was to quietly look for a place to dump waste somewhere, actually anywhere. Meanwhile local protests which became frequent were systematically attacked by a series of strong responses by BMP and the police and included hoisting false criminal charges against the protesting local residents in an attempt to beat down their resistance. Even the Pollution Control Board took its time to react to this crisis – even though the protests resulted in breakdown of law and order were widely covered in the media.[7]

5 Letter from Shri Darshan Shankar, FRLHT to Ms. Latha Krishna Rao, Secretary, Environment and Ecology, GoK, Ref: FRLHT/ADMN/2004 dated 22 July 2004.

6 Letter from Shri. I.M.Vittala Murthy, IAS, Secretary to Government Environment and Ecology to Shri K. Jyothiramlingam, IAS, Commissioner BMP, Bangalore, Ref: FEE 81 ENV 2004 dated 7th September 2004

7 See for instance http://www.hinduonnet.com/2005/08/06/stories/2005080615190200.htm, Last accessed July 25th 2010

Picture 4: Truckloads of waste being dumped on Bailappa's land

Bailappa, meanwhile, had no qualms about continuing to lease his land as the monetary gains were stupendous. In addition to the lease rent from the land (which began at Rs. 12000 per month but later escalated to Rs. 75,000/-), he also earned money for every truck that was allowed to dump waste (estimated at Rs. 200/truck). Agreements reveal that 50 trucks per day was the capacity negotiated, though field verification confirmed that between 150 to 200 trucks dumped their waste daily in this land.[8]

Section 2.4: What this mess does to human health and local environment

As money making and administrative callousness combined to make a mess of Mavallipura, the health and environmental impacts of such illegal dumping were becoming increasingly evident. An FRLHT health camp for local communities in June, 2005, barely two years after dumping had commenced, reported that a "majority of patients (both children and adults alike) suffered from allergic rhinitis, allergic dermatitis, repeated infections, diarrhoea, sleeplessness, cough and upper respiratory tract infections. It observed severe health conditions at their own campus like dyspnoeal, choking, burning, sensation in the eyes, giddiness, nausea, headache, dry cough, sore throat, allergic rhinitis and allergic dermatitis and urinary tract infections". The agency "register(ed) (its) protest with (BMP), against the fire and smoke caused due to illegal & unscientific burning of City Waste at Mavallipura dump yard, Yelahanka" and complained that the adverse consequences on health "exist only where one is subjected to polluted air and water contamination".[9]
The pitch of people's protest against Bailappa's landfill continued to intensify as entire villages began to suffer from the unbearable stench and the rampant spread of Chikungunya, Malaria and even Dengue. Women and children, as is to be expected, were the worst affected. Families could not even have a meal in peace because of the menace of flies everywhere. They resorted to sitting inside mosquito nets even for a meal!

The cause for such health impacts is fairly simple and straightforward to explain. Organic matter constitutes a major chunk of household wastes. Municipal garbage mostly contains household waste – estimated to be as high as 60%. Organic waste decomposes easily and becomes an attractive habitat for the breeding of a variety of insects and animals. These organisms are robust disease spreading vectors. Humans, cattle, sheep and goats easily contract diseases as they suffer mosquito bites, get infected by swarms of flies and not infrequently are bitten by vicious packs

8 Each garbage truck has on an average 6-8 tonnes of waste

9 Letter from D.K. Ved, I.F.S., Additional Director, FRLHT to Medical Officer of Health, Bangalore Mahanagara Palike dated 21st June 2005.

of dogs and other rodents which are everywhere. In addition, there are hundreds of scavenging birds, such as kites, crows and vultures, who apart for acting as disease spreading vectors also posed a serious threat to aviation. Another major problem with municipal solid waste is that they contain a very high volume of plastics. Coloured plastics contain pigments made from heavy metals like Cadmium, Copper, Lead, Cobalt, etc. which are highly toxic in nature.[10, 11] The manner in which Bailappa managed the landfill in Mavallipura included liberal burning of these plastics, thus releasing such toxic chemicals into the atmosphere. It appears that Bailappa employed the plastic burning method to reduce the volume of the waste accumulated, so more fresh waste could be dumped to generate more income.

Picture 5: Smoke emerging from burning of wastes at Mavallipura

Burning plastics also contain dioxins and furans, and the deadly cocktail of airborne chemicals spread far and wide, polluting air, water and soil. Humans and cattle suffer a variety of bronchial disorders and there is widespread manifestation of more deadlier diseases like cancer and kidney failures. Such toxic gases are also known to diminish plant productivity. In addition, the horrendous stench forces one to lose the ability to smell contributing to widespread emergence of acute depression.

A further complication of dumping mixed wastes is that it can easily be contaminated by a variety of industrial and biomedical wastes given the weak monitoring of where the waste comes from. Added to this is the insistence in the 2004 agreement that dead animals should be allowed to be dumped and refusal on the part of Bailappa will be viewed seriously.

Section 2.5: Long term Impacts of the Waste Dumping

Such deliberate neglect of standards and norms ensured that the landfill soon became a reservoir of putrefying and decomposing matter, leaching out a deadly cocktail of pathogens and toxic chemicals into the soil, air and water. Bailappa had not provided any non permeable lining and BMP did not care to insist on conformance with any standard.

10 Rolf U. Halden. "Plastics and Health Risks." Annual Review of Public Health. Volume 31, Page 179-194, Mar 2010 -environmental-hazard-25892-3-1.html on March 6 2010.

11 http://www.cpcb.nic.in/Plastic_waste.php, Last accessed July 25th 2010

KSPCB the key regulatory agency, was completely oblivious to this massive polluting site.

Picture 6: Leachate stored in artificial ponds

Rain and other runoff collected these toxic leachates and quickly ensured they permeated into ground and surface waters. Often times the volume of leachates were so large that they had to be stored in artificially created ponds. The purpose was to use the sun's heat to evaporate the liquid – as in a solar pond. But the volume was so high that often this thick bubbly putrefying slurry overflowed spreading stench all around and contaminated soil and water everywhere that it flowed. Soon downstream drinking water sources were polluted beyond repair. Without any alternative, the unfortunate resident victims of Mavallipura continued to depend on their highly contaminated bore-wells, open wells, and lakes for water. A string of water borne infections and diseases followed.

The landfill is in close proximity to the Yelahanka air base and Jakkur flying school. This is a cause of concern because of increased instances of bird hits due to this close proximity. Below is a newspaper article highlighting these concerns.

AIR FORCE AUTHORITIES WORRIED

Garbage dump attracts birds, flights hit

By Kavitha Kushalappa DH News Service Bangalore:

The 100-acre site at Mavallipura where the BMP is gearing to set up its much touted scientific landfill is just about 9.5 km from the Yelahanka Air Force Station and it is understood to be violative of the Aircraft Rules, 1937.

'If all the birds gather here, how will the planes fly?' The Yelahanka Air Force Station authorities are asking the Bangalore Mahanagara Palike (BMP) something akin to that. In other words, the BMP is being told to buzz off with its thrash and garbage.

The 100-acre site at Mavallipura where the BMP is gearing to set up its much touted scientific landfill is just about 9.5 km from the Yelahanka Air Force Station and it is understood to be violative of the Aircraft Rules, 1937.

Reportedly as per the said rules, things on the lines of a garbage dumping yard shall not be permitted within a 10 km radius of the Air Force Station. Meanwhile a 'no objection certificate' from the Air Force Station is among the clearances the Karnataka State Pollution Control Board wants the BMP to produce before it gives the final nod for the landfill.

Immediate concerns

But for the Yelahanka Air Force Station, the immediate concerns are more than the scientific landfill.

The open dumping ground in Mavallipura where the BMP is presently dumping the city garbage is even closer to the Air Force Station - 8.5 kms and the scavenging birds are aplenty in the vicinity. Reportedly, in the recent past there have been three cases of bird-hits on aircrafts. It is said that in one instance the engine had to replaced.

BMP sources would not say anything on the open dumping yard, but said that a round of discussion was held with the Air Force authorities on Tuesday "to convince them that there would be no bird menace from their landfill."

When contacted Yelahanka Air Force Station spokesperson Wg Cdr V M Raghunath clarified: "We are not against the scientific landfill. We are against the open dumping yard." He however did not commit on the 'no objection certificate' sought by the BMP. "We have just received the proposal, we will look into it," he said.

More importantly, he sought to point out that Yelahanka Air Force Station is one of the busiest Air Force stations and is the home ground of events as big as the biennial Aero-India shows. "Some amount of planning needs to go into it (landfill project). We will discuss it," he said.

Source: http://archive.deccanherald.com/Deccanherald/Feb242006/city2048112006223.asp, Last accessed July 25th 2010

Section 2.6: Getting the Pollution Control Board to act on pollution in Mavallipura

Picture 7: Rag picker picking recyclables amidst un-segregated wastes

Dalit Sangarsh Samithi – Secural (DSS-S) has been in the forefront of the agitation against the reckless pollution in Mavallipura and surrounding villages. After numerous appeals to local Village Panchayats and BMP officials to stop polluting their villages went without heed, DSS organised the local villagers to take up the matter with the Karnataka State Pollution Control Board.

In October 2005 DSS initiated a formal complaint to the Board in which it stated that: "Bailappa and his children who live in Subedar Palya have been dumping waste in Survey Nos. 59 and 72 of Jarakabande Kaval for over three years. Every day over 150 truck loads of toxic waste that is dumped has rendered land and water toxic, caused unbearable stench, and affected every living human, animal and plants in the area. Affected villages include Mavallipura, Subedar Palya, Lingarajapura, Ramagondanahalli, etc. where people and cattle are suffering from the spread of smoke, stench and unbearable swarms of mosquitoes and flies." The complaint continues to narrate that on 22nd October 2005, Bailappa and his family in collusion with BMP officials released thousands of litres of leachates that had accumulated in the dump into the downstream grazing pasture in Survey No. 8. This toxic water soon found its way into wells, streams and lakes, and consequently all drinking water sources were contaminated. It was pointed out that the contamination of Mavallipura, Shivakote and Kandpura lakes is also contributing to the contamination of the Arkavathi River.[12]

12 Complaint dated 24 October 2005 of Mavallipura and surrounding residents mobilised by Dalit Sangarsh Samithi (S) to Member Secretary Karnataka State Pollution Control Board.

A combination of protest and legal actions finally got KSPCB moving. In February 2006, the Board initiated Criminal proceedings against Bailappa and his son by filing a Criminal Complaint before the Metropolitan Magistrate in Bangalore.[13] The grounds were that "the Accused persons who are owners of land measuring about 15 acres in Sy. No. 70 of Suerapalya, Jarakabande Kaval, Bangalore, have entered into an agreement with the Commissioner, BMP agreeing to permit BMP to dispose of 50 trucks of Municipal Solid Wastes in their lands on certain agreed terms and conditions.... While entering into the said agreements the said Accused persons have not taken any prior consent from the Complainant Board as required by law to permit such disposal facility and the Accused Persons have unauthorised and illegally permitted the BMP to use the said land for disposal of MSW." Interestingly, and quite questionably, the Board exempted BMP from criminal action, even though it claimed in the petition that BMP was "under legal obligation to provide processing and disposal facility to dispose of Municipal Solid Waster generated in Bangalore city as per the terms and conditions of the authorisation" and was an accomplice with Bailappa in causing pollution and setting up an illegal landfill.

The closed cycle of Bangalore polluting Bangalore

Merely 2.5 kms. downstream of this landfill flows River Arkavathi. It is upon this river that the Thippagondanahalli Reservoir was built in 1933 as the the first major drinking water irrigation project that helped Bangalore grow into the megapolis that it is today. In a tragic turn of events, the river that fed the city less than a century ago has now become a victim of serious pollution from the very city it sustains. The toxic leachates of Mavallipura have begun to contribute to the flow of industrial effluents from Peenya industrial estate into Arkavathy.

The Arkavathi and Kumudavathi river catchments are protected by a special order of the Dept of Ecology and Environment, dated 12 January 2004. This order categorically states that any pollution within the Arkavathi and Kumudavathi river catchments in strictly forbidden under relevant provisions of the Water and Air (Prevention and Control of Pollution) Acts. * That despite this order the BMP had negotiated with Bailappa to locate a massive unscientific landfill in the catchment area of the river is astonishing evidence of callous disregard to environmental protection orders of the Govt. of Karnataka by its own subordinate agencies.

* Dept. of Forest, Ecology and Environment, Govt. of Karnataka, G..O. No. FEE 215 ENV 2000 dated 12 January 2004

The petition also describes the extensive adverse impact this illegal dumping caused to Mavallipura and surrounding villages, and to the downstream Arkavathy river and the tanks of Kormanakunte, Mavallipura, Shivakote and Arvara Kandapur village. The petition states that "the leachate generated by the dumping of the municipal solid waste would definitely joins to (sic) the tanks and ultimately pollute the Arkavathy River. The citizens of Bangalore will be forced to drink this contaminated water. Under these circumstances, the accused persons are guilty of heinous offence and should be punished rigorously".

The petition confirms that "BMP and accused/persons authorities are unauthorised (sic) disposing of the MSW in the said land which belongs to the Accused persons. During the inspection it was noticed that private lorries engaged by B.M.P. were unloading the Municipal Solid Wastes in the said land without any pre-treatment and further leachate has generated there. (sic) and more during rainy season and the same is collected in the artificial check dam built by the BMP and the Accuse persons. The said leachate was overflowing in the nearby natural valley."

This complaint also reveals the fact that the Board had authorised the setting up of scientific landfills by BMP at two locations in Bangalore – Mavallipura and Kannahalli – by its order of 18 August 2004. This order arrays a range of conditions that has to be met with in setting up the landfill including strict conformance with all applicable provisions of the MSW Rules, Water Act, Air Act and Environment Protection Act. The order also requires that BMP "remove all solid wast that has been dumped unscientifically in the outskirt of the Bangalore & remove the same to the authorised landfill site coming up at Kannahalli and Mavallipura within the specified time frame.." In effect, the plan envisaged was that Mavallipura would be one of two sites that would completely receive Bangalore's garbage.

If BMP complied with this order, it certainly could not have been on the basis of the Agreements with Bailappa for the simple reason that the site approved for the scientific landfill was Survey No. 8, and not on Survey Nos. 70 or 72 which Bailappa claimed were his lands.

Based on these facts, the Board contested before the Court that the accused persons, Bailappa & others must be

13 Criminal Complaint Case No. CC 261/2006 dated 18 February 2006 filed by Karnataka State Pollution Control Board against H. Bailappa and his sone S. B. Hanumantharayappa, in the Court of the Metropolitan Magistrate at Bangalore (MMCT-1).

punished under Section 44 of the Water (Prevention and Control of Pollution) Act – The punishment sought for this criminal violation could include imprisonment for 2-6 years and/or a fine as the landfill did not meet the clearance conditions. This case is still pending in the Court and no formal resolution has been affected by the Board in pursuing the matter to logical closure.

Section 2.7: Bailappa's landfill on Forest Land

There were three major consequences of the Board initiating criminal proceedings against Bailappa.

1. Firstly, BMP was forced to annul its agreement with Bailappa. As a result the landfill was abandoned. A disastrous consequence has been that the waste that has piled up, continues to pollute even to this day and no decontamination has been undertaken.
2. BMP was finally forced to begin the process of building the scientific landfill approved on Survey No. 8 and entered into a contract with Ramky Infrastructure Ltd. over the designated 100 acres plot on Sy. No. 8 – grazing pastures of Mavallipura.
3. The question of whose land was being dumped upon by BMP and Bailappa for years, resurfaced and the Forest Department finally took notice.

The extensive media support that was generated finally got the Karnataka Forest Department moving to assess if Bailappa had encroached forest land to set up his illegal landfill. Forest surveys revealed that a substantial portion of the landfill had actually been developed in forest land, and BMP had perhaps wilfully overlooked this major violation when it concluded an agreement with Bailappa.

Once it was confirmed that forest land had been encroached, the Karnataka Forest Department was content in merely recovering the forest area. This was done in the most illegal and unscientific manner - the mountains of garbage that had accumulated over the years were burnt off over several days. To cover up the evidence of what lay beneath, tonnes of soil was imported to cover up the toxic mess within. The Forest Department did not initiate any criminal action whatsoever either against Bailappa or BMP for violating forest protection laws and diversion of forest land to a non-forest purpose with a profit motive.

Section 2.8: Ramky's Scientific Landfill on Mavallipura's Grazing Pastures

KSPCB had authorised the establishment of two scientific landfills for Bangalore in its order of 18 August 2004, one of which was to be at Survey No. 8 over 100 acres that constituted grazing pastures of Mavallipura Village. For a village that was predominantly sustaining on agriculture for a living, the criticality of losing common lands was only known to farmers and cattle grazers.

Picture 8: Google Image showing the location of illegal landfill on Bylappa's land, and the landfill currently operated by Ramky

As soon as they came to know of the possible acquisition of their grazing pastures, local farmers submitted a representation to the Revenue Secretary, Govt. of Karnataka and district authorities, appealing against allocation of this land for a municipal landfill. The representation states: "We are agriculturalists by profession. We own lands in and around the above said Mavallipura village. Our only source of livelihood is agriculture. We reliably learn that about 100 acres of land is leased by Bangalore Mahanagara Palike for 30 years to dump the garbage and other waste materials collected from all parts of the city. The said land is in Sy. No. 8 …. and the lease amount is fixed at Rs. 1,000/- per year. The said land is Gomala land. It was left as grazing land for the cattle of several villages in and around... (and even) this is insufficient for the grazing of cattle."

Picture 9: Wastes dumped in Ramky facility

Highlighting the potential consequences of this decision to their lives and livelihoods, the appeal stated, and rather prophetically, that the "act of grant of land on lease is not in the interest of public. Dumping of garbage and waste material in the open place will cause/create health hazards to the residents of the nearby villages. It will create a problem of its own like spreading contagious diseases. The people of surrounding village will not get good air. The air gets polluted. At present, the residents of the surrounding village are enjoying good health and living happily." Expanding on the potential impacts, the farmers argued that if the landfill were allowed "diseases may spread not only among people but would also "affect the health of animals". They appealed that "before taking the decision to grant the land, the Government/concerned authorities should have called for the opinions of the residents of the surrounding villages. That has not been done. Such an act of concerned authorities is illegal and arbitrary".

With the benefit of hindsight had the authorities taken full cognisance of this petition and ensured that local people were consulted on the issue of locating a landfill at Mavallipura, the outcome may well have been to reject this site as inappropriate from a variety of perspectives. But as is the practice with administrators in general, such petitions are given scant regard and often disposed off without any consideration of the merits. What follows now is the story of how this callous decision to set up a "scientific landfill" in Sy. No. 8 of Mavallipura, turned out to be another disaster.

Section 2.9: What Ramky promised, and What Ramky delivered

A Concession Agreement was concluded between BMP and Ramky Infrastructure Ltd. (RIL) on 11 August 2004 to set up a scientific landfill on the basis of Build-Operate-Transfer (BOT) scheme at Survey No. 8 of Mavallipura village over 100 acres to manage a contracted quantity of 600 tonnes of mixed solid waste per day. The total life of this plant per the Agreement is 30 years and it was made commercially operational on 29 January 2007 and without a consent for operation from KSPCB, as required. The financial terms of this agreement result in Ramky receiving Rs. 2,45,71,800[14] per year from BBMP which includes 85% of the tipping fee per annum. The remaining 15% which amounts to Rs.43,36,600, is what Ramky would receive post closure of landfill. And this is the income till March of 2009 when

14 This figure is arrived at by considering 400 tonnes waste per day x 365 days x Rs. 198 tipping fee x 0.85 (percentage of income) = Rs. 2,45,71,800

tipping fee is Rs. 198. The amount increases post March 2009.

According to BBMP, the original Agreement with RIL has been transferred to its subsidiary M/s Ramky Enviro Engineers Ltd. (REEL).[15] In an undated Schedule 1 form that has been filed to secure no-objection certificate from KSPCB, it is confirmed that the implementing agency is REEL. However, the current operating clearance from KSPCB valid until 31 December 2010 is categorically issued in favour of RIL and not REEL. This complicated reallocation of portfolios for seeking clearance and implementation of the scientific landfill raises a whole series of issues. For our purpose, we consider REEL to be the contractor, given the submission in the application for consent for establishment made to the KSPCB.

Picture 10: Huge pit dug as part of process to begin construction of the scientific landfill

The website of Ramky Group projects REEL as a subsidiary company and a "specialist multidisciplinary organization with a turnover of around Rs. 2500 cr. focused in the areas of Civil, Environmental & Waste Management infrastructure with specific emphasis on 'Public Private Partnership' projects. The Group has a reckonable presence in more than 55 locations in the Country in addition to branch offices at Saudi Arabia, UAE and Singapore."[16]

The website claims that REEL's "...Hyderabad Waste Management Project, Dundigal Village, Ranga Reddy District was awarded in recognition of the efforts put in by the management, staff, employees and workers in achieving Occupational Health and Safety Assessment Series 18001 (OHSAS 18001) certification. The award was given by Sri R. Venkata Reddy, Hon'ble Minister for Cooperation, Labour, Employment & Factories Government of Andhra Pradesh in the 39th National Safety Day Celebrations organized by the Department of Factories Government of Andhra Pradesh and National Safety Council Andhra Pradesh Chapter."

It is also claimed that REEL"bagged the "Best Company of the Year", "Market Leadership in Industrial Hazardous Waste Management "&" Vertical Market Penetration into Biomedical Waste" for the year 2009 in the Waste Management Vertical" awarded by Frost and Sullivan. REEL claims that it has also bagged "the Integrated Municipal Waste Management Project for the city of Hyderabad... (based on a) concession agreement period (of) 25 years (on) BOOT basis. This is the first comprehensive project of its kind in India for Metro cities covering the complete scope of Door to Door Collection, Transportation, Processing and Disposal for the entire GHMC Area. The project is to be established with an investment of Rs. 897 crores, partly funded by government and with anticipated revenues from tipping fee and processing of waste revenues being initially Rs. 100 crore per annum and reaching to Rs. 400 crore per annum from 7th year of operation. The project configuration comprises of four Integrated Waste Management Project Sites with 8 transfer stations and complete logistics for waste collection and transportation from the source of generation. This is

15 According to a letter written by Deputy Commissioner (Health), BBMP to KSPCB, dated 16 April 2009, vide No. DC(H)/112/08-09

16 Source: http://www.ramky.com/ accessed on 16 June 2010

by far the largest MSW Project in the country on BOOT basis and the first MEGA project for REEL." Similar projects have also been secured by the company in Guwahati, Assam.[17]

Picture 11: Construction of landfill in 2006

Ramky Group also claims that its other subsidiary Ramky Enviro "owns 15 Bio-medical Waste Disposal facilities, 12 Hazardous Waste Management facilities and over 5 Municipal Solid Waste Management facilities". It is claimed that the "organization is rolling out new recycling facilities which cover Ferrous and Non-Ferrous metal recycling, Oil recovery, e-Waste management, plastic to fuel and many more."[18] All this presents a picture of Ramky as a very effective and efficient organisation capable of setting up large scientific landfills and managing them in full compliance with law and applicable standards.

Section 2.10: Ramky landfill a threat to Air Defense

What is quite perplexing is that despite opposition from the local communities to so convert grazing pastures of a functional agrarian village into a landfill site, KSPCB approved the site. This was with the full awareness that the site was in close proximity to three airports, two of them highly critical to civil and defence aviation. The MSW Rules state unequivocally that landfills must be located a minimum of 20 kms. from an airfield and that too after taking abundant precautions against attracting birds to waste. Mavallipura is sited about 19 kms. from Bangalore International Airport, about 8 kms. from Jakkur Flying School, and only 5 kms from the critical defence airfield of Indian Air Force at Yelahanka.[19] Clearly with three airfields in the vicinity and a previous case of illegal dumping that was still under prosecution, it is shocking, to say the least, that the BBMP and KSPCB even considered this site as appropriate. The caveat seems to be that the Board shifted the responsibility to the operator (Ramky) to secure "No Objection Certificates" from the airfields, raising a serious question of the Board's intent in enforcing such critical standards.

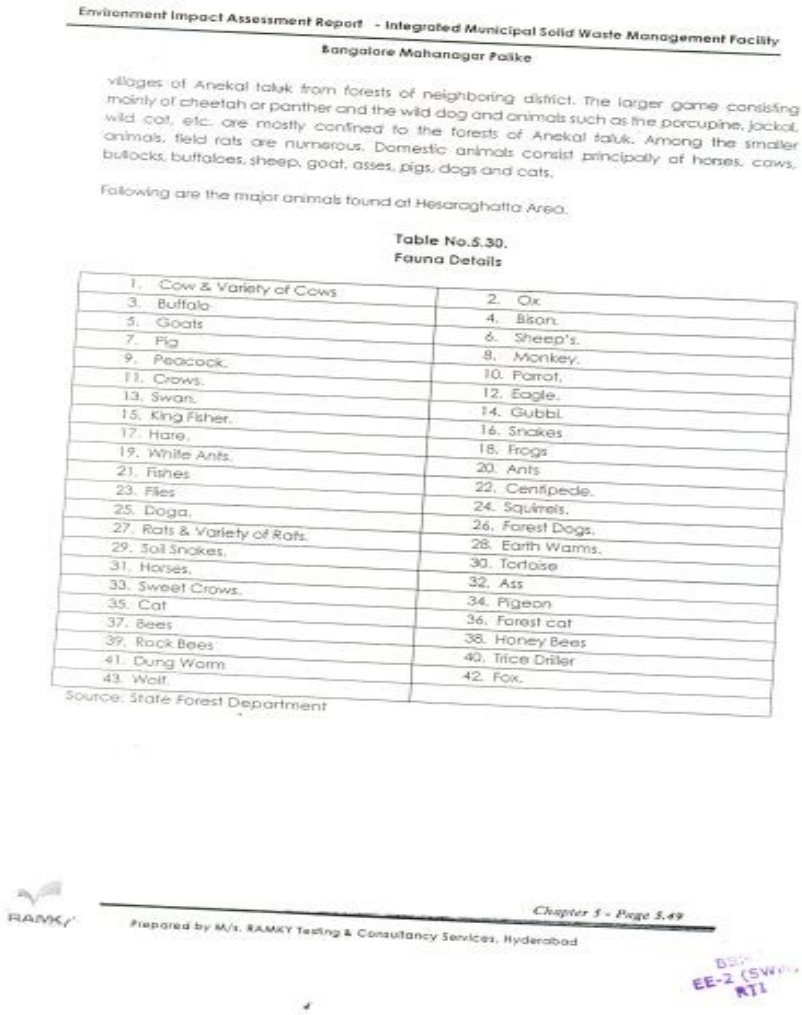
17 Source: http://ramkyenviroengineers.com/PressRoom.html#assam accessed on 16 June 2010
18 Source: http://ramkyenviroengineers.com/AboutRamky.html accessed on 16 June 2010
19 Minutes of the 10th meeting held on 28th July 2004. Ref No.: KSPCB/MSW/DEO2003-04/1096 dated August 5th 2004

Mavallipura is located within close proximity of three major airfields, and the high bird density is a major threat to aircraft flyways – Bangalore International Airport (BIAL) at 19 kms., Jakkur Air Base at 7 kms., and Yelahanka Air Base is a mere 5 kms. away. The Municipal Solid Waste Management Rules demand that such landfills should be at least 20 kms. from the edge of airports. Below is a google image showing the distance between Yelahanka Air base and the landfill at Mavallipura

Section 2.11: Environment Impact Assessment of the Landfill

In what appears to be a strong collusion of interests, the Environment Impact Assessment Report for the landfill was prepared by M/s Ramky Testing and Consultancy Services, a division of REEL, during January-March 2004. When the subsidiary of an operator is undertaking an impact assessment, it is unlikely that the study will be objective.

As is to be expected, the EIA is high on volume and low on substance. It acknowledges[20] that "the selection of a site for developing landfill is one of the most important decisions to be made by the municipality/municipal corporation in developing and implementing its waste management plan." Further acknowledging that "(u)ltimate impacts of waste disposal on human life including ecosystem and its causative factors necessitate identification and development of site selection criteria" the study confirms that "(t)o ensure that an appropriate site is identified, a systematic process of selection needs to be followed".



Environment Impact Assessment Report - Integrated Municipal Solid Waste Management Facility

Bangalore Mahanagar Palike

villages of Anekal taluk from forests of neighboring district. The larger game consisting mainly of cheetah or panther and the wild dog and animals such as the porcupine, jackal, wild cat, etc. are mostly confined to the forests of Anekal taluk. Among the smaller animals, field rats are numerous. Domestic animals consist principally of horses, cows, bullocks, buffaloes, sheep, goat, asses, pigs, dogs and cats.

Following are the major animals found at Hesaraghatta Area.

Table No.5.30.
Fauna Details

1. Cow & Variety of Cows	2. Ox
3. Buffalo	4. Bison.
5. Goats	6. Sheep's.
7. Pig	8. Monkey.
9. Peacock.	10. Parrot.
11. Crows.	12. Eagle.
13. Swan.	14. Gubbi.
15. King Fisher.	16. Snakes
17. Hare.	18. Frogs
19. White Ants.	20. Ants
21. Fishes	22. Centipede.
23. Flies	24. Squirrels.
25. Doga.	26. Forest Dogs.
27. Rats & Variety of Rats.	28. Earth Warms.
29. Soil Snakes.	30. Tortoise
31. Horses.	32. Ass
33. Sweet Crows.	34. Pigeon
35. Cat	36. Forest cat
37. Bees	38. Honey Bees
39. Rock Bees	40. Trice Driller
41. Dung Worm	42. Fox.
43. Wolf.	

Source: State Forest Department

RAMKY

Chapter 5 - Page 5.49

Prepared by M/s. RAMKY Testing & Consultancy Services, Hyderabad

EE-2 (SW...) RTI

Picture 12: Scanned image of Chapter 5, Page 5.49 of EIA

Thereon, EIA proceeds to array a variety of its features, which interestingly claims that the nearest airport is 30 kms. away, when in fact the Yelahanka Air Base in merely 5 kms. from the site. The study also erroneously claims that there are no ecologically sensitive zones within a 10 kms. radius, when in fact there is an order of the Dept. of Ecology and Environment of 12 January 2004, which predates the study, and declares this area as an ecologically sensitive zone as it forms the watershed of the Arkavathy and Kumudavati rivers.

20 Section 3.2: Mavallipura Site Features, Environment Impact Assessment Study for Integrated Municipal Solid Waste Management Facility at Mavallipura, Prepared by M/s Ramky Testing and Consultancy Services, undated.

The sloppiness of the study is evident in many other aspects of its reporting and weak analysis, and appears to have been a ritualistic exercise to fulfil a legal demand. This is most evident in the manner in which the fauna found in the area is described, claiming the source to be 'State Forest Department'. The study claims that the following animals are seen in the region: swan (not found in India), Bison (if this is meant to be the Indian Gaur, then it is mainly in the Western Ghats and there is no record of sighting this wild animal here at all), "soil snakes" (a peculiar way to say there are snakes, but which ones?), "Rats & Variety of Rats" (!), "Sweet Crows" (Is this meant to suggest a crow is now a table bird? In an attempt to bring down its population perhaps?), that there are "Bees" and also "Rock Bees", Wolf (again the Indian wolf has not been recently sighted in this area), and something claimed to be a "Trice Driller". This list is a sorry revelation of the absolute disregard there is to appreciate the critical importance of an EIA, and it is truly unfortunate that this study even formed the basis of a site selection. Shockingly, there is simply no effort or even recognition of the importance of assessing human health from an epidemiological perspective.

Picture 13: Landfill being managed by M/s REEL

Be that as it may, this EIA provides us with a range of facts that seem to have been the basis on which clearances were secured for the landfill. The most relevant aspect is the description of the "Design of Waste Management Facility for Mavallipura Site" which is extracted below:

"Day to day collected waste from the house holds, sweepings and market waste and other sources of waste from the Bangalore city Municipality will be collected by the private contractors and delivered to the facility. The facility has been designed for 1000 MT/day.

i. Upon receipt of waste at the facility, the same shall be weighed, logged and the waste shall be put in the bulk separator or Rotary sieve based on the physical quality of the waste received from the transporting trucks.
ii. In bulk separator the waste shall be segregated into inert materials (i.e. recyclables and construction materials) and degradable materials. The degradable materials are sent to compost plant. In rotary sieve grit, glass, plastics and other inert materials will be segregated.
iii. The inert and construction materials will be sent to directly to the land fill.
iv. The degradable materials will be sent to the compost plant for manure preparation.
v. Any leachate (water that has come in contact with water) generated in the above processes will be collected and treated at the leachate treatment facility."

It is also reported in the study that "(t)wo scheme have been worked out. In the first scheme the waste would be only composted with rejects being sent to landfill and in the second scheme part of the waste would be sent to composting

and balance mixed waste would be processed to fluff to generate power." In a chart it is explained that the "waste to energy" project would be of 600 TPD capacity, based on converting waste to fuel/fluff for a capacity generation load of 7.5 MWH.

A schematic at Section 4.3 in the study details the overall scale of the project, and confirms that it would include:

Picture 14: Leachate stored in an artificial pond and left for sun drying

1) Gate House
2) Reception of Waste and Weighing
3) Pre-processing
4) Secondary Segregation
5) Recycling Facility
6) Organic Waste Processing Facilities – Composting Facility
7) Sanitary Landfill
8) Leachate Collection, Treatment and Disposal"

The question that now arises is if REEL has implemented, in the minimum, what they said they would in the Mavallipura landfill.[21]

Section 2.12: How Ramky runs its landfill at Mavallipura

A visit to the Mavallipura landfill reveals that most of the features of waste management that was proposed are not being implemented. There are, of course, some windrows – for composting – spread over a couple of acres. There is no segregation of waste prior to sending them to these composting units, and it appears the capacity of these windrows is too low to accommodate the entire volume of waste that rolls into the facility. As a result most of the waste is dumped into a huge dug-out, which it is claimed is the Landfill.

21 Section 4.5: Mavallipura Site Features, Environment Impact Assessment Study for Integrated Municipal Solid Waste Management Facility at Mavallipura, Prepared by M/s Ramky Testing and Consultancy Services, undated.

Picture 15: Birds swarming over the landfill

Spread over an area of approximately 30 acres, and at least 20 metres deep, this massive hole in the ground is completely filled up with unsegregated solid waste. It towers over the ground level by at least 5 metres, and resembles without any doubt a mountain of putrefying garbage. JCBs frequently help trucks unload the waste as they roll in and push them as far as possible into the pit from the margins. Hundreds of crows, kites and dogs swarm the place scavenging food. At the lower end of the pit, a perfunctory canal is dug out to drain out leachates, which is led into a huge pound spread over a couple of acres. This pond which is buttressed only by a polythene sheet is claimed to be the solar evaporation pond. What happens thereafter? Once this pond is full, it is quietly drained out by yet another canal into the streams that run into Mavallipura tank.

Picture 16: Leachate being drained into a canal

In the Concession Agreement and the EIA, REEL claims that the landfill is designed to hold a total of 32,85,000 tonnes of waste that would accumulate over 20 years at the rate of 164250 tonnes per annum. This landfill is expected to have bottom lining of 90 cm thick clay + 1.5 mm HDPE + 300 mm gravel. In addition, the top lining would have 60 cm thick clay + 15 cm drainage + 45 cm vegetative cover.

The leachate collection system per the Agreement is expected to be a biological treatment system with the main protection walls covered with 250 mm dia HDPE and lateral ones supported by 200 mm dia HDPE. The risk factor of flooding is guaged as "storm water collected on the land fill site will be directed to a first flush retention pond which shall be designed for a sufficient capacity to cover a 1 inch 100 years 10 minutes storm event".[22]

The EIA and Concession Aggreement both claim that the project would involve a Leachate/Effluent Treatment Facility. The EIA reports (at Sec. 4.3.6) that the "leachate generated from the different section of the facility will be collected and will be used to maintain the moisture content in the composting waste. The left over leachate will be sent to the treatment plant for further treatment." The Concession Agreement (at Section 3.5 (b)) states that REEL "...shall provide a leachate treatment plant ...of appropriate capacity but with a minimum initial capacity of 15 cu m/hour with suitable technology to ensure treatment of leachate to Inland Surface Water Standards as per IS: 2490: Part I 1981 Tolerance Limits for Industrial Effluents. The Leachate Treatment Plant shall be designed as a modular unit and so as to allow for increase in capacity in line with the increase in leachate treatment requirements. Overall design of the leachate system should be such as to ensure that there is no percolation of the leachate into the ground and it does not come into contact with any water body."

Today, Ramky has merely dug a massive pit which is several tens of feet deep and acres across with only 2 acres provided with non permeable High Density Poly-Ethylene sheet according to the show cause notice issued by KSPCB to BBMP. [23]

Section 2.13: Protests against the Ramky landfill

On 7th October 2009, there was a riot in Mavallipura. The horrendous stench from the Ramky landfill had for days on end kept people restless and sleepless. But on the night of the 6th the perfunctory leachate pond inside the facility overflowed and the water gushed downstream into Mavallipura tank, contaminating everything in the way. When local villagers rushed to check how the water had flowed out, they realised to their horror that hundred of gallons of this toxic discharge had been facilitated out of the landfill by digging trenches – so the overflow would not accumulate within the REEL facility, but instead flow downstream into the village.

Livid at such active pollution of their water bodies, the villagers surrounded the facility and locked up the gates. Tens of trucks that were rolling in to dump their waste were stuck. Without discharging their load they could not turn back. This crisis caused quite a stir with the BBMP senior officials, who rushed to the defense of Ramky staff. There were no violent outbursts when the met with the villagers. In fact they were led into the reception centre, and quickly locked up. Villagers demanded that no less an official than the Commissioner should turn up to assess the damage that had been done to their lives, livelihoods and their local environment.

By the end of the day, the Commissioner never came as he was on a road trip with the Chief Minister to assess developments in Bangalore. He instead sent his deputy, Shri. Maheshwar Rao, IAS, Jt. Commissioner, who despite his best efforts could not convince the villagers to back down from their demand that the facility must be immediately shut down. Police were summoned as a local BBMP official turned up with hordes of goondas to rough up the villagers, and caused a near breakout of violence. As tempers eased, it was decided that the matter would be finally resolved in a meeting with the Commissioner, then Shri. Bharat Lal Meena, IAS, which was eventually held on 9th October 2009. He promised comprehensive clean-up, pollution and cattle survey, ground water contamination, health camps and that fresh borewells would be dug to provide clean drinking water.

22 Section 4.18: Mavallipura Site Features, Environment Impact Assessment Study for Integrated Municipal Solid Waste Management Facility at Mavallipura, Prepared by M/s Ramky Testing and Consultancy Services, undated.

23 Letter from Member Secretary, KSPCB to Deputy Commissioner (Health), BBMP, Ref No. KSPCB/MSW/SEO-2/EO/DEO/AEO/2007-08/1602 dated July 20th 2009.

Picture 17: Meeting with Ramky and BBMP officials on October 7th 2009

In this meeting the Commissioner promised that the land fill would conform with all the standards and safeguards per the clearance conditions, but refused to the demand to the relocation of the landfill. He also confirmed there have been serious violations both in the siting as well as the management of the landfill and acknowledged that the landfill proved a threat to the Yelahanka Air Force Base.

As we write this report, several months later, none of the commitments made by the Commissioner have been kept. The Ramky landfill continues to pollute with impunity and the management approaches are no better than what they were then.

Section 2.14: Weak Regulation or No Regulation by KSPCB

As and when there are protests from local communities, KSPCB officials rushed to the area and quickly conducted some water analysis, confirm pollution, issue notices and conduct hearings. Except following up with punitive action against Baillappa, the Board has simply failed in comprehensively and systematically addressing the concerns of the local communities.

Following the October 2009 incident of local protests, KSPCB issued a 7 day show cause notice on BBMP stating that:

"….

1. It was informed that around 60-70 truck lods of average 6-8 tones which amounts to total of 450-500 tons of solid waste is coming to the processing facility.
2. The platform provided was overloaded and with heaps of waste up to 20 feet of height was noticed. There was no proper treatment of the entire waste like segregation, overturning, maturation of the waste.
3. The facility has compost screening plant of capacity 150MT/day which was not working during inspection. Around two thousand tons of compost has been stored on the land without impervious platform, which also generating leachate.
4. The developed landfill is not maintained according to the authorization conditions, and not maintained soil layer on each layer of waste dump and not provided the HDPE sheet to the whole landfill site.
5. Adjacent to the landfill site around 2000 to 3000 MT of Municipal Solid Waste was dumped on open land indiscriminately without segregation, which leads to generation of lot of leachate and due to rain water bund provided for landfill area at north-western side has been breached and the leachate has flowed into the natural drain, finally joins the Mavallipura water tank. This ha spolluted the water quality of the village water tank against which the villagers have complained to the Board.
6. The leachate generated from the platform is collected in lined storage tank, which was not managed properly and the tank has not been provided with proper pump and pipeline system. Most of the leachate has been let into the Kacha unlined pit & which has joined the storm water drain and stagnated

nearby the entrance gate which has resulted in smell nuisance. The said natural valley water leads to the Mavallipura Tank & Shivakote tank. The whole water looks like dark in colour and emitting pungent smell in the entire area.

7. The conditions of Schedule III and IV of MSW rules and authorization orders have been completely violated.
8. Not submitted the Annual report in Form II has not been submitted as per authorization conditions."

It is evident that observations of the Regional Officer of KSPCB concur with our findings in this report. The question that now remains is if the scale of pollution is so extensive, why are regulatory authorities hesitating to take action per law and relieve the unfortunate communities of Mavallipura and surrounding villages from their misery of living with Bangalore's waste.

The extensive and deep impact such neglect has had on the health of downstream communities and the local environment, is evident from a variety of water analysis that ESG has conducted. An analysis of which follows:

Section 3: Water Quality Sampling and Analysis

Section 3.1: Overview

ESG undertook comprehensive analysis of the quality of water in various upstream and downstream locations of the Mavallipura landfills during 2006 (months) and 2009 (months). The purpose of this analysis was to establish the pollution impact of the illegal landfill developed by Bailappa for BMP between 2003-6. The study in 2009 was undertaken to establish if the pollution loads had come down following the establishment of the scientific landfill by REEL. The study reveals that far from the pollution levels that were very high in 2006 returning to normal, the 2009 analysis reveals that pollution loads are very high and the implications on human health and environment are very serious in the short term and particularly in the long term as toxicity accumulates.

Section 3.2: Sampling Methodology

Ten grab samples of water around the Mavallipura waste dumps were collected during November 2009 and tested for various parameters that included assessing chemical and biological indicators of pollution. In particular bacteriological loads, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD) and heavy metals analysis was undertaken.

The samples were collected in 2 litres cans for chemical and heavy metal analysis. The cans were rinsed thrice with the water sampled and subsequently samples were collected taking necessary precautions against external contamination. For BOD and COD analysis, samples were collected in separate half litre bottles as per procedure and stored in ice packs post collection. The samples were reached to the authorized lab within 3 hours of collection. Bacteriological samples were collected in sterilized glass bottles and similarly submitted to the lab in 3 hours. A google image map of the different locations of sample collection is shown in Picture 18.

Picture 18: Google Image showing sampling locations. (Note – FRLHT is not shown in this image as it is upstream of the landfill)

Description of sampling locations as indexed in Picture 17

1. Water from pond on Bylappa's land.
2. Water from Koranakunte Lake (outside the Ramky Solid Waste Dumping facility)
3. Water from Koranakunte Well (outside the Ramky Solid Waste Dumping facility)
4. Borewell water from Anand's farm
5. Borewell water from Mavallipura Village
6. Borewell water from Nagaraj's house
7. Borewell water from Yellamma Temple at Mavallipura village.
8. Mavallipura village lake water sample
9. Borewell water from Dhanraj's house
10. Borewell water from FRLHT campus (from a tap near the security room at the gate)

The water samples collected included 6 samples from borewells, 3 from lakes and one from a well. Analysis of each of these is discussed in detail below.

Section 3.3: Parameters checked

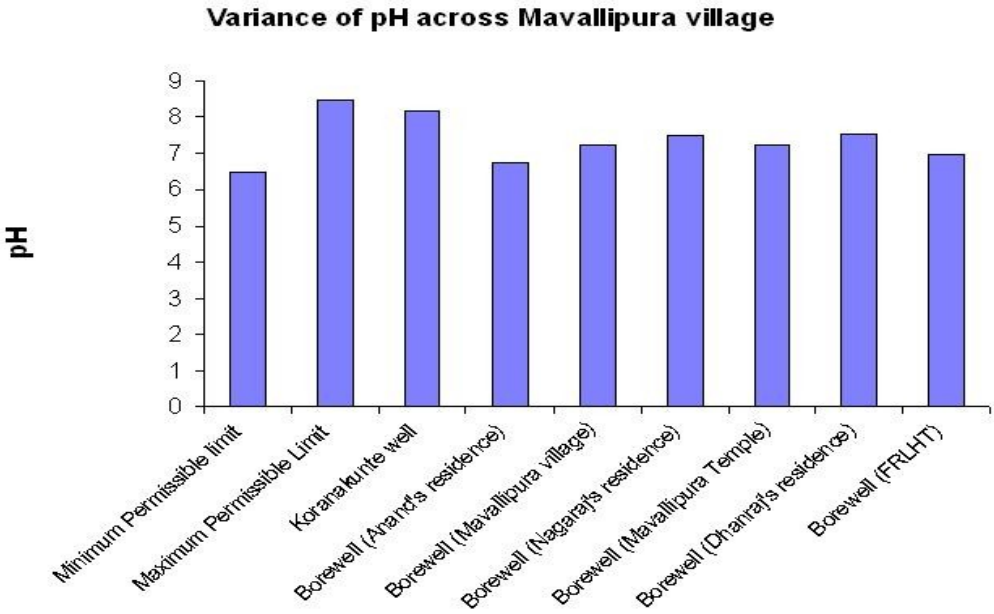
Section 3.3.1: Borewells and Wells

Of the ten samples that were collected, five borewell samples were from different location across the village of Mavallipura and the one other borewell sample was taken from FRLHT located at an elevated location from both landfills. The sample from the open well was collected outside the Ramky facility.

Section 3.3.1.1: pH

pH is the measure of concentration of hydrogen ions in a given water sample and is used to detect the acidic, alkaline or neutral nature of water sample.

Water with pH of less than 6.5 is soft, acidic and corrosive in nature resulting in leaching of metal ions. This results in leaching of metals from pipes, plumbing fixtures, and even utensils and consequently leaches out toxic metals.

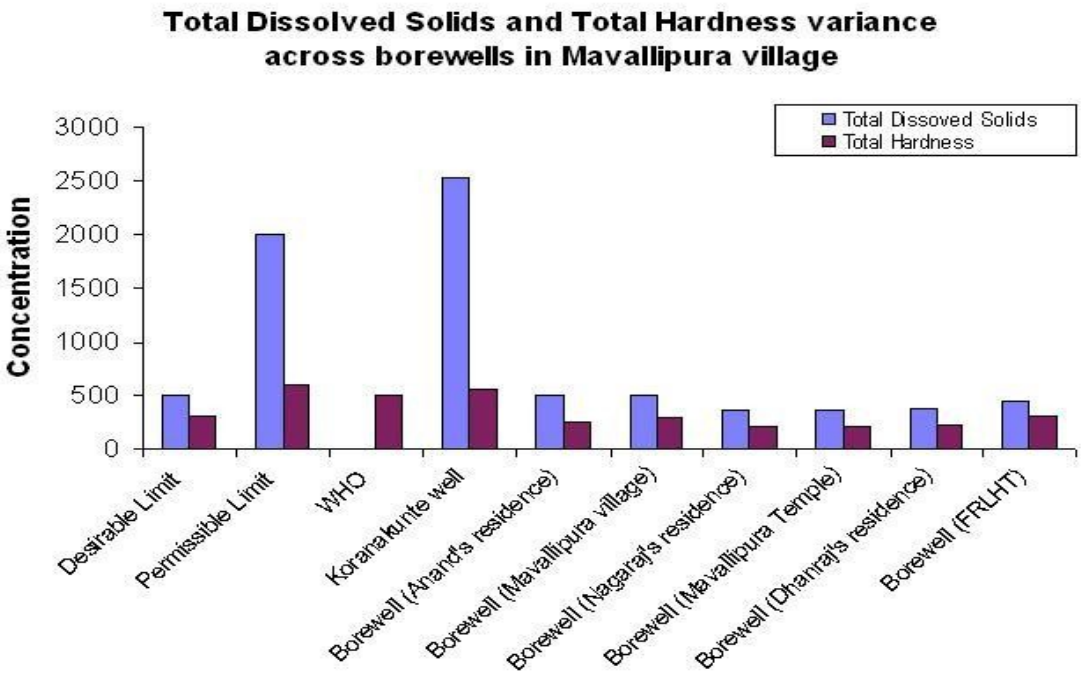


Graph 1: Variance of pH across borewells in Mavallipura village(Analysis done by Department of Mines and Geology, Govt. of Karnataka)

Water with pH greater than 8.5 is hard and alkaline in nature. They cause more aesthetic problems than health problems like giving a bitter taste, deposition of scales on utensils etc[24].

Analysis: All water samples at Mavallipura have a pH within the range of 6.5 to 8.5[25] which is the permissible level of pH in drinking water. pH of water in Koranakunte well is 8.17 bordering the maximum permissible pH value of 8.5. A slight increase in pH in observed in water sample collected from borewell at Anand's residence between 2006 (Analysis done by Essen and Co.) at 6.58 to 2009 at 6.74. pH of water samples collected at FRLHT are more or less the same at 7.02 in 2006 and 6.97 in 2009.

Section 3.3.1.2: Total Dissolved Solids (TDS) and Total Hardness (TH)



Graph 2: Variance of Total Dissolved Solids (TDS) and Total Hardness (TH) across borewells in Mavallipura village(Analysis done by Department of Mines and Geology, Govt. of Karnataka)

Total dissolved solids consist mainly inorganic salts, small amounts of organic matter, and dissolved gases. An increase in level of cations and anions in water having high TDS can increase hardness, corrosiveness, and contribute a salty taste to the water.

Hardness is the indicator of the extent to which bicarbonates, chlorides and sulphates (mainly of Ca, Mg and Na) are dissolved in water. The hardness caused by bicarbonates is called temporary hardness since it can be removed by heating. The hardness caused by sulphates and chlorides and Ca and Mg is called permanent hardness since it cannot be removed by heating.

Hardness in water hinders lathering of soap/detergent. Salts present in hard waters get deposited alongside water pipes, cooking utensils and water heaters causing inconvenience, maintenance problems and loss of equipment. Water with a total hardness greater than 500 ppm is considered hazardous to human health.

Analysis: All water samples in Mavallipura were in the permissible range except the Koranakunte well sample which

24 See for instance http://www.water-research.net/ph.htm Last accessed March 1, 2010.

25 See for instance Central Pollution Control Board website; http://cpcb.nic.in/Water_Quality_Criteria.php; Last accessed December 23rd 2009

was observed to contain water having high TDS and TH.[26] Two sampling points were common for analysis done in 2006 and 2009, namely, FRLHT and borewell water sample from Anand's residence. In 2006, Total Hardness for samples collected from FRLHT and Anand's residence were 114mg/l and 73 mg/l respectively. While in 2009, the values were 300 mg/l and 256 mg/l respectively. Similarly, TDS in samples collected from these two locations in 2006 had concentrations 212 mg/l and 198 mg/l. Again in 2009, the concentrations at these two sampling points increased to 450 mg/l and 500 mg/l respectively. The increase is more than double as compared to 2006.

Table I. Classification of water hardness (hardness as calcium carbonate) [27]

	mg/l or ppm	grains/gal
Soft	0 - 17.1	0 - 1
Slightly hard	17.1 – 60	1 - 3.5
Moderately hard	60 – 120	3.5 – 7.0
Hard	120 – 180	7.0 - 10.5
Very Hard	180 & over	10.5 & over

Section 3.3.1.3: Anions (Bicarbonates, Carbonates, Chloride, Fluoride, Nitrate, Sulphate)

Anions are negatively charged ions, which have an affinity towards positively charged cations.

a. Bicarbonates and Carbonates

Presence of bicarbonates and carbonates in water that is used for irrigation purposes is a cause of concern as these ions will combine with calcium and magnesium, which are required nutrients for plants in the soil, and precipitate them as carbonates thus reducing their concentration in relation to sodium in the soil. Consequently the relative salt concentration increases and could induce adverse osmotic pressure on the roots, causing dehydration. Bicarbonates and carbonates also increase the pH of soils thus rendering them alkaline and unsuitable for plant growth and unfavourable to soil microbial activity. Their concentration contributes to the destruction of soil structure and reduction of water percolation into the soil. [28] [29]

Analysis: There is no desirable limit mentioned for bicarbonates and carbonates in either Indian standards or International standards like Euro or WHO. However, Koranakunte well has exceedingly high amount of bicarbonates (662 mg/l). Also, all samples except one borewell sample had a concentration of greater than 200mg/l. Carbonates were found to be absent in all samples.

b. Chloride

Chloride occurs in all natural waters in widely varying concentrations. The chloride content of water increases with increase in the mineral content of the water. There are many ways in which chloride salts gain access to natural waters. The presence of relatively high chloride concentration in fresh water (about 500 mg/L or more) may be an indication of sewage pollution. Salt (NaCl) used in foods, is excreted with body wastes; sewage carries these chlorides into the receiving waters[30].

Chloride in reasonable concentrations is not harmful to humans. At concentrations above 250mg/L it gives a salty taste to water, which is objectionable to many people.

The chloride concentration in waters used for irrigation of agricultural crops is an important consideration since high chloride content along with salinity at the root zone of irrigated plants makes it difficult for crops to absorb water

26 See for instance: http://www.water-research.net/totaldissolvedsolids.htm; Last accessed December 23rd 2009
27 See for instance, http://www.chemtronicsindia.com/water-softener.htm; Last accessed December 23rd 2009
28 See for isntance, http://www.lenntech.com/applications/irrigation/bicarbonate/bicarbonate-hazard-of-irrigation-water.htm; Last accessed December 23rd 2009
29 See for isntance, http://www.wrights-trainingsite.com/stabilonb.html; Last accessed December 23rd 2009
30 Nathanson, Jerry A., Basic Environmental Technology, Prentice Hall publications.

against a negative osmotic pressure.[31]

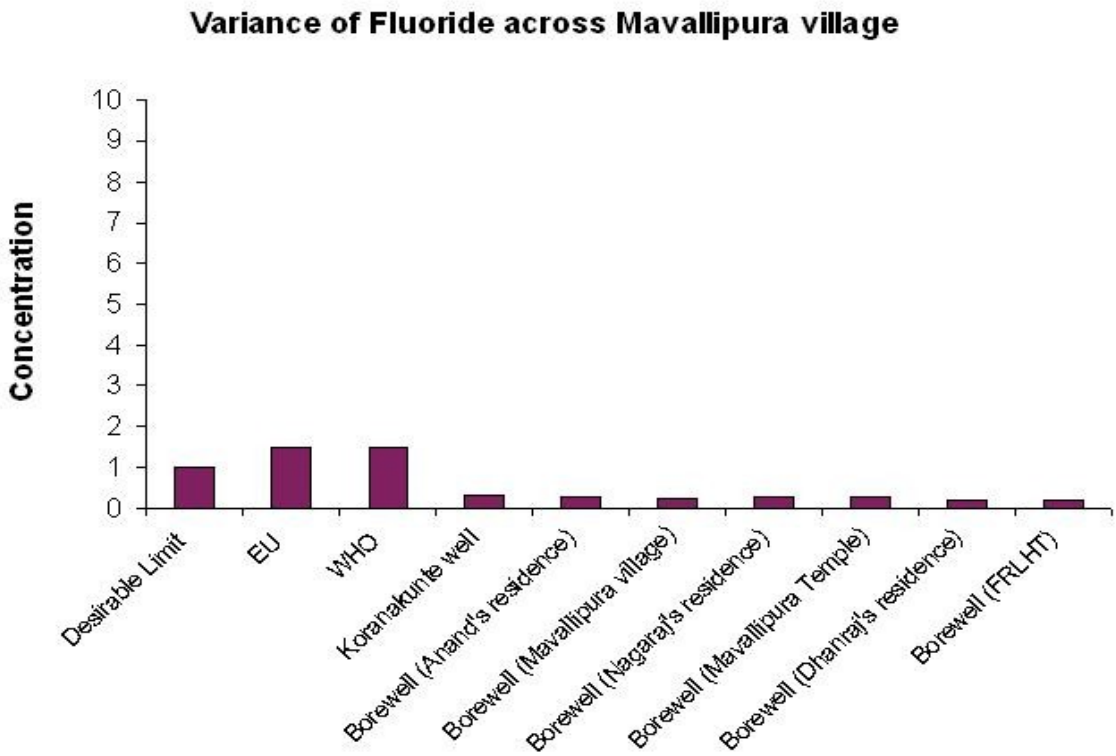
Analysis: The desirable limit for chlorides in drinking water is 250 mg/l. Except Koranakunte lake, none of the samples showed presence of chlorides beyond this limit. Koranakunte well showed exceedingly high amount of chloride concentration at 980 mg/l. When we compare the concentrations of chloride obtained from analysis done in 2009 at FRLHT and borewell water from Anand's residence to analysis done in 2006 we see an increasing trend. In 2006, concentrations of chloride were 20.49 and 35.98 mg/l respectively. Analysis performed in the year 2009 indicate the current concentrations levels are 123 and 202 mg/l respectively. In the past six years there has been a six fold increase in concentration levels of chloride.

c. Fluoride

Fluoride is an essential hardening component of the human bone like chloride. Low fluoride content results in softening of the bones and high fluoride content results in causing the bones to become brittle.

Fluorides cause respiratory failure, fall in blood pressure and contribute to general paralysis. Continuous ingestion of non-fatal doses of fluorides causes permanent inhibition of growth. Fluoride concentration in excess of 2 ppm in drinking water in temperate regions and 0.4-0.7 ppm in tropical regions may lead to mottling of enamels and bones – a condition known as fluorosis.

Many plants are extremely sensitive to Hydrogen-Fluoride concentrations even at low ranges such as 0.02-0.05 ppm. Orange and lemon trees exposed to fluoride emissions produce smaller yields while gladiolus turn brown or die on exposure to fluorides. More than 2 dozen plants are known to synthesize fluroacetate which is highly toxic and is used in rodenticides. Livestock also can be a victim of fluoride poisoning as a result of ingestion of contaminated vegetation [32] [33].



Graph 3: Variance of Fluoride across borewells in Mavallipura village (Analysis done by Department of Mines and Geology, Govt. of Karnataka)

31 Ministry of Environment and Forests, Municipal Solid Waste Management and Handling Rules 2000, http://www.envfor.nic.in/legis/hsm/mswmhr.html, Last accessed October 15th 2009

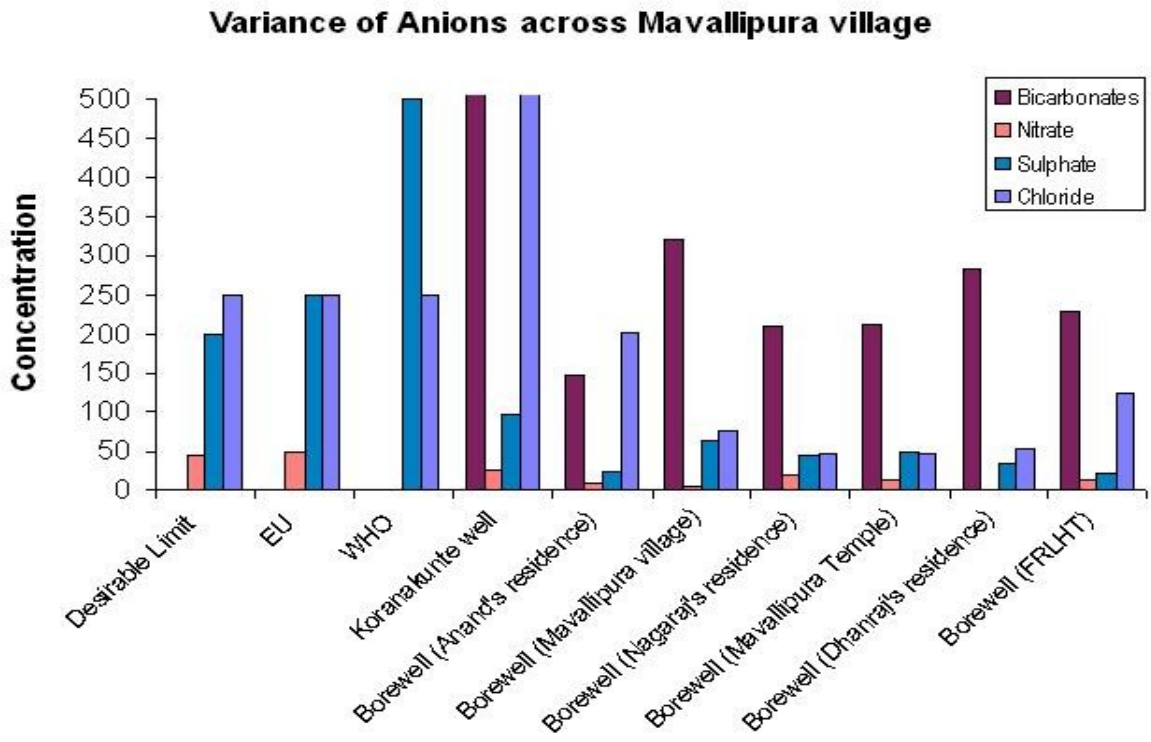
32 http://www.acu-cell.com/fcl.html; Last accessed 23rd December 2009

33 Kannan, Krishnan, Fundamentals of Environmental Pollution, S. Chand & Company, New Delhi.

Analysis: All samples had fluoride concentrations within the desirable limit of 1mg/l. The concentration of fluorides is more or less the same over the past 3 years.

d. Nitrates

Nitrates are nitrogen-bearing molecules that are essential for the formation of proteins in plants since plants other than legumes cannot absorb free nitrogen from the atmosphere. Proteins are made up of carbon, hydrogen, oxygen and nitrogen and are necessary for growth and development and for various metabolic processes. Hormones, enzymes and haemoglobin in humans are made up of proteins.



Graph 4: variance of anions across borewells in Mavallipura village (Analysis done by Department of Mines and Geology, Govt. of Karnataka)

In doses between 5 to 10 mg/kg of body weight does not produce any significant toxic effects in humans. But at levels of 20mg/kg of body weight it could be lethal. Rather than nitrate itself, the metabolic products of nitrates produce toxicity.

NO3 ------> NO2 ------> N2O2 ------> NH2OH ------> NH3
Nitrate Nitrite Nitric oxide Hydroxylamine Ammonia

Nitrite and Hydroxlamine are inducers of Methemoglobinemia. It is a condition wherein ferrous iron in the blood is oxidised and thereby loses its oxygen-carrying capacity, which leads to hypoxia and death. Mono-gastric animals have relatively high tolerance to nitrate since reduction to nitrate in their bodies is minimal. Human babies are at a high risk of nitrite toxicity because they do not have free HCl in their stomach and therefore nitrate is readily reduced to nitrite by the bacteria in the stomach and the duodenum. [34]

Analysis: Nitrate concentration in all samples analysed was found to be within the desirable limit of 45 mg/l. There has not been any significant change in concentration of nitrates in water samples from FRLHT and borewell water at Anand's residence.

34 Central Pollution Control Board website; http://cpcb.nic.in/Water_Quality_Criteria.php; Last accessed December 23rd 2009

e. Sulphate

The sulphate ion is one of the major anions occurring in natural waters. However for people who are not used to high sulphate concentrations, drinking water with high concentration on sulphate can result in diarrhea and dehydration. Also, high sulphate concentration is extremely harmful to babies and children. Animals are also very sensitive to presence of sulphates in water.

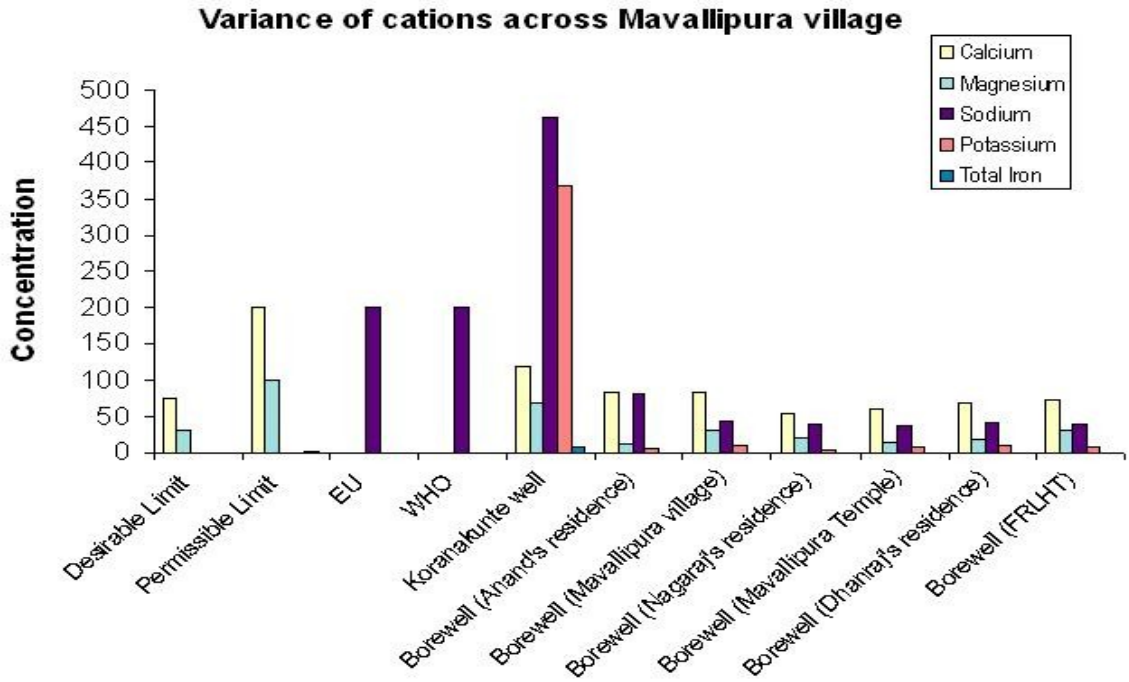
Analysis: The desirable limit for sulphate is 200 mg/l, and all samples contained less than half the desirable concentration level. In 2006, concentration of sulphates at FRLHT and borewell water sample from Anand's residence was 10.31 and 8.91 respectively. When the samples were analysed in 2009, the concentrations were 21.2 and 24.8 respectively, depicting a two fold increase in concentration.

Section 3.3.1.4: Cations (Calcium, Magnesium, Sodium, Potassium, and Total Iron)

Cations and positively charged ions that have an affinity towards negatively charged anions.

a. Calcium and Magnesium

Calcium and Magnesium are the two most common minerals that cause hardness in water. The degree of hardness increases as the amount of Ca and Mg increases in water. Ca and Mg dissolves in soil and water and easily remain in soluble forms. Even though the human body requires 0.7 to 2.0 grams of calcium per day as a food element, excessive amounts can lead to kidney and gall bladder stones. Calcium also serves an important role in the health of bodies of water. In natural water it is known to reduce the toxicity of many chemical compounds on fish and other aquatic life. [35]



Graph 5: Variance of cations across borewells in Mavallipura village (Analysis done by Department of Mines and Geology, Govt. of Karnataka)

Analysis: All samples showed concentrations of calcium and magnesium below the permissible limit of 200 mg/l and 100 mg/l respectively. However, three of the seven samples had concentrations of these elements greater than the desirable limit of 75 mg/l and 30 mg/l. These were samples taken from Koranakunte well, borewell at Anand's residence and the common borewell for Mavallipura village. Borewell water sample obtained from FRLHT, which is at

35 Sawyer, McCarthy and Parkin, Chemistry for Environmental and Engineering Science, Tata McGraw Hill Edition.

farther away than the rest of the samples has concentration closer to the desirable limit of presence of calcium and magnesium. In 2006, concentration of calcium in FRLHT and borewell at Anands residence was 28.05 and 18.03 mg/l respectively while concentration of magnesium was 10.69 and 6.8 mg/l respectively. In 2009, the concentration of calcium increased to 72 and 83 mg/l, while that of magnesium increased to 30 and 12 mg/l.

b. Sodium and Potassium

Presence of sodium and potassium in drinking water is not a cause of concern unless they are present in exceedingly high amounts. Excess intake of sodium is associated with health problems like cardio-vascular diseases and blood pressure. High concentrations of these salts in irrigation water is also detrimental to the soil and to plants. [36, 37]

Analysis: There are no Indian standards for presence of sodium and potassium in drinking water. However Euro and WHO standards mention 200 mg/l as the threshold concentration for presence of sodium in drinking water. Koranakunte well has very high concentration of both sodium and potassium at 463 mg/l and 368 mg/l respectively. Analysis of both sodium and potassium was done in 2006 and hence there is no comparitive chart of these two parameters.

c. Iron

Iron exists in soils and minerals mainly as insoluble ferric oxides and iron sulphides (pyrite). In some areas it is also present as ferrous carbonate (siderite) which is slightly soluble. Since ground water usually contain significant amounts of carbon dioxide, appreciable amounts of ferrous carbonate may be dissolved by the reaction shown in the equation:

$$FeCO_3(s) + CO_2 + H_2O \qquad Fe^{2+} + 2HCO_3^-$$

Water contaminated by Fe and Mg cations are turbid in nature due to oxidation of iron and manganese to Fe(III) and Mn(IV) and form colloidal precipitates. Oxidation rates may be increased by the presence of certain inorganic catalysts or through the action of microorganisms. Both iron and manganese interfere with laundering operations, impart objectionable stains to plumbing fixtures, and cause difficulties in distribution systems by supporting growths of iron bacteria. Iron also imparts a taste to water supplies which is detectable at very low concentrations. [38]

Analysis: The desirable and permissible concentration of iron in potable water are 0.3 mg/l and 1 mg/l respectively. On looking at the results, we observe that koranakunte well has a concentration of 6.77 mg/l which is way beyond even the permissible limit of presence of this cation. Borewell sample obtained from Anand's residence showed presence of iron at concentration of 0.46 mg/l, which a slightly more than the desirable limit of 0.3 mg/l. Similarly, borewell sample taken from Dhanraj's residence showed a concentration of 0.21 mg/l, which is closer to the desirable limit. The rest of the samples showed presence of iron at concentrations between 0.02 – 0.07 mg/l. In 2006, both FRLHT and borewell water sample from Anand's residence had a concentration of iron at 0.05 mg/l. While concentration of iron at ground water sample in FRLHT is almost the same at 0.02 mg/l, there is a steep increase in borewell water sample from Anand's residence at 0.46 mg/l.

Section 3.3.1.5: Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD)

BOD is the measure of organic matter present in a water sample that can be oxidized by bacteria while COD is the measure of chemicals present in the water sample which can be oxidized. [39]

Analysis: Potable water should have BOD concentration less than or equal to 2 mg/l. BOD and COD was absent is all samples except two samples i.e. Koranakunte well, and bore well water sample from Nagaraj's residence. In both cases the concentration of BOD is extremely high at 81.6 and 32 mg/l. As per Indian standards water that is used for bathing should also have a BOD of less than 3mg/l whereas here we observe the values are much more than this level too. All other water samples showed zero concentration of BOD and COD. In 2006, when analysis was done BOD and COD

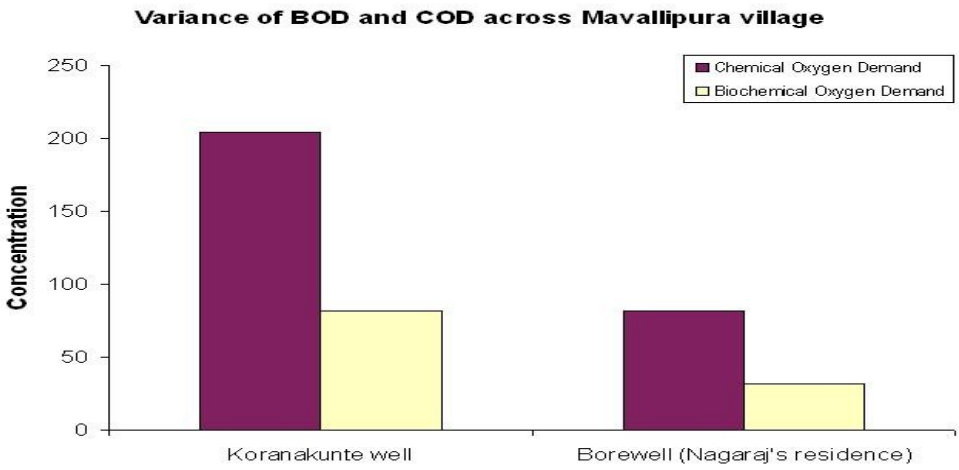
36 http://turfgrassmanagement.psu.edu/irrigation_water_quality_for_turfgrass_sites.cfm; Last accessed December 23rd 2009

37 http://www.acu-cell.com/pna.html; Last accessed December 23rd 2009

38 Central Pollution Control Board website; http://cpcb.nic.in/Water_Quality_Criteria.php; Last accessed December 23rd 2009

39 http://www.heritagesystemsinc.com/resources/BodvsCod.pdf

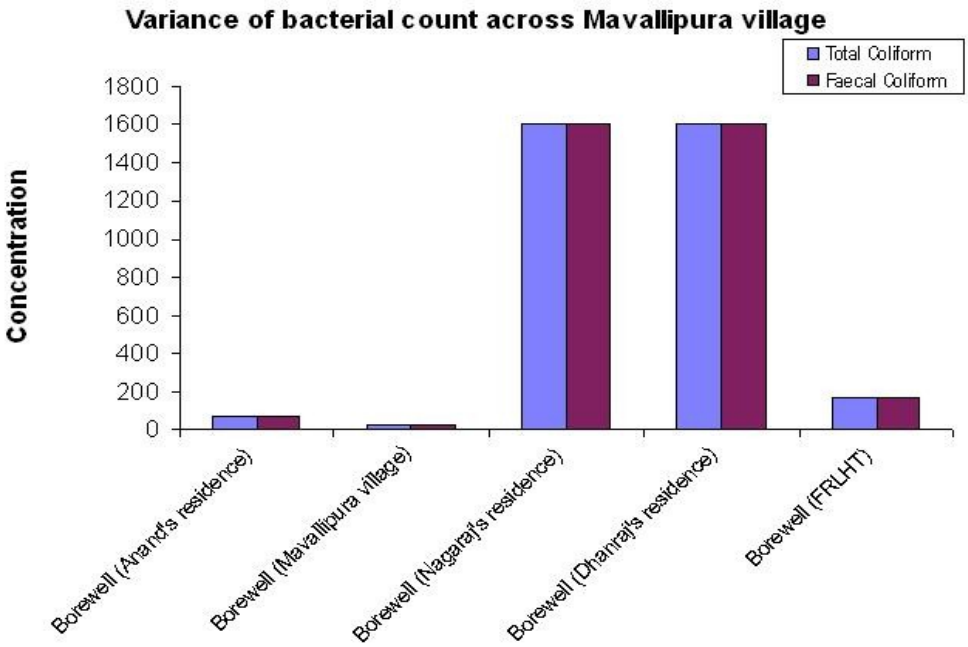
were absent in water sample from Nagaraj and Dhanraj's house. While BOD was absent in water sample from Dhanraj's house, water sample taken from Nagaraj's house has a BOD of 32mg/l.



Graph 6: Variance of BOD across borewells in Mavallipura village (Analysis done by Department of Mines and Geology, Govt. of Karnataka)

Section 3.3.1.6: Bacterial Count

The presence of *E.coli* in water is used as an indicator of fecal contamination originating from the intestine of warm-blooded animals, which includes humans. *E.coli* belongs to a class of bacteria called the coliform bacteria. The term Coliform bacteria includes the genera Escherichia and Aerobacter some of which are found even in soil. Therefore there is a presumptive and a confirmed test for the presence of the broad category of total coliforms and fecal coliforms respectively and a completed test for the presence of *E.Coli*. The Most Probable Number (MPN) Test gives us an approximate number of coliform organisms present in a volume of water thereby indicating the extent of fecal contamination.

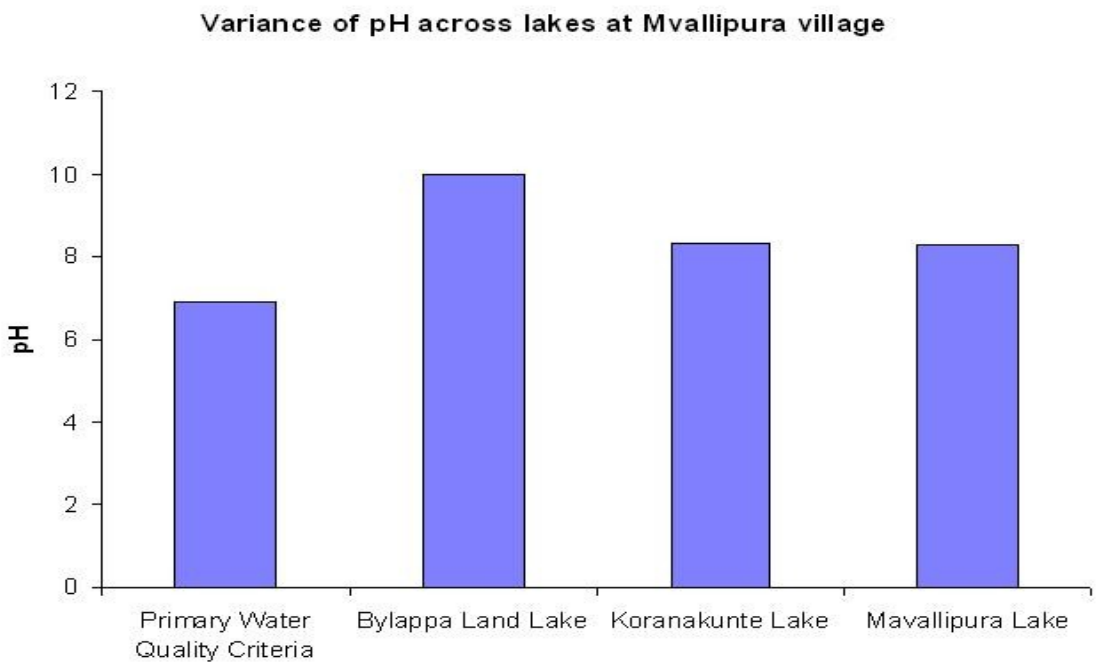


Graph 7: Variance of bacterial count across borewells in Mavallipura village (Analysis done by Department of Mines and Geology, Govt. of Karnataka)

Analysis: Potable drinking water should have zero faecal contamination. However, on observing the results of analysis for bacterial contamination, we see that all the five samples subject to the analysis showed presence of faecal contamination. Sample taken from a common borewell at Mavallipura village showed presence of faecal coliforms at a concentration of 23 MPN/100ml. Borewell water sample taken from Anand's residence had a concentration of 70 MPN/100ml. Borewell water taken from FRLHT, which is farther away from the landfill or Mavallipura village, was also contaminated at 170 MPN/100ml. Water samples collected from Nagaraj and Dhanraj's residence has shockingly high levels of bacterial contamination at greater than 1600 MPN/100ml. Fecal coliforms were completely absent from all of the borewell water samples that were analysed in 2006, thereby indicating some influx of pollution into the ground water over the past three years.

Section 3.3.2: Lakes

Section 3.3.2.1: pH



Graph 8: variance of pH across lakes in Mavallipura village (Analysis done by Department of Mines and Geology, Govt. of Karnataka)

Analysis: The primary water quality criteria for pH in lakes should be 6.9 [40]. All three lakes have values much greater than that. Having a greater pH has an adverse effect on the biotic life in lakes. For fishes to survive the pH range of 6.5 to 8.5[41] should be maintained. The pH of lake at Bailappa's land is close to 10 which is much greater than the pH for fishes to survive in the lakes. Also, Koramakunte and Mavallipura lake have pH 8.31 and 8.27 which is greater than the ideal 6.9 pH a lake should have. When water from Mvallipura lake was analysed in 2006 pH was at 7.73. Though this value is not ideal, it is also not as alkaline as the water is now.

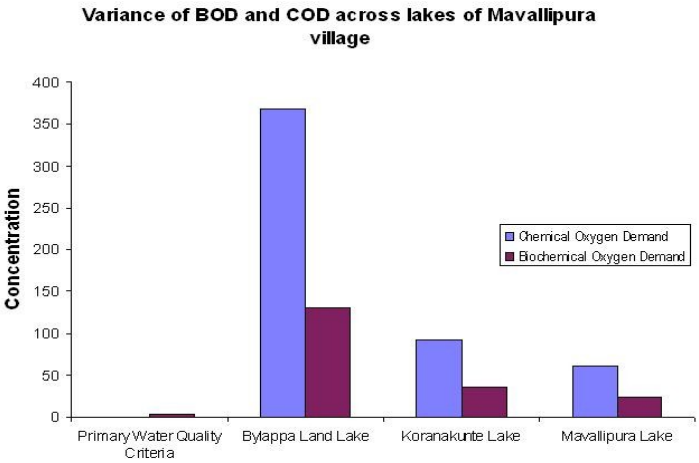
Section 3.3.2.2: BOD and COD

Analysis: Similarly, BOD of 3mg/l is ideal for lakes, however in all of the three lakes the values found were much greater than that of the ideal value of 3mg/l. Excess BOD results in accumulation of organic matter and further to the process

40 Lake Development Authority, Karnataka; http://www.ldakarnataka.co.in/status_of_lakes.htm; Last accessed December 23rd 2009

41 Central Pollution Control Board Website; http://cpcb.nic.in/Water_Quality_Criteria.php; Last accessed December 23rd 2009

of eutrophication or dying of lakes. All of the lakes are well above the desirable limit of 3 mg/l. Bailappa's land has very high BOD at 131 mg/l. Koramakunte and Mavallipura Lake also have high BOD at 35.3 and 23.5 mg/l. In 2006, Koramakunte well showed concentrations of BOD and COD at 20 and 70 mg/l respectively. In 2009, these values have increased to 35.3 and 91.8 mg/l respectively.

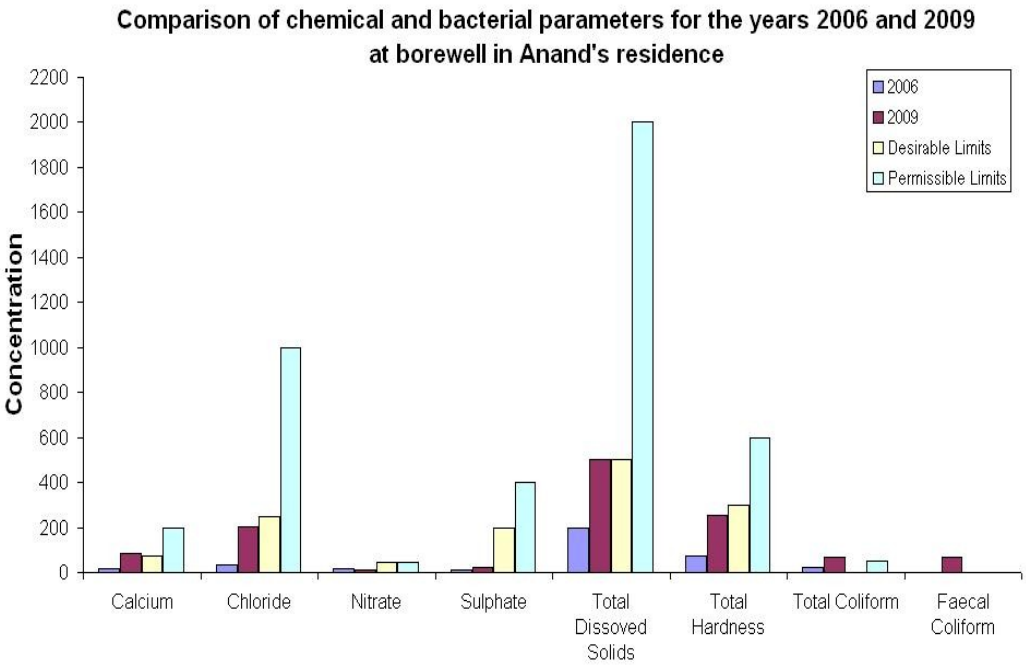


Graph 9: Variance of BOD and COD across lakes in Mavallipura village (Analysis by Department of Mines and Geology, Govt. of Karnataka)

Section 3.3.3:Comparison and Analysis of results of 2006 and 2009

Water quality analysis across Mavallipura village was also done in the year 2006. The potability of water was in question even then, but what is worse is over the period of three years, the quality of water has become worse. Detailed comparison of the different parameters for the two years is done below.

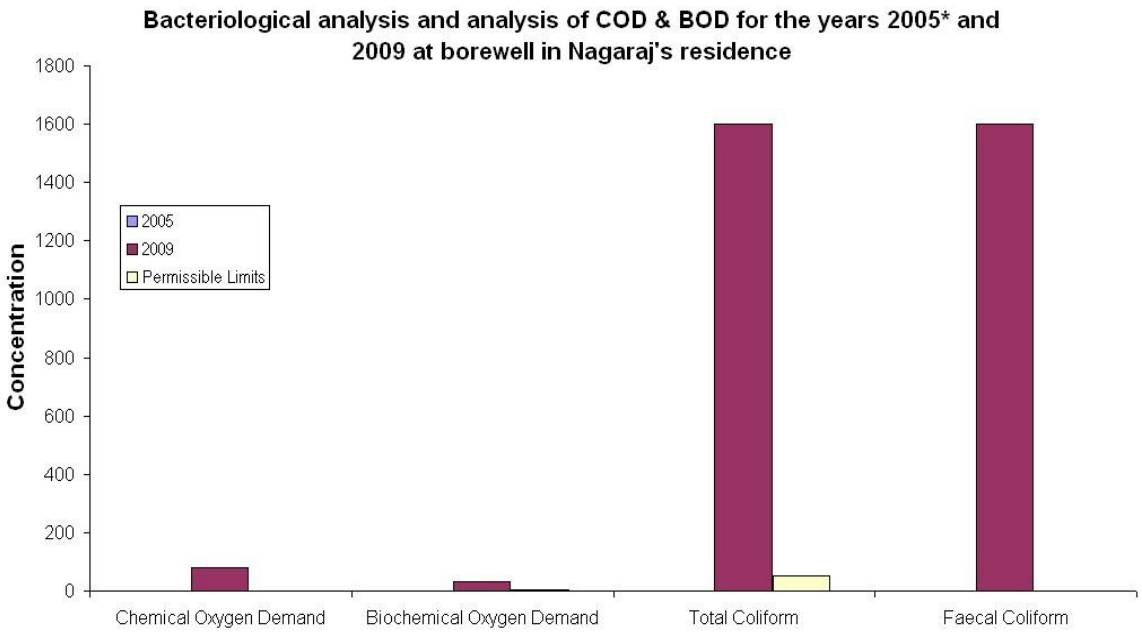
Section 3.3.3.1: Borewell at Anand's residence



Graph 10: Comparison between 2006 (Analysis done by Essen and Co., Malleshwaram, Bangalore) and 2009 (Analysis done by Department of Mines and Geology, Govt. of Karnataka) in borewell water sample collected from Anand's residence.

Graph 10 shows the values of different parameters of water sample collected from borewell at Anand's residence. One can observe a definite increase in all the parameters. For instance Calcium and TDS were very low as compared to the desirable values in 2006. Now they have shot up and have exceeded the desirable limit. Similarly, chlorides and Total hardness have now increased and are bordering the desirable value. Major concern is of the faecal coliforms which were completely absent when analysed during the year 2006 are now present at an alarming level of 70 MPN/100ml now.

Section 3.3.3.2: Borewell at Nagaraj and Dhanraj's residence

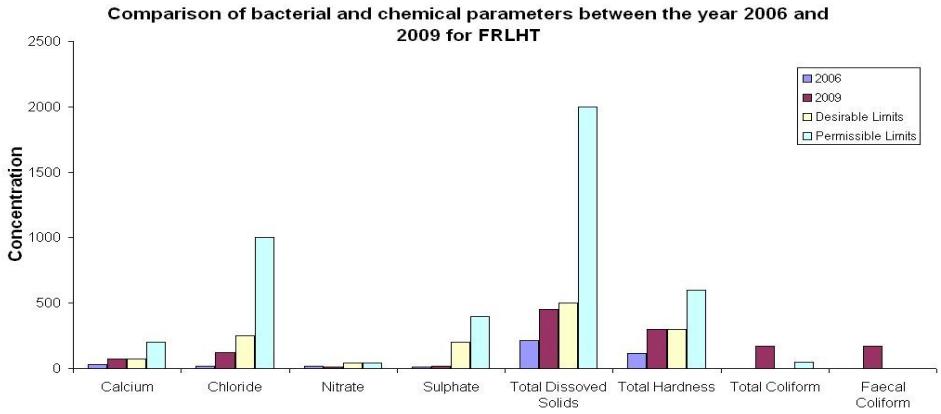


Graph 11: Comparison between 2005 (Analysis done by KSPCB, Bangalore) and 2009(Analysis done by Department of Mines and Geology, Govt. of Karnataka) in borewell water sample collected from Nagaraj and Dhanraj's residence.

There was no bacterial contaminantion in any of the two borewells when water was analysed in 2005. However, today the bacterial contamination was not just found to be present but at a level beyond the permissible limit in samples taken from both the houses. A BOD of 32mg/l was observed in water sample collected from Nagaraj's residence, when the permissible limit is 2 mg/l for drinking and 3 mg/l for bathing. The concentration of faecal coliforms was exceedingly high at concentration greater than 1600 MPN/ 100ml. Similarly high bacterial contamination was observed in water samples collected from Dhanraj's residence too. However BOD and COD was absent in samples collected from Dhanraj's residence. The water which was potable in the year 2006 can no longer be used without proper pre treatment.

Section 3.3.3.3: FRLHT

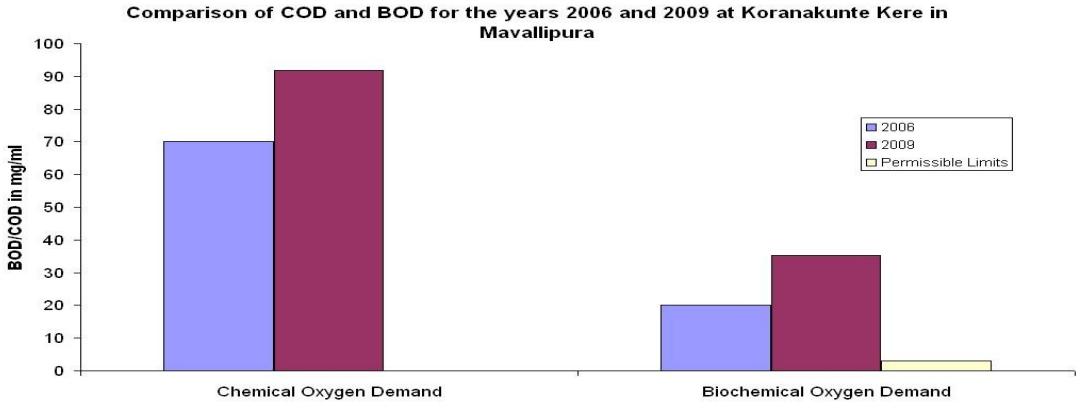
FRLHT was not polluted when water samples were analysed in 2006. In fact FRLHT water sample was used as a control to show harmful effects of dumping wastes to surface and ground water sources of nearby localities. Now, the situation has gone down to the level with this source of water has been polluted. Concentration of chlorides, calcium, sulphate, TDS, TH, has increased since analysis was done in 2006, though the concentrations are still within the desirable concentrations for potable water. The major concern is presence of faecal coliform bacteria at a concentration of 170 MPN/100ml. Faecal coliforms were completely absent when water was analysed in 2006, which has now increased to alevel making the water not fit for drinking.



Graph 12: Comparison between 2006 (Analysis done by Essen and Co., Malleshwaram, Bangalore) and 2009(Analysis done by Department of Mines and Geology, Govt. of Karnataka)

Section 3.3.3.4: Koranakunte Lake

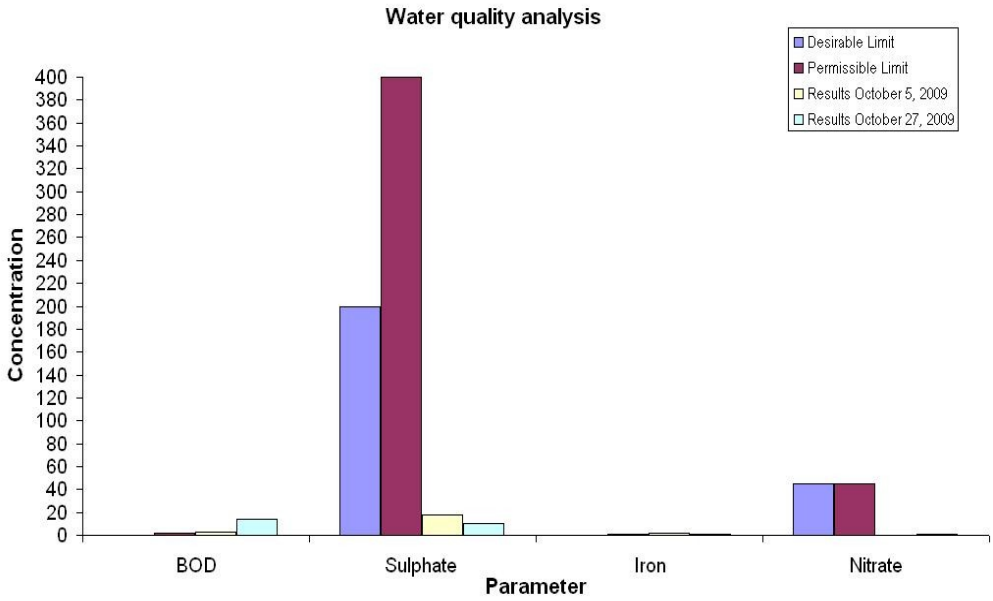
Koranakunte Lake was polluted even in 2006 having high BOD and COD levels. These values have increased considerably over the past three years. High values of BOD and COD and the increasing trend is making it extremely essential that some action be taken on getting the lake cleaned up before it contaminates other ground water sources.



Section 3.3.3.5: Mavallipura village lake

In October 2009, Karnataka State Pollution Control Board conducted a water analysis of Lake in Mavallipura village.[42] The sample collection was done on two days, one at the beginning of the month and another at the end of the month. Both the samples show exceedingly high levels of BOD. Graph 13 shows the concentration of various parameters analysed by them. Sulphates, Iron and Nitrates were found to be within limits. But BOD was found to increase even within the one month wherein it was analysed. Further to that, ESG collected samples on November 31st, 2009. And BOD analysis done on the sample showed the increase in BOD in the lake is more than double from 14 mg/l to 35.3 mg/l.

42 Analysis reports of Karnataka State Pollution Control Board Central Environmental Laboratory dated 27th October 2009 and 6th November 2009



Graph 14: Comparison of analysis done by KSPCB on 5th and 27th October 2009 in Mavallipura village lake

Section 4: Health Impacts of Mavallipura's landfills

Over the past several years, it has become increasingly evident that the high rates of pollution due to the Mavallipura landfills are seriously affecting the health of local communities. Livestock is also highly affected. With water contamination widespread, diarrhoea is common. This has resulted in people becoming increasingly vulnerable to a variety of infections. Children and women are the worst affected.

Cattle rearers and farmers are directly exposed to the toxic discharges from the waste dumps. A variety of skin infections are prevalent amongst these people.

Bronchial infections are also widespread, what with waste being burnt frequently. Many a time, discarded plastics and other combustible materials are burnt on open ground, causing widespread air pollution. A distinguishing feature of the air pollution caused by the landfills is the unbearable stench. Loss of appetite, sleeplessness, depression are resulting due to this situation. In turn this takes its toll on the general health of the population.
Children of Mavallipura look quite unnourished. While acute poverty may be a factor contributing to this situation, children from relatively better off families too look rather weak. Enquiries with parents reveal that children fall sick frequently, even if well nourished. In some cases immunity levels are so low, that children never know what it is to be

Picture 19: Photograph of a kid in Mavallipura village suffering from "some" heart ailment

healthy. An alarming indicator of such toxicity in children is their vulnerability to infectious diseases such as meningitis – sometime affecting all children in a family and neighbourhood.

Picture 20: Photograph of siblings suffering from meningitis

Like the children of Mavallipura, the livestock too look rather famished. This again is not necessarily because of lack of nutrition, for there is still plenty of open ground to forage, even after Ramky was allotted the village's grazing pastures for the landfill. Cattle rearers complain that their livestock do not produce enough milk as they are constantly sick –

polluted water being a major causative factor. As a result the life span of cattle has reduced. Sheep rearers complain that the weight of their sheep and goats is under par, and point again to the toxic pastures and waters as reasons why.

A most alarming indicator of the high rate of human toxicity is that the village has discovered a sudden spike in the rate of cancers, kidney failures and heart diseases. Also prevalent is a sudden fall in immunity levels of small children.

Picture 21: Photograph of Rajanna who was suffering from cancer finally succumbing to the disease in July 2010

A survey of the drinking water sources of Mavallipura and surrounding villages three years ago had revealed that not one source of water is potable. In fact many water samples reported high levels of heavy metals.[43]

Things have not changed till today. Water analysis was repeated and the samples were analysed to check its potability and again no source of water was suitable for drinking. It was especially shocking to see two water samples having faecal bacteria count of greater than 1600 per 100ml for two of the samples. This is from samples which had zero bacterial count when the analysis was conducted in 2006. It is no wonder than that many residents of the village have been suffering with various bacterial infections like amoebiosis, gastroenteritis and kidney failures.

None of the borewells at the Mavallipura village and FRLHT are potable in nature, with especially high bacterial contamination. This makes appropriate pre-treatment of water as mandatory before consumption.

There is without doubt an increase in level of contaminants in the ground and surface water samples collected since past analysis. The reason being continued inappropriate management of wastes leading to leaching of contaminants to the water sources.

Hence it is essential to clean up the area of wastes responsible for water contamination in order to prevent further influx of water borne diseases

43 For a detailed discussion of the contamination of water in Mavallipura, please access ESG's report at: http://www.esgindia.org/campaigns/Mavallipura/docs/MavallipuraSWM.pdf

Section 5: Mavallipura's illegal landfills

The Municipal Solid Waste (Management and Handling) Rules (MSW Rules) was formulated by the Government of India in 2000 following directions of the Supreme Court of India in a Public Interest Litigation to ensure comprehensive, sanitary, environmentally friendly and scientific management of solid waste in urban areas.[44 45]

The Constitutional 74th Amendment (Nagarpalika) Act delegated to local urban elected bodies the responsibility of solid waste management within their jurisdiction.[46 47] Despite such judicial and statutory requirements, Bangalore continues to dump a substantial portion of its waste in various points in the peri-urban area and the hinterland of the metropolis.

Schedule I of the MSW Rules require each municipal authority to develop appropriate waste management and disposal mechanisms. Further, it requires that scientific landfills must be developed by 31st of December, 2003. To this day, Bangalore does not comply with this direction of the Supreme Court and is also in comprehensive violation of the MSW Rules.

Schedule III of the MSW Rules provides detailed specifications for landfills regarding the selection of a site, facilities that should be available at the site, steps to be adopted to prevent spreadof pollution at these sites, monitoring requirements, and the closure and post-closure care of the site. These detailed specifications were created to ensure that highly hazardous facilities should not cause any harm to human habitats and environment of surrounding areas.

This report exposes the fact that the Ramky landfill has not been sited in accordance with the MSW Rules and other statutory regulations. It is, in fact, located close to an airbase (see Picture 8), Mavallipura village, Mavallipura tank, forest land, and is in the watershed of the Arkavathi river. Thus raising serious questions about what factors, if any, BBMP considered when choosing this location for construction of the landfill.

Ramky has failed to provide proper pollution control facilities at the landfill, in comprehenisve violation of the MSW Rules. The regulatory provisions demand that leachate generated by landfills must be treated by effluent treatment plants. While the EIA Study as well as the agreement between BMP and Ramky clearly describe an Effluent Treatment Plant (ETP) at the landfill site, Ramky has constructed no such facility.[48 49] Instead, leachate is collected in a pond, which on reaching its full capacity is pumped to another leachate pond and subsequently out into neighbouring village ponds and tanks. The only semblance of pollution prevention is a layer of plastic sheeting along the margins of the pond. There is no guarantee that the base of the pond is similarly lined. Recently, these receptacles became full to the brim, causing the leachates to breach their ponds and release these toxic waters to Mavallipura tank.

There is no record to prove that Ramky received waste with the consent of KSPCB as required per the Water (Prevention and Control of Pollution) Act. Whenever there have been acute pollution events, KSPCB has issued notice on Ramky and BBMP, and this has happenned more than once, on grounds of non-compliance with clearance conditions and violation of MSW Rules..[50, 51, 52 53] However, KSPCB has failed to proceed on such notices with punitive and corrective action.

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44 Dr. B.L. Wadehra vs. Union of India and others [(1996) 2 SCC 594 at 595], & Almitra Patel vs. Union of India

45 Municipal Solid Waste (Management & Handling) Rules, 1999; http://envfor.nic.in/legis/hsm/mswmhr.html; Last accessed December 22nd 2009

46 Manual on Municipal Solid Waste Management (first edition) by the Expert Committee constituted by the Ministry of Urban Development, Government of India, May 2000, Pg. 511.

47 The Constitutional (Seventy Fourth Amendment) Act, 1992; http://indiacode.nic.in/coiweb/amend/amend74.htm; Last accessed December 22nd 2009

48 Agreement between BMP and Ramky

49 Environment Impact Assessment Report – Integrated Municipal Solid Waste Management Facility, BMP. Chapter7, Page 7.6

50 Letter from Senior Environmental Officer, KSPCB to Joint Commissioner (Health), BMP and Managaing Director, M/s Ramky Infrastructure Ltd. Dated October 17, 2008.

51 Letter from Member Secretary, KSPCB to Deputy Commissioner (Health) dated July 20th 2009.

52 Letter from Member Secretary, KSPCB to Deputy Commissioner (Health) dated August 19th 2009.

53 Letter from Regional officer, KSPCB Bangalore North to Deputy Commissioner (Health) dated October 12th 2009.

The REEL EIA claims that the landfill will conform with the standards prescribed in the MSW Rules – in particular that leachates will be treated and that there would be continuous analysis of the treated leachate to ensure they are within the acceptable limits. However, there is no evidence of any leachate treatment system, or monitoring capacity at the facility. [15]

A "scientific" landfill has a non permeable lining system along its base and walls to ensure no waste material spreads to surrounding lands and to prevent leachates from percolating into the ground. Further, the wastes brought in daily are segregated, organic waste composted, and the refuse compacted and disposed with a cover of a layer of soil at the end of the day. This avoids stench from these wastes spreading the surrounding areas. This also prevents breeding of flies, mosquitoes and other disease carrying vectors. Once the landfill reaches its full capacity, it is covered as in a silo so that there is minimum infiltration and erosion.

The Ramky facility is no such landfill. The pits are not concrete lined, there is no impermeable layer to prevent groundwater contamination, no soil is used to cover the garbage dumped thus exposing communities to millions of flies and mosquitos that breed in the landfill. The leachates are collected in open ponds that are shabbily designed and are claimed to work as solar evaporation ponds. No effluent treatment plant exists in the landfill. When it rains the leachate ponds overflow and easily spread their toxic discharge into other surface and ground water aquifers contaminating them.

Such unscientific and shocking way of 'treatment of solid wastes' has resulted in pollution of water bodies around the Ramky facility. On closely observing the Ramky landfill, one observes that in the name of the landfill, what actually exists is a huge pit which has been dug out and filled with garbage everyday for the past three years. The waste now is brimming over the tops of this pit, and it seems clear that the landfill is already exceeded its capacity. This is alarming becausing Ramky's dumpyard per EIA and clearance requirements is meant to last at least 20-25 years.

This dump is also in violation of the government order notified by the Department of Forest, Ecology and Environment protecting 1453 sq km around the Tippagondanahalli Reservoir that is used to supply water to some parts of Bangalore.[54] The dump falls in Zone 1 identified by the order and is about 3 kms from the river flow and about 12 km by aerial distance from the reservoir. The order observes that "there are number of industries in the catchment area, whose effluents along with underground leachate and sewage flow into the TGR thus affecting the quality of water" and considers it "essential to protect this sensitive area of TGR catchment and to prevent any activity that leads to contamination of the reservoir". In a site inspection the KSPCB has noticed that leachate from this dump is being let into an artificial tank, and released into Mavallipura tank – which is part of a chain of lakes that ultimately discharge into the Tippagondanahalli Reservoir.[55]

According to the MSW Rules, BBMP is required to submit an annual report on the solid waste processing and disposal facilities in its jurisdiction to KSPCB, with a copy to Karnataka Department of Urban Development. This report has to be filed by the 30th of June every year. There is no such reporting by BBMP till the year 2006.[56] On its part KSPCB has not initiated any punitive action against such non-compliance, thus encouraging a very callous approach to solid waste management. As a result both waste handlers and regulators regularly fail in their statutory obligations to conform with the norms per law.

The situation in Mavallipura is alarming. The thorough mismanagement of the Ramky landfill and the consequent damage to human health and environment, is compounded by the long term damage due to the unscientific abandoning of the earlier landfill run in the neighbouring grounds by Bailappa. Together, these landfills pollute every day, and have made life miserable for the local populace.

Another alarming factor is that these dump yards are in close proximity to the Yelahanka Air Force Base, which is a little over 5 kms. away. Old airport design standards[57] prescribe that slaughtering of animals and of depositing rubbish, filth and other polluted and obnoxious matter within a radius of ten kilometers form the aerodrome reference point is

54 Government order no. FEE 215 ENV 2000 (dated 12th Jan, 2004) notified by the Department of Forest, Ecology and Environment.

55 Proceedings of Personal Hearing held with M/s Bangalore Mahanagar Palike (BMP) on November 11th 2005

56 An application was made by ESG under the Right to Information Act to get a copy of the Annual Report to be submitted every year by the BMP to the KSPCB on 26th May, 2006. The KSPCB replied that they had not received any such reports.

57 Aircraft Act, 1934; http://dgca.nic.in/rules/act-ind.htm; Last accessed December 22nd 2009

prohibited. This clause is meant to avoid attraction of birds as they pose a deadly threat air crafts. Yelahanka Air Force Base has suffered at least two major accidents in recent years, and because it is a Defense airport, the cause has not been revealed on grounds that they constitute official secrecy.[58]

58 ESG's Right to Information Application seeking the causative factors were rejected by the Indian Air Force in its decision dated 20 December 2007 Ref No. Air HQ/99616/12/AOA Speaking Order No. 55/2007

Section 6: Conclusion

The Mavallipura landfills are a clear indicator of the callous disregard that BBMP has for public health and environmental laws and standards of India. It is also demonstrative of their active contempt to the directions of the Hon'ble Supreme Court of India which has gone into extraordinary detail and effort to arrest environmental pollution. This situation is also an alarming indicator of the appalling dismissal of the Fundamental Right of the communities of Mavallipura and surrounding villages to live a life of dignity, and in a clean environment.

People are dying in Mavallipura today. Despite many falling sick with increasing regularity, there simply has not been any comprehensive effort on the part of BBMP or the health authorities to attend to this health crises. It is deeply worrying that many are reporting incurable diseases like cancer, kidney failure, etc. which could well be a result of the high toxicity in the ambient environment. Two deaths in July 2010, one of Rajanna, a victim of cancer, and 15 year old Akshay Kumar due to dengue, are alarming indicators of the deteriorating health status of local communities.

While BBMP and the landfill operators, Ramky and Bailappa must accept full responsibility for this unfortunate calamity, it must also be recognised that this kind of situation arises due to the acute disregard to a simple and effect solution to the problem: segregating waste at source, composting organic waste locally, recovering recyclables locally to the maximum possible extent, and only transporting useless and hazardous material to landfills. For this to happen, everyone who generates waste must own up the responsibility for the adverse impacts we are causing on the people of Mavallipura, and similar communities around Bangalore.

Unless we take this proactive approach, it is more than likely that such landfills will continue to cause extensive pollution and disturb the peace, quiet, health and livelihoods of impacted communities. Our use and throw approach will also certain impact us, indirectly. What is dumped in Mavallipura is polluting water sources of the Arkavathy River, waters from which is pumped back to Bangalore.

The purpose of this report is to awaken us to our collective failure and also lay the ground for punitive action against BBMP, landfill operators and regulatory agencies who are dealing with life and environment callously.