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Restoring Urban Ecology at Sir M. Vishweshwarayya Marga

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Abstract

As a city grows, changes are seen in many locations, especially along the major and wider roads. When the road is the important connecting link between two major points, then it will be the fastest-changing line. The changes are even more rapid when that road is major connectivity between twin cities. Hubballi and Dharwad are considered to be among the fastest-developing cities in Karnataka. These cities are growing towards each other as well as growing outwards. One can see an unobstructed commercial development along the road between them. There are some gaps seen, which have to be filled. These gaps are becoming unsafe stretches for pedestrians and vehicles in some places. Such stretches are seen with open drains, grey water, broken footpaths, absence of lighting, footpath encroachment, abandoned buildings, neglected ponds etc. One of such gaps is seen between Vidyagiri and Gandhinagar of Dharwad city, known as "Sir M. Vishweshwarayya Marga" along the HD-BRTS corridor. This research aims at intertwining social safety, connecting such gaps with active and positive urban design intervention, and making them more pedestrian-friendly throughout the day and night.

Keywords: Twin-cities, Safe pedestrian way, universal accessibility, HD-BRTS corridor, urban ecology.

Introduction

Urban ecology is the scientific study of the relation of living organisms with each other and their surroundings in an urban environment. An urban environment refers to environments dominated by high-density residential and commercial buildings, paved surfaces and other urban related factors that create a unique landscape. The goal of urban ecology is to achieve a balance between human culture and natural environment. Storm water management is getting more prominence in city area and city planning. It is now being as resource to address water scarcity in urban areas. Some of the developed countries use storm water to recharge ground water aquifer after adequate treatment.

Source: *news9live.com*

Fig 1: Location of Dharwad district in India map

Hubli-Dharwad twin cities fall under the tier-II cities list in Karnataka. After Bangalore and Mysore, These cities are developing rapidly all along the major transit corridors. Major cities like Mangalore, Belgaum, Gulbarga, and Davangere are other cities coming in tier-II categories in Karnataka. Hubli-Dharwad has recently added with International quality airport serving many cities within India. Hubli has the Head-quarters of South-western railways. IIT Dharwad is a new addition to the glory of this city along with existing Karnatak University, University Agricultural Science, High Court, Hubli APMC yard (one of the biggest in Asia), Karnataka State Law University, SDM Medical Sciences University, TATA motors, Marcopolo, Hitachi, Infosys, Deshpande foundation and many multinational companies as landmarks. All these cater to the growth of population within the cities and by migration. There needs to be proper supply and maintenance of infrastructure to cater to the growing needs of population, industries and institutions.

For the last 5 years Hubli and Dharwad cities are connected with the BRTS corridor which led to the development of commercial landuses along its length and more importantly the footpath along both sides of the corridor for the safe passage of pedestrians and at many places people use is for most of the times. There is safe signaling also for crossing the roads at all junctions and is in operation from 8am to 8 pm. There are issues in the continuity of these footpaths in certain stretches between these cities. There are some abandoned places along the transit line of 20 km, they need to be addressed to make the whole stretch a beautiful journey.

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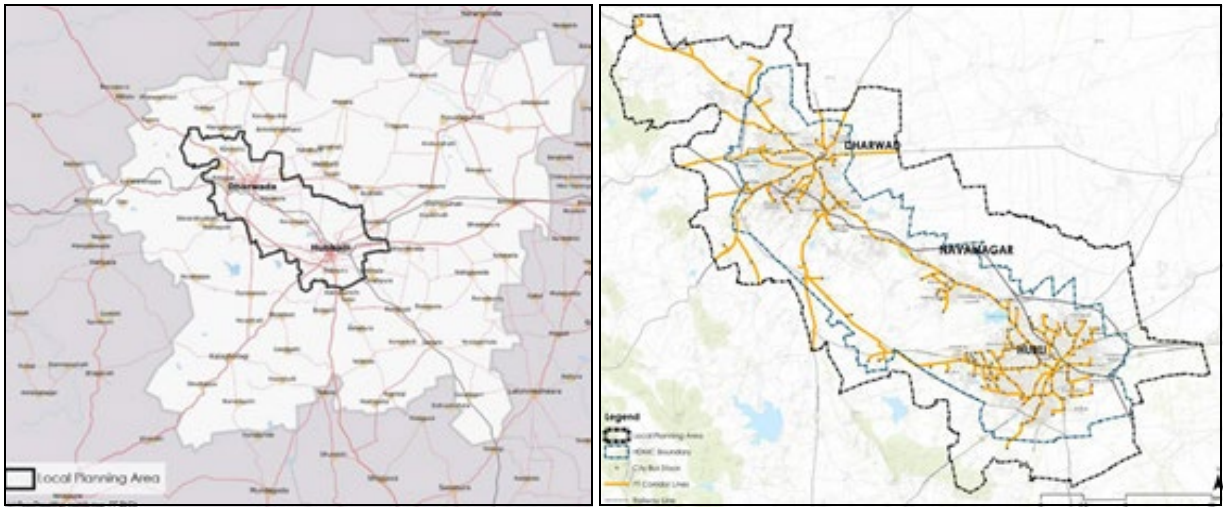


Source: *1. Wikipamia commons, 2. link.springer.com-Visualising public transport accessibility to inform urban planning policy in Hubli-Dharwad, India Published: 23 November 2021*

Fig 2: Location of Sir M. Vishweshwarayya Marga, Dharwad

Background Study

Dharwad is known as the education hub of north Karnataka since it has many well-known colleges and universities. Along with people within the city and surrounding villages, people from surrounding districts and Kalyan Karnataka region come to Dharwad to study PUC, Diploma, ITI, degrees, Engineering, Master degrees, Medical, dental, PhD., and many other courses. The crowd is seen everyday morning all over the city filled with students coming to colleges, and evening waiting for buses to return to their destinations. They have a belief in education institutions in Dharwad, that they will be taught in a good way to empower their future. These students have to move from their houses or hostels to tuition classes, Lunch, dinner and back to their houses every day. Many times tuition going students tend to go home after late evenings. They have to move through certain zones where there are no public, street lights, footpaths, signals, or security for them. They even have to cross overflowing, bad odour, and stagnant drainage water in the rainy season. All these create a safety concern for pedestrians more than vehicles. Pedestrians here include not only students, but elderly people, children and women.

The charts below shows that Dharwad has highest rainfall in last 40 years and will have good rainfall in next 20 years as projected by the department of agricultural meteorology, UAS, Dharwad.

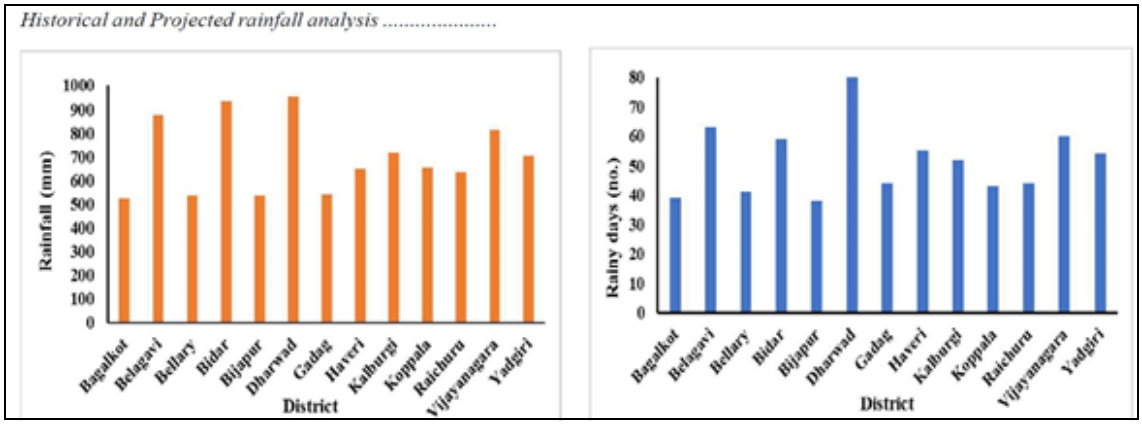


Fig 3: Annual rainfall and annual rainy days across the region over last historical period from 1981 to 2020

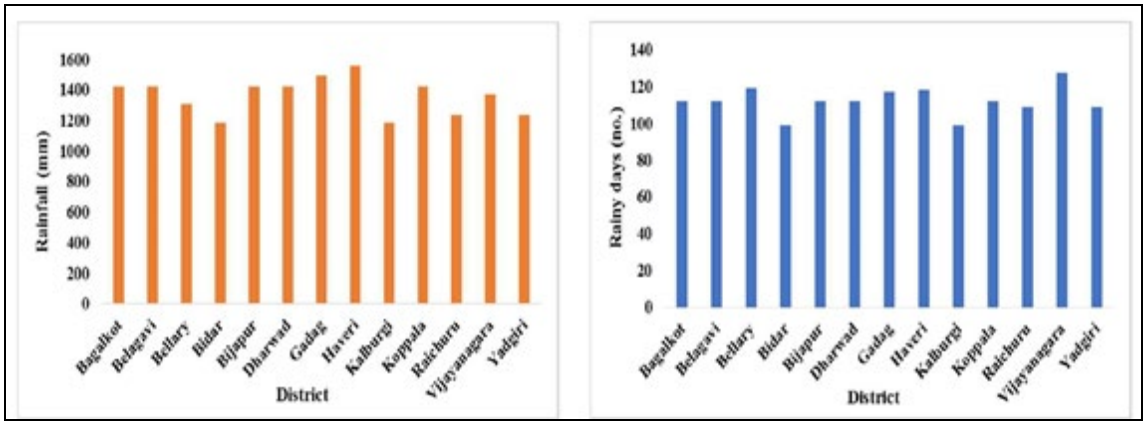


Fig 4: Annual rainfall and annual rainy days across the region for the projected period from 2021 to 2040.

A simple formula to calculate rain water collected in one year is:

Mean annual rainfall in mm x area in m² x runoff factor = collected rainwater in litres.

Importance of Lakes: Man-made lakes have been constructed mostly to store seasonally available water, usually for urban water supply and/or irrigation. Man-made lakes may perform several other function in the manner as natural lakes like ground water recharge or influence on microclimate and may gradually, over long periods, turn into wetlands, that support rich biodiversity and have high biological production. The functions of lakes as ecosystem provide great value services to humans.

Fig 5: Google Earth image showing the BRTS corridor, service road, footpath and pond portion.

Fig 6: Area highlighted with colour shows different localities around the main road and pond.

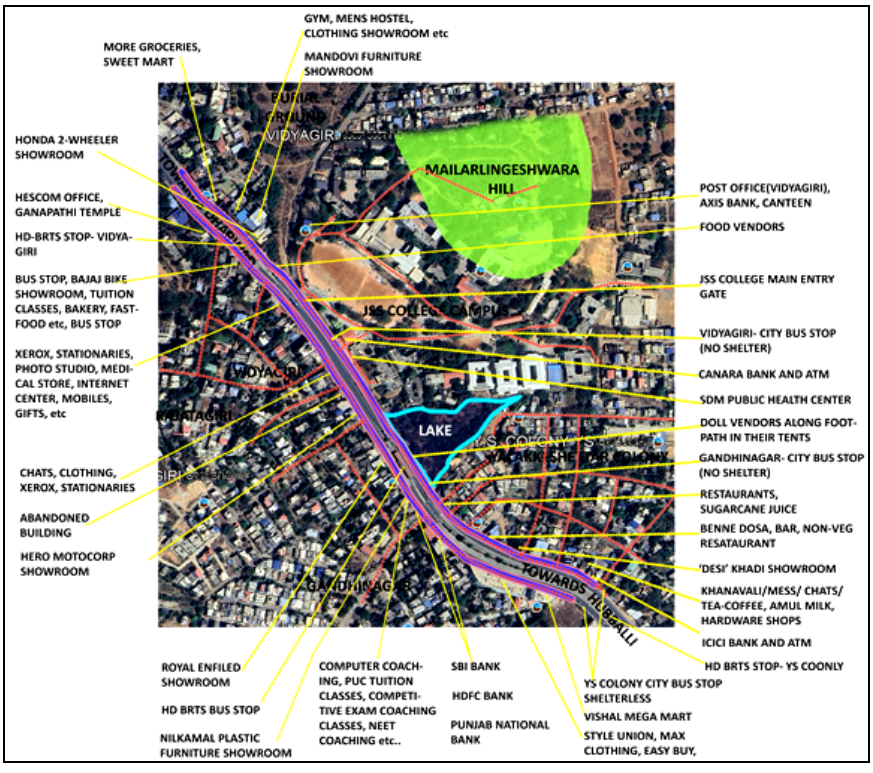


Fig 7: Map showing the amenities along the street on both side.

About the Location: The road between Dharwad and Hubli passes in North-South direction. 'Sir. M. Vishweshwarayya Marga is located at 3 km from Jubilee Circle of Dharwad and 17 km from Rani Channamma circle of Hubballi. Rajatagiri and Vidyagiri are at west side of the road and Mailarlingeshwara hill and JSS College are on the eastern side of the road. Both form a valley at the junction and this is the where HD-main road passes through. Gandhinagar is located on slopes of Vidyagiri and Rajatagiri. YS Colony is lower than all of these areas. The land is almost flat at the southern side of YS colony up to Navalur Village. Pedestrian movements are highlighted with red-dotted lines in the map, They all start from main road and go in depth from main road. Because of the presence of school and colleges at this area, it becomes crowded during morning and evening peak hours say from 9.00 am to 11.00 am and evening 5.00 pm to 8.00 pm. People in Hubli-Dharwad use BRTS bus services, sometimes they use local CBT buses and private bus services operated by Bendre city bus service. Passengers need shelter to wait for these buses as well if they want to travel by buses other than BRTS (Chigari bus).

Fig 8: Time line of Google Earth images to show the presence of pond

From the above google earth images at different periods, it can be observed that there exists a water body which went on filled with drainage water and soil from surrounding areas and hence its capacity to store water is reduced with time. In the 2011 earth image, there were no trees in the middle of water body. Hubli-Dharwad's main road was still a 2-lane road without divider. But there are trees grown in the place of water in 2020 earth image. In 2012, the HD-BRTS work started between Hubli and Dharwad. Roads need to be widened and for this purpose, many old trees were cut down.

At end of 2020 when BRTS bus service started, the organisation states that it planted 10 trees for every one tree that was cut during the corridor work. We get to see them in Hubli-Dharwad in different parts of the city. One of them is the Navaluru hill. It is now covered with greenery and catering to the loss of trees before.

Natural lakes are not only storage reservoirs, they maintain the ecosystem with complex geology, climate, hydrology and biology anthropogenic influence in their entire drainage basins. Natural lakes perform several functions that includes hydrology, biology and other ecological functions at both ecosystem and landscape levels, depending upon their location, nature, age, size, depth, turnover rate and catchment area. Most riverine lakes play a very important role in flood mitigation and ground water recharge. At landscape level, large lakes significantly influence microclimate and therefore influence biotic diversity. Several socio-cultural and economic functions are associated with the lakes.

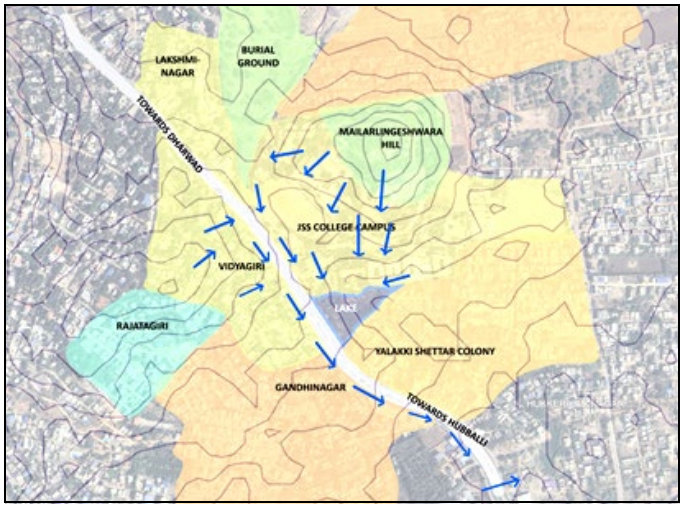


Fig 9: Contour map showing the slopes and arrows showing present condition of flow of storm water.
(Contours map generated in QGIS)

Issues

Storm water from Gandhinagar and Vidyagiri hilly areas flows towards main road and flows down along the road. This is due to the absence of under passage for storm water.

Blockage of surface runoff from Mailarlingeshwara temple hill towards pond, due to the construction of new buildings inside JSS college campus. The area where rain water falls and is collected is the catchment area and in this region, most of the land is covered by buildings. Other than this, rain water from road surfaces needs to have passages under footpaths at regular intervals. BRTS corridor has cement concrete road, service road has tar pavement, footpath has cement block pavers, and all these surface don't have water percolating capacity. Any small pores left in pavers is filled with soil and dust which makes them impervious.

Following are the Approximate Areas of above Said Localities:

- Vidyagiri and Gandhinagar: approx.16.7 hectares
- JSS college campus and Mailarlingeshwara hill: approx.13.2 hectares
- Road surface (1km): approx. 1.37 hectares.
- Total area: 31.27 hectares
- Add area of the pond: 1.27 hectare

Fig 10: The sectional elevation shows the valley between Mailarlingeshwara hill and Vidyagiri

Fig 11: The sectional elevation shows the valley between Mailarlingeshwara hill and Gandhinagar bus stop.

Un-shaded footpath for pedestrians during day time, due to cutting of trees during BRTS corridor project. Absence of shelter for city bus stops on this route (Vidyagiri, Gandhinagar, YS colony). Encroachment of footpaths, parking issues for two wheeler, four wheeler and bus stops. Drainage overflow from hilly regions of Vidyagiri and Gandhinagar area flows onto the main road, which blocks the pedestrian movement. Old and unused buildings along the footpath, half constructed buildings with GI sheets barricades falling on footpath. Broken footpath and drainage clogging not cleaned time to time. No lighting for footpath on both sides of road. Universal accessibility issues and social safety issues for all category, especially for women, children and old aged. Blocking of surface runoff towards the pond from Vidyagiri and Gandhinagar hilly areas. Absence of drainage underpass (BRTS corridor) from Vidyagiri to pond side. Blockage of surface runoff from Mailarlingeshwara temple hill towards pond, due to the construction of new college and school buildings inside JSS campus. Landfill at the edges of Pond Bund and landfill at the road edge by footpath vendors beside Gandhinagar BRTS bus stop. Pond overflows during rainy season due to the breakage of pond bund long ago which is no repaired. All overflow water flows through narrow naala inside YS colony area, which again overflows in residential areas. Absence of dedicated park for children and elderly people in this precinct. CCTV surveillance have to be made at the road, footpath, Gandhinagar, Vidyagiri and YS junctions. Below are the images showing all issues stated above.

Fig 12: Issues due to shortage of bus shelters (Vidyagiri, Gandhinagar, YS colony).

Fig 13: Encroachment of footpaths on both sides of the road

Fig 14: Parking issues for two-wheeler, four wheeler and bus stops

Fig 15: Drainage overflow from hilly regions of Vidyagiri and Gandhinagar area onto the main road, blocks pedestrian movement.

Fig 16: Broken footpaths and drainage clogging need to clear for pedestrian movement.

Fig 17: Issues with old and unused buildings along the footpath and under constructed buildings with GI sheets barricades falling on footpath.

Fig 18: Universal accessibility issues at footpath

Fig 19: Night pictures showing the streets and footpath without street lights.

Fig 20: Pond overflows during the rainy season due to the breakage of pond bund long ago, this is due to the loose soil. All overflow water flows through narrow naala inside the YS colony area. Which overflows in residential areas and blocks the easy flow of other drainages.

Fig 21: Access to pond bund is blocked due to footpath vendors and waste thrown by night food stalls beside Gandhinagar BRTS bus stop.

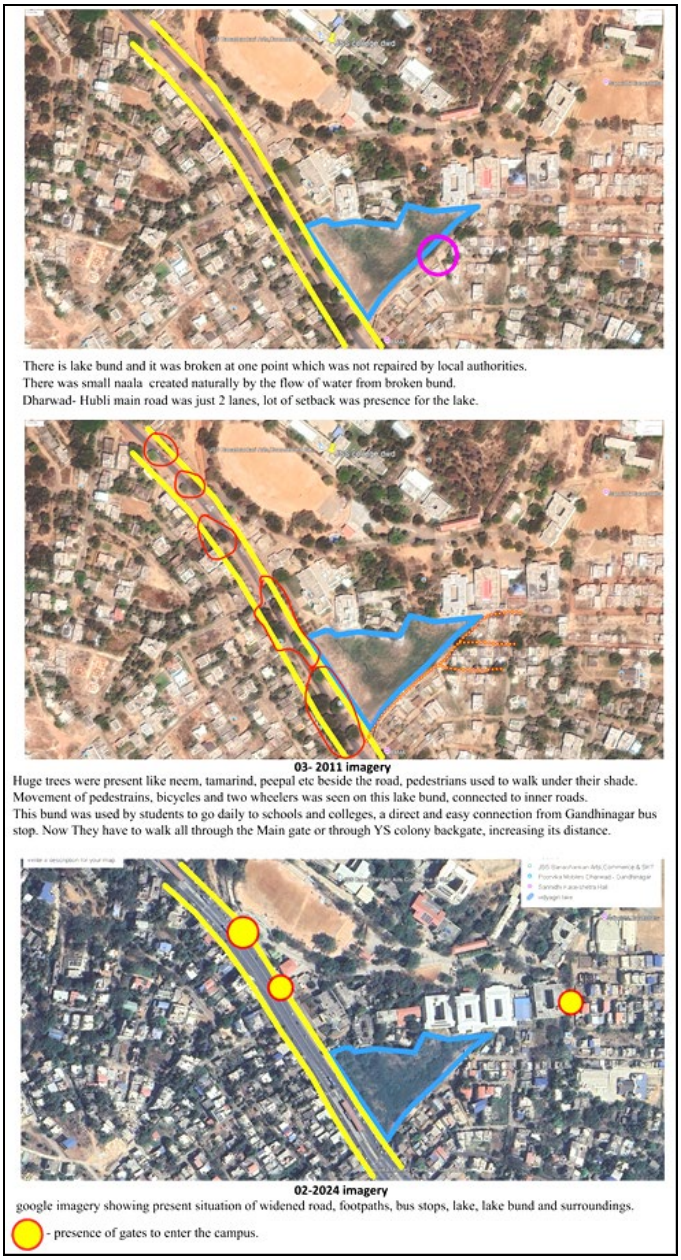


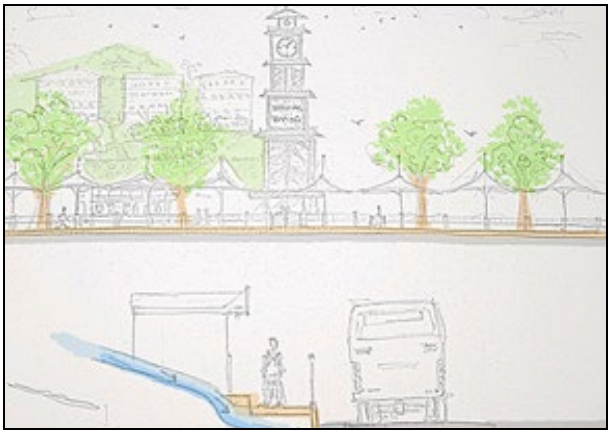
Fig 22: Condition of road stretch before and present.

Taking into the consideration of exiting issues and possible future issues that may arise, we need derives two major strategies to solve them:

1. **Redesigning Footpath**
   - Provide shading devices to footpaths with native species of trees as boulevards.
   - Porous footpath pavers for percolation of surface water into the ground instead of existing cement non-porous pavers.
   - Provide streetlights and make sure that they are lighting the footpaths on both sides of roads for the movement of pedestrians after sunset.
   - Footpath encroachment has to be cleared from vendors, under-construction sites and debris.
   - Provide shelters for bus passengers at Vidyagiri, Gandhinagar and Y.S. Colony stops, so passengers can get shade in summer and shelter in rainy seasons. Also, help elderly people to sit and wait for CBT buses.
   - Small passages have to be created under the footpath at regular intervals so that surface water from the road flows towards the pond.
   - Provide grating at the road junction of the main road and slope roads.
   - Provide dust bins at regular intervals.
   - Provide CCTV at regular intervals for the safety of the public during the day and night.
   - The park will enhance the quality of space in the vicinity by allowing children and the elderly to spend time. The clock tower in the park will become a valuable landmark.

2. **Rejuvenating the Pond**
   - Redesigning open drains on both sides of the road, with proper connection of storm water drains to main drains by introducing inspection chamber at the junctions.
   - Maintaining reduced slopes to slow down the water flow from hilly region to main drain line.
   - Increasing the height of footpath so as to avoid overflow water on footpath.
   - Possibilities of rejuvenating the pond by connecting under passage for storm water to flow from Gandhinagar and Vidyagiri hilly region towards the pond.
   - All residential and the school and college buildings have huge roof areas. So, making compulsory rule to direct all buildings' roof water towards the pond.
   - Making proper storm water catchment valleys in the hilly region to collect rain water and direct it towards the pond.
   - Need to redirect building drainage lines away from pond to avoid polluting the pond.

Sketch showing conceptual layout



Sketch showing street elevation and part section

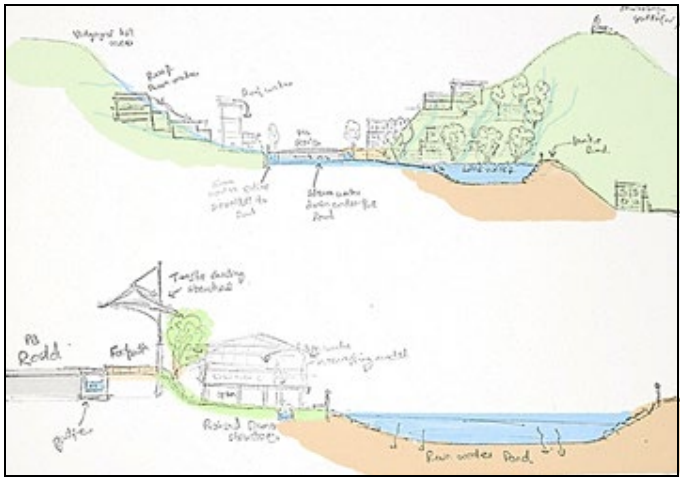


Fig 23: Conceptual sketches showing the strategies to solve the issues at the location (sketches by author).

The major strategy here is to make the pond gets water from surrounding hill region from Vidyagiri, Gandhinagar, Mailarlingeshwara hill and JSS campus. Following image shows stepwise movement of storm water into the pond in basic Low Impact Development design (LID).

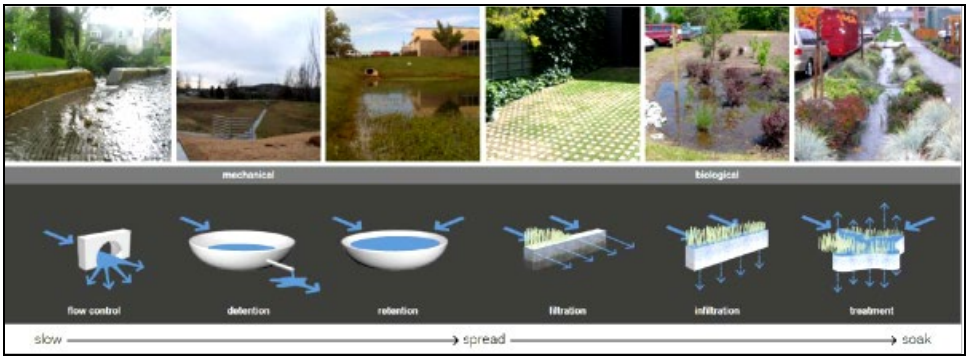


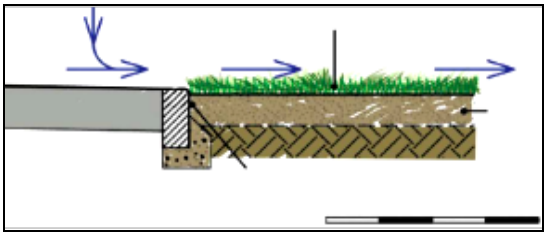
Fig 24: Low Impact development processes

Flow Control: The regulation of storm water runoff flow rates
Detention: Temporary storage of storm water runoff in underground vaults, ponds or depressed areas allow for metered discharge that reduce peak flow rates.
Retention: The storage of storm water runoff on site to allow for sedimentation of suspended solids.
Filtration: The vertical movement of storm water runoff soil, recharging ground water.
Treatment: Process that utilize phytoremediation or bacterial colonies to immobilise contaminants in storm water runoff.
(Source: Manual on artificial recharge of ground water, Ministry of water resources, Central ground water board)

Fig 25: The process of flow control, Detention, Retention, Filtration, infiltration and Treatment in the proposal.

Fig 26: Make proper way for rain water surface runoff and direct it towards the pond by cleaning and removing the debris from its way. The catchment area in the surrounding hilly areas provides better supply of rain water to this pond. (3D view by author).

On steeper slopes, water moves faster as compared to flat lands, this increase flow of storm water aided by a lack of required vegetation cover results in transport of larger amount of sediments along with it. Urbanisation in hilly area increases the paved surface by concrete, road, building footprints. These are not permeable to water, rain water cannot percolate through the paved surfaces easily. This results in gushing of storm water to low lying areas and causing frequent flooding, water logging. The storm water runoff from urban areas will come into contact with the pollutants like drains, oil spills, urine, waste vegetable material, decaying materials, hazardous chemicals etc. Hence it needs to be filtered/treated before letting into the pond. Use of filter strips is one idea to filter the storm water naturally.



Cross section of a filter strip

Fig 27: Buildings in the surrounding area have to be adopted with rain water collecting system. Roof water has to be collected from all building roofs in the vicinity. Make separate channels for roof water to flow towards the pond.

Fig 28: Trees and streetlights along the footpath and trees on northern side of lake.

On the other side is to redesign the footpath between Vidyagiri and Gandhinagar junctions. Make this footpath wider up to 4.0 m from 1.5 m before, so pedestrian can enjoy the view towards the pond, halt for some time and proceed. A line of trees shade the footpath during the whole day and street lights provide light after sunset. Trees are planned with respect to sun path direction, it give gives cooling effect on the way throughout 1km stretch of footpath. Pedestrian can walk through it comfortably during daytime. Another set of trees are planned along the northern side of pond in line with JSS college campus, this hides the building from direct view as there are hostel building on this side of the campus.

To add to this vista, a clock tower is added in the proposal. Since, this is the point where people catch their buses, children go to school and college. This junction is becoming busier day by day since the availability of all amenities at Gandhinagar and YS colony. It marks the second entry point from Hubli to Dharwad city after YS colony.

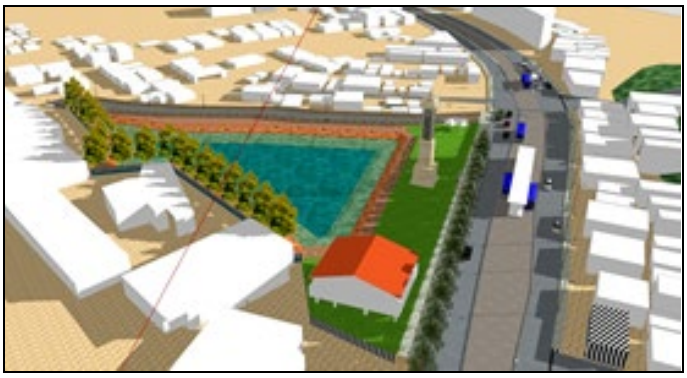


Fig 29: Birds eye view showing the strategies of redesign.

Fig 30: View from the bund side of the pond looking towards Gandhinagar junction.

The park beside the pond is equipped with working models of rain water harvesting techniques. One building to demonstrate all the possible techniques of harvesting rain water in any building. This park will be open to the public, not only for leisure, also to learn about the importance of water.

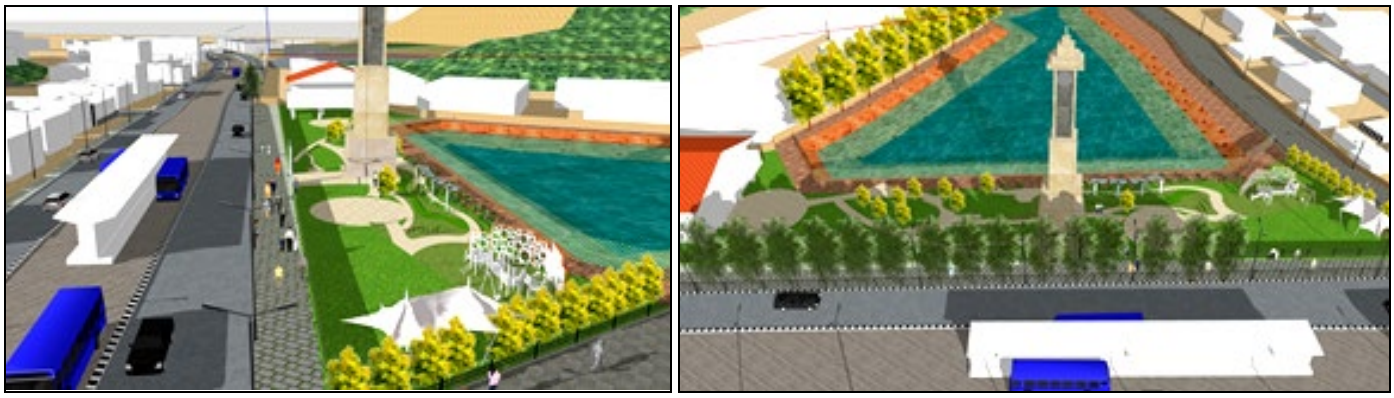


Fig 31: Birds eye views showing rejuvenating strategies for pond and park

Fig 32: The existing condition of the road, footpath and pond

Fig 33: Proposed strategies for rejuvenating the place

Considering the roof catchment area of surrounding regions, it is observed that lakhs of litres of rain water is just left off to flow towards the low lying regions without being harvested and without percolating in the ground.

Storm water inlets are system used to collect surface drain, runoff to an underground storm water drain system. Inlets are systematically fixed on pavements, on gutter sections, medians, and road side edges, junction of footpath and road paving.

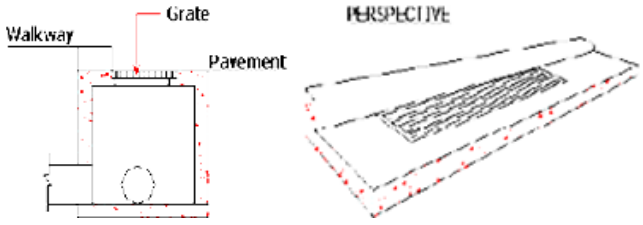


Fig 34: Grate inlet details for road surface runoff.

Catchment basin is an inlet system designed to retain debris transported by storm water and sediments which might enter storm water drain and clog the storm water pipes. The pipes from several outlets at a corner may discharge into same catch basin. These require periodic maintenance to be effective otherwise they may get bad odour and mosquito nuisance.

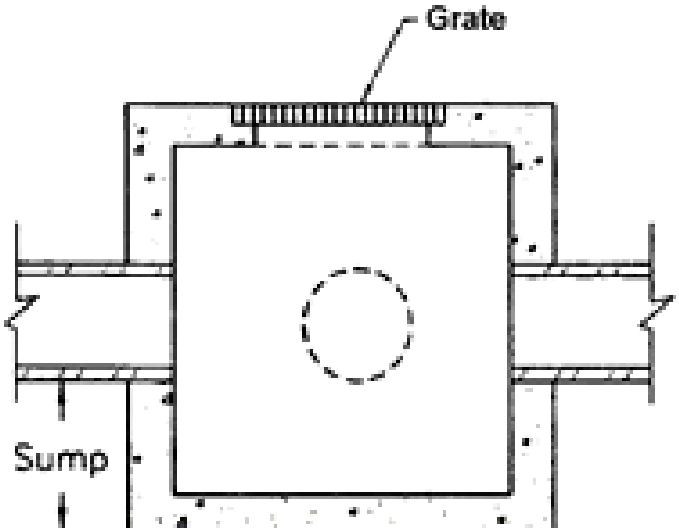


Fig 35: Catchment basin

Conclusion

Dharwad city has experienced highest rainfall in north Karnataka region since last 40 years and may receive good rainfall in next 20 years. It is necessary to collect rain water and use it for domestic purposes. Roof water collected from residential and large institutional buildings have to be directed towards the pond. By adopting the strategies discussed above, issues with footpath and pond can be solved. Since footpath is in direct contact with pond, both issues have to be solved together. Thousands of pedestrians will get benefitted from footpath and residences benefit from the rain water recharge. Footpaths can accommodate 50% more pedestrians daily. The park with a clock tower will become a landmark at this place. This becomes a proper play area for children since there are no well-maintained parks in the vicinity. Rainwater can be harvested in better manner and this will increases the water table level in the surrounding vicinity and bore wells will have water throughout the year. Hence, the urban ecology can is restored. Some developed countries have taken into practice of Water Sensitive Urban Design (WSUD), Low Impact

Development (LID), Sustainable Urban Drainage System (SUDS), Best management practices (BMP) in their urban planning to economise storm water management and also for water security. By incorporating such systems our localities can become self-sufficient in water requirements.

Acknowledgement
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