ENVIS CENTRE, CHANDIGARH
# NewsLetter
Paryavaran - Patra
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Chandigarh State of Environment

## RAIN WATER HARVESTING: CHANDIGARH

### INTRODUCTION

Rain water harvesting is a water sustainable technique used for collection and storage of rain water from roofs and artificially created surfaces into natural reservoirs, tanks, man-made catchment areas or by infiltrating in sub-surface aquifers. This stored water can be utilized for future use, replenish depleting ground water resources, reduce flooding and erosion activities, recharge local aquifers, rejuvenate water-scarce zones and also reduce water bills. It is a cost effective technique that reduces the dependence on water wells and do not require installations of expensive purification systems.

### Components of a Typical Rain Water Harvesting System

There are five basic components of a typical rain water system, namely-

**Catchment**- This is the surface area where the rain water is collected. It could be a rooftop, a landscaped area or a paved flooring

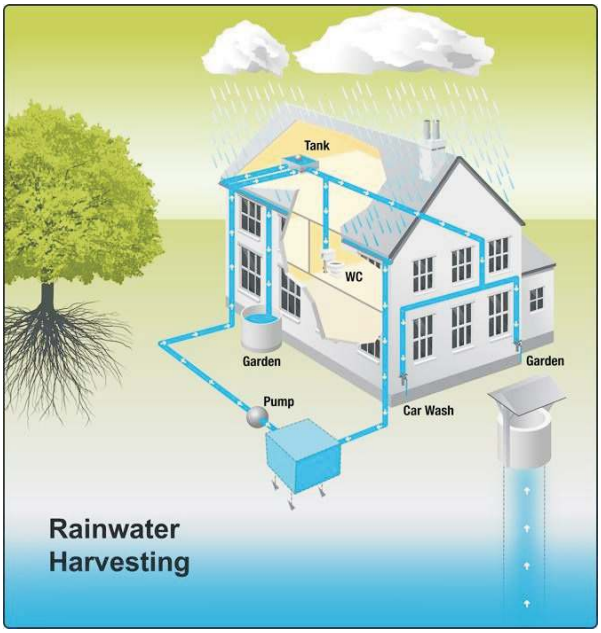
**Gutters and Down Take Pipes**- These are the conduits that lead the water from the catchment surface to the storage tank.

**Filters and First Flush Devices**: The purpose of these barrier filters is to remove grit, leaves and dirt that comes along with rainwater and has a tendency to get transported from the catchment into the storage tank. When it rains after a long gap, the rooftops are usually very dirty and the rainwater also carries with it a lot of dissolved air pollutants. The first flush device diverts the water from the first rain so that it does not enter the storage tank.

**Storage Tanks**: These can be above the ground or below the ground.

**Delivery Systems:** Piping systems that convey the stored rainwater till the point of end-use.

It is not recommended to use harvested rainwater for drinking, cooking and dishwashing unless water quality issues are verified and necessary treatment is executed.

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Paryavaran Patra

# Ancient systems of Rain water Harvesting in India

## Madakas

Madakas are one of the fast disappearing traditional rainwater harvesting structures found in the laterite belts of Karnataka and Kerala. They are naturally occurring depressions with high terrain on the three sides where water from the surrounding laterite slopes, mainly runoff from the rains, is accumulated. These have been traditionally used to harvest rainwater by constructing bunds on the open fourth side of the depression to check this runoff from the slopes. The laterite soil in agricultural areas is ideal for madakas as laterite belts have faster absorption and depletion of water and madakas aid in slow percolation of water through the cracks and are thus often compared to percolation ponds. This helps in recharge of groundwater and water oozes through springs and other outlets into manmade tanks or wells, which are located near the point of water collection in the madaka.

Bunds made of rocks constructed on one of the sides of the madaka to restrict the flow of water

## Ahar-Pyne System

Ahar-Pyne system, a traditional water harvesting system still practiced in the south Bihar plains of India . It is indigenous irrigation technology; an Ahar is rectangular embankment type water harvesting structure, i.e. A catchment basin embankment on three sides & forth side being the natural gardient of land itself and pyne are the irrigation channels

## Surangas

Surangas, a sustainable water harvesting system is practiced in Kasargod district, Kerala which are now being gradually replaced by borewells to meet the water needs of the community. The word ‘Suranga’ is derived from a Kannada word for tunnel. Surangas can be compared to a horizontal well or cave excavated in hard laterite soil formations from which water seeps out, and flows out of the tunnel to be collected in open ponds. Despite their decline, they continue to be a lifeline for a large number of farmers in Kasargod, who depend on surangas to meet their drinking water needs.

## Taankaa

Rainwater harvesting is not a new science in India. There are several traditional practices across the country where rainwater was stored safely and used in times of need. One such example is the 'Taankaa' system in Gujarat.

Around 10,000 houses in the city of Ahmedabad have large underground tanks or 'taankaas' that can each store 25,000 litres of rainwater. These serve as mini reservoirs for families during water scarcity. When tested for quality, they have proven to meet WHO norms.

Source: www.indiawaterportal.org

E-mail : ch@envis.nic.in Web : www.chandigarhenvis.gov.in

## Increasing Water Demand in Chandigarh

The annual average rainfall of Chandigarh is 1059.3 mm which is calculated to be 60380.1 million litres or 13241 gallons or 36.28 MGD per annum. Chandigarh is recepient to heavy rainfall during the months from July to September. This is a vital source of water that helps rejuvenate ground water resources and various other aquifers present at different locations in the city. On one hand, Chandigarh is a rapidly growing city and in the last decade (2001-2011), its growth rate has been observed to shoot higher. There will be an increment of 60% in the overall population of Chandigarh from 2011 to 2036.Thus the demand for water in Chandigarh has increased and will continue to do so. It is estimated that by 2026, the water demand will be 523.41 MLD (Million Litres per day), i.e. 22.73% higher than 2011 demand of 426.50 MLD. This shortage could be due to lack of a proper framework, inefficient guidelines, inadequate soil management practices, unsustainable activities like excessive pumping of ground water. Due to such actions, ground water levels at different locations of many aquifers in Chandigarh have been suppressed on an average of 4m in the past 6 years.

## Water Consumption in Chandigarh

| Year | 2015-16 | 2016-17 | 2017-18 | 2018-19 |
|---|---|---|---|---|
| Total Domestic Consumption Urban + Rural ( In Kilolitre) | 82240208 | 84741421 | 68392060 | 14458108 |

Source:Executive Engg., MCPH, Div 2, No. of Water Works & Water Consumption; Statistical Abstract Chandigarh

## Futuristic Water Consumption Pattern

| Year | Population in Lac | Domestic Requirement @150 LPCD In MLD | Industrial Commerical Requirement in MLD | Community Institutional Requirement in MLD | Total Leakage MLD | Total Reqirement | Horticulture Requirement in MLD | Gross Requirement MLD |
|---|---|---|---|---|---|---|---|---|
| 2026 | 24.19 | 362.85 | 39.27 | 62.28 | 40.05 | 540.74 | 161.8 | 702.54 |
| 2031 | 29.46 | 441.9 | 40.82 | 64.76 | 47.33 | 639 | 161.8 | 800.8 |
| 2036 | 35.91 | 538.65 | 42.46 | 67.35 | 56.19 | 758.51 | 161.8 | 920.31 |

Source: Climate Action Plan, UT., Chandigarh

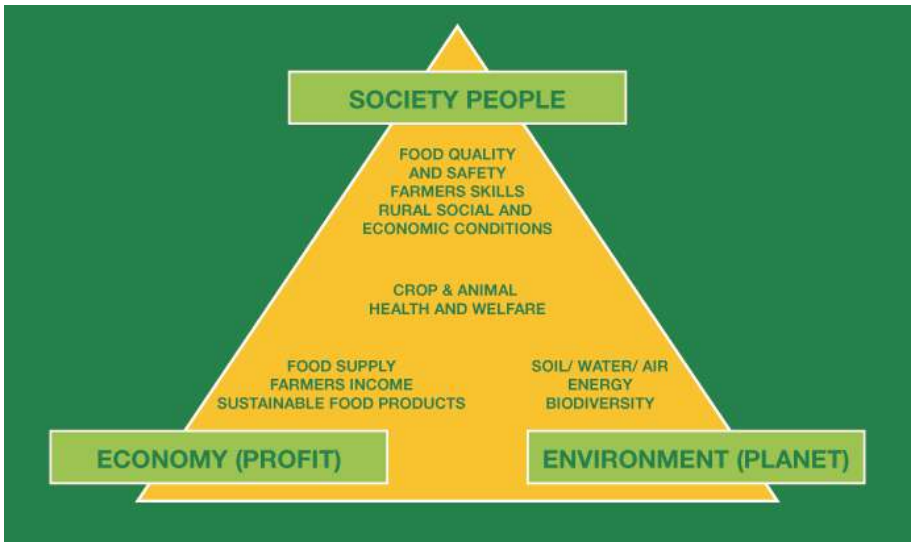
It is believed that the Third World War will be about water and fulfilling increasing water needs. The total domestic water consumption in urban and rural areas of Chandigarh have successfully decreased in the year 2018-19 as compared to previous years. This advancement is due to increasing awareness about the sustainable use of water, conscious efforts on behalf of Chandigarh Administration, Eco-clubs, teachers, parents and students in the form of campaigns, seminars, workshops, documentaries etc. Initiatives like the 'Swach Bharath Abhiyan' played a eminent role in making public cognizant of the need to conserve water and live by the principles of a minimalist. Although, it is estimated that by the year 2036, the total domestic, industrial and community water requirement of Chandigarh will escalate to approximately, 648.46 MLD. This current scenarios of critically depleting aquifers, lack of drinkable water, altered climate systems around the world can be revived solely with collective community effort.

## Drinking Water Status

| Year | Covered Status (Not Covered Partially | Level of Supply (LPCD) | No of Existing Water Source | Type of Water Source | No of Stand Post Taps | No of Stand Posts With Platform Drainage Arrangements | Total No of House Connection |
|---|---|---|---|---|---|---|---|
| 2014-15 | 100% | Potable Water 10 Hrs Per Day | 2 | Canal Water & Deep Bore Tubewells | 319 No's | 319 No's | 158363 No's |
| 2015-16 | 100% | Potable Water 10 Hrs Per Day | 2 | Canal Water & Deep Bore Tubewells | 720 No's | 720 No's | 142633 No's |
| 2016-17 | 100% | Potable Water 10 Hrs Per Day | 2 | Canal Water & Deep Bore Tubewells | 720 No's | 720 No's | 156668 No's |
| 2017-18 | 100% | Potable Water 10 Hrs Per | 2 | Canal Water & Deep Bore | 720 No's | 720 No's | 156668 No's |
| 2018-19 | 100% | Potable Water 10 Hrs Per Day | 2 | Canal Water & Deep Bore Tubewells | 720 No's | 720 No's | 156668 No's |

Source:Executive Eng., MCPH, Div.1, 2 & 3, O.S.D. Chief Engg., Chandigarh. Superintending Engineer, MCPH Circle, Chandigarh.

In terms of drinkable water, Chandigarh is fully covered and well equipped with 10 hours per day of potable water supply with two essential water sources, namely deep tube well and canal water. The number of stand posts with proper platform drainage facilities are upto 720. The length of pipelines from Kajauli water works to Chandigarh is approx- 27.50 KM x 4.Tap stands distributes water many users, it should thus be our social obligation to turn off these public taps when not in use and put our best foot forward on an individual level for their efficient maintenance. Chandigarh households have a total of 156668 number of connections.




Water plays a crucial role in balancing the ecosystems of a region. The three important drivers of a society are people, economy and environment, all requiring optimum water consumption for sustaining.Wheather it's the food supply chains, energy demands, livestock rearing or management of soil and air, water management plays a crucial role for sustenance of life on planet earth. This can be achieved by incorporating efficient assessment, evaluation techniques, demand management options, enabling environment policies and holistic institutional frameworks. People serve as the crucial link between the sustainable functioning of the economy and environment.

## Ground Water Resources in Chandigarh

| Status of Ground Water | 2009 | 2013 | 2017 | 2019 |
|---|---|---|---|---|
| Annual Replenishable Ground Water Resources (MCM) | 2173 ham | 2159 ham | 4216 ham | 4216 ham |
| Provision for Industrial/Domestic and other uses & Natural Discharge etc. | 217 ham | 216 ham | 422 ham | 3320 ham |
| Available Ground Water Resource | 1956 ham | 1943 ham | 3794 ham | 3794 ham |
| Net Ground Water Draft | N.A. | N.A | 3378 ham | 3378 ham |
| Balance Ground Water | 1956 ham | 1943 ham | 416 ham | 416 ham |
| Level of Ground Water Development | N.A. | N.A | 89% | 89% |
| Categorization | N.A. | N.A | Safe | Semi-Critical |

Source: Scientist 'D' & TS for Regional Director, Superintending Hydrogeologist for Reg. Dir. Ground Water Board, Chandigarh

The annual ground water resources of Chandigarh have only increased over the years owing to the well planned and scientific development of ground water resources, increased sustainability of existing abstraction structures and effective soil conservation practices. On the contrary, earlier as per Ground Water Resource Estimation (GWRE) 2013 Chandigarh was in Safe category but in GWRE 2017 (as per GEC 2015 methodology) Chandigarh is in Semi Critical Category. Reason being there is no ground water draft from shallow replenishable aquifers, however, the ground water is now being abstracted from deeper aquifer to the tune of 3378 MCM/Year (Net ground water draft). This has led to 89% level of ground water development. The available ground water resources have increased from 1943 ham to 3794 ham because supplied water and leakage have been taken into account.

## Water Conservation Practices in Chandigarh

Owing to Chandigarh's well laid out drainage system, tapping storm water and progressive channeling it into recharge trenches can not only tackle the ground water decline but also solve the flooding problem of the area. Thus, Chandigarh has a capacity to tap and harvest 70% of the rain that goes into water drains. The percentage of draining in different zones are mentioned below-

| | |
|---|---|
| Residential Areas | 38% |
| Roads | 20% |
| Public and Institutional Buildings | 10% |
| Commercial Area | 5% |

The total Capacity of water be available fro recharge annually is: 58 sq km (area) x 1059.3 (rainfall) x 0.5 (rainfall coefficient)= 30,720 million litres. In order to reduce the dependence on ground water a short time legal frameworks have been laid down by the administration to make provisions for rain water harvesting mandatory vide notification dated 16.10.2008. while granting the additional covered area to buildings with size above 500 sq km .

Source: Scientist 'D' & TS for Regional Director, Superintending Hydrogeologist for Reg. Dir. Ground Water Board, Chandigarh

## Major Rain Water Harvesting Systems in Chandigarh

| No. Of Units | Type of scheme | Total annual Capacity (Lakh Cubic meter) |
|---|---|---|
| 6 | Roof Top Rain Water Harvesting | 0.144-0.13 |
| 1 | Rain Water Harvesting through Roof Top & Pavement catchments | 34.5 |
| 1 | Recharge Trenches | 9.5 |

Source: Ex.Er. Project Public Health Division No.7,Chandigarh,Chandigarh Housing Board, 8, Jan Marg, Sector 9 D, Chandigarh.

E-mail : ch@envis.nic.in Web : www.chandigarhenvis.gov.in

## Major Rain Water Harvesting Systems in Chandigarh

| | | |
|---|---|---|
| 2010-13 | Judge House No.3 | Sector 3 Chandigarh |
| 2010-13 | Govt. Model Sr. Sec. School | Sector 37-B Chandigarh |
| 2010-13 | Govt. Model Sr. Sec. School | Sector 26 Chandigarh |
| 2010-13 | Govt. High School | Sector 42-B Chandigarh |
| 2010-13 | Govt. Model Sr. Sec. School | Sector 19-C Chandigarh |
| 2010-13 | Govt. Model High School | Sector 26-C Chandigarh |
| 2010-13 | Govt. Model Sr. Sec. School | Sector 19-D Chandigarh |
| 2010-13 | Govt. Sr. Sec. School | Sector 40-B Chandigarh |
| 2010-13 | Govt. High School | Sector 27-C Chandigarh |
| 2010-13 | Govt. High School | Sector 25 Chandigarh |
| 2010-13 | Govt. High School | Sector 38-D Chandigarh |
| 2010-13 | Govt. High School | Sector 41-A Chandigarh |
| 2010-13 | Govt. Model Sr. Sec. School | Sector 37-D Chandigarh |
| 2010-13 | Govt. High School | Sector 35-D Chandigarh |
| 2010-13 | Govt. Model Sr. Sec. School | Karsan Village Chandigarh |
| 2010-13 | Govt. Girls High School | Sector 22-C Chandigarh |
| 2010-13 | Govt. Model Sr. Sec. School | Sector 16-D Chandigarh |
| 2010-13 | Govt. Girls High School | Sector 22-A Chandigarh |
| 2010-13 | Govt. Model Sr. Sec. School | Sector 21-C Chandigarh |
| 2010-13 | Govt. Girls High School | Sector 15-C Chandigarh |
| 2010-13 | Govt. Model Sr. Sec. School | Sector 45-A Chandigarh |
| 2010-13 | Govt. Model High School | Sector 28-D Chandigarh |
| 2010-13 | Govt. High School | Village Maloya U.T.Chandigarh |
| 2010-13 | Govt. Model Sr. Sec. School | Sector 34-D Chandigarh |
| 2010-13 | 3 No's Judge House | Sector 19-B Chandigarh |
| 2010-13 | Industrial Training Institute (ITI) | Sector 28-D Chandigarh. |

| | | |
|---|---|---|
| 2010-13 | Govt. High School | Village Maloya U.T.Chandigarh |
| 2010-13 | Govt. Model Sr. Sec. School | Sector 34-D Chandigarh |
| 2010-13 | 3 No's Judge House | Sector 19-B Chandigarh |
| 2010-13 | Industrial Training Institute (ITI) | Sector 28-D Chandigarh. |
| 2010-13 | Govt. Model High School | Sector 41-D Chandigarh. |
| 2010-13 | Tourist Information Centre, Capital Complex | Sector 1 Chandigarh. |
| 2010-13 | Hostel For GMCH | Sector 32 Chandigarh. |
| 2010-13 | Govt. Girls High Sec. School | Sector 18-C Chandigarh. |
| 2010-13 | Govt. Girls High School | Sector 38 DMC Chandigarh. |
| 2010-13 | Govt. Model Sr. Sec. School | Sector 23-A Chandigarh. |
| 2010-13 | Paryavaran Bhawan Building | Sector 19-B Chandigarh. |
| 2010-13 | Govt. Model High School | Sector 46-D Chandigarh |
| 2010-13 | Additional Deluxe Building | Sector 9 Chandigarh |
| 2010-13 | Govt. Model Sr. Sec. School | Sector 35-D Chandigarh |
| 2010-13 | Govt. Model Sr. Sec. School | Sector 10-A Chandigarh |
| 2010-13 | Govt. Girls Model Sr. Sec. School | Sector 33-D Chandigarh |
| 2010-13 | Govt. Model High School | Village Mouli Jagran Colony Chandigarh |
| 2010-13 | Govt. Model Sr. Sec. School | Sector 20-D Chandigarh |
| 2010-13 | Govt. Model High School | Sector 28-C Chandigarh |
| 2010-13 | U.T. Office Building | Sector 9 Chandigarh |
| 2010-13 | Govt. Girls High School | Sector 8-C Chandigarh |
| 2010-13 | Govt. High School | Sector 29-B Chandigarh |
| 2010-13 | Govt. Primary School | Sector 38-B Chandigarh |
| 2010-13 | Govt. Model High School | Village Dhanas Chandigarh |
| 2010-13 | Govt. Girls Model Sr. Sec. School | Sector 32-C Chandigarh |
| 2010-13 | Govt. Model High School | Sector 7 Chandigarh |
| 2010-13 | Govt. High School | Sector 30-A Chandigarh |
| 2010-13 | Govt. Model High School | Sector 29-A Chandigarh |
| 2010-13 | Govt. High School | Sector 31 Chandigarh |
| 2014-15 | Govt. Hr. Sec. School | Sector 38 (DMC) Dadu Majra Colony Chandigarh. |
| 2016-17 | Dr. Ambedkar Institute of Hotel | Sector-42 U.T.Chandigarh |
| 2018-19 | Chandigarh Housing Board Office Building | Sector 9 Chandigarh |

The total installed capacity of rain water harvesting systems in Chandigarh from the year 2010-2019 is 111.67 million litres

Source: Ex.Er. Project Public Health Division No.1Chandigarh,Chandigarh Housing Board, 8, Jan Marg, Sector 9 D, Chandigarh.

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# Newsletter
Paryavaran - Patra

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## Ground Water Regulation in India

### EVOLUTION OF GROUNDWATER REGULATION

- 1882: • INDIAN EASEMENT ACT, 1882
- 1970 - 1992:
  - MODEL BILL (1970)
  - REVISED MODEL BILL (1992), (2005) (2016)
  - The Water (Prevention & Control of Pollution) Act, 1974
  - Water Cess Act, 1977
  - Environment (Protection) Act, 1986
- 1997:
  - CENTRAL GROUND WATER AUTHORITY
  - WATER QUALITY ASSESSMENT AUTHORITY (Not existing at present)

### INDIAN EASEMENT ACT (1882)

The Indian Easements Act (1882) confers on the owner of the land, the right to collect and dispose, within his own limits, all water under the land which does not pass in a defined channel. This enables the owner full control of the water beneath his property.

## Aquifer Yield of Chandigarh

| Year | Field | Pb | Cd | Mn | Fe | As |
|---|---|---|---|---|---|---|
| 2018 | Water Samples of Tubewell | 0.000-0.022 mg/l | 0.004-0.007 mg/l | 0.003-0.360 mg/l | 0.000-2.89 mg/l | <0.01 |
| 2018 | Water Samples of Tap Water | 0.009-0.015 mg/l | 0.006-0.007 mg/l | 0.000-0.030 mg/l | 0.130-1.390 mg/l | - |
| 2018 | Water Samples of Hand Pump | 0.000-0.110 mg/l | 0.004-0.006 mg/l | 0.001-0.800 mg/l | 0.100-3.430 mg/l | - |

Source: Scientist 'D'; Central Ground Water Board, U.T. Chandigarh

| Year | Shallow Unconfined Aquifer) | Deep (Confined Aquifer) | Unit |
|---|---|---|---|
| 2001 | 5-10 | 20-45 | mbgl |
| 2019 | 3.39-41.61 | 33.16-100 | mbgl |

Source: Scientist 'D'; Central Ground Water Board, U.T. Chandigarh

The water level of confined and unconfined aquifers in Chandigarh have increased from 10 meter below ground level (mbgl) to 41.61 mbgl for shallow aquifers and 45 mbgl to 100 mbgl for deep confined aquifers. In addition, the depth of shallow borewells in Chandigarh is about 90 m and 240-305 m for deep borewells and have a suitable artificial recharge system in the form of Trench cum recharge well and check dams in hilly/ forest areas.

Chandigarh is playing well within limits for concentration of major ground water elements such as Iron, Cadmium, Manganese, Iron and Arsenic. There are toxic elements are found in Chandigarh Ground Water samples for the year 2020.

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