SUSTAINABLE URBAN GROUND WATER MANAGEMENT
Present scenario and future challenges

R.S. Sinha
Sr. Hydrogeologist
Ground Water Deptt., U.P.

R.S. Sinha
Sr. Hydrogeologist
Ground Water Deptt., U.P.
A Key Resource

• *In urban development, Ground Water plays a key role, as surface water sources are inadequate.*

• *But it is perhaps the most neglected resource.*

• *The resource is not being given the desired importance.*
URBAN SCENARIO

- There are overall 630 major and small townships in U.P.

- Majority are located on alluvial aquifers of Indo-Gangetic plain

- Dependency on ground water for drinking & allied purposes, especially in big cities have mushroomed

- In most of the other urban centers, 80-90% of drinking water demand is being met through tube wells & hand pumps.

- Private tube well construction activity, especially in multistory buildings & housing colonies, is going on unchecked
URBAN GROUND WATER- UNDER STRESS

• The resource is being extracted without having any knowledge of its potential.

• Ground water domain in Urban centers of U.P.
  - under severe stress, both quantitatively & qualitatively.

• Unscientific and unregulated ground water extraction in urban areas have almost reached to unsustainable levels.

• Poor quality trends of groundwater have also emerged as possible threat to potable water supplies.
URBAN SCENARIO

• The reason being that no methodology could be evolved so far for estimating the resource potential within the urban domain.

• Due to concrete development, vertical recharge in urban areas has gone down appreciably and the dynamic resource potential has almost exhausted.

• Over-exploited condition developed in Lucknow, Kanpur, Ghaziabad and other areas.

• Overall situation of groundwater resource in urban centers is quite grave, but it has never been given due recognition.
URBAN ISSUES

• The resource availability of urban groundwater is not known
• Micro level urban aquifer dynamics of Ganga basin is also not clear
• Urban rain water harvesting has been started in hurry without the prior study of urban hydrogeological conditions.
• Scientific aspects of recharging are being ignored.
• Unscientific implementation of recharge schemes may pollute the alluvial aquifers, which once get polluted, can never be revived.
• Various gaps & lacuna in development & management process of urban ground water.
Alarming Situations in Urban Centers

- In urban centers, ground water situations are much more disturbing.

- The rate at which ground water levels in major cities are going down, it is possibly difficult to rejuvenate/recover.

- The reason being that the drinking water supplies are heavily dependent on ground water.

- Major cities including Lucknow & Kanpur are experiencing high water level decline due to over exploitation & resultant stress on aquifer group I (upto 150 mbgl).

- Lucknow city: Glaring example of ‘Hydrogeological Stress’ with ground water level decline of 50 cm to 1.5 Mt./yr.
YEARLY GROUND WATER LEVEL DECLINE IN MAJOR CITIES OF UTTAR PRADESH

GWL Decline (Cm./Year)

- Meerut: 91
- Ghaziabad: 79
- GB Nagar (Noida): 76
- Lucknow: 70
- Varanasi: 68
- Kanpur: 65
- Allahabad: 62
- Muzaffar Nagar: 49
- Agra: 45
- Jaunpur: 37

Annual average decline between 2007-2011
URBAN GROUND WATER RESOURCE ESTIMATION: NO NORMS, NO EFFORT

- Scientific norms have not been evolved for the urban areas.
- This is the reason that ground water resource potential for the urban areas is not known.
- Indiscriminate resource development is taking place on unscientific lines.
- No regulation for Ground water exploitation.
SEPARATE NORMS REQUIRED

• GEC-97 norms are not suitable/valid for computing the groundwater resources of urban areas

• In urban areas the vertical recharge components may be quite small

• Total vertical recharge may be severely curtailed
  – Due to large paved areas
  – Almost complete absence of the recharge form applied irrigation/canal seepage

• Vertical Recharge shall be only the rainfall recharge.

• Hence, separate norms are required for urban areas.
SCENARIO OF RAIN WATER HARVESTING -SOME FACTS

• Since 2000, various rain water harvesting schemes executed by different agencies in the state.

• But the desired results could not be obtained.

• The scientific & engineering approach in the implementation of RWH schemes is missing.

• The concept is yet to be scientifically understood.

• There is no effective implementation & monitoring mechanism in the state
RWH – AN “AREA SPECIFIC ISSUE”

Rain Water Harvesting structure is an area / site specific system.

- ‘Hydrogeology’ is the most vital component of RWH, providing base line informations for planning, designing and implementation of RWH & Ground Water recharge programme in an area.
  - Locations feasibility.
  - Rainfall data.
  - Water level decline & depth to ground water.
  - Magnitude of ground water extraction.
  - Status of ground water resource.
  - Lithological configuration.
  - Qualitative & quantitative aspects.
GUIDELINES FOR RWH & GWR

Ground Water Department has issued detailed guidelines in April, 2006 - which are not being followed

• Areas of continuous Ground Water level Decline
  - Where post-monsoon ground water level is more than 8 mt. deep b.g.l. and annual decline of water level is above 20 cm. in pre-monsoon. (This condition pertains to Alluvial region).
  - In Hard rock region of Bundelkhand- Vindhyans, the depth to water level limit will be 5mt.bgl.

• Over-exploited / Critical Blocks

• Over-exploited Urban Areas
POLICY INITIATIVES IN RAIN WATER HARVESTING

Govt. of UP has initiated Rain Water Harvesting and Ground Water Recharge Programme in the State in a big way and various initiatives have been taken.

- Executive Committee under the Chairmanship of Chief Secretary constituted to review RWH schemes in the State.

- Ground Water Deptt. declared as “Nodal Agency” to monitor RWH & GW Management.

- TCC under chairmanship of DM for RWH Projects.
---POLICY INITIATIVES

- 16\textsuperscript{th} to 22\textsuperscript{nd} July declared as Ground Water Week.

- RWH introduced as subject for 6th to 8th class.

- Ground Water Policy declared on 18\textsuperscript{th} Feb, 2013.
DECISIONS TAKEN –

- Conserving existing ponds / reservoirs in new housing schemes.
- Provision of 5% land for water body.
- DEPTHS OF PONDS – 3 mts (Identify natural catchment & feasibility assessment).
- In parks, only 5% area be covered with concrete / pavements.
---PROVISIONS OF RWH & GWR

- Foot paths / tracks be provided with permeable/perforated blocks. Pavements should not be concrete.
- Recharge shaft not to be constructed in ponds where risk of industrial/other pollution may occur.
- Direct recharging of rain water to aquifers from open/paved/unpaved areas is not permitted (as per G.O. April,2006).
In lay-out plans of (newly/ proposed) Group Housing schemes (Govt./Pvt.), separate network of pipes for combined RWH / recharging system be provided.

Vide G.O. Dated 01-07-08, Housing department, GOUP, has modified the initial provisions of RWH, wherein recharging system made compulsory for plots of 300 sq.m. & above.

GOVT./SEMI GOVT. BUILDINGS:
Installations of RWH/GWR structures are made compulsory for all Govt./semi Govt. buildings in the state.
COMBINED RECHARGE SYSTEM
(A new policy provision)

• Combined Recharge System has been made mandatory for new housing colonies.

• Order issued by Housing Department in June, 2009
POLICY DECISIONS FOR INDUSTRIES

- For Ground Water Level/Quality monitoring, PIEZOMETERS made compulsory for industries.

- Rain Water Harvesting: All industries, including existing and new, which are drawing ground water shall mandatorily undertake artificial recharge measures.
CHALLENGES & GAPS

• No rules/provisions for existing housing colonies, leaving a major chunk of urban areas, remain unutilized for RWH.
  – A big gap.
• The collective system of Roof Top RWH is the most feasible and potential option to conserve the storm water run-off especially in the existing residential colonies.
• Rain Water harvesting is being carried out in Isolation.
• No effective monitoring/implementation mechanism
• No department made responsible for assessing the impact of RWH, the exact benefit is yet to be estimated.
CHALLENGES & GAPS

• Area specific concept & the geo-scientific guidelines not being followed.

• Hydrogeological parameters being neglected

• Pre-project hydrogeological surveys in mega schemes not conducted.

• In spite of the ban, rain water from paved / unpaved area, parks, open fields is allowed in some cases for direct recharging of aquifers. This is a matter of pollution risk.

• Various provisions of Government orders on RWH are not being properly implemented.
---CHALLENGES & GAPS

• Construction of recharge shafts in ponds has not been stopped, despite risk of contamination.

• No mechanism to monitor the status of RWH in private buildings.

• There are gaps in the implementation methodology.

• Maintenance of recharge structure, especially roof top system is being totally ignored. Such negligence may lead to chocking of structure with risk of bacteriological pollution.

• There is also no mechanism of assessing impact of recharge schemes.

• Line departments are implementing recharge schemes in isolation.

• Overall, the monitoring & implementation mechanism in the state is almost fragmented.
RWH IN PARKS AGAINST NORMS
RWH IN PARKS AGAINST NORMS
RWH IN PARKS AGAINST NORMS
Direct Recharging – A criminal negligence

• The direct recharging of rain water run-off through recharge wells from unpaved areas is not allowed.
• It may pollute the aquifers.
• The filters usually provided in such RWH systems can only check the physical impurities.
• The chemical contaminants dissolved in the run-off water can not be separated/ checked through this filtration method.
• Such contaminants will percolate into aquifers through injection wells.
• Such recharging should be discouraged.
• Should be treated as an act of criminal negligence for polluting the aquifers.
Unscientific Recharge System in Ram Manohar Lohia Park, Lucknow closed

- Way back in 2005, a RWH project was undertaken in Ram Manohar Lohia Park situated in Gomti Nagar, Lucknow.

- Hydrogeological considerations were ignored.

- 29 recharge wells of 60 m. depth constructed for recharging the storm water run-off from the open, unpaved catchment of the park.

- It was found that there were all chances of percolation of contaminated water from unpaved area directly into the aquifer and pollute ground water.

- Subsequent to directions, the concerned agency sealed all Recharge Wells constructed in the park to avoid any risk of groundwater contamination.
Undesirable Wastage of Ground Water

• Most of the urban water supplies are dependent on ground water.

• Due to faulty distribution system & pipe leakages and wastage, there are 40% losses.

• In Lucknow city, groundwater based municipal supply is about 300 MLD.

• With the pattern of leakages and overflows from water tanks in majority of the houses, about 120 MLD of ground water is being wasted, which goes to sewer lines.

• If it is saved and extra exploitation is regulated, the damage to aquifers can be checked & declining water levels will improve.
INTERVENTIONS NEEDED- URBAN AQUIFERS NEED IMMEDIATE RESPITE FROM FURTHER GROUND WATER EXTRACTION

• A separate long term IWRM Plan be prepared for a more harmonized conjunctive use of surface and groundwater.

• Excessive withdrawals from top aquifers (<150 mbgl) should be adequately reduced & regulated through a legislative provision.

• Strict measures with public awareness campaigns, are required to check undesirable wastage of drinking water.
  – Through the effective implementation of above 2 measures, ground water withdrawals can be certainly lowered down.

• The peri-urban region of urban agglomerates envisaging prolific aquifers can be systematically exploited to supplement city’s water supply.

• Existing tube wells need to phased out.
MANAGEMENT OPTION FOR URBAN AREA

(a) initial town

(b) town becomes city

(c) city expands
NEED TO MANAGE URBAN GROUND WATER

• Separate methodology/norms for Urban Ground Water Assessment should be formulated on priority basis.

• Comprehensive urban ground water management plans with separate regulatory provisions should be prepared.

• Withdrawals from Stressed Aquifers should be strictly regulated & minimized.

• Rain Water Harvesting & Recharging plans should be perceived in totality & not in isolation.

• In Rain Water Harvesting, risk of ground water contamination should never be ignored.
THANK YOU