Urban groundwater in Africa

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Groundwater is becoming more and more important in urban areas - towns and cities - in Africa. There is rapid urbanisation all across Africa: the UN estimates that by 2035, 50% of all Africans will live in urban settlements. Already in 2017, an estimated 250 million people (40% of the total population) live in urban centres across sub-Saharan Africa. This urban growth is driving a huge growth in demand for water in urban areas, but the lack of adequate management of household and industrial waste in many expanding urban centres is a growing concern. Within the overall pattern of urbanisation in Africa, much of the growth is concentrated in towns and smaller urban centres, not only in big cities. Much of the urban population growth is in low income groups. Both of these factors present additional challenges for water supply and sanitation in general, and for groundwater resource development and protection in particular.

Groundwater has much to offer in urban areas in Africa: it is a resource that urban dwellers, planners and managers can't afford to overlook. But to continue being useful, groundwater must also be protected from pollution and over-abstraction.

This page provides some background on the issue of urban groundwater and links to more information.

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Key issues in urban groundwater in Africa

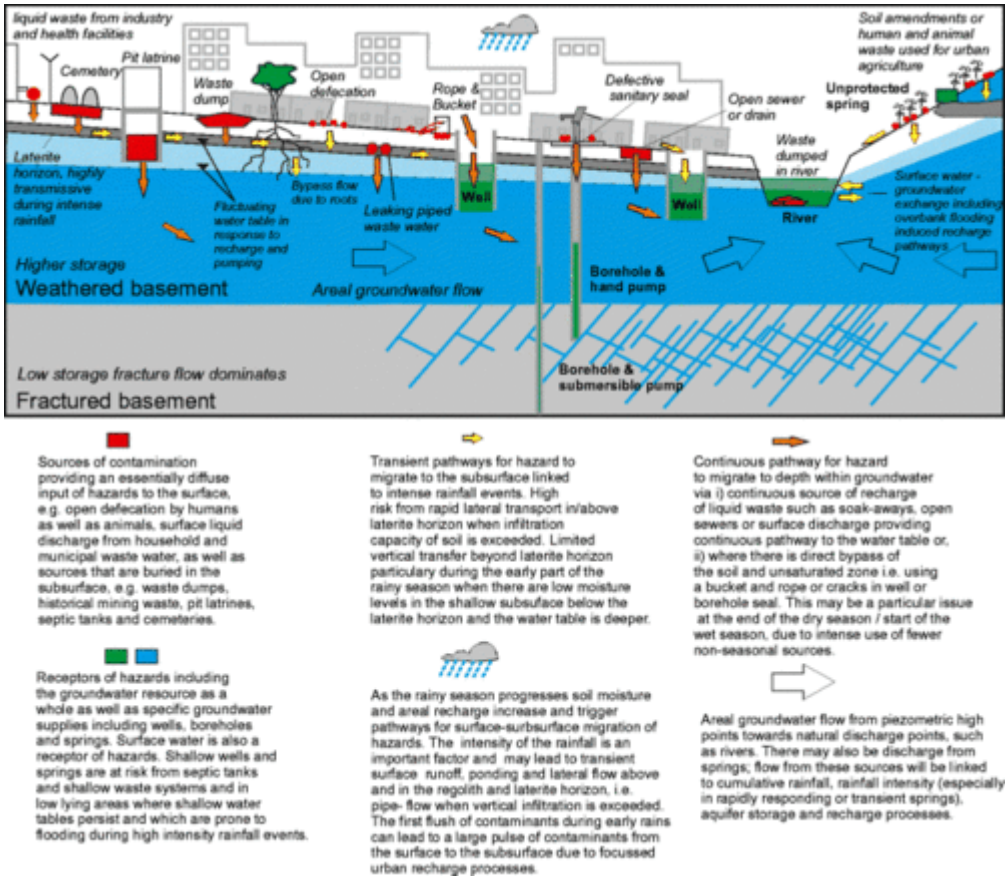
Groundwater pollution / contamination

Groundwater-fed water supplies - such as boreholes and wells - in urban areas in much of Africa are at high risk of contamination. Many towns and cities do not have effective sewerage networks or waste water treatment facilities, and unregulated disposal of sewage, industrial and other solid and liquid wastes is widespread. The rapid growth in urban areas has led to the proliferation of unimproved sanitation provision largely through the use of pit latrines, which are often little more

than a hole in the ground, and are often in very close proximity to wells and springs that are used for domestic water supply. There are also many other sources of groundwater pollution including: large and small factories; leaking sewer pipes; and even improved on-site sanitation facilities such as septic tank soakaways.

Shallower groundwater is at higher risk of pollution than deeper groundwater, because the travel times for pollutants to shallow groundwater are much shorter. Because of this, groundwater from shallow sources, such as hand-dug wells, is more at risk. However, deeper groundwater can also be at risk, depending on the type and amount of pollution and the local hydrogeological conditions, and so even well-constructed deep municipal or private boreholes can be affected.

The diagram below illustrates some of the key potential sources and pathways for faecal contaminants in groundwater in towns and cities in Africa. Many of these are similar for other groundwater contaminants.



Key potential sources, pathways and receptors of faecal contamination in groundwater in urban areas in Sub-Saharan Africa, from Lapworth et al. (2017)

Many pollutants can affect groundwater in urban areas. including microbiological and chemical. Microbiological contamination from faecal waste is the largest source of contamination in urban (and rural) groundwater in Africa. Chemical pollutants include heavy metals and health-impacting chemicals such as cyanide, arsenic and chromium from industry and other municipal sources; pesticides and nutrients such as nitrate and phosphate from urban agriculture as well as domestic sources.

The main sources of groundwater pollution in urban areas are:

- Municipal/domestic waste: for example pit latrines, septic tanks, sewer leakage, sewage

effluent, sewage sludge, urban road runoff, landfill/waste dumps and health care facilities.

- Industrial sources and waste: for example process waters, plant effluent, stored hydrocarbons, tank and pipeline leakage

- Urban agriculture: for example leached salts, fertilisers, pesticides and animal/human waste

- Mining activities: including both current and historical solid and liquid waste

Over-abstraction of groundwater

As urbanisation continues, the demand for water is increasing in urban areas. This demand is being partially met by municipal piped water supplies. Where urban areas have easy access to highly productive aquifers, municipal supplies may be at least partially sourced from groundwater within or near urban boundaries. If municipal abstraction is greater than recharge, it this can lead to localised falling groundwater levels.

Because in most towns and cities in Africa, municipal piped water supplies aren't keeping pace with demand, more and more urban residents are turning to 'self supply' from groundwater sources. This involves digging or drilling private domestic wells or boreholes. Urban community water supplies may also be sourced from boreholes or wells. These boreholes and wells tend to be shallow. As well as being vulnerable to contamination, such shallow aquifers can also be vulnerable to over-abstraction, if too much groundwater is pumped out. The result can be serious localised aquifer depletion, which may lead to boreholes and wells drying up if groundwater levels fall too far; and also brings risks of inducing seepage of contaminated water, or saline intrusion in coastal areas; and can also cause land subsidence (Foster 2018).

Overviews of urban groundwater in Africa

The following lists some recent reports and other documents that give a useful overview of the issues around urban groundwater in Africa.

- Foster S, Bousquet A and Furey S. 2018. Urban groundwater use in Tropical Africa – a key factor in enhancing water security?. Water Policy 20(5), 982-994. Doi: 10.2166/wp.2018.056

- Lapworth DJ, Nkhuwa DCW, Okotto-Okotto J, Pedley S, Stuart ME, Tijani MN and Wright J. 2017. Urban groundwater quality in sub-Saharan Africa: current status and implications for water security and public health. Hydrogeology Journal, 25 (4). 1093-1116. doi: 10.1007/s10040-016-1516-6

- Foster SSD. 2017. Urban groundwater dependency in tropical Africa: a scoping study of pro-poor options. UPGro Working Paper (March 2017).

- Lapworth D. 2017. Urban groundwater and groundwater quality in Africa. Presentation at IAH/GeolSoc 2017 Ineson Meeting, London, UK, 25 October 2017.

- Sorensen et al. 2015. Emerging contaminants in urban groundwater sources in Africa. Water

Research 72, 51-63. Doi: 10.1016/j.watres.2014.08.002.

- Adelana M, Tamiru A, Nkuwa DCW, Tindimugaya C and Oga MS. 2008. [1]. In book: In S.M.A. Adelana & A.M. MacDonald (eds), Applied groundwater studies in Africa, Chapter: 14, Publisher: Taylor & Francis London, Editors: S.M.A. Adelana & A.M. MacDonald, pp.231-260. doi:10.1201/9780203889497.pt3

-Taylor RG and Barrett M. 1999. Urban groundwater development in sub-Saharan Africa. In: Pickford J. (ed). Integrated development for water supply and sanitation: Proceedings of the 25th WEDC International Conference, Addis Ababa, Ethiopia, 30 August-2 September 1999, pp.203-207.

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