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Water quality in urbanized alpine catchments of Central Asia - what happens after the ice?

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Central Asia (CA) is considered a hot-spot for climate-change impact on the water-cycle because of a high density of glaciated, montane catchments. Of particular concern are catchments in the Tien Shan and the Pamir Mountains in the areas, where glacial-fed rivers flow past major urban centres, and in the west of Central Asia near the Caspian and Aral Seas. Climate-change studies, which focus on Central Asia, consider mainly long-term changes in air temperature and precipitation, shrinking glaciers and physical hydrology, complex transboundary water management and policy issues. While, water quality (WQ) has received much less attention yet is noted as a potential issue primarily due to exposure of heavy metals and trace elements due to glacial retreat, release of aerosols deposited in snow and ice, and the dilution of pollutants from urban and farmed areas further downstream. To fill this knowledge gap the current project ‘Solutions to secure clean water in the glacier-fed catchments of Central Asia – what happens after the ice?’ established WQ monitoring program in four CA countries. The project aims to characterise and model, in a consistent and comparable way, the impacts of climate change and diminishing cryosphere on water availability and quality in the selected glacier-fed catchments informing environmental policies and adaptation strategies and building research capacity in the region. To this end WQ sampling and measurements were established in four glacier-fed alpine catchments on rivers passing major cities: Kishi and Ulken Almaty rivers (Kazakhstan, Almaty city), Ala-Archa River (Kyrgyzstan, Bishkek city), Chirchik River (Uzbekistan, Tashkent city), Varzob (Tajikistan, Dushanbe city). The WQ monitoring programme is based on bi-weekly sampling along river elevation profile from upstream (closer to glacierized area) to downstream (up to a reservoir or inflow to a major river). Groundwater (urban, artesian, springs), streamwater, reservoirs have

been sampled and measured for temperature, electrical conductivity (EC), total dissolved solids (TDS), pH, nitrates, phosphates in situ and in the labs by local teams. These measurements are complemented by extended analysis for cations and anions during peak of stream flow (glacier and snow melt period) and low flow season in autumn (baseflow dominated). The preliminary results show that these catchments relatively clean with potentially toxic elements not exceeding WHO drinking water values in all monitored components. The dilution effect of glacier and snow melt on streamwater in summer is reflected in EC seasonal pattern. Primary concerns are elevated nitrate concentrations in urban groundwater in three studied catchments (Kyrgyzstan, Uzbekistan, and Tajikistan) with median values exceeding 10 mg/L of nitrate-N (a WHO's drinking water guidelines threshold). The intermittent spikes of high phosphates in streamwater and groundwater in Uzbekistan in the autumn, in some cases reaching more than 4 mg/L (phosphate-P) are possibly linked to fertilizers wash-out by rainfall.