

Novel Treatment Process Makes Fertilizer from Human Waste

xcess nitrogen and phosphorus in surface waters cause harmful algae blooms, and in densely populated watersheds, human urine and feces in y cuvg y cvgt"uk i pkŁecpvn{"eqpvtkdwvg"vq" this nutrient pollution. Many wastewater plants are at capacity and struggle to meet tightening nutrient removal regulations, prompting them to pass on the cost of related sewer upgrades, in the form of connection and usage fees, to building developers.

When blackwater, including water, urine, feces, and toilet paper, is collected as a separate stream and fully treated onsite, new buildings can dramatically reduce their environmental impact. This option increases climate resilience, saves energy, and produces a natural fertilizer product. Blackwater separation allows new buildings to greatly reduce sewer connection and usage fees, especially when paired with onsite systems that recycle greywater for non-potable reuse, which are kpetgcukpin{"eqooqp"kp"egtvkŁgf"itggp" buildings and water-scarce regions.

Brightwater Tools (a Vermontbased start-up company supported by the U.S. National Science Foundation) has developed a treatment process to manage digested blackwater onsite,

using automated block freeze concentration, pasteurization, and activated ectdqp"Lnvtcvkqp"rtqeguugu0"

Blackwater separation is achieved wukpi "xceww o "łwuj "vqkngvu." y jkej" collect all toilet waste using 83% less water than conventional toilets. The diverted blackwater is pre-processed

ucpkvk | gf"cpf"rwtkLgf"Encuu"C"hgtvknk | gt" product that is collected and distributed by Brightwater Tools through a ugtxkeg"eqpvtcev0"Vjg"ghłwgpv"uvtgco" is recombined with the building's greywater for light treatment and nonpotable reuse to achieve circular onsite wastewater treatment.

Wastewater management companies have expressed that water reuse and nutrient recovery are fundamental to the creation and implementation of sustainable water infrastructure. According to Amalia I una a prin Waterless Urinals 481 L/day 760 g-N/day 3.4 m³-CH₄/day and Urine-Diverting Laborer. 56 g-P/day Toilets Engineers. "A technology that could Block Freeze Upflow Pasteurizer Delunce Anaerobic Charcoal Concentration (Pathogen **AGOP** Sludge Filtration ige liaters in history of Destruction) Blanket (Micropollutant lients' i (LIASB) Removal)cture Digester ater recyclum accounted o grow to 676 g-N/day Line Sludge Removal Non-pote Non-Potable Reuse (e.g.d enumining 11 50 g-P/day, inizing the tollat flushing intention) 4594 L/day Sinks, Showers toilet flushing, irrigation) 459.4 L/day Fertilizer Laundry, etc Greywater Hightwater 1001s is poised to imple-0 25 19/00 Treatment (e.g., Filtration and/or UV) ment next-generation sanitation solu-13,250 L/day 13,709.4 L/day 174 g-N/day 56 g-P/day tions to achieve a circular economy 90 g-N/day 50 g-P/day and a sustainable future.

Brightwater Tools' innovative equipment presents an integrated system for nutrient recovery and non-potable water production from residential wastewater. In this flowchart, q-N/day and q-P/day stand for grams of nitrogen or phosphorus per day, respectively.

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