

NewSan Prototype Simulator






Modelling the Next Generation of Sanitation Systems

Webinar 5: Innovation in resource recovery and reuse



Funded by

BILL & MELINDA
GATES *foundation*

-  1 Key goals of the model
-  2 Target audience
-  3 Users and applications to date
-  4 Main data sources
-  5 Main gaps or constraints to promoting this model

goals

- ✧ To model human excreta (and associated resource fluxes) **from household to final disposal/reuse** (based on Material Flow Analysis);
- ✧ To aid decision makers in identifying appropriate technologies for the optimization of sanitation systems towards sustainability (e.g. nutrient and energy recovery).

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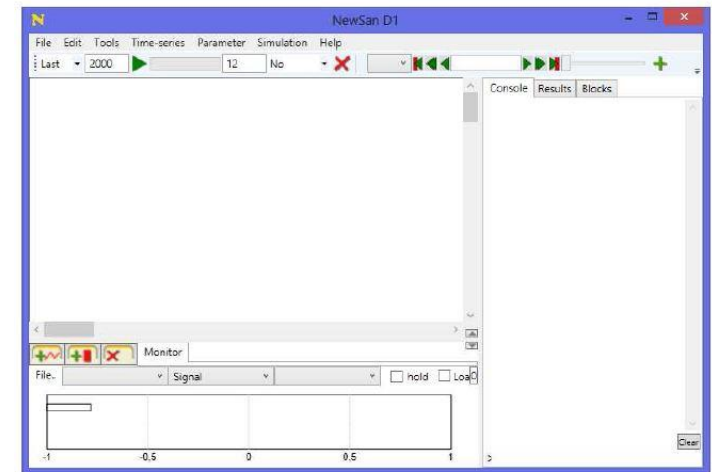
audience

Direct users:

- Engineers & consultants working on sanitation design, planning and management
- Business model developers
- Academic researchers

Beneficiaries:

- Investors, financiers & donor agencies
- Governments
- City planners



An example of Newsan Prototype window

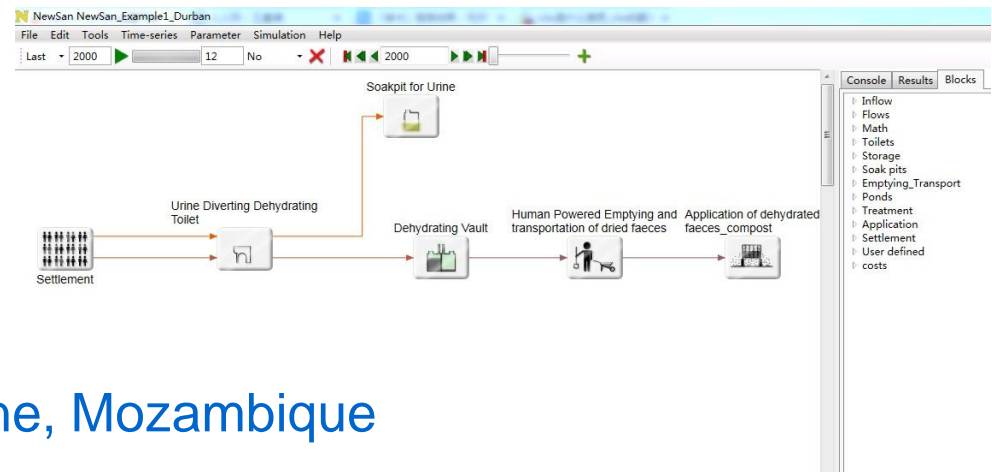
users & applications

Currently in use by:

- ifak
- University College London, UK
- University of Cambridge, UK
- International Water Management Institute (IWMI)
- University of KwaZulu-Natal, South Africa

Interests and future users:

- Duke University, USA
- University of Zimbabwe
- University of Zambia
- University Eduardo Mondelane, Mozambique
- EAWAG (Dorothee Spuhler)
- CEPT University, India



outputs

Waste Flows

- Wastewater
- WW sludge
- Faecal Sludge

Nutrients/Pollutants

- Carbon
- BOD
- COD
- Nitrogen
- Phosphorous
- Potassium

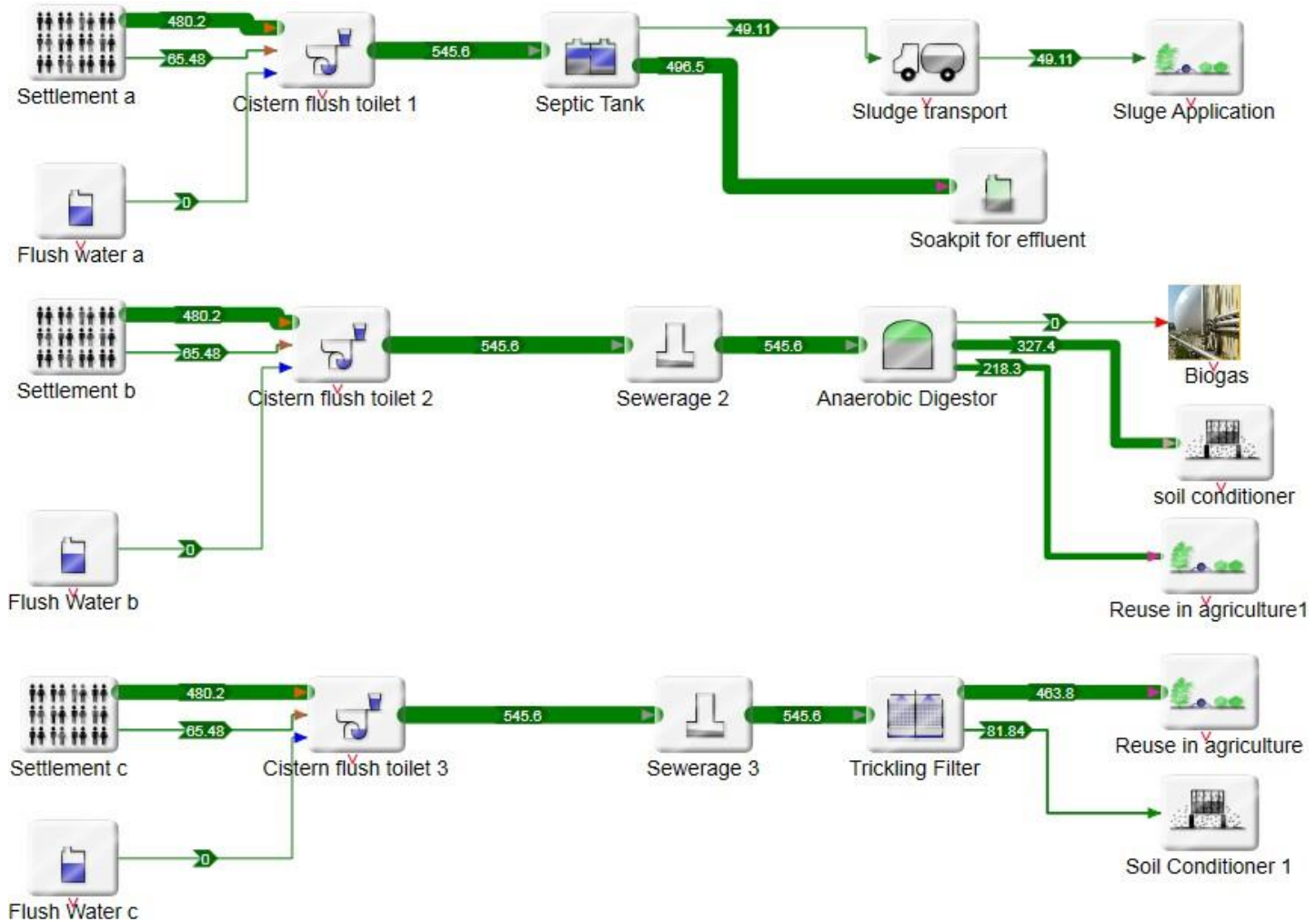
Resources/Economy

- Energy consumption
- CAPEX/OPEX
- Revenue

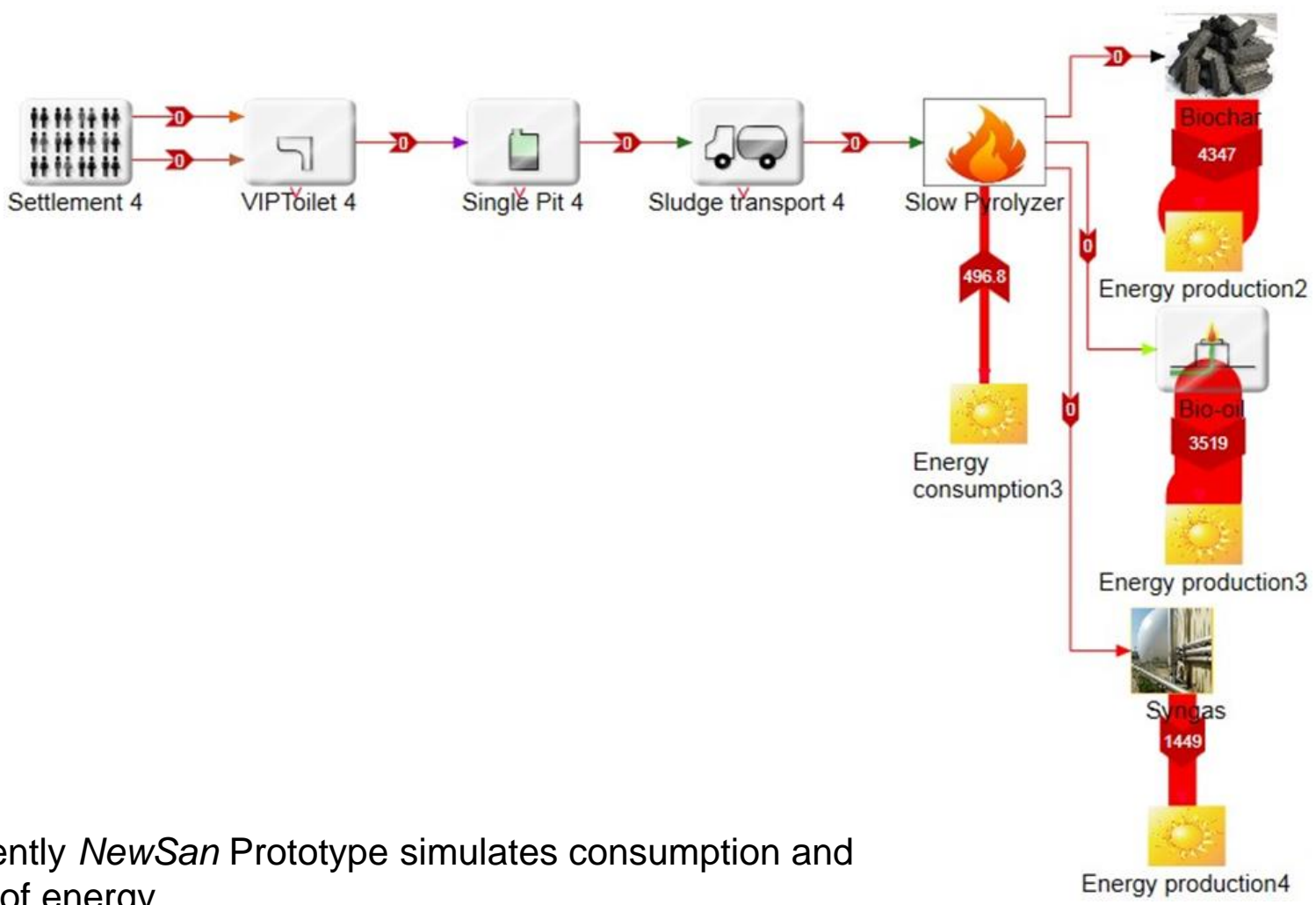
Pathogens

- Coliforms

- Example 1: Simulation of Nitrogen fluxes (kg/day) for flush toilets followed by (a) Septic tank; (b) Anaerobic digester; (c) Trickling filter

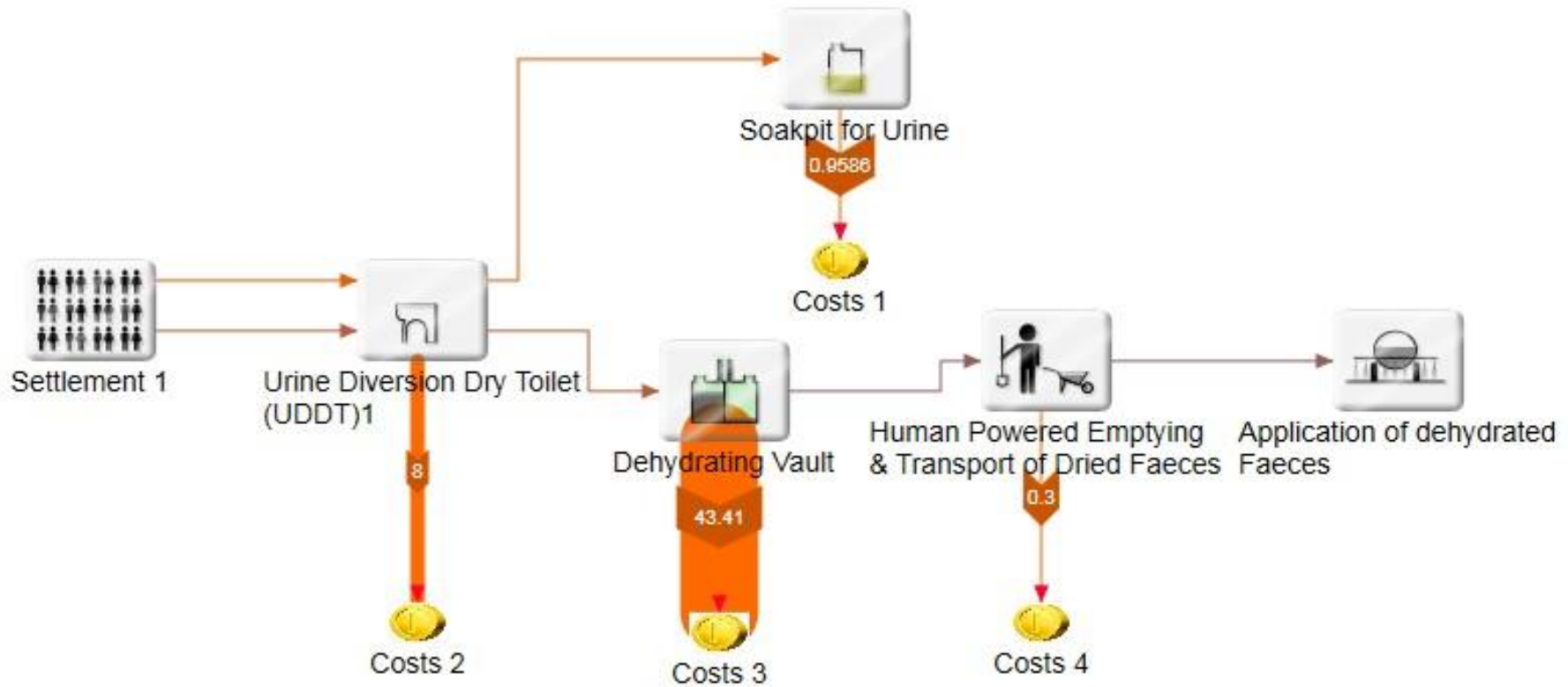


- Example 2: Simulation of energy fluxes (MJ/day) for VIP toilets followed by Slow Pyrolyzer

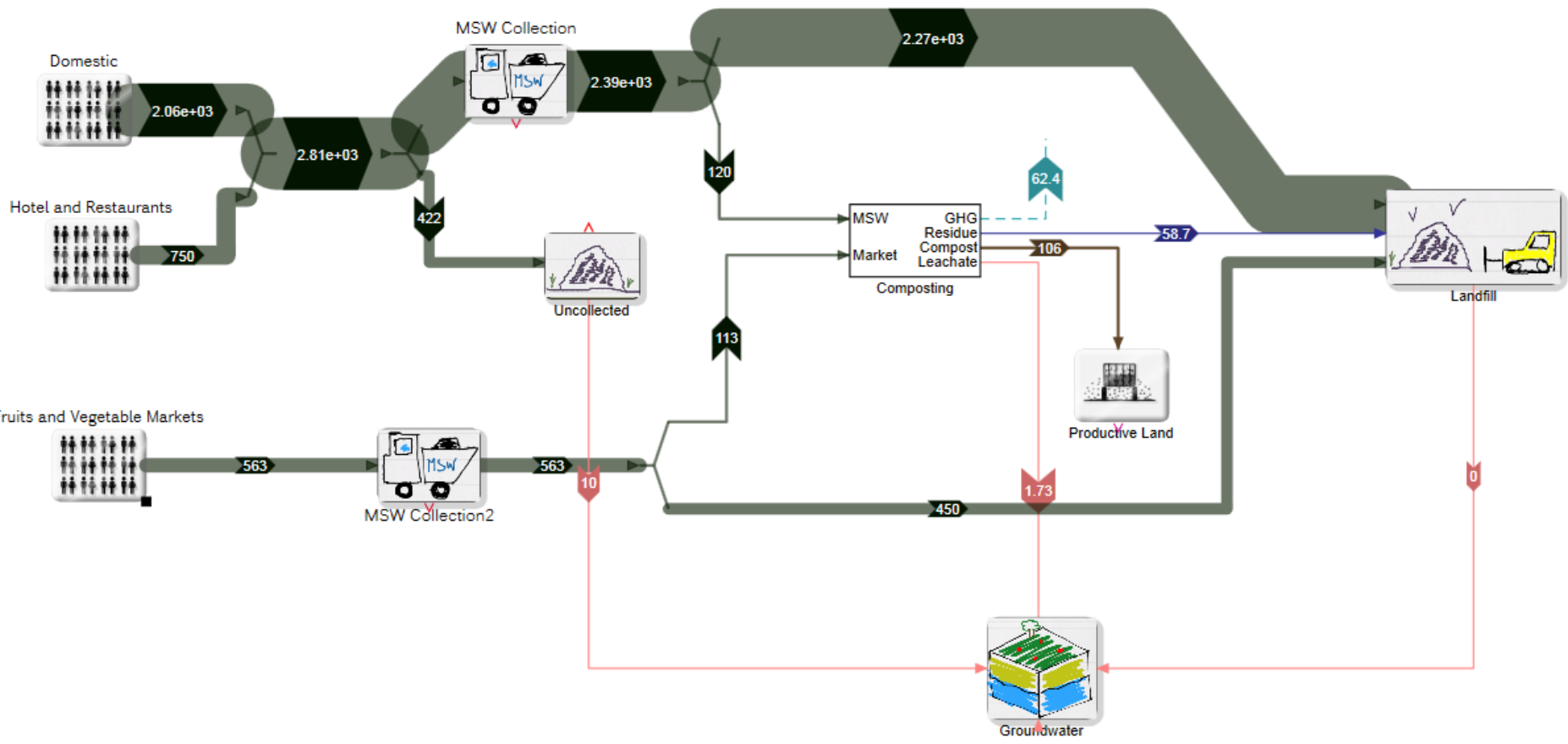


Note: Currently *NewSan* Prototype simulates consumption and production of energy

- Example 3: Simulation of Capex (1000USD/year) for conventional UDDT sanitation system



➤ Example 4: Waste Flows Simulation of Bangalore (by Luca Di Mario, University of Cambridge)



gaps & constraints

- Prototype version, it needs refinement and finalisation
- One dimension model
- GIS interface has not been fully developed yet
- Use standard numbers obtained from literature
- Lack of costs and energy data
- Needs calibration

Appendix

➤ View of the various options for visualization of simulation results in NewSan Prototype

The screenshot displays the NewSan Prototype software interface. At the top, a menu bar includes File, Edit, Tools, Time-series, Parameter, Simulation, and Help. Below the menu is a control panel with a 'Last' dropdown set to '2000', a green progress bar, and a 'Q m^3/d' dropdown set to '12'. A timeline slider is also visible, with '2000' marked.

The main area shows a Sankey diagram of a wastewater treatment plant. A blue callout box labeled '1) Selection of time instant' points to the timeline slider. Another blue callout box labeled '2) Click line to select flux for result representation' points to a line in the Sankey diagram. A third blue callout box labeled '3) Simulation results of the selected sludge stream at the selected time instant' points to a table on the right. A fourth blue callout box labeled '4) alphanumeric display of measurement values at the given time instant' points to the same table. A fifth blue callout box labeled '5) Selection of pollutant fraction to be visualised within the Sankey diagram' points to the 'Q m^3/d' dropdown. A sixth blue callout box labeled '6) Selection of pollutant fraction to be represented in the time-series plot' points to a dropdown menu at the bottom right.

The table on the right, titled 'Line of type BL', shows simulation results for a selected sludge stream at the selected time instant. It has two columns: 'Concentration' and 'Value/Unit'.

Concentration	Value/Unit
N	211.9 mg/l
P	28.62 mg/l
K	0 mg/l
C	0 tonnes
BOD	457.1 mg/l
COD	919.6 mg/l
E	0 kWh
Pathogen	0.505 count/litr
Flow rate	5151 m ³ /d
	0

Below the table, there is another table with columns 'Load' and 'Value'.

Load	Value
N	1091
P	147.4
K	0
C	0
BOD	2355
COD	4736
E	0
Pathogen	2.601
	0

At the bottom, a 'Monitor' window shows a time-series plot. The y-axis ranges from 211 to 213, and the x-axis ranges from 0 to 12. A blue line is plotted, labeled 'Current/Cistern flush toilet/N mg/l'. A dropdown menu on the right of the plot shows pollutant fractions: N, P, K, C, BOD, COD, E, and Pathogen. A blue callout box labeled '6) Selection of pollutant fraction to be represented in the time-series plot' points to this dropdown menu.

Area data:

- Population
- Population development
- Area (km²)

Household level data:

- Type of technology
- Water consumption (per person per day)
- Household size

Collection System

- Type & capacity of system
- Energy consumption
- CAPEX & OPEX
- Distance to treatment

Treatment data:

- Type of technology
- Treatment capacity
- BOD & COD reduction
- Pathogen type & reduction
- Biogas production
- Energy consumption
- CAPEX & OPEX
- Waste/Sludge production
- Distance to final disposal

Final disposal

- Transportation costs
- Type of final disposal/reuse
- Volume/loading of reuse

Note: **NewSan** has a library with technologies and default values if data is not available