PRINCIPLES OF TRANSITION PATHS

Purposeful Conversion of Water Infrastructure Systems to Multi Stream Variants

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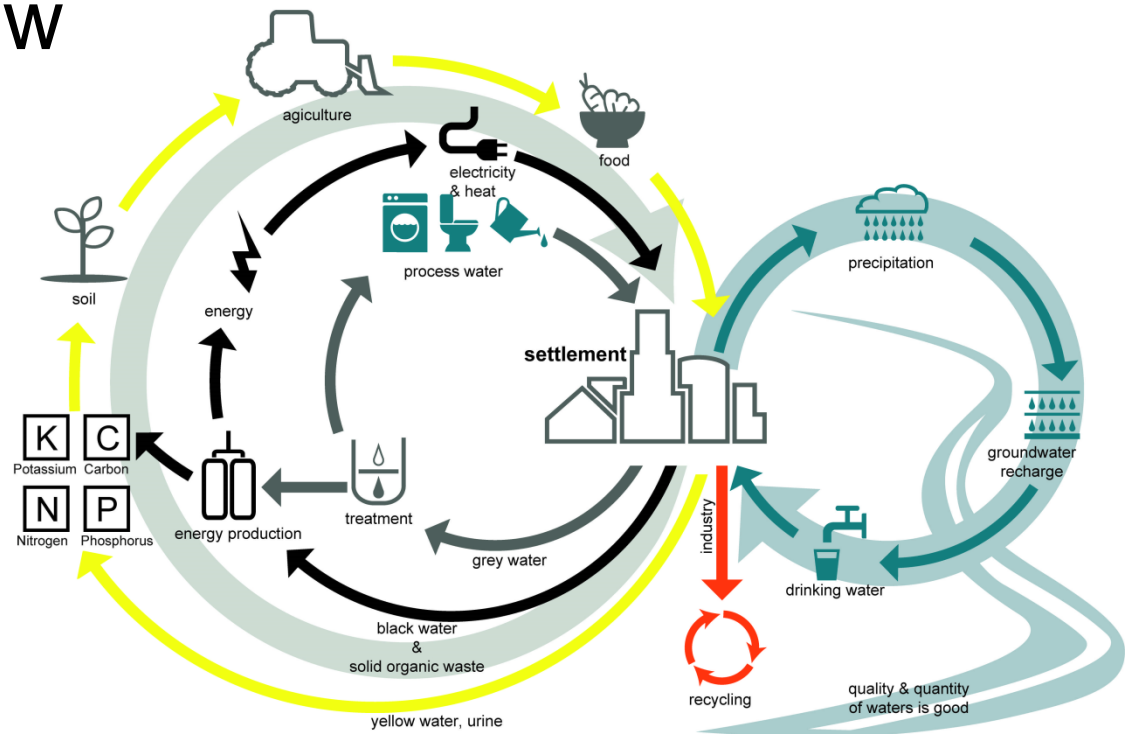**Water Efficiency Conference**
05.-07.08.2015, Exeter

Current Water Infrastructure Systems

- Water-borne sewer systems
- Long amortization period
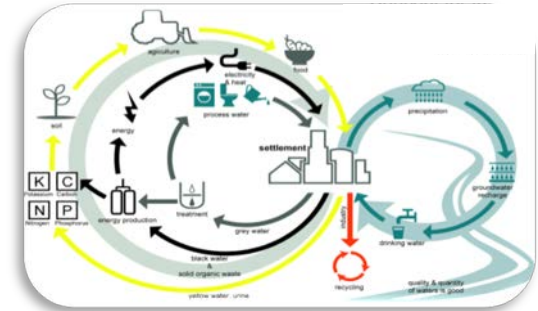- Centralized treatment
- Low resource efficiency

New Alternative Sanitation Systems

- Separate treatment and reuse of source separated flow

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Transition Process

- **Complex process**
  - Technical Implementation
  - User Acceptance
  - …
- **Long-time Development**
- **Specialised Knowledge is Crucial**

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Knowledge Management Tool

- **Requirements**
  - Small and manageable instructions
  - Formal Documentation of Procedures and Decisions
- **Focus on**
  - Design and Implementation Process
  - Technical Aspects

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Documentation by Patterns

- Pattern:
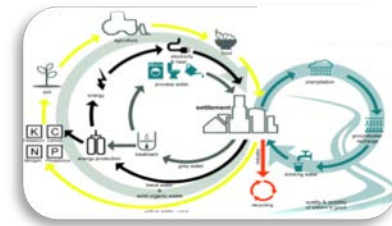 - Christopher Alexander, Architect

    „Each pattern describes a problem, which occurs over and over [...], and then describes the core of the solution to that problem."

  - Problem-Solution Pair
  - Significant implementation:
    - Software Design

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Pattern Structure

- **Pattern Name**
- **Intent**
  - Objectives
- **Motivation**
  - Scenario
- **Applicability**
  - Situation the pattern can be used

- **Components**
  - Catalogue of Elements
- **Requirements**
  - Conditions to be fulfilled
- **Related Patterns**

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Pattern Name
- Co-Digestion

Intent
- Increase organic load to anaerobic digester

Motivation
- Villages may not produce sufficient amount of faeces to operate a digester sufficiently

Applicability
- Situations, when a great amount of co-substrate is available

Components
- Wastewater
- Co-Substrate
- Digestate
- Biogas

Requirements
- Adaptation of legal framework to use „faecal" digestate as fertilizer might be necessary
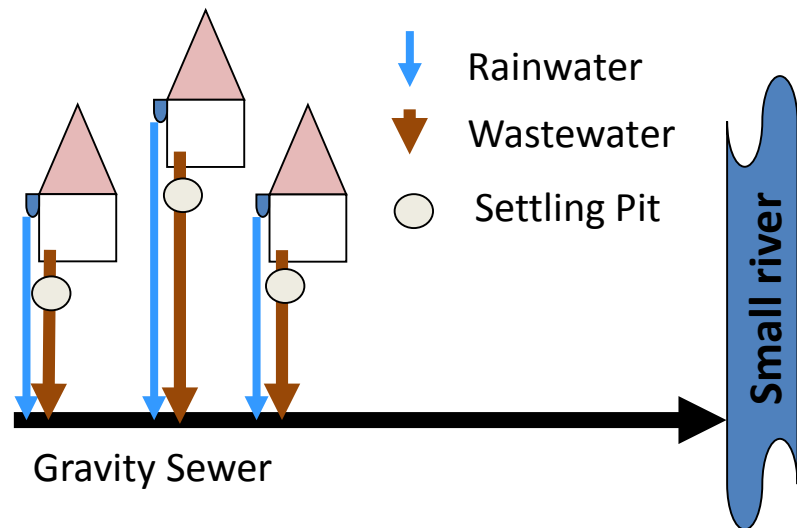
Related Patterns
- Gradual migration
- Local exploration

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Case Study Village

- Eastern Germany
- Rural area
  - Large-scale farms

- Village:
  - 460 inhabitants
  - 50% not connected to biological wastewater treatment

Rainwater
Wastewater
Settling Pit

Small river

Gravity Sewer

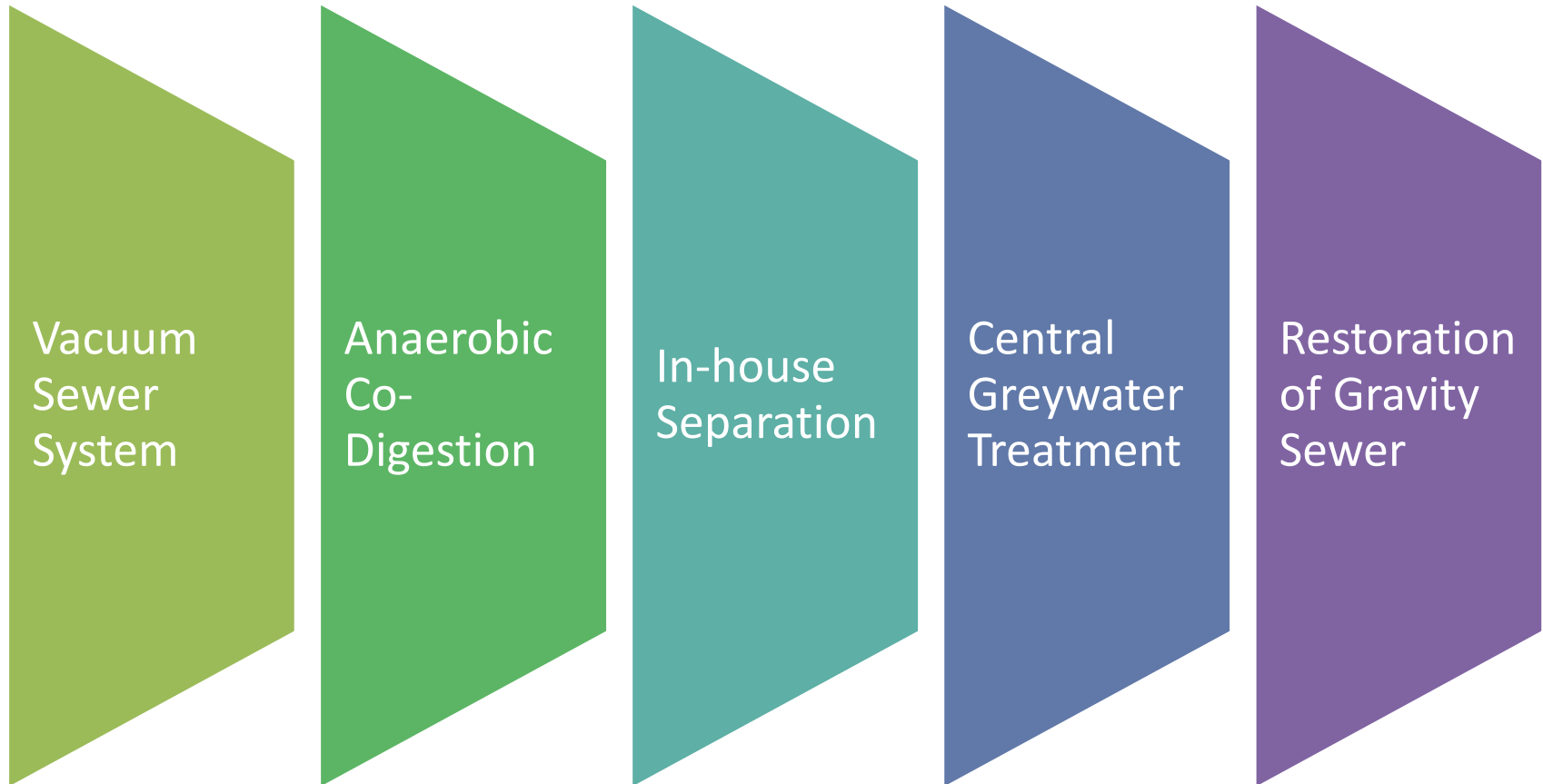Kirsten Maier
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Applied Patterns

- *"Flexible Technologies"*
  - Building a Vacuum Sewer System
- *"Co-Digestion"*
  - Using Agriculture Residues
- *"Gradual Migration"*
  - In-house separation of Grey- and Blackwater
- *"Temporal Component"*
  - Temporary use of old gravity system

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New Alternative Sanitation System

Energy

Anaerobic digester

Fertilizer

Agriculture

Organic residues

Vacuum sewer

Small river

Exisiting gravity sewer

Treatment plant for grey- and rainwater

Rainwater

Greywater

Blackwater

Manhole

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Transition Path

Vacuum Sewer System

Anaerobic Co-Digestion

In-house Separation

Central Greywater Treatment

Restoration of Gravity Sewer

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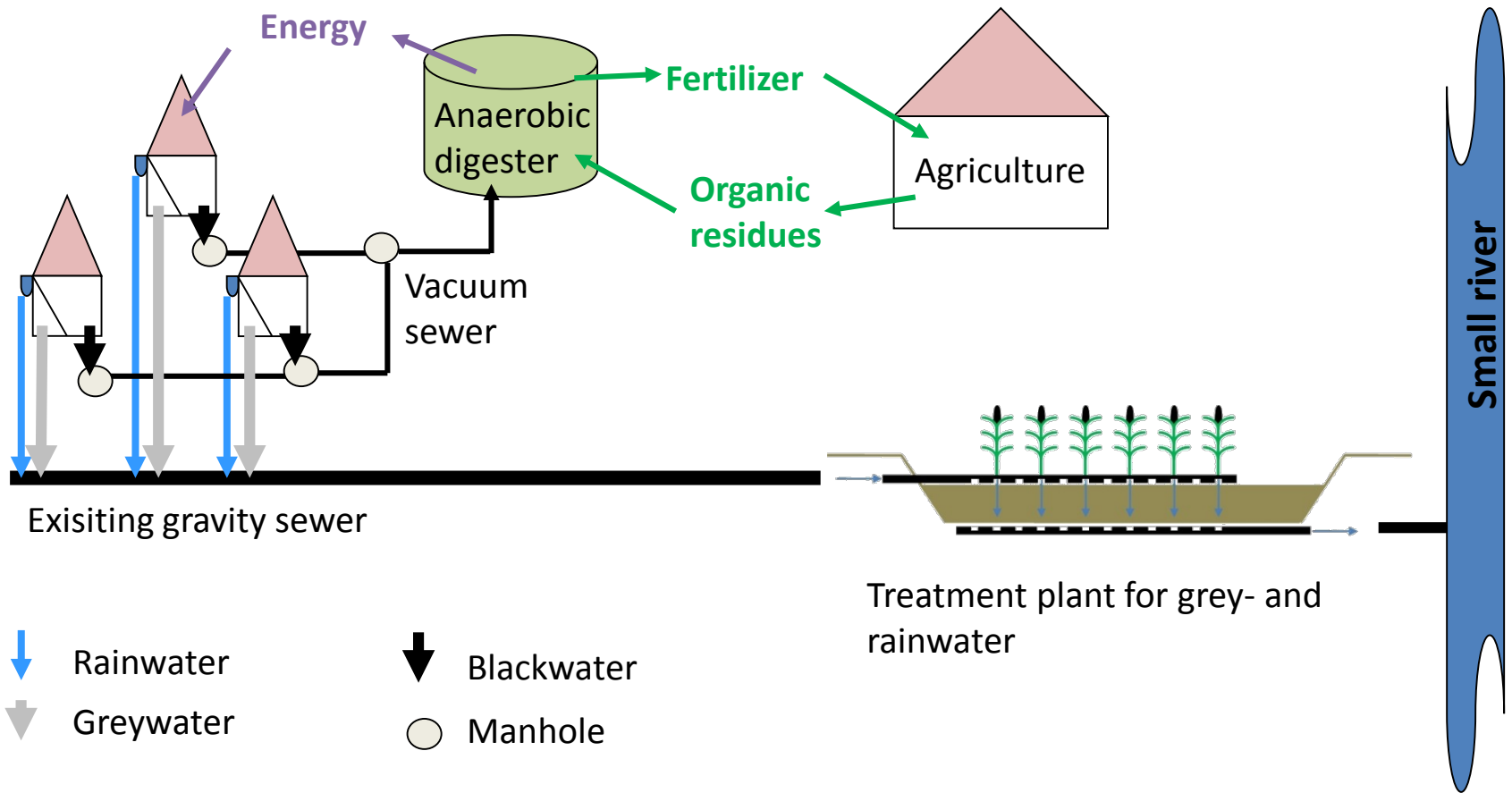
Discussion: Done…

- **Pattern Language**
  - Documentation methodology
  - Structuring of expert knowledge
  - Implementing NASS by transition paths

- **Application in Case Study Area**

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Discussion: But …

- **Pattern Language**
  - Set of Patterns is not complete
  - Pattern description requires adjustments
  - Pattern language needs improvement

- **Involving different stakeholders requires different measures**

- **Engineers are more used to worksheets and standards**

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Thank you for your attention!

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