Assessment of natural organic matter in Irish drinking water

Irish NOM 2016

Hotel Meyrick, Galway City

16th & 17th June

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Work Packages and Deliverables

WP1. Identify high risk catchments for public and private water supplies in relation to NOM across Ireland

WP2. Undertake a surveying and monitoring programme in a six high risk catchments

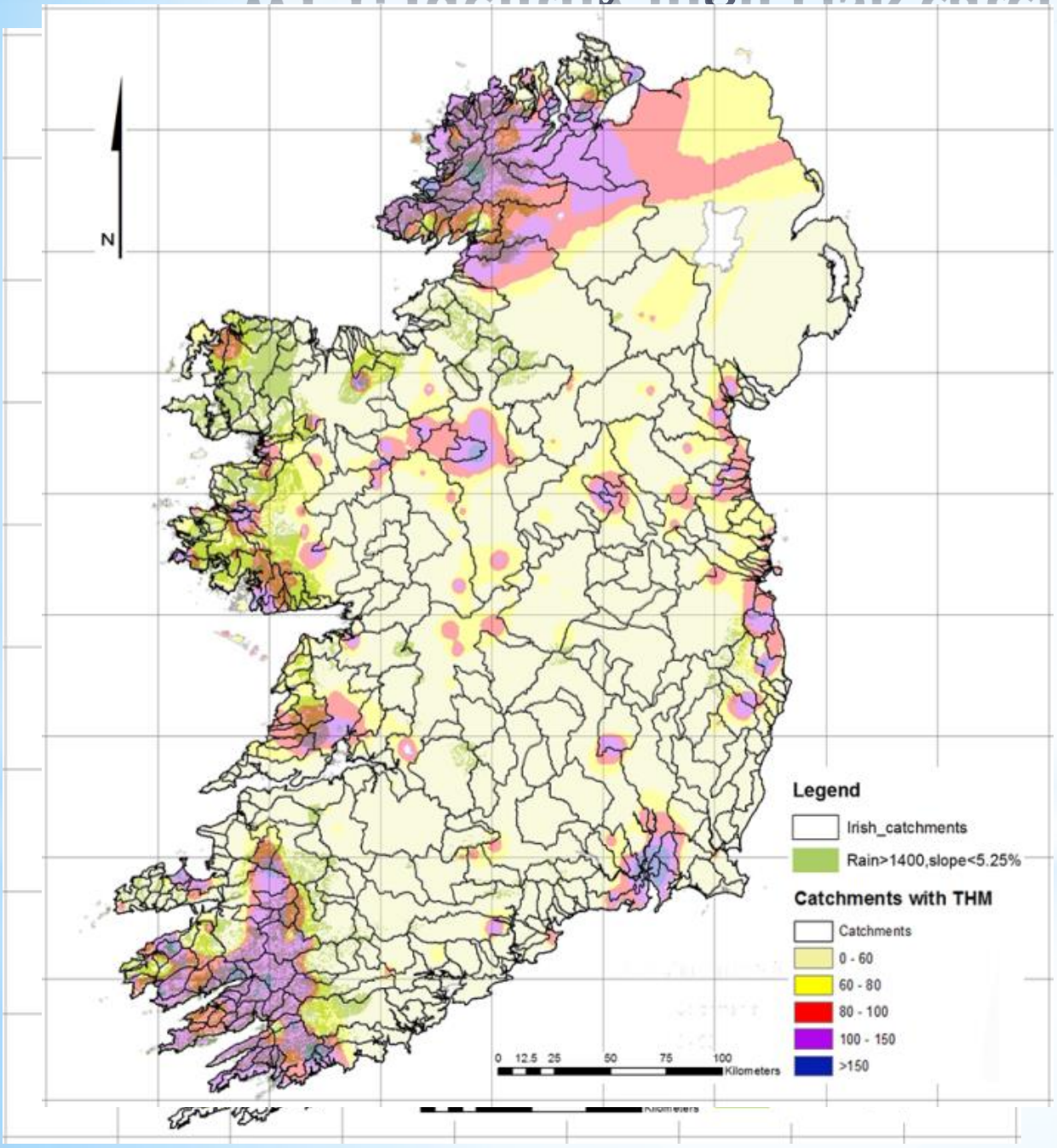
WP3. Estimate likely NOM concentrations in surface and ground water sources in the selected catchments using predictive modeling

WP4. Assess the health risks of NOM to humans based on current knowledge

WP5. Develop guidelines to reduce the risk of NOM in Irish waters

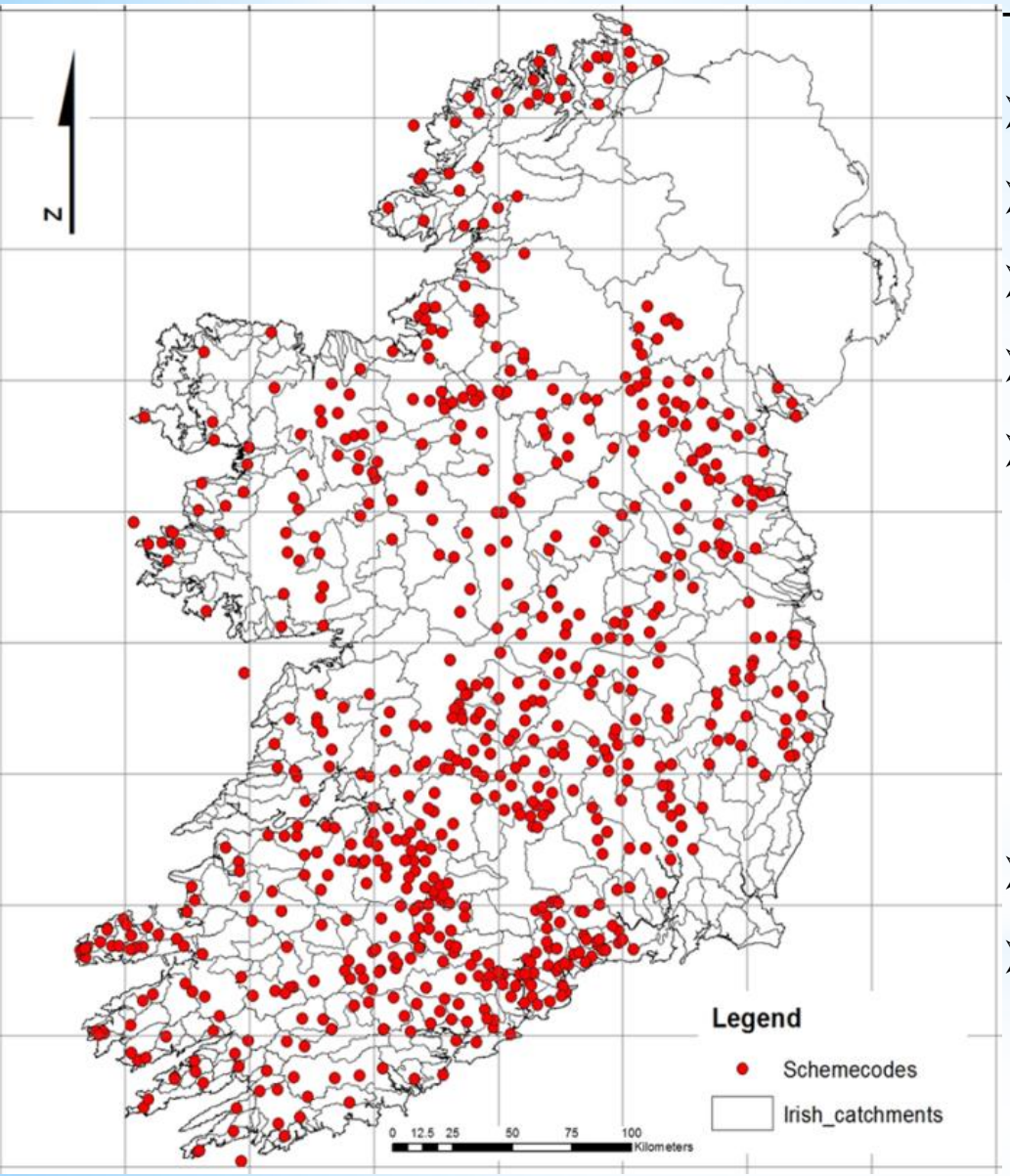
WP6. Project management and dissemination

WP1. Identify high risk catchments for NOM



- Data acquisition (National Soil Dataset; DIPM; LTA Rainfall; DEM; River & Lakes segments; Groundwater vulnerability)
- High risk categories:
  - Peat (presence)
  - Rainfall (>1400 mm – high risk)
  - Slope (<5.25 %)
  - Groundwater vulnerability (extreme & high)

WP1. Identify high risk catchments for NOM



THM Dataset - 2006 – 2013

- 685 schemes (2,289,539 pop.)
- 1,062,700 m^3
- 270 – Surface water (1,777,888 pop.)
- 414 – Groundwater (511,651 pop.)
- Treatment (Level 1 – absence of adequate treatment to remove organic matter; Level 2 - the presence of treatment that is incapable of removing high organic matter)
- Vulnerability (Surface, High, Low)
- % Peat; Upland; Forest; Artificial surfaces; Arable land; Permanent crops; Pastures; Heterogeneous agricultural

WP1. Identify high risk catchments for NOM

Analysis of Variance

Source	DF	P-Value
peat_perc	1	0.163
Pastures_perc	1	0.006
Treat_Code_1	1	<0.001
Vulernability_1	2	<0.001
peat_perc*Pastures_perc	1	<0.001
Pastures_perc*forest_perc	1	0.010
peat_perc*Treat_Code_1	1	0.008

Model Summary – R^2 62.86% of the variation

Summary

Treatment code Level 1 absence of adequate treatment to remove organic matter:

- THMs are likely to increase with increasing % peat & or % peat & pastures in the catchment

Treatment code Level 2 - the presence of treatment that is incapable of removing high organic matter

- THMs are likely to increase with increasing peat and pastures in the catchment

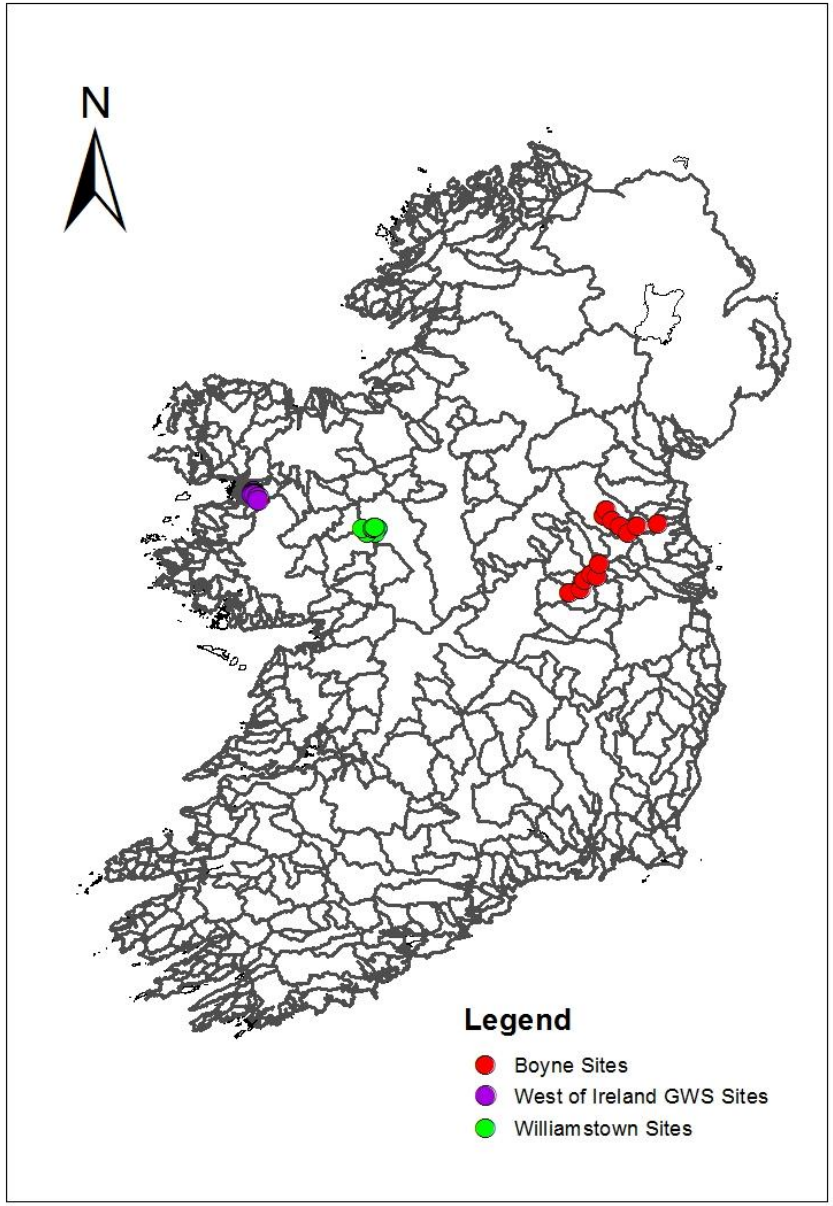
WP2. Survey and monitor programme for NOM

Sites:

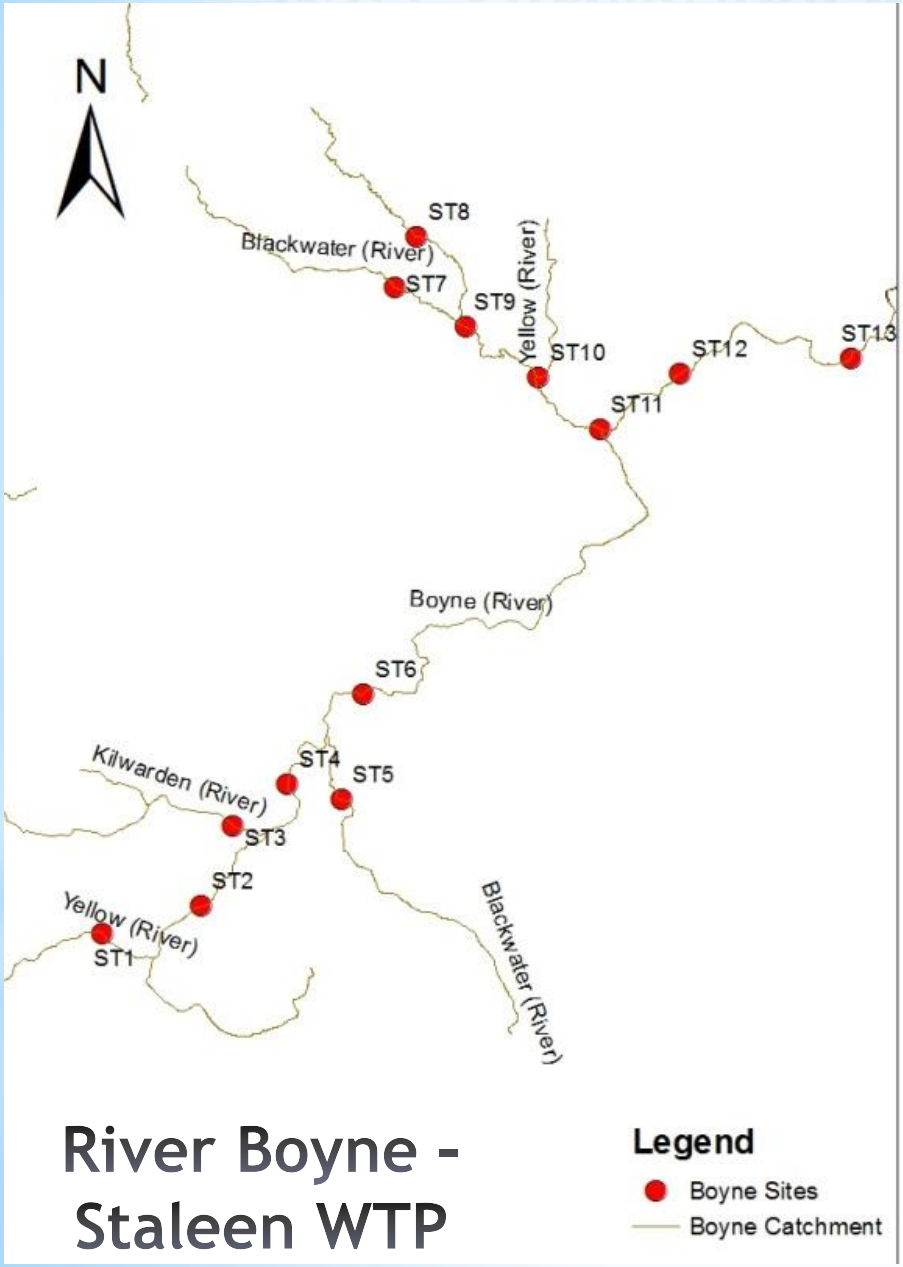
- Boyne
- Williamstown
- West of Ireland Private GWS

Methods:

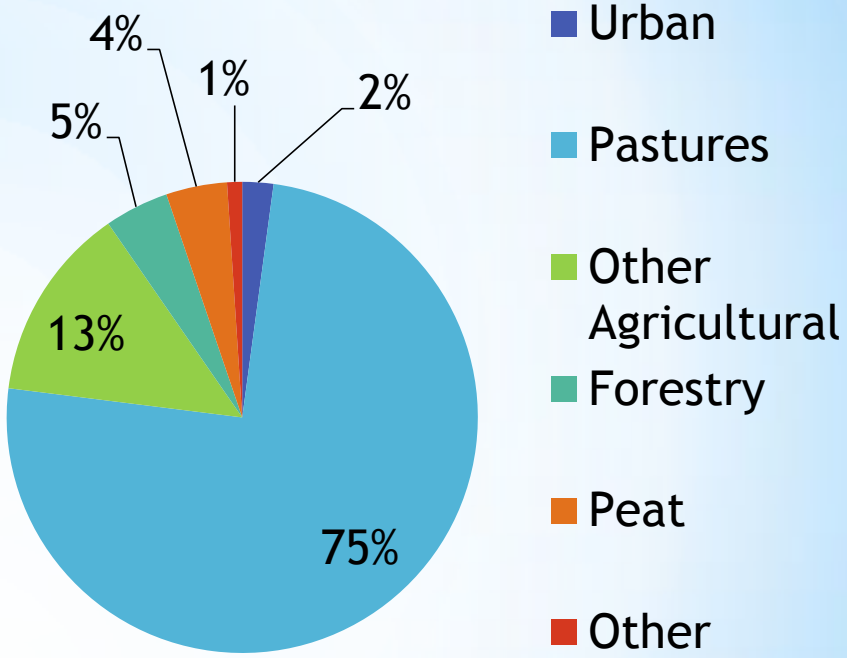
- 18 months water sample collection
- Holistic approach catchment – abstraction – treatment – network
- Using traditional approaches to quantify NOM
- Using ‘novel’ approaches such as F-EEM to examine NOM character



WP2. Survey and monitor programme for NOM



River Boyne - Staleen WTP



Yellow - peat workings
Longwood - forestry
Kinnegad River – MWWTP effluent
Kells Blackwater –WWTP effluents & agricultural
Moynalty - intensive agriculture
Yellow Blackwater - intensive agriculture

WP2. Survey and monitor programme for NOM

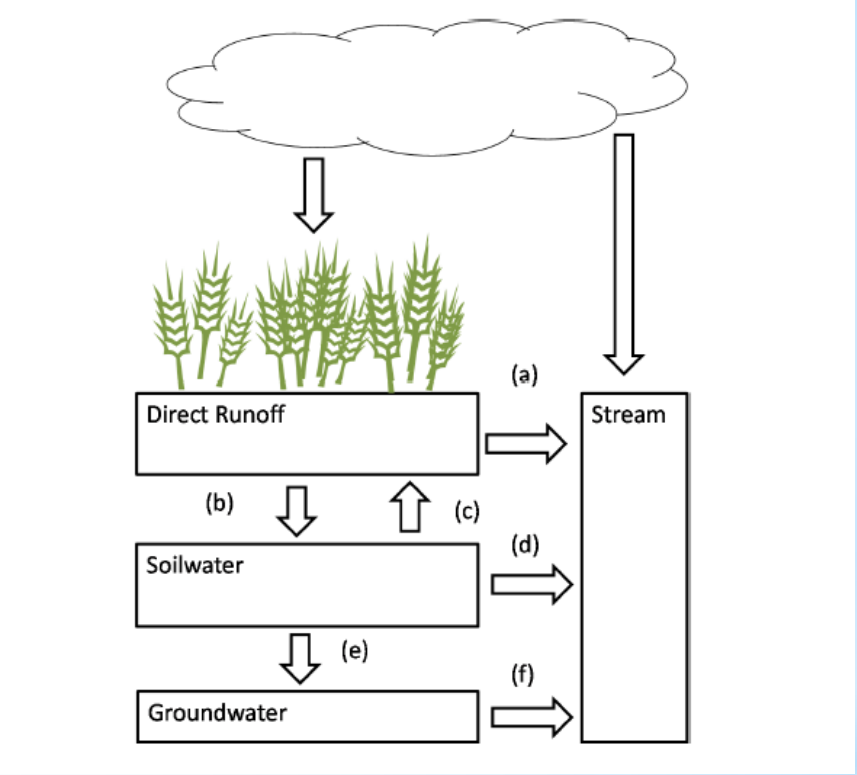
Date	Konelab			BIOTECTOR	UV-Vis		Complete Lab Solutions	Aqualog
	NH4	SRP	TON	D-TOC	UV_{254}	SUVA	THMs	F-EEMS
Aug-14	✓	✓	✓	✓	✓	✓	✗	✓
Sep-14	✓	✓	✓	✓	✓	✓	✓	✓
Oct-14	✓	✓	✓	✓	✓	✓	✓	✓
Nov-14	✓	✓	✓	✓	✓	✓	✓	✓
Dec-14	✓	✓	✓	✓	✓	✓	✓	✓
Jan-15	✓	✓	✓	✓	✓	✓	✓	✓
Feb-15	✓	✓	✓	✓	✓	✓	✓	✓
Mar-15	✓	✓	✓	✓	✓	✓	✓	✓
May-15	✓	✓	✓	✓	✓	✓	✓	✓
Jun-15	✓	✓	✓	✓	✓	✓	✓	✓
Jul-15	✓	✓	✓	✓	✓	✓	✓	✓
Aug-15	✓	✓	✓	✓	✓	✓	✓	✓
Sep-15	✓	✓	✓	✓	✓	✓	✓	✓
Oct-15	✓	✓	✓	✓	✓	✓	✓	✓
Nov-15	✓	✓	✓	✓	✓	✓	✓	✓
Apr-16	✓	✓	✓	✓	✓	✓	✓	✓

WP3. Estimate NOM using predictive modelling

PERSIST

Daily Time Series:
- Air Temperature
- Precipitation

Daily Time Series:
- Soil Moisture Deficit
- Hydrologically Effective Rainfall



* Precipitation, Evapotranspiration and Runoff Simulator for Solute Transport (PERSiST) (Futter et al., 2014)

WP3. Estimate NOM using predictive modelling

INCA-C

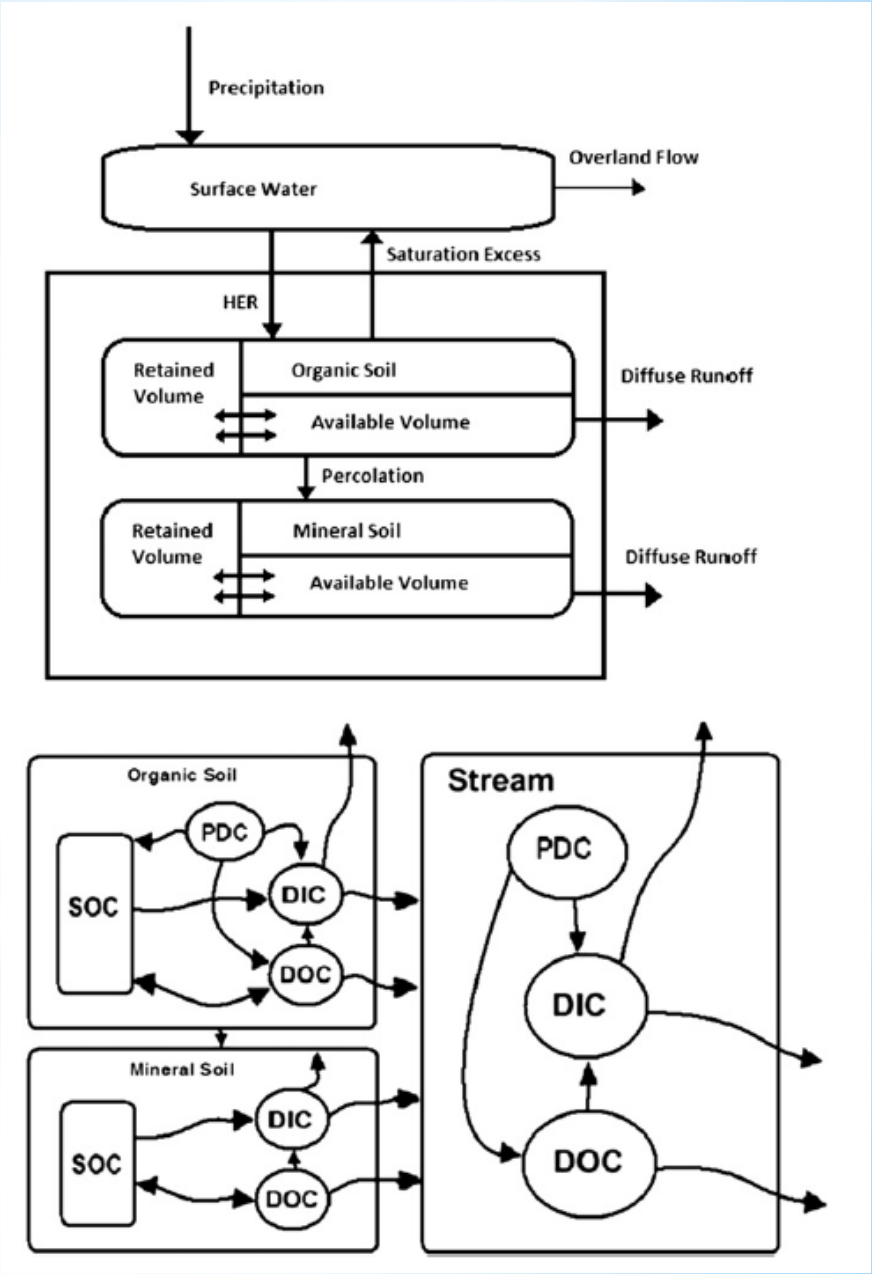
Daily Time Series:

- Air Temperature
- Precipitation
- Soil Moisture Deficit
- Hydrologically Effective Rainfall

Daily Time Series:

- DOC

* Integrated Catchments model for Carbon (INCA-C) (Futter et al., 2007)



Work still to do:

* Analyse the Fluorescence-Excitation Emission Matrices with PARAFAC
* Calibrate the INCA-C model with our DOC data and run future simulations under different climate change scenarios
* Assess the toxicity risk of THMs to Humans

Thank you for your attention