



System of  
Environmental  
Economic  
Accounting

# Emission accounts

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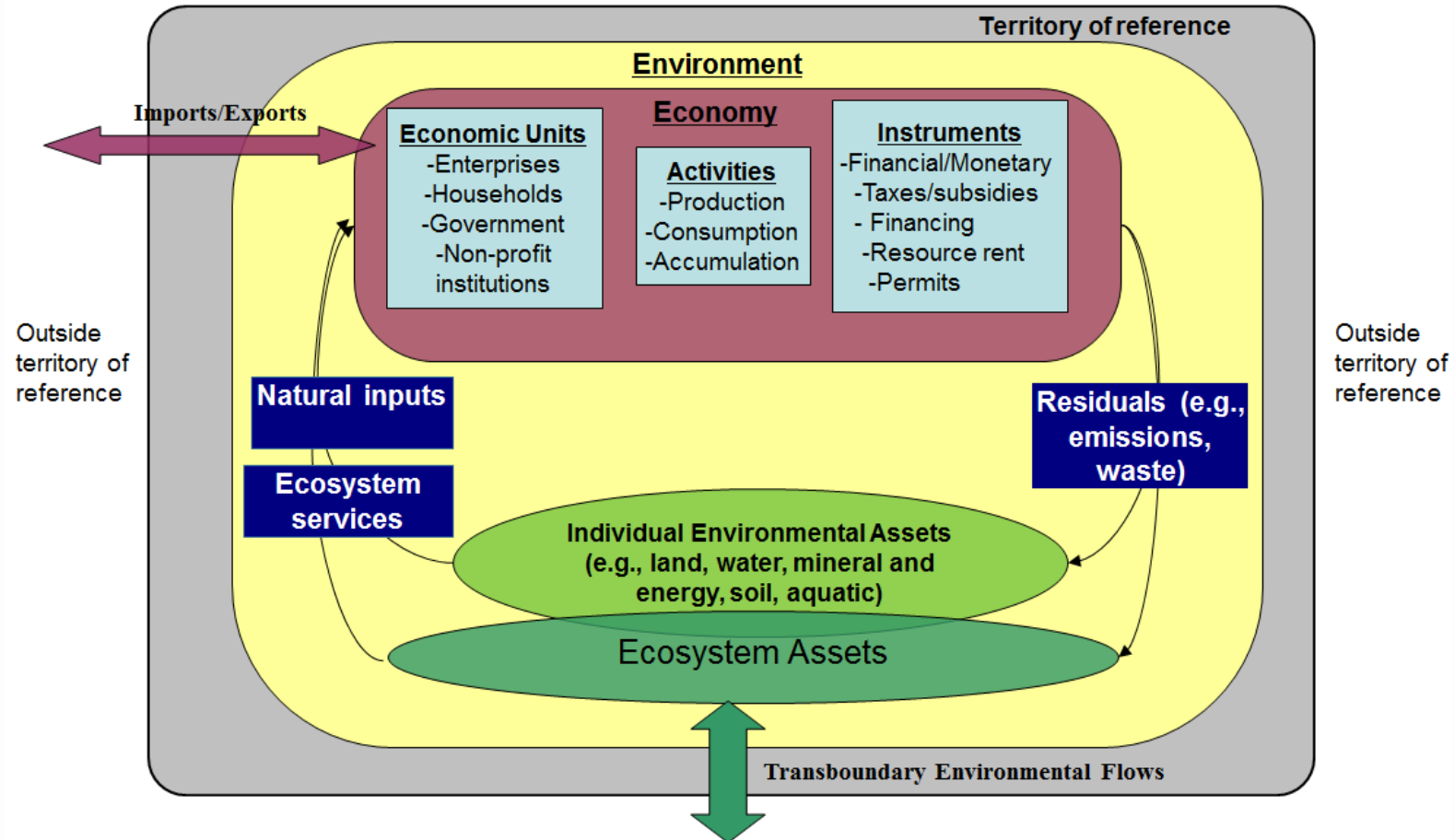
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# SEEA Conceptual Framework



# Types of physical flows accounts in SEEA-CF

Physical flow accounts	Topics covered ( <i>detailed definition</i> )
Full set of supply and use tables for materials	All resources and materials (energy, water, air emissions, water emissions, solid waste) (CF 3.45)
Economy-wide material flow accounts (MFA)	Supply and consumption of energy; air emissions, water emissions, and solid waste (CF 3.279)
Physical supply and use tables for water (PSUT water)	Supply (precipitation) and consumption of water (CF 3.186)
Physical supply and use tables for energy (PSUT energy)	Supply and consumption of energy (CF 3.140)
Air emissions accounts	Air emissions (CO <sub>2</sub> , pollutants) (CF 3.233)
Water emissions accounts	Water emissions (CF 3.257)
Waste accounts	Solid wastes (CF 3.268)



SEEA

CF = Central Framework, white cover edition, refers to paragraph number

# Similarities and differences of various physical flows account in SEEA-CF

- Similarities:
  - > Scope includes
    - Flows from the environment to economy (natural inputs)
    - Flows within the economy (Products flow)
    - Flows back to environments (Residuals flows)
  - > Finer level of focus can be undertaken consistent with the general principles of the PSUT
  - > Same concepts, definitions and standards
  - > Same institutional units
- Differences:
  - > Units of measurement
  - > Key components of the PSUT
  - > Breakdowns of economic activities

# What do water emission accounts measure?

- Present information on the activities responsible for the emissions and releases, the types and amounts of substances, as well as the destination of the emissions (e.g. water resources or the sea).
- Describe, in physical units, flows of pollutants added to wastewater as a result of production and consumption, and flowing into water resources either directly or through the sewage network.

# Why compiling water emission accounts

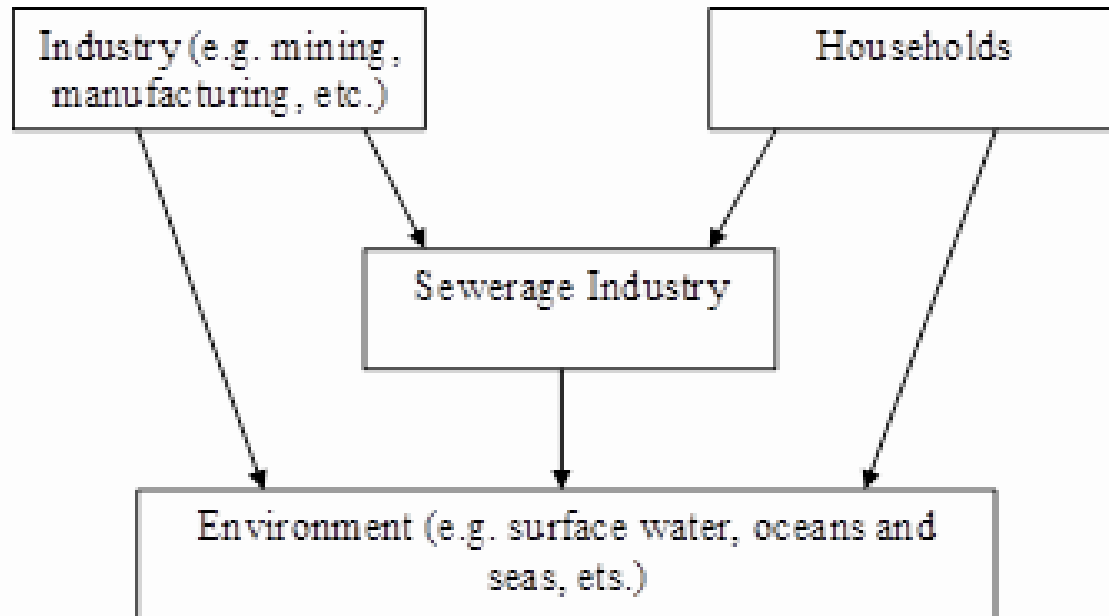
- Emission accounts provide information on
  - > Which activities are responsible for the emission
  - > How much is being emitted
  - > Where is being emitted
- They are useful for designing policies aimed at reducing pressure on the environment

# Why compiling water emission accounts

- Since they are linked to the economic accounts, they allow for
  - > the formulation of cost-effective policies aiming at reducing emissions
  - > the evaluation of the economic impacts of policies aiming at reducing emissions
- Useful tool for designing economic instruments, including new regulations to reduce emissions into the inland water system or seas and oceans

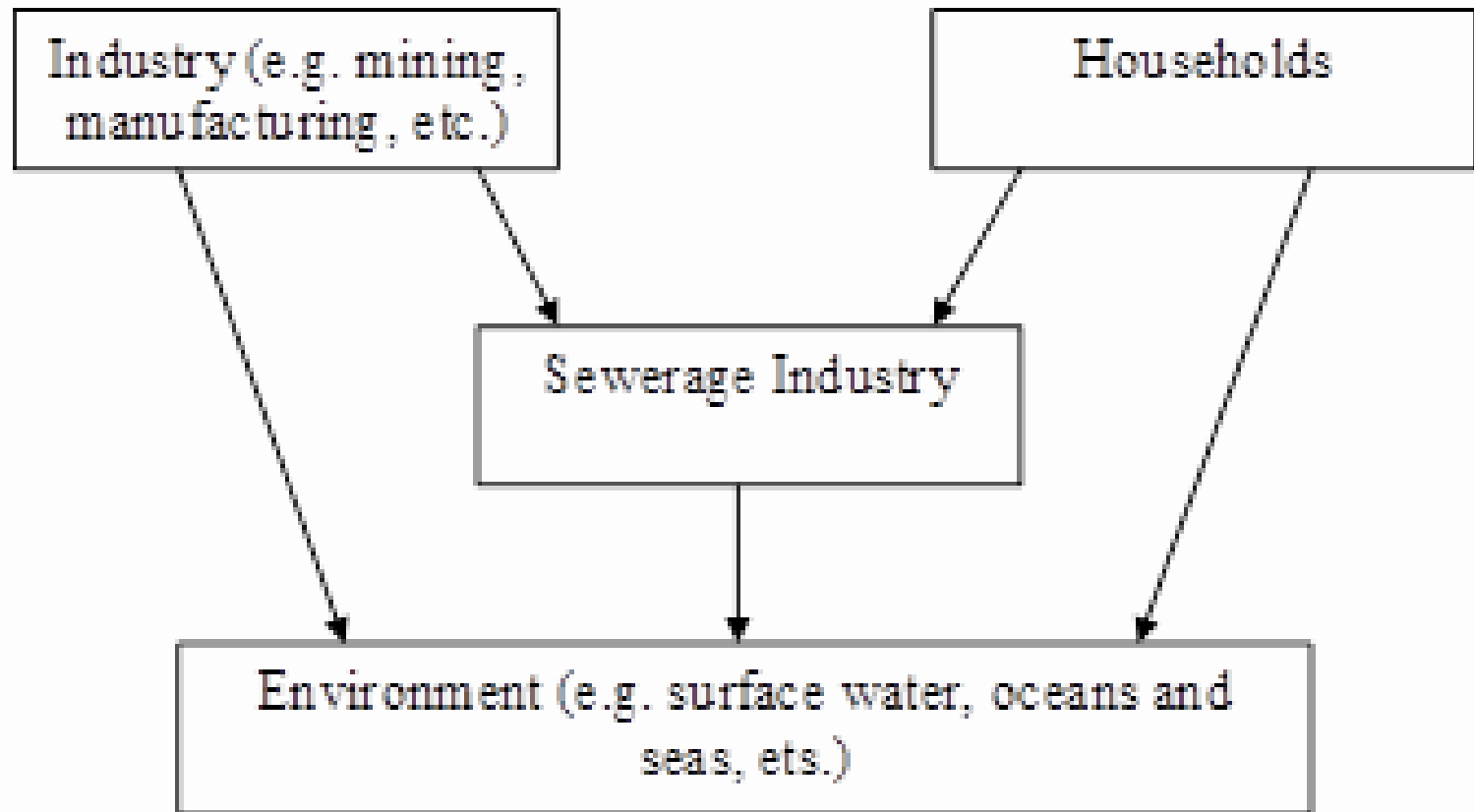
# Emission to water

- Substances released to water resources by establishments and households as a result of production, consumption and accumulation process
- Flows

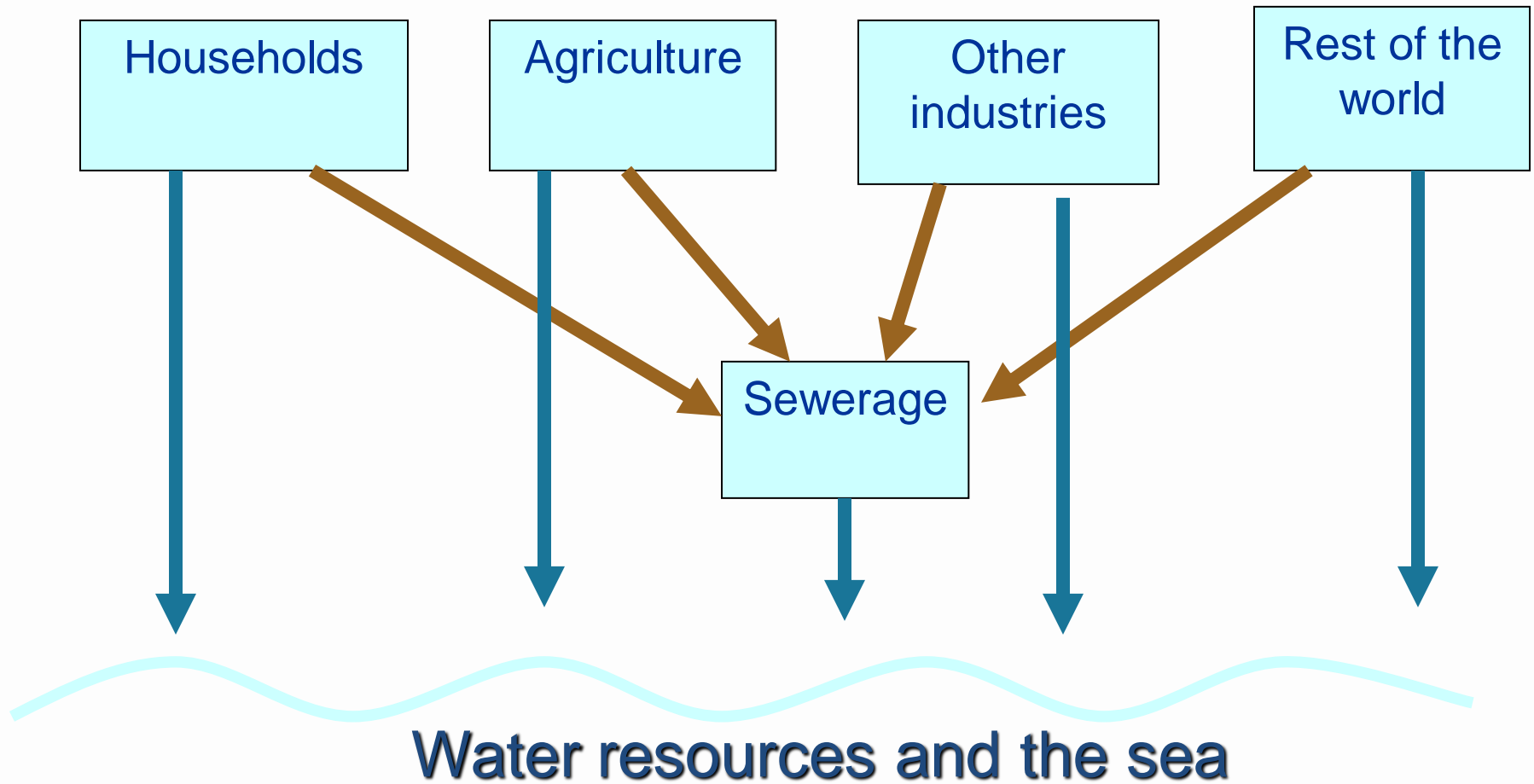




# Flows in water emission account



# Wastewater and pollutants pathways



# Water emission accounts: coverage

- Record the quantity of substance added to water by establishment and households during an accounting period
- Cover
  - › Substances added to wastewater and collected in the sewage system
  - › Substances added to wastewater and discharged directly to water bodies
  - › Substances from non-point sources
    - E.g. emissions from urban runoff and emissions from agriculture

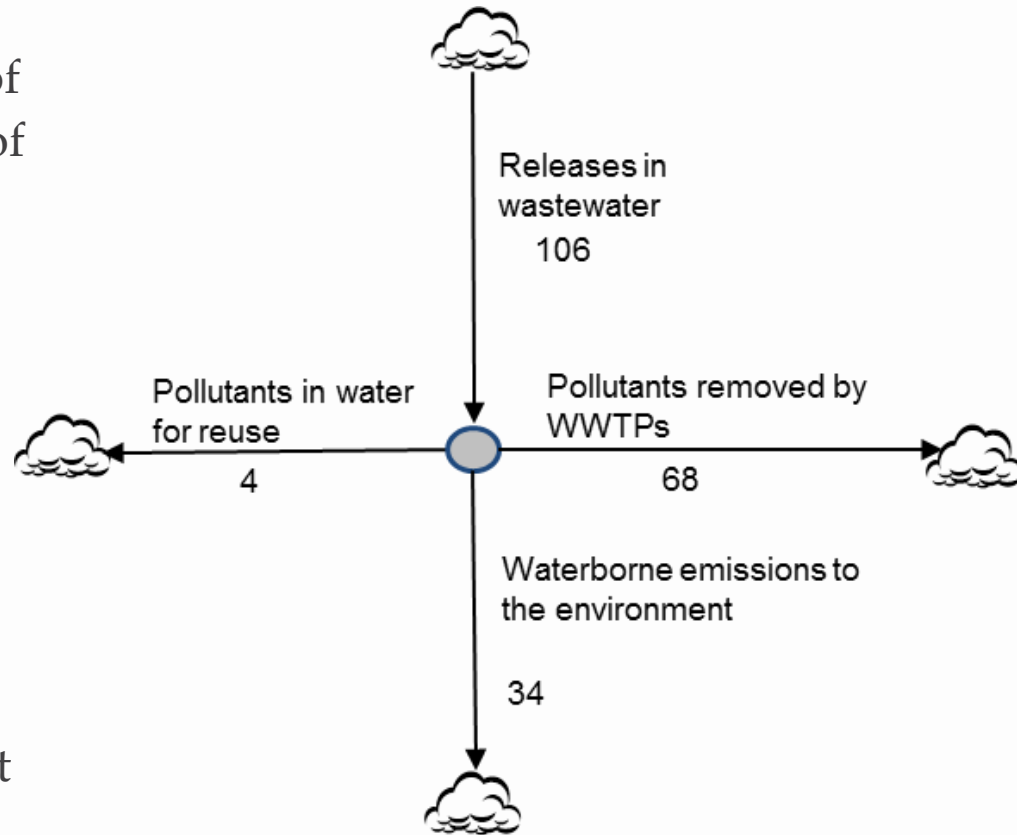
# Water emission accounts: Key components

- Emission by types of substances (supply) and received by the environment (use)
  - > Direct flow to the environment
- Release to (supply) and collection by (use) economic units
  - > Flow to sewage industry

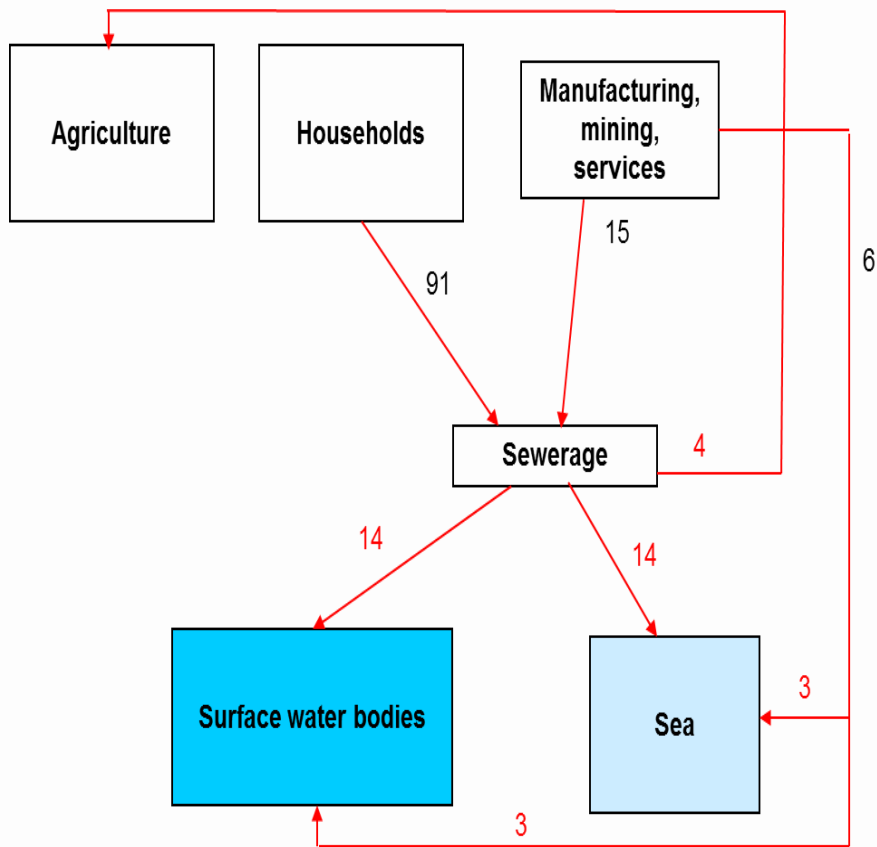
<b>Physical supply table for gross releases of substances to water</b>							
	Generation of gross releases to water			Accumulation	Flows with the rest of the world	Flows from the environment	Total supply
	Sewerage industry	Other industries	Households	Emissions from fixed assets			
<b>Emissions by type of substance</b>							
BOD / COD *	5 594	11 998	2 712				20 304
Suspended solids							
Heavy metals							
Phosphorous	836	1 587	533				2 956
Nitrogen	10 033	47 258	1 908				59 199
<b>Releases to other economic units</b>							
BOD / COD *		7 927	8 950				16 877
Suspended solids							
Heavy metals							
Phosphorous		814	6 786				7 600
Nitrogen		15 139	30 463				45 602
<b>Physical use table for gross releases of substances to water</b>							
	Collection of gross releases to water				Flows with the rest of the world	Flows to the environment	Total use
	Sewerage industry	Other industries	Households				
<b>Emissions received by the environment</b>							
BOD / COD *						20 304	20 304
Suspended solids							
Heavy metals							
Phosphorous						2 956	2 956
Nitrogen						59 199	59 199
<b>Collection by other economic units</b>							
BOD / COD *	16 877						16 877
Suspended solids							
Heavy metals							
Phosphorous	7 600						7 600
Nitrogen	45 602						45 602

# Example of pollution flows in the economy

- Pollution expressed in thousands of metric tons of BOD<sub>5</sub> per year
- The diagram shows that 106 units of pollution (measured in thousands of metric tons of BOD<sub>5</sub> per year) were released by economic activities and households.
- Wastewater Treatment Plants (WWTPs) removed 68 units, and 4 units were included in wastewater that was supplied for further use in the economy.
- Only 34 units of pollution were part of the emissions (emissions are releases to the environment).

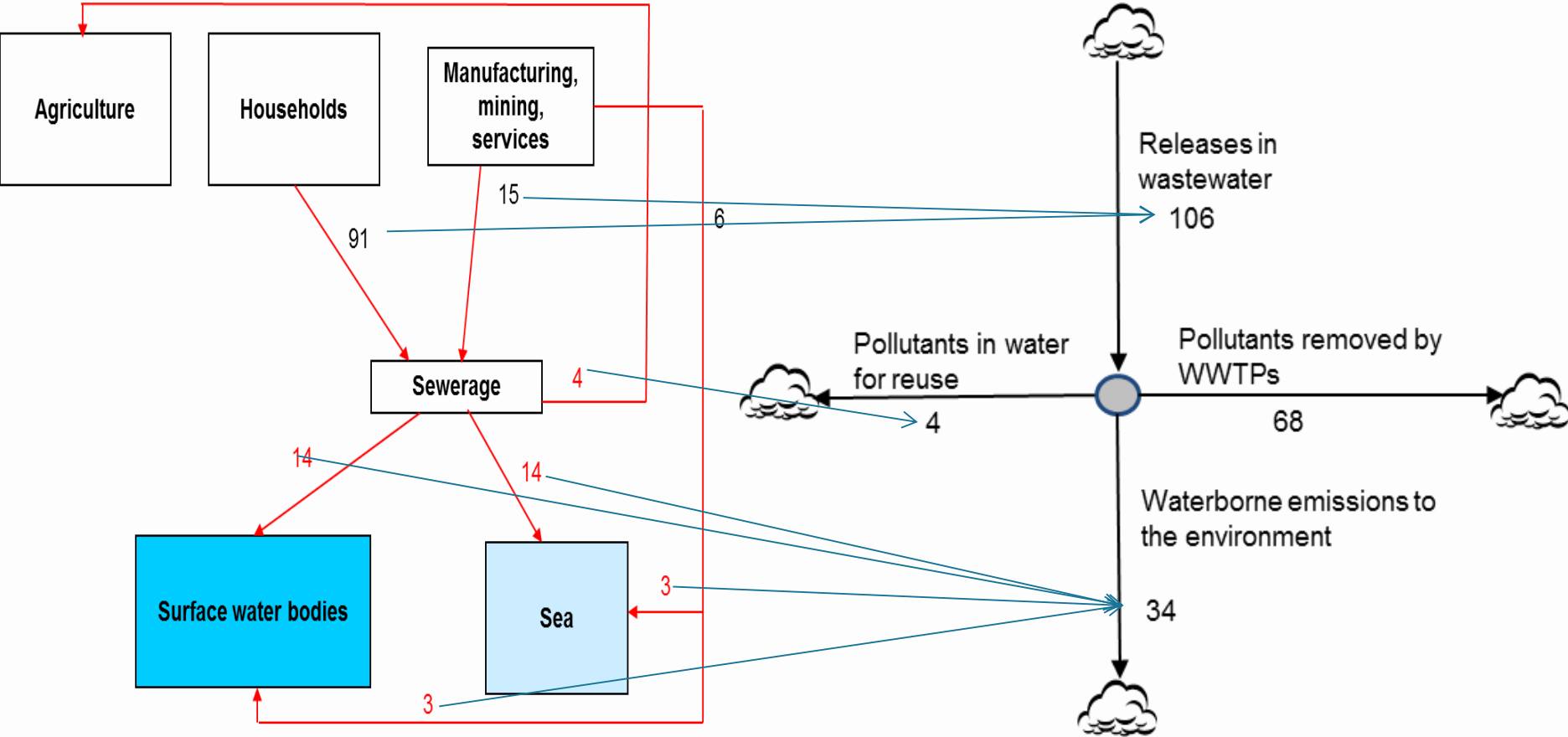


# Example of pollution flows in the economy



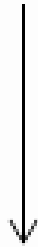
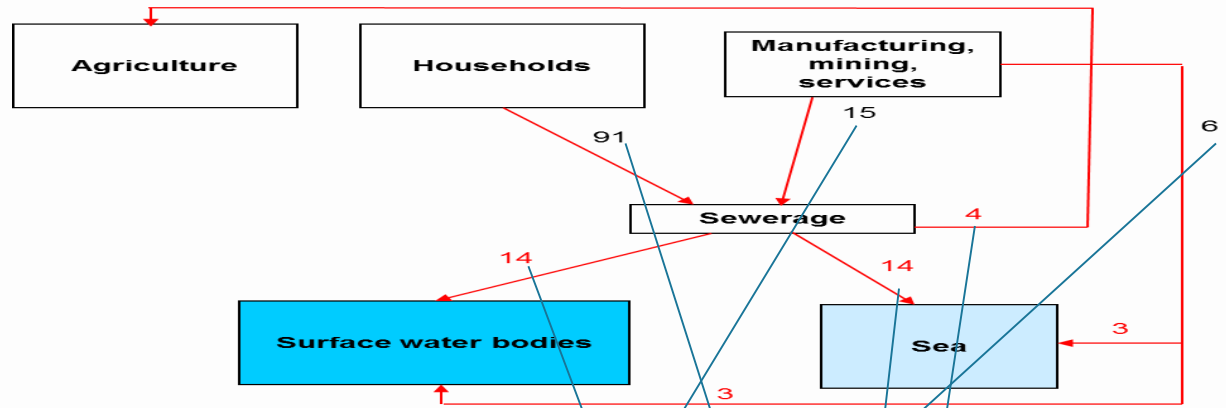
- Further disaggregation of the data is possible, as shown in the figure below.
- households release 91 thousand metric tons of BOD5 to the sewers
- Industries and services release 15 thousand
- 106 thousand metric tons of BOD5 is collected in sewers, but only 28 thousand are released to the environment (emissions)
- Industries and services release 6 thousand metric tons of organic pollution to the environment.
- In summary, the total emissions are 34 thousand tons of organic pollution (28 from sewerage + 6 from industries).

# Example of pollution flows in the economy



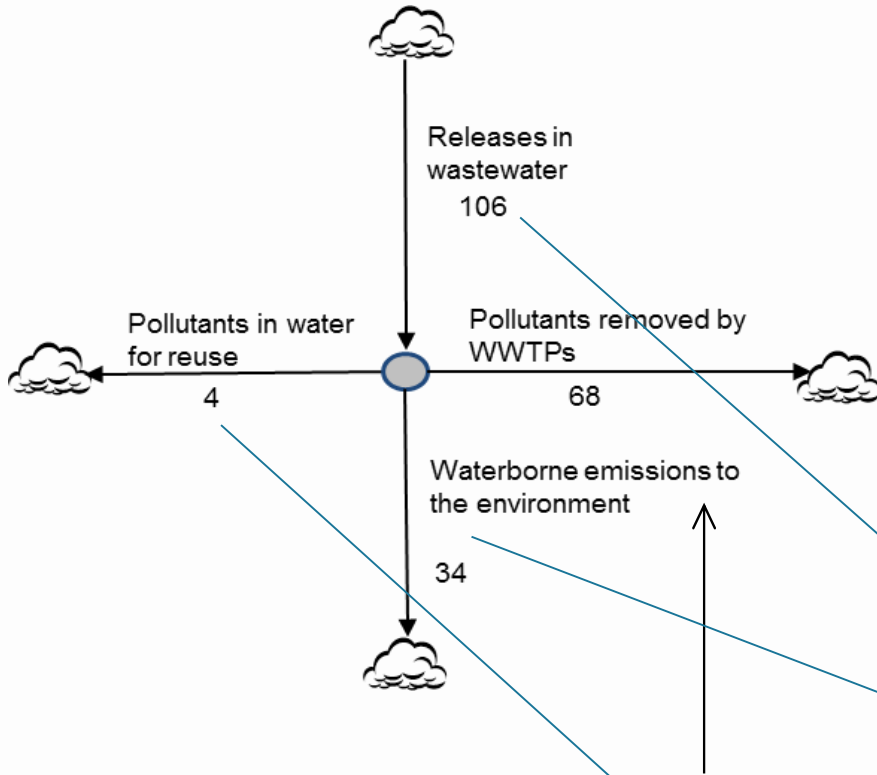


# Example - Supply table



Emissions by test or parameter	Agriculture, ISIC 01-03	Industry and services ISIC 05-99, except 3510, 36, and 37	Hydroelectricity, ISIC 3510	Thermoelectricity, ISIC 3510	Water Supply (drinking water), ISIC 36-A	Water Supply (irrigation water), ISIC 36-B	Sewerage, ISIC 37	Households	Environment	Total
BOD <sub>5</sub>		6					28			34
Releases within the economy		15					4	91		110
	0	21	0	0	0	0	32	91	0	144

# Example - Use table



	Agriculture, ISIC 01-03	Industry and services ISIC 05-99, except 3510, 36, and 37	Hydroelectricity, ISIC 3510	Thermoelectricity, ISIC 3510	Water Supply (drinking water), ISIC 36-A	Water Supply (irrigation water), ISIC 36-B	Sewerage, ISIC 37	Households	Environment	Total
<b>Emissions by test or parameter</b>										
BOD <sub>5</sub>								34	34	
<b>Releases within the economy</b>										
BOD <sub>5</sub>	4						106			110
	4	0	0	0	0	0	106	0	34	144

# Sources

- Two sources
  - > Point sources emission
  - > Non-point (or diffuse) source
- Point sources emission
  - > Geographical location of the discharge of the wastewater is identified
  - > E.g. emissions from sewage facilities, power plants, industrial establishments
  - > They are generally easier to measure since the point of emission to the water resources is clearly identified

# Sources

- Non-point (or diffuse) sources
  - > Sources without a single point of origin or a specific outlet into a receiving water resources
  - > Pollutants are generally carried off the land by storm-water run-off or may be the result of a collection of individual and small scale polluting activities which for practical reasons cannot be treated as point sources of pollution.
  - > Commonly used categories for non-point sources include agriculture and urban areas.
  - > E.g. Urban runoff, releases from individual and small scale activity

# Urban runoff

- Urban run-off: that portion of precipitation on urban areas that does not naturally percolate into the ground or evaporate, but flows via overland flow, underflow, or channels or is piped into a defined surface water channel or a constructed infiltration facility.
- It is generally highly polluted and there is an increasing awareness in the potential danger of discharging it into the environment without treatment.
- Emissions to water in the urban runoff are allocated to the Sewerage industry, ISIC 37 since this is the economic unit responsible for its collection and discharge

# Basic concepts and definitions

- Gross emissions are the pollutants added to the water by an activity, assessed at the point where the wastewater leaves the activity's site (or the dwelling, in the case of households).
- Net (or final) emissions correspond to the pollutants discharged into water resources after treatment.
- Net emissions= gross emissions if there is no treatment of wastewater

# Reallocation of emissions

- In the calculation of net emissions, the release of pollutants by the sewerage industry has to be reallocated to the economic unit responsible for the discharge in the first place
- Net emission = direct emission to the environment + share of emissions released to the environment by sewage industry
- Reallocation of emission
  - › Use average removal rates (e.g. per category of WWTP) or
  - › Use information of known removal rates per WWTP

# Emission accounts

- Industries, households and the “rest of the world” are identified by columns
- They record the pollution added to water by an economic unit (and not the total pollution discharged with wastewater)



# Scope of emission accounts

	Include:	Exclude:
<i>Point sources:</i>	Pollutants added to wastewater	Discharges of heavy metal and hazardous wastes not contained in wastewater ( <i>included in the SEEA waste accounts</i> )  Pollutants resulting from in-situ use (e.g. navigation, fishing, etc.)
<i>Non-point sources:</i>	Urban runoff Irrigation water and rain-fed agriculture	All non-point sources except for urban runoff, irrigation water and rain-fed agriculture

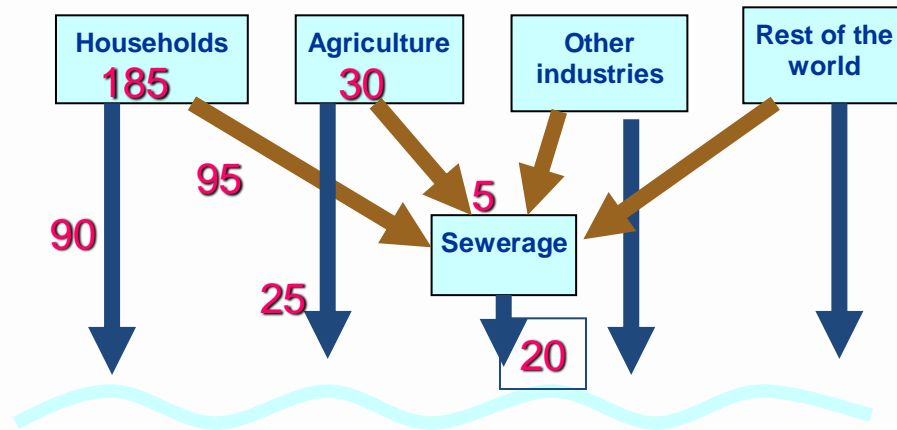
# Water emission accounts: - Inclusion and exclusion

- Do not include “imports” and “exports” of substances through natural flows of water resources
  - › Substances in rivers crossing country borders are not included
- Included in the accounts are emissions of relevant substances from fixed assets, such as from vessels operating within a country’s water resources.
- Include emission due to activities undertaken in water resources or seas

# Emission accounts - Gross emissions

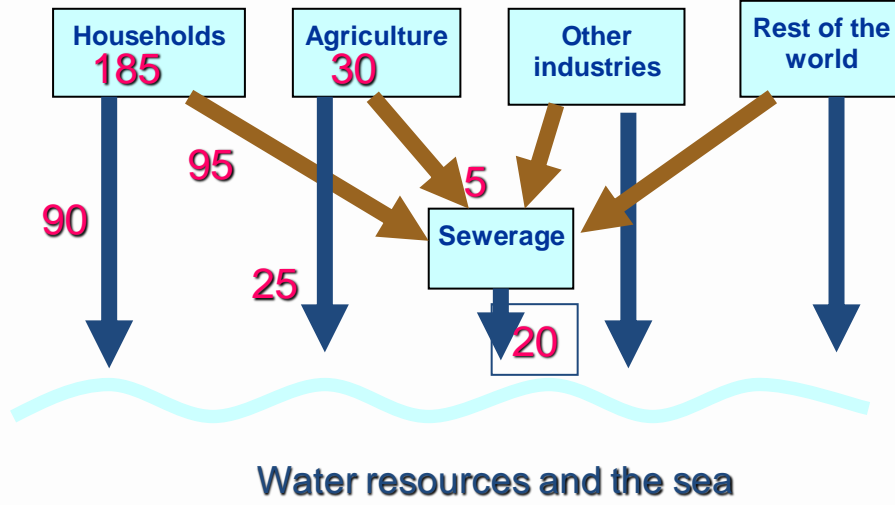
tonnes

Pollutant	Industries (by ISIC categories)							Households	Rest of the world	Total
	1-3	5-33, 41-43	35	36	37	38,39, 45-99	Total			
1. Gross emissions (=1.a+1.b)	<b>30</b>							<b>185</b>		
1.a. Direct emissions to water (=1.a.1+1.a.2=1.a.i+1.a.ii)	<b>25</b>							<b>90</b>		
1.a.1 Without treatment										
1.a.2 After on-site treatment										
1.a.i To water resources										
1.a.ii To the sea										
1.b. To Sewerage (ISIC 37)	<b>5</b>							<b>95</b>		



# Emission accounts – Emission by ISIC division 37

	tonnes
	ISIC 37
Pollutant	
<b>4. Emissions to water (=4.a+4.b)</b>	<b>20</b>
4.a After treatment	<b>20</b>
To water resources	
To the sea	
4.b Without treatment	
To water resources	
To the sea	

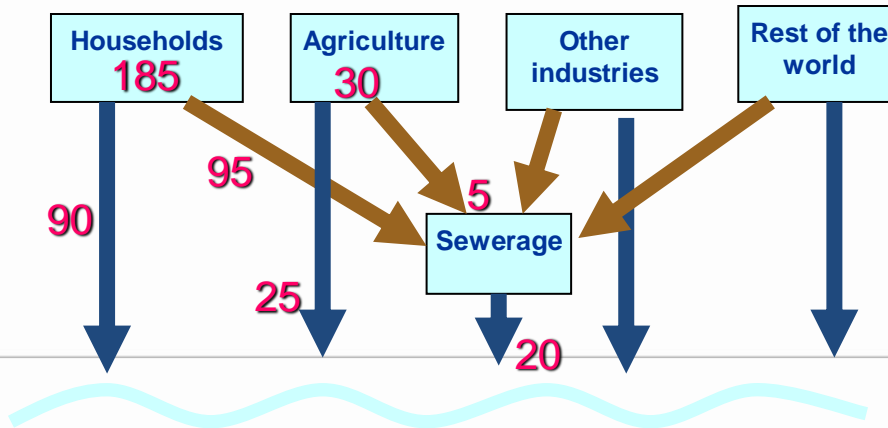


- Now we can reallocate the emissions by ISIC 37 to the activity responsible for the emission

# Emission accounts – net emissions

tonnes

Pollutant	Industries (by ISIC categories)						Households	Rest of the world	Total
	1-3	5-33, 41-43	35	36	37	38,39, 45-99			
1. Gross emissions (=1.a+1.b)							185		
1.a. Direct emissions to water (=1.a.1+1.a.2=1.a.i+1.a.ii)							90		
1.a.1 Without treatment									
1.a.2 After on-site treatment									
1.a.i To water resources									
1.a.ii To the sea									
1.b. To Sewerage (ISIC 37)	5						95		
2. Reallocation of emission by ISIC 37	1						19		
3. Net emissions (=1a+2)	26						109		



# Urban runoff

- Urban run-off: that portion of precipitation on urban areas that does not naturally percolate into the ground or evaporate, but flows via overland flow, underflow, or channels or is piped into a defined surface water channel or a constructed infiltration facility.
- It is generally highly polluted and there is an increasing awareness in the potential danger of discharging it into the environment without treatment.
- Emissions to water in the urban runoff are allocated to the Sewerage industry, ISIC 37 since this is the economic unit responsible for its collection and discharge

# Conclusions

- Emission accounts are addressing new policy-relevant questions
- Existing data collection systems may contain useful information (e.g. Emissions Register)
- May need to set-up specific data collections
- Promotion of usefulness of (emission) accounts is very important. They will aide:
  - Understanding of the costs and benefits of measures
  - discussion with different stakeholders (e.g. agriculture versus industry as polluters of waters)
  - monitoring of environmental efficiency
  - definition of policy goals

# PHYSICAL DATA ITEMS RELATED WITH WATER EMISSIONS



# Wastewater

- Wastewater in SEEA is defined as all the water that is discarded and no longer required by the owner or user
- Wastewater by type of water users discharging
  - > Household
  - > Industries connected to sewer network
  - > Sewage industries
  - > Industries not connected to the sewer network
  - > Agriculture
  - > Thermoelectric plants
  - > Hydroelectric plants

# Data collection

- Common sources of data
  - > Water and/or sewage utilities, companies, associations or regulators
  - > Departments in charge of controlling polluting discharges (they may issue permits and develop inventories of polluting discharges)
  - > National statistics office
  - > Research institutions
- Data collection of wastewater should be done in conjunction with data collection of emissions

# Waterborne polluting release

- Pollution problem
  - > Transmission of disease through water
  - > Reduction of dissolved oxygen in water
  - > Proliferation of aquatic weed and algae
  - > Poisoning of aquatic life and humans
- Emission statistics and accounts are based on the results of tests or analyses (e.g. BOD, COD, TSS) done to wastewater samples

# Pollutants and their measurement

Pollutants	Parameters (Based on Laboratory Tests)
Pathogenic viruses, bacteria, protozoa, and parasitic worms (helminthes) from excreta of people with diseases.	<ul style="list-style-type: none"><li>• Fecal coliforms</li><li>• E. coli</li><li>• Enterococci</li></ul>
Organic Matter	<ul style="list-style-type: none"><li>• Biochemical oxygen demand (BOD)</li><li>• Chemical oxygen demand (COD)</li><li>• Total organic carbon (TOC)</li></ul>
Nutrients	<ul style="list-style-type: none"><li>• Total Nitrogen (TN)</li><li>• Total Phosphorus (TP)</li><li>• Total Kjeldahl Nitrogen (TKN)</li></ul>
Toxic substances that often accumulate through the food chain (E.g. metals, persistent organic pollutants, and cyanides). Also known as micro-pollutants.	<ul style="list-style-type: none"><li>• Tests to detect the presence of metals (e.g. Arsenic, Cadmium, Chromium)</li><li>• Tests to detect persistent organic pollutants (POPs), such as PCBs.</li><li>• Tests to detect cyanides.</li></ul>
Substances that change the physical properties of water. It includes a wide variety of properties that may reveal the presence of pollutants.	<ul style="list-style-type: none"><li>• Total Solids (TS)</li><li>• Total suspended solids (TSS)</li><li>• Temperature</li><li>• Conductivity</li><li>• Acidity (pH)</li><li>• Color</li></ul>

# Data items related with waterborne pollution

**Waterborne pollutant releases to other economic units (data item J)**

**Sources of data: Data from wastewater utilities.**

**Data processing required: Estimates of the different types of waterborne pollution released by economic activities and households to the sewer network. Pollution is measured using different parameters, usually based on laboratory tests of wastewaters.**

**Relevant agencies:**

- **Wastewater or sewerage utilities.**
- **Ministry of Environment.**

**Statistical projects to be developed:**

- **Inventory of wastewater treatment plants.**

## Waterborne pollutant emissions to the environment from point sources

**Sources of data:** Estimates of waterborne pollution emitted to inland water resources, to the sea, or to land, by households and the different economic activities.

**Data processing required:** Estimates of the different types of waterborne pollution released by economic activities and households. Amount of pollution retained in wastewater treatment plants based on treatment efficiencies reported by the wastewater treatment operators. Pollution is measured using different parameters, usually based on laboratory tests of wastewaters. Some pollution may be collected in sewer networks and the rest discharged directly to the environment. The waterborne pollution collected in sewer networks is also discharged to the environment with or without treatment.

**Relevant agencies:**

- Wastewater utilities.
- Ministry of Environment.

**Statistical projects to be developed:**

- Inventory of discharge points.
- Inventory of wastewater treatment plants.

## Waterborne pollutant emissions to the environment from non-point sources (data item K.2)

Sources of data: Estimates of waterborne pollution emitted to inland water resources, to the sea, or to land, by diffuse sources of pollution, such as the following: fertilizers, herbicides, and insecticides from agricultural lands; oil, grease, and toxic chemicals from urban runoff and energy production; organic matter from septic systems.

Data processing required: Information about the amount of nitrogen and phosphorous applied to crops in the form of fertilizers.

### Relevant agencies:

- Ministry of Environment.
- Ministry of Agriculture (for non-point pollution emitted by agricultural activities).

### Statistical projects to be developed:

- Map of agricultural and industrial areas that discharge non-point pollution.



**THANK YOU**

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