Interreg North-West Europe
Co-funded by the European Union

Rural Roadwater Rescue

Rural_Roadwater_Rescue
Legal Boundaries

D 1.1.2

Period 3

30.04.2025

Rijkswaterstaat
Ministry of Infrastructure and Water Management

RÉPUBLIQUE FRANÇAISE
Liberté
Égalité
Fraternité

Cerema
CLIMAT & TERRITOIRES DE DEMAIN

DVGW

TZW
Technologiezentrum Wasser

Vlaanderen
is milieu

imec

CK

Content

Abbreviations

WFD:	Water Framework Directive
FD:	Floods Dir = Flooding Directive
WS&D:	Water Scarcity and Drought
DWD:	Drinking Water Directive
PS&EQS:	Priority Substances and Ecological Quality Standards
GWD:	Ground Water Directive
UWWTD:	Urban Waste Water Treatment Directive
ND:	Nitrates Dir. = Nitrates Directive
BWD:	Bathing Water Directive

1 Introduction

Climate change is pushing us to use water rationally. In that respect, water flowing off roads seems mostly underused. It flows off towards the roadside or goes immediately to the sewerage system whether or not via a buffer basin towards the sea. This while there is a clear need for water from society. How this should be done, however, is not entirely clear. It is from this circular economic angle that Rijkswaterstaat has breathed life into the Rural Roadwater Rescue project.

However, before we can think of re-use (Fig. 1) it is important to set out the **legal boundaries** relevant to roadwater management. Water pollution is managed by legislation along the many different components of the water cycle, by standards for emission and imission related to anthropocentric activities: permits and standards set the framework to ensure a good ecological status for groundwater, surface water and sea. Rainwater runoff often has a special status. Often it is considered to be clean. However, research shows that also rainwater can carry a considerable amount of pollutants when in contact with man-made infrastructure, which in fact could be of concern if it is not being managed well.

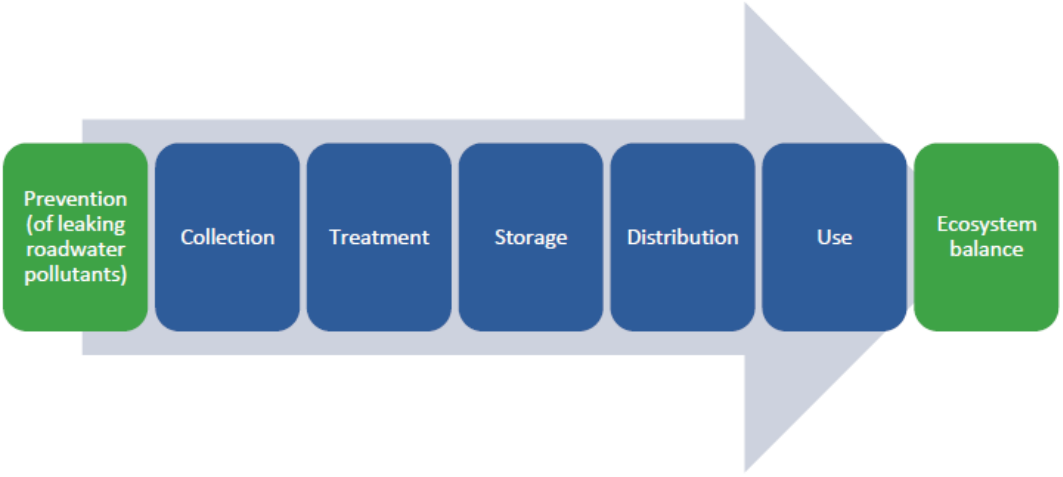

Fig. 1 Different steps defined in RRR to put roadwater to other usages.

Therefore within this activity, we made an overview of existing relevant European and national legislation for Flanders, the Netherlands, Germany and France. We identify the differences and similarities in the approaches, we identify the possible legal gaps, and list up a set of standards that could be inspiring in identifying possible uses and roadwater treatment needed.

1.1 The need for legal boundaries and scope of this study

Legal boundaries can be found within the green square's domains (1; Fig. 1), which will define whether roadwater could be used (2); focusing both on how to prevent deterioration from our ecosystem balance; and ensuring a sustainable water resource for people, planet and profit.

From the perspective of the Flemish Environment Agency, as water manager of the first category of unnavigable watercourses and as regulator of the water chain, we set requirements for both water quantity and quality for surface water, groundwater and drinking water, in implementation of European regulations in Flanders.

With this study, we want to provide an overview on what are the boundaries (with focus on water quality) taking in to account (1) the European regulations that guide our operations and

(2) the existing national legislation for the different partner countries; that result from or are adapted in response to implementation; of European legislation. We limit ourselves (mainly) to the regulations of Flanders; the Netherlands, Germany and France. We base ourselves on internet sources; knowledge within our network (i.e. in partner meetings; through interviews…) and on the bibliographic results and survey results from Activity 1 (cf. D1.1.1).

2 European regulation as a driver for water related policy

The European Union (EU) has established a comprehensive framework of water-related legislations that sets out common standards and objectives to ensure a sustainable use and protection of water resources. This framework serves as a powerful driver for national water policies.

While the objectives (outcomes) are defined, the way to reach them can be defined more freely by the Member States. The implementation of European water legislation in national policy involves a degree of flexibility that allows Member States to adapt the directives to their country specific context while still achieving the overarching aims set by the EU. Member States are allowed to adapt national implementation slightly differently.

National legislation implementation can differ taking into account country specific local conditions (i.e. geographical, climatic, environmental, socio-economic): specific (intermediate) targets and timelines for reaching the objectives (phased approach); and different types of measures can be decided. Also the mechanisms for public participation (involving stakeholders, including local communities, NGOs, and industry representatives) in the development and implementation of water management plans can differ between member states. Monitoring and reporting are obligatory, but can be filled in differently. Member states have the freedom to align their water management policies with other sectoral policies (i.e. agriculture, industry, and urban planning), creating a more holistic and sustainable approach.

However, in general, a minimum European standard is set. The degrees of flexibility ensure national water policies are not only aligned with EU objectives but also tailored to the unique challenges and conditions of each Member State. To conclude, Member States are encouraged to develop and share innovation and best practices that go beyond the minimum requirements.

2.1 Water Framework Directive and other European water legislation

The cornerstone of EU water legislation is the Water Framework Directive (WFD), adopted in 2000. The WFD establishes a holistic approach to water management, aiming to achieve 'good status' for all EU waters, including rivers, lakes, groundwater, and coastal waters. It sets out the principles of integrated river basin management, emphasizing the need for member states to develop River Basin Management Plans (RBMPs) and Programmes of Measures (PoMs) to address the specific challenges within each river basin district. The WFD also promotes public participation, ensuring that stakeholders and communities are actively involved in water management decisions.

Complementing the WFD are several other directives that address specific aspects of water protection. The Groundwater Directive (2006/118/EC) focuses on protecting groundwater from pollution and achieving good chemical and quantitative status and falls within the green boxes. The Urban Waste Water Treatment Directive (91/271/EEC) sets standards for the collection and treatment of urban wastewater to prevent pollution of water bodies. The Bathing Water Directive (2006/7/EC) aims to protect public health and the environment by regulating the quality of bathing waters. The Drinking Water Directive (EU 2020/2184) provides strict regulations related to human consumption. These directives, among others, create a cohesive and comprehensive legislative framework that member states must implement and integrate into their national policies.

For an overview of all relevant European water related legislation to roadwater management, cf. Table 1.

2.2 Evolution of water policies: from an anthropocentric to a more holistic approach

Since the 1970s, water policy has evolved significantly. Initially, policies focused on setting standards for water quality and usage to prevent competition distortions within the European market. This period saw the introduction of directives like the Drinking Water Directive (75/440/EEC) and the Bathing Water Directive (76/160/EEC). These "former" EU legislation typically relates to the human water cycle, also referred to as the small cycle addressing human health directly and indirectly through resource protection by combining quality standards and emission controls (Fig. 2).

In the late 1980s, the approach shifted towards more integrated and restrictive environmental objectives, influenced by growing ecological awareness, towards the so called natural water cycle, covering the complete hydrological and related natural processes (Fig. 2).

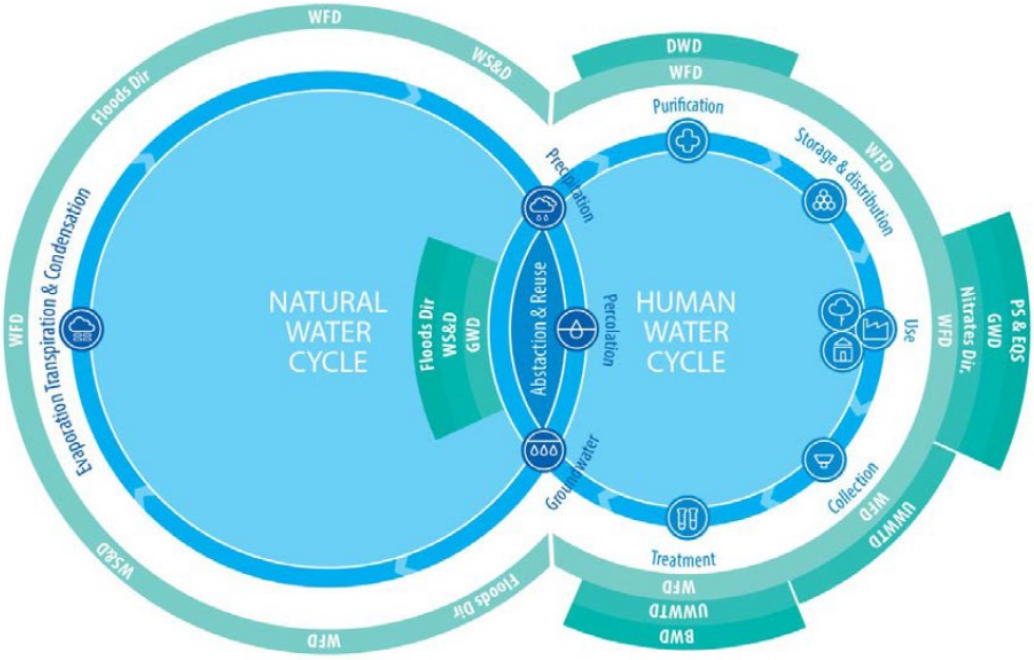

Fig. 2 Diagram showing the larger natural water cycle (i.e. evaporation, precipitation…) and the smaller human water cycle (i.e. use, treatment), showing how they are independent from one another and how they can be linked to the different relevant EU legislations (Zandstra 2015).

The Water Framework Directive (WFD) of 2000 marked a major milestone, aiming for a holistic management of water resources across Europe, strengthening environmental objectives and introducing new tools such as river basin planning and economic instruments aiming at achieving a more efficient use of water and thus reducing water use.

Since the implementation of the Water Framework Directive (WFD) in 2000, there have been several significant changes and updates to water policy regulations. The WFD itself has been complemented by other directives, such as the Groundwater Directive (2006) and the Environmental Quality Standards Directive (EQSD), which set specific standards for pollutants and groundwater protection and repealed dated former directives (i.e. 76/464/EEC on Dangerous Substances).

In 2019, a Fitness Check of the EU water legislation concluded, that, while the framework was broadly fit for purpose, there were areas needing improvement, such as investments, implementation, and integrating water into other policies. This led to the adoption of the EU's Zero Pollution Action Plan in 2021, which aims to reduce pollution to levels that are no longer harmful to health and ecosystems by 2050. Additionally, the EU has introduced regulations on water reuse (2020) and marine environmental policy (Marine Strategy Framework Directive, 2008), further strengthening the integrated approach to water management (Table 1).

These changes reflect a continuous effort to adapt and enhance water policy to address emerging challenges and ensure sustainable water management for future generations. Furthermore, the focus has expanded to include not only water quality but also the quantity, resilience, and overall health of aquatic ecosystems. This integrated approach reflects a broader understanding that water management is intrinsically linked to broader environmental, social, and economic objectives.

Table 1 Overview of European water related legislation to the example of Zandstra 2015 adapted for use in RRR relevant to roadwater management

Legislation	Year (update)	Scope	Instruments/tools	Summary of main objectives
Direct				
Bathing water Directive	1976 (most recent: 2006/7/EC, currently under review)	Human use, quality	Quality standards, RBMP	To preserve, protect and improve the quality of the environment and To protect human health by complementing WFD with regard to bathing water
Drinking Water Directive	1980 (2020/2184 recast; Member States have to transpose the Directive into national law and comply with its provisions by 12 January 2023.)	Human consumption, quality	Quality standards, watch list mechanism	Protect human health by ensuring the quality of water intended for human consumption To improve access to water intended for human consumption
Urban Waste Water Treatment Directive	1991 (91/271/EEC, recently revised in 2022, provisional agreement 29 January 2024)	Industrial and households waste water collection, treatment, quality	Emission controls, identification vulnerable areas	To protect the environment from the adverse effects of urban waste water discharge and treatment and of biodegradable industrial waste water from the agro-food sector
Nitrates Directive	1991 (91/676/EEC)	Agricultural, quality	Emission controls, identification vulnerable areas	To reduce water pollution caused or induced by nitrates from agricultural sources
Water Framework Directive	2000 (2000/60/EC, an amendment is proposed in 2022 to revise the lists of pollutants in surface and groundwater)	All aspects of the water cycle – considering all pressures and impacts (industrial, households, agricultural), quality & quantity	RBM, emission controls, quality standards, economic instruments	To prevent further deterioration, protect and enhance the status of all aquatic ecosystems (surface and groundwater, incl. coastal and transitional waters) by an integrated approach to ensure sustainable ecosystems. Can be considered together with Ground Water Directive; and Environmental Quality Standards Directive (and PS Directive)
Environmental Quality Standards Directive	2008 2008/105/EC	Surface water	Quality standards	Protect the aquatic environment from a list of priority pollutants because of the significant risk they pose.
Priority Substance Directive	2013 (2013/39/EU: updated 7 of the 33 PS's and added 12 new PS's to the EQS)			
Groundwater Directive	1980 (most recent: 2006/118/EG, an amendment is proposed in 2022 adding pollutants to Annex 1 and 2)	Groundwater, quality & quantity	Quality standards, emission controls	To establish specific measures to prevent and control pollution of groundwater To complement the WFD on the provisions preventing or limiting inputs of pollutants
European Soil Strategy	COM(2021) 699 final	Soil quality	Vision, working towards sustainable management and necessary legislation, increasing monitoring	EU soil strategy for 2030 to restore soil health, increase monitoring effort (soil passport), develop a dedicated legislative proposal on soil health by 2025, promoting sustainable management etc.

Water re-use regulation	2020 (2020/741)	Agricultural use, quality	Quality standards, emission controls, permits	Encourage and facilitate water reuse in the EU to anticipate water scarcity..
Flooding Directive	2007 (2007/60/EC)	Ensuring a well living environment, quantity	Spatial planning: (re)create space for water	To establish a framework for the assessment and management of flood risks, aiming at the reduction of the adverse consequences for human health, the environment, cultural heritage and economic activity.
COM on Water Scarcity & Drought	2007 COM [(2007) 414]	Ensuring a well living environment, quantity	n.a.	Presenting policy options at EU, national and regional levels to address and mitigate the effects of water scarcity and droughts
Indirect				
Birds Directive (N2000)	1979 (amended in 2009, by the Birds Directive; 2009/147/EC)	Nature conservation	Special Protection Areas (SPAs), Natura 2000 conservation objectives and management, require an EIA when impacted by human project developments	To protect species of wild birds in the EU.
Habitat Directive (N2000)	1992 (92/43/EEC)	Nature conservation	Special Areas of Conservation (SACs), Natura 2000 conservation objectives and management, require an EIA when impacted by human project developments	To ensure biodiversity through conservation of natural habitats and wild fauna and flora in the EU.
Environmental Impact Assessment Directive	1985 (updated to 2011/92/EU and amended by 2014/52/EU)	Environmental protection	Making an environmental impact assessment of the environment prior to human development projects, public consultation, report added to the decision making process	To ensure that environmental considerations are integrated into the decision-making process for projects such as nuclear power stations, motorways, waste disposal installations, and more.
European Climate Law	2021 (2021/1119)	Climate regulation framework towards climate neutrality (mitigation, adaptation)	National Energy and Climate Plans (NECPs): impact several policy areas: a strong link with water policies (WFD, FD) conservation policies (BD, HD), circularity and energy policies.	Define the path towards 2050 climate neutrality objective through all policies, in a socially fair and cost-efficient manner.
Marine Strategy Framework Directive	2008 (2008/56/EC)	Marine water protection	Integrated management, environmental targets and indicators, Program of Measures (similar to WFD)	To protect the marine ecosystem and biodiversity upon which our health and marine-related economic and social activities depend.
Ecodesign for Sustainable Products Regulation	2009 (updated to 2024/1781; also amending amending Directive (EU) 2020/1828 and Regulation (EU) 2023/1542)	Ecodesign	Ecodesign requirements for physical goods	To ensure that the production of physical goods on the EU market has a low environmental impact. Ultimately the regulation aims to improve the circularity, energy performance, and overall environmental sustainability of products.

2.3 Regulations to take into account when exploring the possibilities for roadwater use

Depending on the further "end" destination of roadwater (i.e. natural cycle– surface water or groundwater, soil; or human cycle- bathing, drinking, irrigation (agriculture) or other domestic/industrial usage), different European legislations will apply.

In Fig. 3 we roughly tried to link the framework of different policies involved depending on the route of roadwater to natural ecosystems (1) or human usage (2); also taking into account the initial prevention step (preventing pollution to end up in the roadwater by ecodesign).

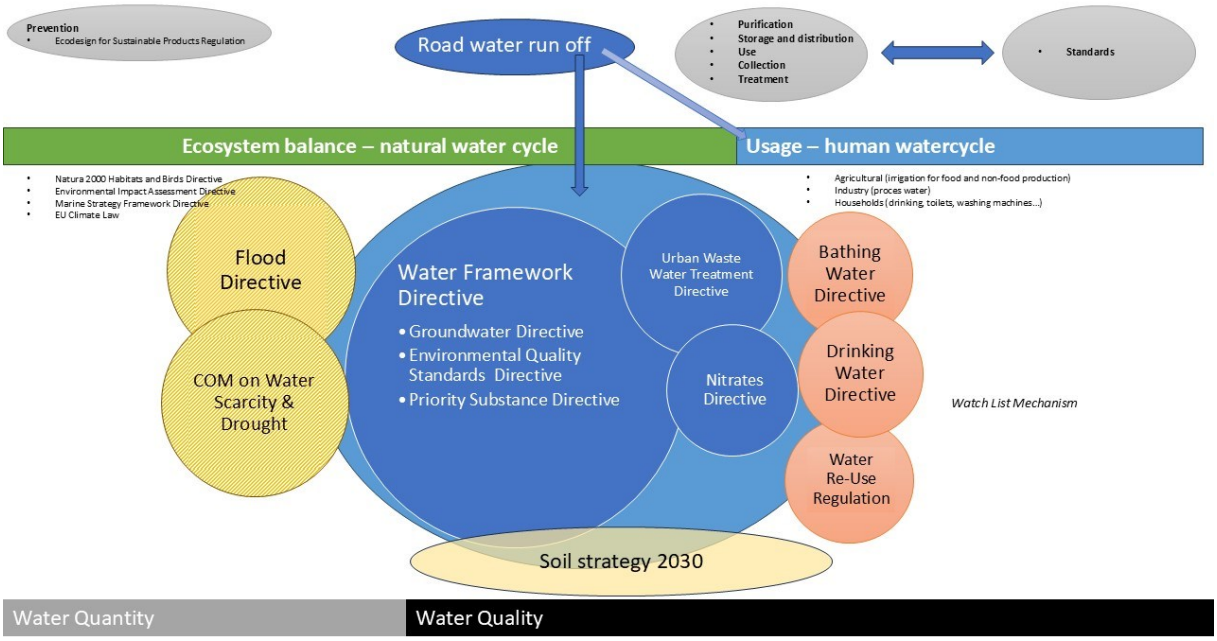

Fig. 3 Framework of different policies involved for water quality and quantity; within both the natural and human cycle that might be relevant for roadwater management depending on the end destination or "usage" intended. (author's own analysis)

However, European legislation might be implemented in different ways in national policies as described earlier (within the introduction of Ch. 3). Therefore in the next chapter, an overview is gathered of **relevant national legislations**, indicating the EU policy of Table 1 that is implemented herein (and indicating also to which step in which cycle (Fig. 2) it can be found relevant (as an example: natural/human; infiltration/use; resp.).

3 National water policies and instruments relevant to roadwater management

The national legislations are presented in Table 2 per country, indicating also to which EU policy it is linked; and to which step in the water cycle it can be relevant based on Fig.2.

The influence of European legislation on national water policies is profound, driving the development and implementation of national laws, regulations, and management practices that align with EU standards. Member states are required to transpose EU directives into their national legal frameworks, ensuring that the principles and requirements set out in the directives are effectively enforced at the national level.

This process involves the adaptation of existing laws (1) and the creation of new legislation (2) to address the specific requirements of each directive.

Table 2 Overview of national legislation gathered within the Interreg RRR network relevant to roadwater management

Country	Legislation	Scope (quality/quant.; surface water, ground water, other…)	Instruments/tools	Implements the following EU directive(s)	Summary of main objectives	Relevant to which step of the water cycle (Fig.)
Flanders	Decree Integrated Watermanagment (Decreet Integraal Waterbeleid – DIW/Waterwetboek) 2003	Quality, quantity, surface water, ground water	Quality standards, RBMP, PoM, Watertoets: pre-emptive right to buy grounds in areas prone to flooding	WFD, EQS, PSD, GWD, FD	Good ecological status for all waterbodies	All
Flanders	Executive order "Water Test" (Uitvoeringsbesluit Watertoets: guidelines to the application of the water test to local, provincial and regional authorities providing permits) - 2006	Quality, quantity, surface water, ground water	Coupled to permits – binding advice: the result of the water test is included as a water paragraph in the permit or in the approval of the plan or program.	WFD, EQS, PSD, GWD, FD	Good ecological status for all waterbodies	All
Flanders	Law on the protection of surface water against pollution (Wet op de bescherming van de oppervlaktewateren tegen verontreiniging) 1971	Quality, quantity, surface water, ground water	Fees for discharging pollutants in surface water	WFD, EQS, PSD, GWD, FD	Legislation regarding fees for wastewater treatment (polluter pays principle)	Use, collecting, treating
Flanders	Executive order discharge industrial waste water to WWTP following from "Law on the protection of surface water against pollution (Uitvoeringsbesluit lozing bedrijfsafvalwater op RWZI) - 2014	Quality, surface water	Emission control	UWWTD	Evaluate connectivity, remediation contracts for permanent discharges, temporary discharges, emergency discharges and well drains (i.e. during construction works)	Collection, treatment

Flanders	Regional Urban Planning Ordinance stormwater (Gewestelijke Stedenbouwkundige Verordening Hemelwater) - 2023	Quantity	Design rules for sewage systems	UWWTD	Collecting and treating urban runoff	Collection, treatment
Flanders	Code of good practice for sewage systems (Code van Goede praktijk Rioleringssystemen) - 2012	Quantity	Design rules for sewage systems	UWWTD	Collecting and treating urban runoff	Collection, treatment
Flanders	Decree General Provisions Environmental Policy (Decreet Algemene Bepalingen Milieubeleid) - 1995	Environmental protection	I.e. Permits	WFD, FD, GWD, EIA	General environmental provisions	Use
Flanders	Vlarem II Part 4 and part 6: Executive order following from Decree General Provisions Environmental Policy (Vlarem II uitvoeringsbesluit) 1995 (- 2012)	Quality, surface water	Emmission control on human activities; sectoral and non-sectoral)	UWWTD,	Collecting and treating urban and industrial runoff	Use, collection, treatment (and discharge)
Flanders	Vlarem II – Part 2: Executive order following from Decree General Provisions Environmental Policy: standards for surface water and groundwater (integrating WFD)	Quality, quantity, surface water, ground water	Standards	WFD, EQS, PS, GWD	Quality standards surface water, ground water, sediments (water)	Natural water cycle (SW, GW)
Flanders	Vlarem II – Part 2: Executive order following from Decree General Provisions Environmental Policy and annexes: also includes other standards for different types of use integrating the other related EU directives – annexes – 1995	Quality, quantity, surface water, ground water	Standards	i.e. BWD, DWD	Quality standards for bathing water, drinking water, water for fishing, for shell fish water, river beds	Human cycle (drinking, bathing, fishing)
Flanders	Decree on the quality, quantity and supply of water intended for human consumption (Besluit van de Vlaamse Regering over de kwaliteit, on activitieskwantiteit en levering van water bestemd voor menselijke consumptie) - 2023	Quality	Standards	WFD, DWD	Water quality requirements for supply and production of water intended for human consumption.	Use
Flanders	Technical regulations on water intended for human use (Technisch reglement water bestemd voor menselijke aanwending)- 2009	Quality	Technical prescriptions	WFD, DWD	These regulations describe the design, sizing, construction, maintenance and protection of indoor systems for potable water and second-circuit water (well water or rain water).	Distribution, use
Flanders	Decree regulating operations within wetlands and water protection zones (Besluit reglementering handelingen binnen de watergebieden en de beschermingszones) – 1985	Quality	Regulations limiting specific type of activities	DWD	These regulations aim to protect the drinking water quality by limiting the activities within the protected area (I, II and III) and wetlands	Use
Flanders	Guidelines on above and underground infiltration infrastructures	Quantity (quality)	To comply with "Code van Goede Praktijk Rioleringen"	WFD	The guidelines follow the preferred order of runoff	(restoring the) Natural water cycle

Flanders	Drinking water decree (20/01/2003)	Quality, drinking water	Standards and protocols	DWD	Quality demands for drinking water	Use
Flanders	Playbook circular water use Flanders	Quailty, alternative water sources	Dynamic document,	Re-use act	The Circular Water platform, a public-private partnership, is exploring how to accelerate circular water use.	Human cycle
France	National law n° 64-1245, dated 16/12/1964 - distribution of water and the fight against its pollution	Quality, quantity, surface water, ground water	Base of the French system of water management according to 6 French main basin catchments and related institutional organization	WFD, EQS, PSD, GWD	Basin catchment water management and organization	All
France	National law n°92-3, dated 3/01/1992 – "Loi sur l'eau"	Quality, quantity, surface water, ground water (and territorial sea water)	Water planification tools : - SDAGE (Schéma Directeur d'Aménagement et de Gestion des eaux) - SAGE (Schéma d'Aménagement et de Gestion des eaux)	WFD, EQS, PSD, GWD	Recognize water as a "common heritage" for the nation. Give tools for water bodies management policies with SDAGE and SAGE	All
France	National law n°95-101, dated 2/02/1995 - on strengthening environmental protection	Quality,quantity, surface water, ground water, drinking water?	Annual report on the price and quality of water and sewage services. It introduces also the liability of legal entities	DWD, UWWTD	Management and report of the drinking water and sewage services performances	Human water cycle
France	National law n°98-535 dated 1/07/1998 – human consumption safety	Quality, quantity, drinking water	Law ensuring quality and access to drinking water	DWD	Strengthening health monitoring and control of the health safety of products intended for humans	Human water cycle
France	National law 2004-338 dated 21/04/2004 – user pay principle	Quality, quantity, surface water, ground water	Implementing directive 2000/60/EC in national legislation	WFD	Basin catchment water management and organization	All
France	National law 2006-1772 dated 30/12/2006 related to water and aquatic environment	Quality, quantity, surface water, ground water	Financing of water policies (fees) Creation of the "Office National de	WFD	This law modified the one from 1992 on certain aspects concerning	all

			l'eau et des milieux aquatiques"		rainwater management.	
France	National law 2009-967 dated 3/08/2009 and 2020-788 dated 12/10/2010	Quality, quantity, surface water, ground water	Trames vertes et bleues	WFD, GWD, (N2000)	Preserve and restore the ecological continuity of environments necessary to achieve or maintain good ecological status or good potential for surface water bodies by 2015. ("grenelle")	All
France	National law 2014-58 date 27/01/2014 "MAPTAM"	Quality, quantity, surface water, ground water	New organization of local authorities within the different communities (region, department and municipalities) and their related skills	WFD	Translation and transfer to local actions	All
France	National law 2016-1087 dated 8/08/2016	Quality, quantity, surface water, ground water	Protect-Restore-compensate It also created the French Biodiversity Office.	N2000	Protect, restore and enhance biodiversity and French natural heritage by avoiding, reducing or offsetting the negative effects of human activities on the environment. AFB is the controlling authority.	Natural cycle
France	National law 2017-1838 dated 30/09/2017 – disaster law	Quality, quantity, surface water, ground water	Creation of a new skill "GEMAPI	FD	Management of aquatic environments and flood prevention' for public communities	Natural cycle
France	Technical guideline: Pollution d'orgine routére: conception des ouvrage de traitement des eaux – guide technique (Cerema)	Quality, quantity, surface water, ground water	Technical guideline on how to manage roadwater runoff.	WFD, GWD, DWD	Includes a method for assessing the vulnerability of water resources; characterization of accidental, seasonal and chronic pollution; description and maintenance of protective structures;	All

					and sludge management.	
France	Decree no. 2024-796 of 12/07/2024 - concerning the use of water unfit for human consumption	Quality, quantity, rain water	Standards	Re-use	Uses of water unfit for human consumption	Human cycle
France	Reglement d'assainissement (local scale)	Quality, surface water	Standards	WWTD	Local rules for wastewater and rainwater connection management, wastewater qualité	Natural cycle
France	Article R. 211-133 of the French Environment Code (31/08/2023)	Quailty, alternative water sources	Included in the "Code de l'environnement"	Re-use act	Sets out the requirements for the reuse of treated wastewater,	Human cycle
France	Décret n° 2023-835 (29/08/2023)	Quailty, alternative water sources	Decree on the uses and conditions for reuse of rainwater and treated wastewater	Re-use act	This new decree, revoking Decree n° 2022-336 that was in place since March 2022, should facilitate the development and implementation of water reuse schemes in the country	Human cycle
France	Arrêté du 14 décembre 2023 on watering green spaces with reuse water	Quailty, alternative water sources	Complements decree 2023-835	Re-use act		Human cycle
France	Arrêté du 18 décembre 2023 on crop-irrigation	Quailty, alternative water sources	Complements decree 2023-835	Re-use act		Human cycle
France	Décret n° 2024-33 (24/01/2024)	Quailty, alternative water sources	Authorizes certain uses of treated waste water in the food sector depending on the quality class (A-D)	Re-use Act	Supplemented by a decree and order dated July 8, 2024. The permitted uses concern the preparation, processing and preservation of all foodstuffs and goods intended for human consumption.	Human cycle
Netherlands	Omgevingswet (01/01/2024)	Quality, quantity, surface water, soil protection, ground water	The Omgevingswet bundles all environmental legislation and procedures. Part of the activities are transferred to local governance (Omgevingsplannen)	WFD, GWD, UWWTD, EIA, BWD	National and local rules	Natural cycle, human cycle (bathing water)
Netherlands	Bruidsschat (= transitional legislation)				Transitional legislation for local level	
Netherlands	Besluit Activiteit Leefomgeving (Bal) (01/01/2025)				Describing environmentally harmful activities and discharge activities	

Netherlands	Besluit Kwaliteit Leefomgeving (21/12/2024)				Environmental quality requirements and assessment rules for activities included in Bal	
Netherlands	Waterschapsverordening (6/9/2024)				Level of the Waterschappen (regional water)	
Netherlands	Omgevingsplan = at the municipal level; implementing the provincial omgevinsgverordening				Local level translation (includes rules for activities allowed in groundwater protection area)	
Netherlands	Kader Afstromend Wegwater (7/12/2023)	Quality, quantity, surface water, soil protection, ground water	Follows the principles defined by Bkl and Duty of care	WFD, GWD, UWWTD, EIA	National: RWS (for highways and provincial roads)	Natural cycle
Netherlands	Structuurvisie Ondergrond (STRONG)	Soil protection	The structural vision focuses on sustainable, safe and efficient use of soil and subsoil, balancing utilisation and protection, from 30 -200 meters	GWD	Provincially regulated	Natural Cycle, human cycle
Netherlands	Drinkwaterwet en Drinkwaterbesluit	Quality, quantity, drinking water	Ensures the safety and availability of drinkinwater delivery	DWD	Drinkingwater companies, provinces, municipalities and waterschappen	Human Cycle
Germany	Richtlinie für die Entwässerung von Straßen, 2021: ARS 6/22	Quality, quantity, surface water, ground water	rules for roadwater discharge into water bodies	WFD, GWD	At the point where the infiltrating roadwater enters the groundwater, it must be of a quality that does not affect the groundwater.	Natural water cycle
Germany	Abwasser-Verordnung (AbwV)	Quality, surface water	requirements for the discharge of waste water into water bodies	UWWTD	Analysis of the vulnerability of surface water and groundwater must be carried out. Roadwater treatment plants are designed with this vulnerability in mind to prevent the input of harmful substances to	Natural water cycle

					the environment.	
Germany	Law on the organisation of the water balance ("Gesetz zur Ordnung des Wasserhaushalts (WHG)")	quantity, surface water, ground water	Water protection areas, floodplains, flood emergence areas; software tool for structural (preventive) measures (not public)	WFD,GWD (FD)	Area designation; structural features	Natural water cycle
Germany	Ordinance on the Protection of Groundwater (GrwV) ("Verordnung zum Schutz des Grundwassers (GrwV)")	Quality, ground water	Regulations of the district governments/ water authorities for planning approval Threshold values, concentration	GWD	Calculation of pollutant concentrations at the soil-groundwater interface; IT tool: Software tool for Autobahn GmbH (not public)	Natural water cycle
Germany	Drinking Water Ordinance ("Trinkwasserverordnung (TrinkWV)")	Quality, drinking water	Parameter list (by nature, this can only be partially complied with in open systems) - standards	DWD	Internally as a quality feature for the effectiveness of the water treatment installation	Human cycle

3.1 Flanders

3.1.1 Polluted or non-polluted stormwater

Vlarem II does not define polluted stormwater. However, a definition could be deduced from other relevant definitions in Vlarem II, art. 1.1.2:

- "rainwater": collective term for rain, snow and hail including thaw water.
- "Wastewater": the polluted water from which one disposes, is required to dispose or intends to dispose, excluding rainwater that has not been in contact with pollutants;
- "industrial wastewater" means any wastewater that does not meet the provisions of domestic wastewater or cooling water;
- "pollutants" means any substance likely to cause pollution, as listed in Annex 2A , attached to this Decree;
- "natural enrichment" means the process by which water, without human influence, absorbs certain substances present in the soil;
- "pollution" means the direct or indirect discharge by man of substances or energy into the aquatic environment, as a result of which human health may be endangered, aquatic life and ecosystems may be harmed, or any lawful use of the water may be interfered with.

Based on these definitions, "polluted stormwater" means "rain, snow, hail, including thaw water, contaminated with pollutants or energy discharged directly or indirectly by humans, as a result of which human health may be endangered, aquatic life and ecosystems may be harmed, or any lawful use of the water may be interfered with."

This emission action should be understood as a classified action. By analogy to the definition "natural enrichment," **stormwater can be considered non-polluted unless substances are added to stormwater by humans through reporting or permitting activities.**

3.1.2 Classification stormwater

An interpretation (Fig. 4) is given for further classification of stormwater within the BBT study "Contaminated stormwater from waste storage facilities", published in 2015. A distinction here is made between polluted and non-polluted stormwater.

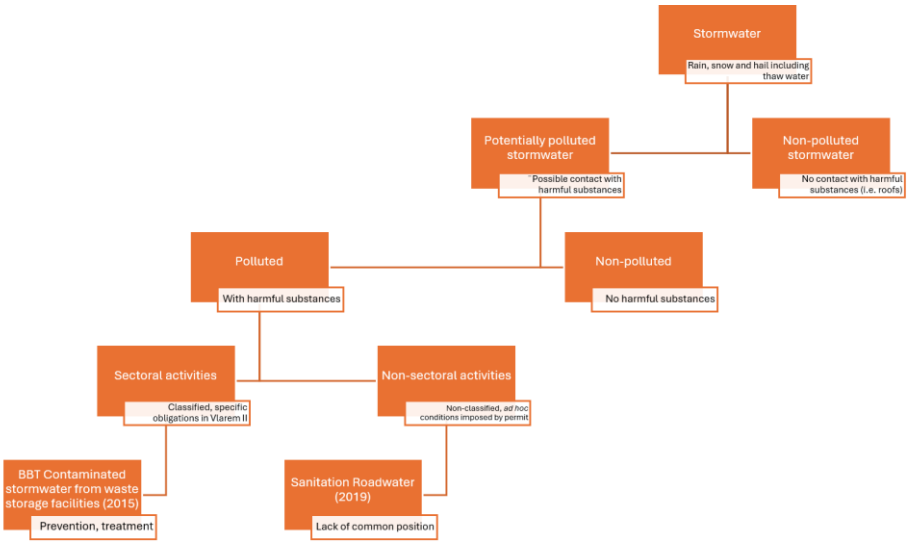

Fig. 4 Classification framework for rain-/stormwater for sectoral and non-sectoral activities suggested for Flanders based on the BBT study Contaminated stormwater from waste storage facilities from 2015 (VMM, non-published communication, from 2019)

The legislator assumes that rainwater runoff from a roof, patio, driveway, etc. is only contaminated to a limited extent, and is therefore considered unpolluted rainwater. This stormwater must be collected, reused and retained on site and/or infiltrated into the soil as much as possible.

On industrial sites, however, stormwater can come into contact with pollutants. Rainwater that falls on paved areas that may be contaminated by the operation of a classified facility (e.g., container parks, scrap yards, tank farms) is considered industrial wastewater (BA). Criterion is thus the classification requirement.

This means that for this:

- discharge standards apply;
- wastewater tax must be paid.

The classification criterion for hazardous substances **(ICGS**) for surface water is used as a criterion for the presence of e.g. hazardous substances.

3.1.3 Preventive or treatment measures

Before polluted rainwater can be discharged, appropriate measures are necessary.

A number of obligations (placement of oil separator, covered storage, etc.) are regulated for sectoral activities. In addition to the general and sectoral discharge conditions, additional conditions may be imposed via the necessary permits. The nature of the measures imposed differs depending on the activities performed, the location, the presence of sewage/surface

water, etc. A standard choice for connection to sewers or to rainwater drainage infrastructure is therefore not possible.

- ➔ Wash and refueling sites
  Wash and refueling sites are usually covered. The choice for connection to sewers or to rainwater drainage infrastructure depends on the situation and the on-site drainage possibilities. In accordance with the sectoral discharge conditions, preventive measures must always be taken, namely the installation of a oil separator with sediment trap. After the oil seperator, discharge to the sewage is preferred; only if there is no sewage connection is available, the "effluent" of the treatment system can discharge to drainage water infrastructure or surface water with an additional coalescence filter. Depending on the sector, additional measures may be imposed (e.g. physicochemical treatment for metal processing).
- ➔ Storage and unloading areas
  - In the case of uncovered storage and unloading areas and large paved business areas, the choice of discharge to the sewage collector or to the rainwater drainage infrastructure also depends on the situation, on-site drainage facilities and the nature of the activities. Preventive measures are imposed depending on the nature and quantity of the runoff water.
- ➔ Parking lots
  Certain large paved surfaces are not classified according to Vlarem (e.g. parking lots for cars). Stormwater runoff is considered non-polluted here. Nevertheless, the discharge may have an impact on groundwater or surface water quality. From a preventive point of view, it is therefore recommended in a number of cases to provide treatment in places where rainwater could potentially be polluted with mineral oil or other poorly soluble hydrocarbons.
  By analogy with parking lots for passenger vehicles, the discharge of rainwater originating from parking lots for vehicles other than passenger vehicles is also not considered operational wastewater (exception to classification criterion sections 15.1.1 and 15.1.2). This is in line with Vlarem regulations in which there is no legal obligation to store commercial vehicles on an impermeable floor. Potential environmental damage can be prevented by taking preventive or purification measures.
  - A distinction is made here between surfaces where contamination is spread very diffusely (e.g. parking lots laid in permeable pavements, grass concrete tiles, etc.) and pavements where all contamination comes to a single point.
  - In parking lots with central drainage, the following peripheral facilities are the general rule:
    - ⇨ Sewer: the classic oil separator with sediment trap is required as the minimum treatment technology.
    - ⇨ Surface water/groundwater: an oil separator with coalescence filter is the basic requirement here.

It is important that the separator works efficiently and is therefore properly dimensioned and maintained. The construction, dimensioning, capacity calculation and maintenance of oil separators must comply with European standard NEN-EN 858. Technical specifications can be found at WASS (BE) or Infomil (NL).

This is mostly an affordable and not very complex installation.

3.1.4 Legislational gaps for roadwater in Flanders

Roads are considered a non-sectoral activity. Therefore stormwater runoff from roadways is legally considered non-polluted stormwater, to which the provisions of the Code of Good Practice for the Design, Construction and Maintenance of Sewerage Systems (Code van Goede Praktijk) applies without prejudice.

In reality, this stormwater runoff is found to contain various pollutants from motorized traffic and road infrastructure. From a preventive point of view, it may therefore be necessary to apply preventive or treatment measures.

The Best Available Technique "Contaminated stormwater from waste storage facilities" specifically developed for sectoral activities and the study Sanitation Roadwater developed as part of a pilot project in LIFE Belini by VMM can be inspiring.

Besides some general regulations, no specific obligations are defined for roads for its impact on the environment with respect to quality. However additional conditions may be imposed *ad hoc* via the necessary permits by the competent authorities. For typical highway and national roadway projects their impact will be evaluated by the Environmental Impact Assessment (EIR). An EIR is an informative document and not a decision instrument. The decision of the competent authority on whether or not to permit or authorize the project takes into account not only the environment, but also other sectors (social, economic and technical interests) and public participation.

Currently, a common position on the quality aspect involving all necessary departments (groundwater, permits, waste water, surface water, soil) is lacking.

Especially since decoupling non-polluted stormwater and infiltration is (justifiably) more and more largely promoted taking into account mitigating the impacts of climate change, also considering and assessing the necessary minimum requirements to ensure quality of the environment should be covered.

3.1.5 Decoupling non-polluted stormwater

In Vlarem II, special attention is paid to the disconnection of non-polluted rainwater for both classified and unclassified establishments on the basis of the deliberate implementation of the prevention principle with respect to the flooding problem, the principle of maximum sanitation at the source and the prevention of desiccation.

It is clear that mixing polluted wastewater with unpolluted rainwater is not desirable. Efforts should be made to keep stormwater on-site long enough to approximate natural runoff.

For sectoral activities the following conditions are included

Art. 4.2.1.3 §4 'A complete separation between wastewater and rainwater originating from roof surfaces and ground surfaces is mandatory at the time a separate sewer system is constructed or reconstructed, unless otherwise stipulated in the environmental permit or implementation plan.

For existing buildings in a closed building, the separation between wastewater and rainwater originating from roof surfaces and ground surfaces is only mandatory if it does not require the installation of pipes under or through the building.'

Art. 4.2.1.3 §5 'Without prejudice to other legal provisions, environmental conditions from these regulations or environmental permit conditions, for the disposal of rainwater preference must be given to the disposal methods as listed below in descending order of priority:

1. *collection for reuse;*
2. *infiltration on own property;*

3. *buffering with delayed discharge into a surface water or an artificial drainage route for stormwater;*
4. *discharge into the stormwater outfall (RWA) in the street.*

Only when the Best Available Techniques do not permit any of the aforementioned disposal methods, may stormwater be discharged into the public sewer system in accordance with the statutory provisions.'

Similar conditions are set for non-sectoral activities.

For companies, the provision 'unless otherwise stated in the environmental permit' does allow an exception to be granted through the permit, based on a motivated study. Maximum disconnection is hereby pursued. If no exception to the separation obligation is included in the permit, the decoupling from stormwater from the sewer system is compulsory.

3.1.5.1 Gewestelijke Stedenbouwkundige Verordening Hemelwater (GSVH) – 2023 – Regional Ordinance for Urban Stormwater, Flanders

February 10, 2023, the Flemish Government definitively approved a new regional urban development ordinance on cisterns, infiltration facilities, buffer facilities and separate discharge of wastewater and stormwater. This ordinance replaces the July 5, 2013 ordinance and is a significant reinforcement of it.

Retention, storage and only as a last resort discharge of water have long been one of the guiding principles in integrated water policy. The previous rainwater regulations have systematically further implemented this.

However, the impact of weather extremes is increasing with climate change. For example, the past few years have been marked by extreme rainfall events with large-scale flooding in July 2021 on the one hand and prolonged droughts in 2017, 2018, 2019, 2020 and 2022 on the other. Therefore, the objective is to keep water maximally on site. In this way, we can bridge droughts and reduce the impact of paving on flooding.

Every drop counts. Therefore, efforts should be made by both private and public, to keep stormwater on-site long enough to approximate natural runoff.

The ordinance sets out rules on:

- there are minimum volumes of rainwater cisterns;
- there are standards for infiltration facilities and buffer volume for large paved areas (if for technical reasons no infiltration facility can be constructed);
- the collected rainwater must be used as much as possible for applications that do not require drinking water quality, including toilet flushing, cleaning water, washing machine and outdoor use;
- at the latest when the building, paving/extension, outbuilding, covered structure or pavement is put into use, the rainwater harvesting pit, infiltration or buffer facility or delayed discharge shall be installed and put into use and remain in use from then on;
- possibility of including obligations related to stormwater collectively.

Note that many materials, due to their technical aspects and their impact on infiltration into the soil, count as paving.

This regulation is valid throughout the entire Flemish region. Provinces and municipalities can delegate stricter regulations for their territory.

For more info, see the accompanying technical background document to the GSVH on the CIW website. An updated version was recently approved (March 20, 2024). Since beginning 2025, the GSVH is also applicable to public domain, and hence including roads.

Rules on how to be compliant with this GSVH regulation and the "*Code van Goede Praktijk Rioleringsystemen*" mostly focus on water quantity aspect.

For this there is an agreed and preferred way of dealing with storm(rain)water runoff discharge:

1. Avoiding runoff
2. (Re)using rainwater
3. Infiltration, by preference aboveground
4. Buffering and delayed discharge
5. Discharge rainwater piping
6. Discharge to mixed sewer

There is a ban on infiltration of rainwater into the soil when polluted rainwater is discharged from polluted surfaces of e.g. industrial sites, when classified in Vlarem (cf. earlier). The polluted rainwater must be disposed of separately cf. discharge conditions Vlarem II. See conditions imposed in the environmental permit. The sewerage manager can impose additional requirements.

In the GSVH 2013, infiltration was prohibited in drinking water catchment zones I and II, but this prohibition was removed in the GSVH 2023. Encouraging the installation of climate adaptive infrastructure from a quantitative point of view. Within water catchment zone III, the drinking water companies recommend only infiltrating above ground (in case of a calamity, this can be observed quickly and is easier to clean up). It is always best to seek prior advice from the drinking water company. It is possible that additional conditions may be imposed by the drinking water utility in the environmental permit.

Suggestion given on quality aspect in the VLARIO guidelines on infiltration state is limited: "It is often useful to pre-treat/filter rainwater before it enters the infiltration facility to promote its proper functioning." Some advice is given on oil-separation and sedimentation.

Other legislation applicable to quality and infiltration is linked to "*Besluit reglementering handelingen binnen de watergebieden en de beschermingszones*" , that ensures the protection of drinking water wells, inhibiting certain type of activities in protection zone I and II. However, this is mostly targeting the use of pesticides, implementing EU legislation 2009/128/EG.

3.2 Netherlands

Regulations for rain water discharging from roads, include rain water from bridges, tunnels, viaducts and other engineering structures, and public areas. For the Netherlands, which type of legislation applies, depends on where the roadwater is discharged into (soil, surface water or sewer; drinking water protection zone or not); and whether it is done with purpose (for water abstraction immediately afterwards) or not.

Fig. 5 shows which type of legislation has to be followed and who is responsible for its regulation:

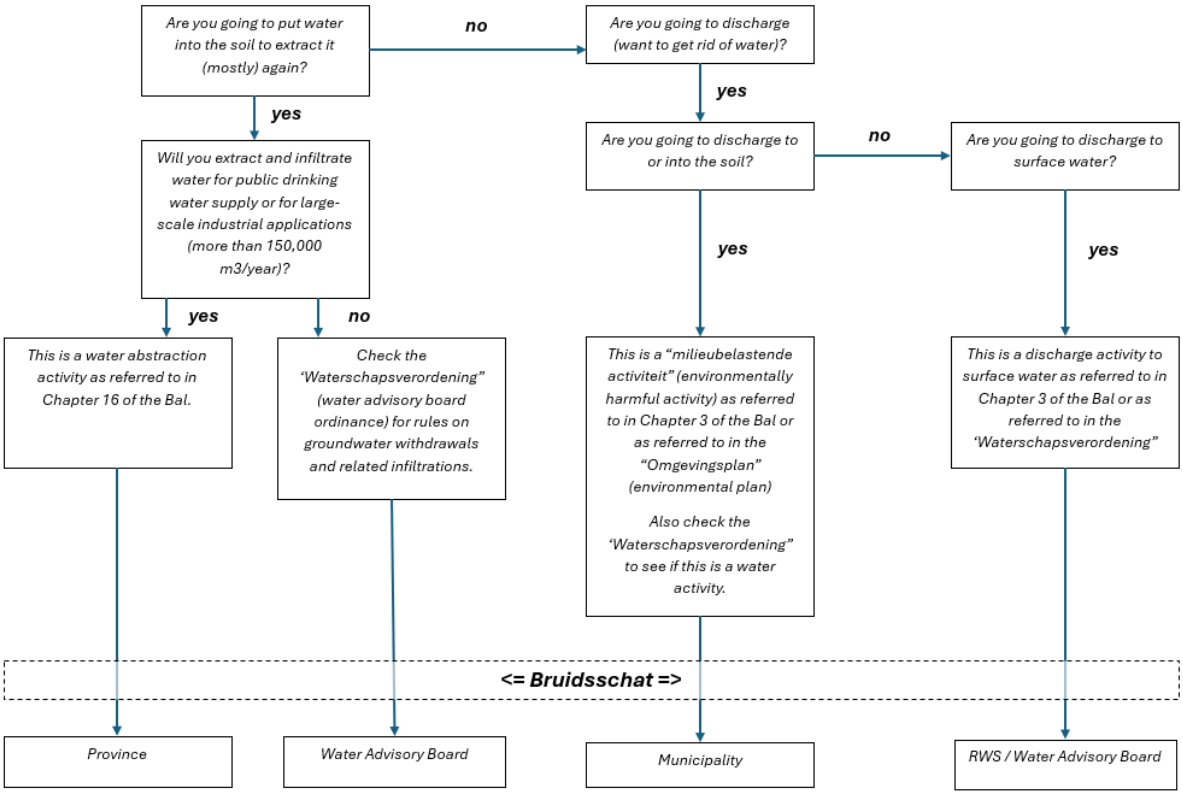

Fig. 5 Decision scheme on defining the type of activity (water/ soil), the competent authority and the legislation that is applicable in the Netherlands (communication by Rijkswaterstaat, based on "Legal Scheme Responsible Infiltration," in: Report Responsible Infiltration. KWR, Deltares and FLO Legal [in prep.].

3.2.1 Framework Roadwater runoff and the newly adopted Omgevingswet

The Netherlands have been studying the impact of roadwater runoff to the shoulders since the 80ies, and it has been topic of long debate between road and water managers. Within the period of 2007-2009 national legislation has been developed within the law of soil protection ("Wet Bodembescherming") within the "Besluit Lozen buiten Inrichtingen" (Blbi, 01/07/2011) - which in itself also links to the "Wet Milieubeheer" and the "Waterwet". However, since 2024 the "Wet Bodembescherming" has been replaced by the "Omgevinsgwet", which bundles 26 existing regulations to protect the environment.

It also regulates roadwater discharge (runoff) when it arrives into the soil (including SUD's, infiltration ditches not connected to surface water bodies).

The "Omgevingswet" replaced and bundled different types of relevant legislation (i.e. Bewust lozen buiten inrichtingen; infiltratiebesluit…). A general buildup of the Omgevinsgwet can be seen in Fig. 6.

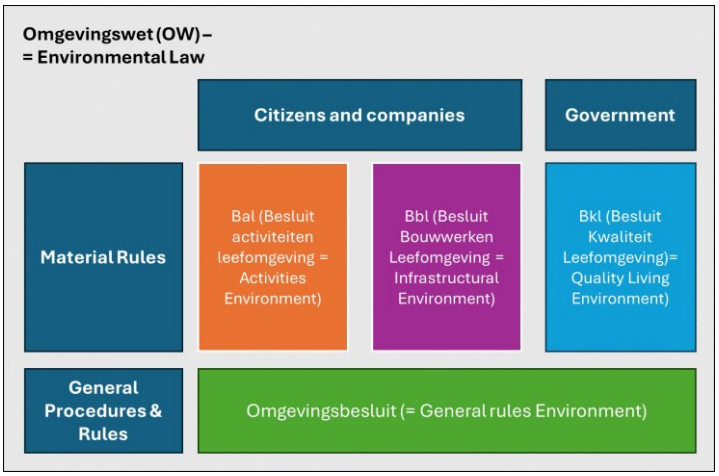

Fig. 6 A schematical representation of the "Omgevingswet" – Environmental Law (NL) built up by the 4 common measures of administration/governance (Algemene Maatregelen van Bestuur – AmbV), including the general state (Rijks)regulations for the physical living environment.

Depending on the nature of the activity; roadwater runoff can be considered a water activity or a "milieubelastende activiteit" in chapter 3, by the Bal ("Besluit Activiteiten leefomgeving"), cf. Fig. 5. With the Omgevingswet the competences for provinces and municipalities and waterschappen are further decentralized from the national legislation and regulated at the level of the provinces and municipalities via the so called "Bruidsschat". The Bruidschat can be translated as "transitional legislation" in which municipalities' rules will end up in the "Omgevingsplan"; the province's rules in the "Omgevingsverordening"; the water advisory board's rules in the "Waterschapsverordening". The "Bruidschat" (or transitional legislation) prevents a gap in rules when passed from central (State) to decentral.

The manager of the site or surface where the stormwater has settled is responsible for taking preventive measures and can then be held accountable for taking them under the specific "Duty of care". The measures may include, for example: keeping the terrain clean, handling environmentally hazardous substances in such a way that contamination of the rainwater is prevented, taking into account in the choice of materials exposed to rainwater the fact that when rainwater comes into contact with these materials, pollutants may enter the rainwater (leaching), or a method of weed control that prevents unnecessary contamination of the rainwater.

Rijkswaterstaat developed the framework "Kader Afstromend Wegwater" for highways and national roads (and "Kader Verzorgingsplaatsen"), based on investigations of the pollution to mitigate their impact to the environment. The most recently updated version of "Kader Afstromend Wegwater" (December 2023) is still based on the Blbi.

3.2.2 A preferred pathway of discharge

Generally, there is a preferred pathway of discharging rain water from roads:

1. Prevent or limit runoff roadwater;
2. Prevent or limit pollutants in runoff roadwater;
3. Separation of water flows, with respect to contaminants;
4. Soil infiltration (soil passage) at source;
5. Discharging (indirectly) to a national water body;
6. Discharging (indirectly) to local water;
7. Discharging to local sewer (if permitted).

Rainwater originating from national roads and provincial roads is preferably discharged to the soil. If discharge into the soil is not (or not completely) possible, discharge is (partly) allowed into a surface water body. Outside the urban area (i.e. in rural area), the discharge of runoff roadwater into a municipal sewage system is usually not possible, because there are no sewage systems there, or only sewage systems, which are not intended for stormwater drainage. When discharged in the sewer, the “Wet Milieubeheer” is followed (updated 1/1/2025, dates back from 1996). The preferred order of discharge is still regulated by the “Wet Milieubeheer”. When connected to sewers, a permit is required. Discussion sometimes arises with permits and timeframes, and when to review them.

For municipalities the preventive measures that need to be taken, as previously regulate by the Blbi, are not specifically prescribed by the Omgevinsgwet and therefore not translated to specific measures required within the “Omgevingsplan”. However they should follow in the from the Duty of Care that is imposed.

The Bruidschat delivers a framework that can be implemented differently within the “Omgevinsgplan” and hence, can differ between provinces and municipalities. Within the Omgevinsgplan there are restrictions in “distance to” and “blends used in” the roadsides; however, not to water quality. Projects can deviate, if motivated, taking into account the “Duty of Care” principle.

This relatively new legislation is mostly applied when roads and road infrastructure are renovated; although in theory apply to all (also existing).

When the roadwater is discharge in a surface water body it is regulated by the Waterschapsverordening: nationally by Rijkswaterstaat (“rijkswater”); or regionally by the Waterschappen in Bkl (WITtoets).

For discharge activities to ground water, the Province or the Waterschappen (water advisory boards) are involved. (cf. scheme Fig. 5) and Annex XIX applies to the infiltrated water, complementing Art. 8.89 from Besluit Kwaliteit Leefomgeving (Bkl) – which is a copy-paste from Annex I from the previously prevailing “Infiltratiebesluit”.

For “milieubelastende activiteiten” (discharging the water to soil) mostly it is regulated by the municipalities, unless large volumes are concerned (province) within the Omgevinsgplannen as defined in Chapter 3 from Besluit Activiteiten Leefomgeving (Bal) - which is based on Duty of Care; and can differ between local authorities.

3.2.3 The Water Immission tool (WITtoets)

The Water Immission Test is a (model) tool which is part of the Manual and that is mandatory used when assessing a permit application for discharge activities into surface water and on a sewage treatment plant (Art. 8.88 Bkl) and environmentally harmful activities (Art. 8.9/8.10 Bkl) in order to meet the **“no deterioration principle”** of the Water Framework Directive. An application and manual is developed.

Read also the interview with juridical expert and road managers from Rijkswaterstaat from the Netherlands (Annex I).

3.3 Germany

3.3.1 Guidelines for non-polluted roadwater runoff for federal highways to compensate natural water cycle interruption

In Germany, there are no regulations directly referring to road runoff water, its quality criteria or its use. **It is in general mandatory, that the water volume, which cannot be naturally seeped due to the sealed highway, must be recirculated to the water cycle on another way and there are technical regulations for the treatment of the roadwater before recirculation.** The rules for roadwater discharge into water bodies are regulated for all kinds of roads (BAB, B roads and L roads) in the road drainage guideline 2021 ("Richtlinie für die Entwässerung von Straßen"), derived from the wastewater ordinance ("Abwasser-Verordnung, AbwV") which is monitored and approved by the local lower water authority (local = place of discharge or drainage).

These regulations make it a requirement, that pollutants must be taken into account when constructing a roadwater treatment plant. However, this is not because the roadwater quality is classified as environmentally harmful. On the contrary: the treatment plant construction regulation also provides an opportunity to temporarily decommission the treatment plants and roadwater can be drained over the shoulder, if i.e. repairs or deep cleanings must be carried out. It would therefore be allowed to flow off the sides of the highway and seep into the ground. This is what happens on smaller roads (federal, state, and county roads).

For federal highways, however, it was decided to collect the water in water treatment plants. The installation of a roadwater treatment plant is generally required by law. This is an environmental protection measure. If gasoline or similar spills onto the highway by accident, it doesn't end up in the landscape next to the highway. De-icing salt is also a factor. The pollutants separated in the water treatment plants come from a very large sealed area (several square kilometers): oily residues (floating) and heavy particles (sedimentation) can accumulate and are removed from roadwater.

The Wastewater Ordinance is only observed if, as an exception, street water flows into the municipal sewer system (this occurs more frequently on B and L roads), which can be the case if highways are running through cities.

3.3.2 Stricter and diverse rules in groundwater protection area's: treatment, monitoring and software tools

In addition, the regulations are often depending on the designation of a groundwater protection zone. Therefore, when working on highway projects, an analysis of the vulnerability of surface water and groundwater must be carried out. Roadwater treatment plants are designed with this vulnerability in mind to prevent the input of harmful substances to the environment. In the case of very strong water vulnerability, costly measures are put in place to combat water pollution by road runoff water.

There are other laws and regulations in Germany, that could become relevant for roadwater utilization, especially when the natural water cycle (surface and ground waters) are influenced. The law on the organisation of the water balance ("Gesetz zur Ordnung des Wasserhaushalts,

WHG") regulates structural features or designation areas with the aim to protect water protection zones, flood emergence areas and floodplains. A software tool for structural (preventive) measures was internally developed by the NRW road construction authority ("Straßen.NRW"), for motorways, B-roads and L-roads (not public). This tool, on the basis of experiences from previously acquired water licences, serves as a working guide for the implementation of the statutory regulations in order to obtain further authorisations. The Autobahn GmbH emerged from this and continues to use and develop the BAB part of this tool.

The ordinance on the protection of groundwater ("Verordnung zum Schutz des Grundwassers, GrwV") is regulating the groundwater quality and the non-public IT tool from Autobahn GmbH, as described previously, is used at this point for renovations and constructions in water protection zones, to calculate pollutant concentrations at the soil-groundwater interface. It also helps water authorities with planning, approval and threshold values by giving information about regulations of the district governments.

These regulations, including software tools, were developed and coordinated jointly with the water authorities. They are now an integral part of every planning process. The water authorities trust that the water treatment plants are thus properly planned. Approvals are then granted very quickly.

Also the German drinking water ordinance ("Trinkwasserverordnung, TrinkwV") can serve as an optional quality feature for Autobahn GmbH internally to evaluate the effectiveness of the water treatment installation, as it provides a list of relevant parameters. However, the threshold values of the TrinkwV are not mandatory for road runoff water treatment.

3.3.3 Financing of the roadwater treatment plants

In terms of responsibility, when the roadwater is treated, water quality testing is part of the maintenance work of water treatment plants. This is coordinated with the responsible Untere Wasserbehörde (lower water authority) or ordered by the authority.

All costs associated with roadwater treatment have to be payed by the responsible road construction authority. For federal highways, this is the Autobahn GmbH des Bundes (Federal Highways Company). It is wholly owned by the Federal Ministry of Transport. For federal, state, district, and urban roads, the road construction authorities are different depending on the federal state or the size of the city or municipality.

The obligation to cover costs, however, is based on the fact that road structures interrupt the natural water cycle, which must be compensated for by roadwater treatment. So pollution removal is part of it, but not the primary purpose. However, the road construction authority is not considered responsible for the pollution. If pollution is caused by a traffic accident (firefighting water, street cleaning, etc.), the polluter or their insurance company pays. This would also apply, for example, to oil-contaminated soil next to the road.

The construction of roads (including water treatment plants) is part of the public services of the state (so-called Daseinsvorsorge).

3.4 France

In France, there are also no specific regulations directly referring to road runoff water, its quality criteria or its use. The latest French regulations focus mainly on the reuse of rainwater from rooftops. Infiltration of rainwater is demanded by most planning documents. For example, current rainfall (first few millimetres) should, if possible, no longer be discharged into watercourses. Developers must also manage their stormwater discharges up to a return period of 20 to 100 years, by installing a buffer system, to avoid floods problems downstream. Or have to think how to manage exceptional return period with “accepted” flooded area.

Projects are examined to determine if they have direct or indirect impacts on the aquatic environment (surface water, groundwater, wetlands…) at each step (construction phase, operating phase, exceptional conditions). Then regarding to the “Nomenclature Eau”, the project may be subject to various regulations.

For a road project an analysis of the vulnerability of surface water and groundwater must also be carried out. Roadwater management must take into account this vulnerability to prevent the input of harmful substances to the environment.

Objectifs de qualité ou qualité des eaux de surface[2]	Usages				
	Sans AEP[1]			AEP[1]	
	Nombre d'usages à moins de 5 km[3]			Distance[3]	
	< 2	2 – 3	> 3	1-10 km Rouge	> 10 km Jaune
1A - 1B	Jaune	Rouge	Rouge		
2 - 3	Vert	Jaune	Rouge		

Fig. 7 Vulnerability classes from the French technical guideline developed by Cerema from 2007; based on an analysis of the surroundings and the legal conditions set by the WFD and GWD.

During periods of drought, when a water shortage is foreseeable in a given geographical area, gradual and temporary water restrictions are triggered by prefects to preserve priority uses. Last decade there was repeated drought leading to water restriction. Since 2015, every year with the exception of 2021, more than half of the departments in the main land of France have experienced summer restrictions over all or part of their territory. Over the period 2002-2014, such a situation had only occurred four times. 2022 is recorded as a remarkable year in terms of the duration and severity of the restrictions, as well as their geographical scope, because even areas in the north part of France was impacted. 2023 was also marked by a major drought, with low water table levels at the start of the summer, due to a precipitation deficit between October 2022 and February 2023.

Then in April 2023, a plan dedicated to resilient and concerted water management has been published. Among the 53 actions, some relate to (i) increase water sobriety, (ii) use alternate water resources. These alternate waters resource have been then defined as “water unfit for human consumption” (Eaux Impropres à la Consommation Humaine) and include for example rain water collected downstream non accessible surfaces or grey-water, but roadwater runoff are not listed. 2023 water plan aims to develop reuse of water with an objective of 1000 projects of reuse by 2030.

French legislation regarding water reuse is currently “moving” with quite recent texts (2023 and 2024).

For an overview of relevant national legislation linked to the European Re-use act of June 2020, see table 2. As roadwater is not listed as a water unfit for human consumption, the following regulations are not directly applicable but the stakes are similar and can be a source of inspiration for the reuse of roadwater.

The project owner (or operator) of the road basin will have a duty of care regarding the quality of the water in the basin. The operator or project owner must therefore take precautions to control the quality of the water made available.

4 Comparing the partner countries 'strategy on roadwater runoff management

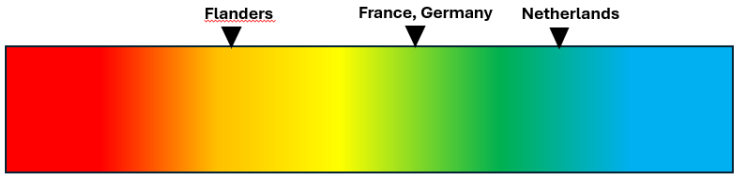

Fig. 8 Positioning each partner country status with respect to setting the boundaries of legal protection needed for the natural environment (expert judgement within the RRR network)

Based on the input from the RRR network and literature study we tried to position the partner countries on the legal status for roadwater based on the following three criteria:

1. A strategy or guideline that includes both quantitative and qualitative aspects: well considered qualitative aspects are included
2. A well-managed maintenance strategy (all stands or falls with maintenance)
3. Full legal protection of the environment ensured with no knowledge gaps

In Fig. 8 red is representing no strategy, management or protection; and blue is representing a well-defined strategy, management and maximum protection.

All countries are aware there is an impact from the rainwater runoff from roadwater to the environment. However, the National road authority in the Netherlands (Rijkswaterstaat, RWS) are clearly the most advanced considering the roadwater impact on the environment, choosing for a climate-adaptive, decentralised approach. Pretreatment is given in the ZOAB asphalt and breakdown lane; and infiltration is limited to the shoulders. It is assumed pollution related to the traffic is accumulated and can be controlled by regular maintenance scraping of the top soil. The advanced state is possibly linked to the fact that RWS it is both a road and water managing authority.

In both Germany and France, centralized cleaning (treatment) systems bringing together runoff volumes from several squares of kilometres exist along the road. These are based on oil separation, sedimentation and (1) infiltration to the ground water or (2) delayed discharge to the surface water bodies nearby separation (cf. Scoping report D1.1.1). In Germany there is a specific guideline for roads, used by the Federal road managing Authority (Autobahn), developed by FGSV (cf. Table 2). Also in France there are specific guidelines developed by Cerema in 2007 (cf. Table 2). Both France and Germany ar position lower with respect to the Netherlands, because of the more elaborate and difficult management. However, assuming the risks are fully managed with the decentralized approach for groundwater infiltration risks.

In Flanders it is only recently that also the public domain is encouraged to promote infiltration of rain water (amongst which road runoff water, since January 2025). However, limited

attention to (pre-) treatment has been given with no legal obligations or clear guidelines on this specific topic. Furthermore the guideline is general applicable to rain water and not specifically developed for roads. There is a study on the sanitation of roadwater, but it does not represent the water managing organisation's vision on roadwater management.

4.1 Legal status of rainwater runoff from roads (roadwater)

Germany, France and the Netherlands take their pre-cautions with runoff of from roads by pre-treatment, however in none of the countries (incl. Flanders) officially **the roadwater quality is not classified as environmentally harmful (no dedicated legal status).**

4.2 Preferential order of discharge

For all partner countries considered (the Netherlands, Flanders, Germany and France) discharging to the (often mixed) sewage system clearly is the last resort and has to be avoided if possible. Exceptions are only allowed and permitted for the most "dirty" stormwater (i.e. from industrial sites, tunnels…). Because relatively clean water entering the sewage system lowers the treatment efficiency of sewage treatment infrastructure. Furthermore, a high amount of water entering the sewage system during high precipitation events within a short period of time for which it is not designed can trigger overflow events of mixed effluent (combined sewer overflow systems), disrupting the ecology of local water bodies.

From a water quantity perspective, it is therefore generally decided to disconnect rainwater from the wastewater sewer system. This also contributes to the recently updated UWWT directive (Annex V) that wants to reduce overflow events from the sewer system (no more than 2% of the annual collected urban wastewater load for larger agglomerations by 2039 and for smaller agglomerations by 2045).

Separate sewer systems for wastewater and rainwater are used, in combination with (where possible) infiltration of rainwater into the soil (the latter is more and more the preferred scenario).

The preferential order (with the first one being the best option) can differ between countries, but it is more or less alike (Table 3).

Table 3 Preferential order of roadwater discharge to the environment

	Netherlands	**Germany***	**France****	**Flanders**
1	Prevent or limit runoff roadwater			Avoiding runoff
2	Prevent or limit pollutants in runoff roadwater;			(Re)using rainwater
3	Separation of water flows, with respect to contaminants	Separation of water flows, with respect to contaminants (for federal highways or when in ground water protection area a treatment is installed in vulnerable areas)	Separation of water flows, with respect to contaminants (for federal highways or when in ground water protection area a treatment is installed in vulnerable areas)	Infiltration, by preference aboveground
4	Soil infiltration (soil passage) at source	Soil infiltration (soil passage) at source	Soil infiltration (soil passage) at source	Buffering and delayed discharge
5	Discharging (indirectly) to a national water body	Discharging (indirectly) to a national or local water body	Discharging (indirectly) to a national or local water body	Discharge rainwater piping
6	Discharging (indirectly) to local water			Discharge to mixed sewer

7	Discharging to local sewer (if permitted)	Discharge to the sewer, when space is limited (often in cities)	Discharge to the sewer, when space is limited (often in cities)	

** Based on personnel communication input from within the RRR associated beneficiary network*

*** Based on input received from the RRR network and the author's own interpretation – the French situation is perceived similar to the German one*

In Netherlands and Flanders there is a preferred decentralized discharge to the soil. However, the reality in Flanders mostly still arrives in the sewage or water course. In France and Germany there seems to be a preferred discharge to water bodies and/or infiltration after more centralized treatment units.

In Germany, the Netherlands and France specific roadwater management guidelines have been developed, clearly taking into account the qualitative aspects. In Flanders decoupling and infiltration infrastructure is promoted; with less attention given to the quality aspects. There is a study on the sanitation of roadwater, but it does not represent the water managing organisation's vision on roadwater management.

In conclusion, there are **no official water management regulations that specifically address roadwater quality management** for the countries investigated in RRR. However there are **different specific recommendations and guidelines for roadwater management** developed by the road authorities, that anticipate to lower the environmental impact; based on the "Duty of Care" principle of the Water Framework Directive (or by thee prevailing soil protection regulation depending on where to the runoff is discharged), regulated *ad hoc*, by the competent authority by environmental permit, including the (binding) advice from the competent administrations involved.

4.3 Legal patchwork distributed among different levels of competent authorities

There are many differences to take into account considering roadwater management, really making it a patchwork of legal regulations depending on

- Country differences
- Regional differences;
- Legal status of the runoff water (considered a waste water?)
- The preferential order of discharge: in to which environmental compartment it is discharged (surface water, groundwater, soil)
- Different levels of competent administrations involved in providing the environmental permit (national, provincial, local; water, nature, soil),
- Additionally, the vulnerability of the surroundings (Natura2000, nature reserves, drinking water protection area, surface water for drinking water abstraction or not etc.).

Another level of complexity that might be added towards the future (if road use would be considered to be cost-beneficial for a well-defined set of uses, cf. D1.1.3), could be depending on the types of water demand in the surroundings.

5 Exploring the existing legal boundaries for roadwater use possibilities

Currently active use of roadwater for the human cycle has not been considered, taking into account the composition of the roadwater (oil, PAH, salt, heavy metals, microplastics…). However, it does not seem so farfetched, considering the preferential order of discharge (in which reuse – if locally interesting and feasible depending on the water demand and supply – is preferred before infiltration), lowering the use of "high drinking water quality" water where possible.

Several guidelines exist that could be used to prospect the position of "user possibilities of roadwater" and to identify the treatments needed (cf. D1.3.1). In a first instance, we could think **of low quality, second circuit uses, i.e. for car washes.**

Within this report we listed the relevant regulations and research that could be important, inspiring and applicable for defining different categories for circular water (re)use, trying to help develop a framework.

We identified the following EU regulatory frameworks as relevant:

1. **Waste water quality**
2. **Surface water quality**
3. **Bathing Water**
4. **Irrigation Water**
5. **Ground water**
6. **Drinking Water**

Cf. Annex II (Chapter 8), p. 42-50 for an overview of a **selected set of available standards for substances that could be of concern when thinking of roadwater discharge to the natural cycle (i.e. infiltration) or human cycle (i.e. irrigation)**.

For the **waste water standards** we used the general parameter standards derived from the European Urban Waste Water Treatment Directive and added 4 substances of concern that could be potentially found in roadwater linked to the recently revised directive with respect to quaternary treatment requirements (incl. 4 of the 13 substances of concern for whom 80% removal is requested). Depending on the sectoral classification (human activity) additional parameters could be of relevance.

For the **surface water standards** we included basic ecological quality standards (EQS) from Flanders and France based on the previous studies (cf. bibliographic references in Chapter 8 of D1.1.1 Scoping Report in RRR). We notice standards can differ between countries for the same parameters. Also within countries standards can differ depending on the nature of the waterbody concerned (i.e. lowland small river, large river, lake); or sometimes also the region to which it applies. Furthermore, additional specific objectives may be formulated for the surface water dependent habitat (SPA-H) and bird directive areas (SPA-V) intended to enable sustainable conservation of the European protected habitat types and species for which specific conservation objectives (S-SCO) have been formulated. Lastly, more stringent targets exist for surface water intended for drinking water production and are being updated. These are the environmental quality standards surface water intended for drinking water production abbreviated as EQS Drinking Water (EQS DW).

Looking at the standards for **bathing water and irrigation water** we notice a focus on **microbial components** linked to the increased health risk by possible direct uptake

(swallowing water while swimming); or indirect uptake via crop growth (particular caution with lettuce crops is needed).

For **bathing water,** we used the category “good” from Annex I from the European Bathing Water Directive for inland waters as a reference (there is a class of excellence that can be more strict). No chemical parameters are assessed for bathing water (which does not apply to swimming pools and spa pools).

For **irrigation** we used the most strict class, “class A” from the European Re-use Directive: corresponding to “All food crops consumed raw where the edible part is in direct contact with reclaimed water and root crops consumed raw”. No additional chemical analysis is done for irrigation water as well. However, a thorough risk based assessment has to be made along the complete water chain involved: from collection, to distribution, to use, to discharge.

For the category **groundwater standards** we used Annex XIX from “Besluit Kwaliteit Leefomgeving” (BkI), which is one of the 4 regulations of administration under the “Omgevings wet” for the Netherlands. It defines the quality requirements for discharging water to soil, meant for re-abstraction (“water activity”, Fig. 5); regulated by Art. 8.89. The effective environmental protection of ground water ensures and safeguards the sustainability and quality from our drinking water reservoir.

Finally we added the **drinking water** standards from the European Drinking Water Directive which has the most elaborate set of standards verified, including both chemical and microbial parameters:

Part A: microbiological set of parameters

Part B: chemical parameters

Part C: indicator parameters

Part D: parameters relevant for the risk assessment of domestic distribution systems

6 Discussion and future perspectives: need of defining a legislative framework for roadwater runoff discharge

Although no specific standards for roadwater exist, depending on its “end destination” different regulations apply related to either the natural cycle; or the human cycle. Following Fig. 9, models could be used to see if the way of discharging to the environment is not “deteriorating” its state; or whether the human use envisioned could be legally permitted.

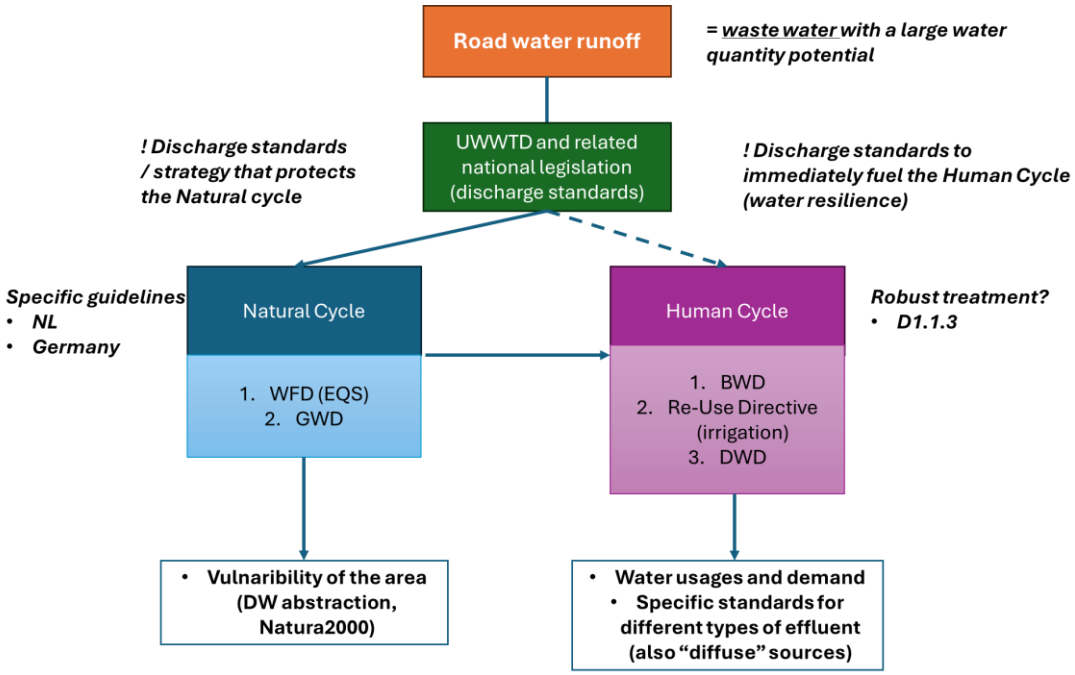

Fig. 9 Schematical overview of the needed legislation of relevance to roadwater discharge to the natural and human cycle (author's own interpretation)

However, the level to which extent the water should be treated, is largely defined by the specific standards targeted. These are also depended on the vulnerability of the zone (i.e. depending on drinking water supply or nature reserve nearby etc.).

Furthermore, part of the existing regulations were not intended with these possible alternative sources of water in mind. Therefore within this chapter we discuss further on the implications for the natural and human cycle, and finally define some recommendations in Chapter 7.

6.1 Natural Cycle: ensure full protection of the environment

Sensu stricto the roadwater is not considered as harmful in any of the countries (no dedicated legal status), and each project is assessed *ad hoc* by environmental permit. However, from literature it is clear and all countries within the project are aware that roadwater runoff can be charged with oil, heavy metals, poly-hydrated carbons etc.

In framework of the urban waste water framework directive, some specific roadwater runoff guidelines have been developed in the Netherlands, France and Germany on how to mitigate the impact on the quality of the environment. In Flanders there is no specific guideline for roads. However there is a "Best Available Technique" on contaminated stormwater from waste storage facilities that could be inspiring for future considerations. Currently quality is limitedly considered in the existing urban stormwater regulations, mostly focusing on quantity (related to flooding and drought).

In the different countries different choices of preferential runoff discharge exist. Generally, prevention of runoff, and the prevention of pollutants in it, should always be the first step of consideration.

Next, it can be chosen to discharge to surface water or soil. In Germany and France it is (mostly) chosen to discharge (delayed) to surface water or infiltrate to the groundwater, after pre-treatment. The pre-treatment is based on oil-separation and sedimentation and mostly applied in the more vulnerable areas (i.e. drinking water protection zone). Hence, large

volumes of surface runoff from kilometres of road are treated in several units along the side. In the Netherlands a pre-treatment is reached by the structure of the asphalt (ZOAB) in the breakdown lane. Next, the remaining pollutants are discharged to the soil where they accumulate. Pollution of the groundwater is prevented by regular ZOAB cleaning and regular scraping of the top soil from the shoulders. This decentralized approach is relatively low in maintenance costs. In Flanders, since recently there is also a preferred pathway towards infiltration of the roadwater runoff in response to the need for a climate-adaptive infrastructure. However, there is no general strategy decided on quality management (no general rules on when a pre-treatment is necessary).

Both options can be justified taken that pre-treatment is regulated by a specific framework or guideline, and a combination of approaches could well be used. However, generally there seems to be a shift towards more infiltration towards the side. Probably, from a climate-adaptive point of view, and considering the high maintenance needed for the sedimentation basins installed.

Overall there are no specific regulations or standards related to the runoff water composition directly. Depending on the compartment to which the runoff is discharged; the impact is evaluated with respect to the standards for surface water, ground water and/or soil (Fig. 8).

Recent studies of the roadwater runoff management strategy used by the Netherlands (Jelmer et al. 2025) and a study on infiltration in France (Tedoldi et al. 2020) confirmed that the impact from infiltration of roadwater to the shoulders to the environment is limited. From a climate adaptive point of view it can be concluded infiltration towards the soil should be the preferred strategy.

Although these studies suggest the pollutants tend to accumulate in the upper layers, the worry that pollutants from roadwater runoff could leak to the deepest groundwater layers and could threaten the drinking water remains. In Flanders, there is no consensus yet on this topic related to quality. Contaminants that have been mentioned to be worrisome from a drainage point of view (personal communication from VMM groundwater specialists, 2021) that could be inspirational include:

Table 4 Standard package for analysis of drainage water and additional mobile pollutants of concern

	Soil	Groundwater
Standard package for analyses of drainage water		
pH		+
pH-KCl	+	
Conductivity and temperature		+
Dry Matter content (%)	+	
Organic matter content (%)	+	
Clay content (%)	+	
Heavy metals (8: lead, zinc, cadmium, cupper, nickel, arsene, mercury, and chrome(III+))	+	+
BTEX (4: benzene, toluene, ethylbenzene, xylene)		+
Mineral oil	+	+
PAH (16 poly aromatic hydrocarbons: naphthalene (NAP), acenaphthylene (ACY), acenaphthene (ACE), fluorene (FLU), phenanthrene (PHEN), anthracene (ANTH), fluoranthene (FLTH), pyrene (PYR), benzo[a]anthracene (B[a]A), chrysene (CHRY), benzo[b]fluoranthene (B[b]F), benzo[k]fluoranthene (B[k]F), benzo[a]pyrene (B[a]P), benzo[g,h,i]perylene (B[ghi]P), indeno[1,2,3-c,d]pyrene (IND), and dibenz[a,h]anthracene (D[ah]A))	+	
VOCl (11 volatile chlorinated compounds: 1,2-dichloorethane, dichloormethane, tetratchloormethane, tetrachloorethene, 1,1,1-trichloorethane, 1,1,2-trichloorethane)		+
Vinylchloride		+
Additional pollutants of concern		

Siltation parameters (Na, K, Cl-, en SO4 2+…)		+
Heavy metals (cobalt)		
Fluoride		
PFAS (PFOS, PFOA...)*		+
**** especially when re-use is also considered***		

Furthermore, new substances of concern may arise (i.e. microplastics, cf. Vercauteren et al. 2021).

It would therefore be recommended to have more research on the local specific possible impact of infiltration to the groundwater by pollutants associated with roadwater runoff (1) and to develop a software tool like the one developed by the Autobahn in Germany, calculating the pollutant concentrations at the soil-groundwater interface for renovations and constructions of roads in water protection zones (2). The output of such a tool can be compared the groundwater quality standards. Also in Flanders, recently *aquaSens*, a model tool that evaluates treatment systems for roadwater has been developed (Vinck et al.2023). This will allow water authorities to assess the impact of the road manager activities correctly and to verify whether a pre-treatment prior to infiltration is necessary or not, depending on the impact to the ground water and vulnerability of the surroundings (drinking water, nature). The model tool should be updated on a regular basis with respect to the most recent knowledge. Pre-treatment should be kept as natural and robust as possible, since maintenance is often challenging to integrate within the overall road management.

Generally, discharge to the sewage systems is to be avoided. However, when the restrictions by the competent authorities involved differ too much it is difficult to find the space needed for infiltration.

Nevertheless, to decide on when and what level of treatment is needed, it would be better to have a more **clear legal status of roadwater (and other stormwater) runoff** linked to the urban waste water directive, defining it as the “waste water” it is. Or may be defining it within a separate stormwater category (i.e. towards a European Stormwater Directive currently missing). This would allow the authorities to define **a consensus decision framework** on the steps needed prior to infiltration in any situation (for different types of stormwater, different measures depending on the textures of underground, and different types of land use and vulnerabilities etc.). Ensuring the possibilities for infiltration are maximized as water becomes more valuable in times of increasing drought events, without compromising the quality of the surroundings.

Setting a clear status and framework of consecutive steps needed will take away the insecurity of *ad hoc* based permit decisions for road managers (which may vary between countries and regions) and could lower the procedural times needed related to possible debate between the competent authorities involved.

It is very likely the construction of roads will be more expensive towards the future taking into account all the considerations described here above. Surely the “polluter pays principle” will open a debate of responsibilities and financing needs, needed at a higher political level. However, the transition towards a climate adaptive environment can be considered a “Duty of Care” regulating the “Natural Cycle” adequately, ensuring both “sustainable use” and “protection” of water for the “Human Cycle” well needed (Fig. 8).

6.2 Human cycle: maximizing use possibilities for Water Resilience

Different legal boundaries have been explored in chapter 5 for roadwater use possibilities. Lowering the use of high drinking water quality where possible feeds into the European Water Resilience Strategy, and contributes to the main recommendations and steps that need to be taken to a water-smart society, i.e.

- Building a water-smart circular economy
- Zero pollution objectives
- Anticipate water-related climate risks
- Support disruptive research & innovation activities
- Leverage digital water opportunities

If we consider the requirements, we see limited chemical parameters within the re-use act for irrigation or bathing. However, a profound risk based assessment should be taken into account.

Many components are substances of high concern (REACH) and for PFAS often a separate communication and set of standards has been issued for the different environmental compartment by the Health Departments (Table 5). Microplastics are another concern clearly linked to roadwater runoff by tyre wear (Vercauteren et al. 2021).

When thinking of roadwater use, one does not think about human consumption, but rather about **second circuit water**, including applications that do not require drinking water quality such as cleaning or toilet flushing.

When doing so, it is important to ensure a separate circuit to protect the public water network.

The microbiological component only becomes relevant for irrigation and for human consumption or bathing.

Table 5 Overview of standards among different environmental compartments for forever chemicals PFAS and derivates in the different partner countries (nav = not a value found)

Country	Surface water	Industrial water	Pumping water/ground water	Bathing water	Drinking water	Soil when re-used
Flanders	0,65 ng/L	Permit required when > 20 or 50 ng/L	<10 ng/L when returned (pumping water)	Sum PFOS, PFOA, PFNA & PFHxS <0,2 µg/L (child) <1 µg/L (adult)	Sum PFAS-20 < 0,1 µg/L Total PFAS < 0,5 µg/L	PFAS-20 < 15 µg/kg ds
Netherlands	0,3 ng/L (PFOA) 0,007 ng/L (PFOS)	Permit required when > 20 or 50 ng/L	*nav*	Sum of PFAS in PFOA eq. <0,280 µg/L (<0,071 µg/L in swimming pools)	Sum PFAS-20 < 0,1 µg/L	3 µg/kg ds (PFOS) 7 µg/kg ds (PFOA) 3 µg/kg ds (other PFAS)
France	PFOS surveillance since 2022 (5 PFAS)	PFOS<25 µg/L Mesures of PFAS-20 required for thousands of plants	20 PFAS to measure starting 2026 < 2 µg/L (before treatment)	*nav*	Sum PFAS-20 < 0,1 µg/L Total PFAS < 0,5 µg/L	*nav*
Germany	*nav*	*nav*	*nav*	*nav*	Sum PFAS-20 < 0,1 µg/L and *Sum PFAS-4* (PFOA, PFNA, PFHxS and	*nav*

					PFOS) < 0.02 µg/L *	

* For mineral water the PFAS standards for DW do not apply (personal communication from RRR network partners)

PFAS might be of concern, however some limited results (n = 5) from monitoring roadwater runoff from an intensively used road near Berchem (Antwerp) in StopUP are positive, showing the concentrations fall below the most strict standard set in Flanders (communication of preliminar results shared by the associated StopUP network, 2025).

6.3 Roadwater runoff treatment

From an environmental perspective, the issue of polluted rainwater from roads differs fundamentally from that of other industrial wastewaters in a number of ways:

- The flow rate varies greatly as a function of weather conditions (e.g. long dry periods during which no polluted rainwater arises versus periods of heavy rainfall during which large quantities of polluted rainwater arise in a short period of time).
- Contaminants in roadwater originate can be linked to traffic (cars, infrastructure), but there may also be a contribution from other sources (industry, households, etc.) via atmospheric deposition. For PAHs, there are indications that the contribution from atmospheric deposition is relatively large, more specifically when located in areas of high air pollution (industrial areas).
- A wide range of contaminants are found in contaminated roadwater, in variable concentrations. It proves difficult to trace the exact origin for all contaminants.

Hence, any treatment will be quite challenging because of the fluctuating flow rate of water arriving at the facility and because of its complex composition; depending on the final end use or discharge intended. In D1.1.3 some possible solutions related to use categories are presented.

7 Conclusion and recommendations

The pollution problem related to and created by the building and use roads is a diffuse pollution source from stormwater runoff, that is currently not clearly acknowledged or tackled by any of the existing European legislation. A combined approach of (1) setting sufficiently clear European standards and policies here for different types of stormwater (incl. roadwater) with respect to the complex and dynamically connected socio-ecological water systems with shared cross-sectoral responsibility and (2) a source-oriented approach, including a modal shift (towards more sustainable transport) and applying circular economy principles (avoiding pollution and integrating re-use) will be necessary to tackle the further diffuse degradation of our environment.

Recommendations

1. Develop a European Stormwater Directive that integrates both the quantitative **and qualitative** minimum requirements for different type of stormwater classes, integrating the requirements from the UWWTD, WFD, GWD, FD, Soil Strategy to better protect the natural environment.
   Or define it within the UWWTD as a specific type(s) of "wastewater" related to stormwater runoff.
2. Develop **(1) a consensus decision framework and (2) technical guidelines** should be developed and provided for the different types of stormwater management (i.e. roadwater, roof water, railway water), managed and monitored in all countries by the **water managing authorities**, and be compliant to the Stormwater Directive, when it is available.
3. In the meantime **model tools** are needed to evaluate the impact on surface water and groundwater, translating the impact to the receiving waterbodies, so the existing standards can be used to meet the "no deterioration principle".
4. Linking the insights gained to the Climate Adaptation and Water Resilience Strategy, **promoting maximal safe infiltration and re-use.**
5. Screen and **update the existing legislation** of bathing water, playgrounds, drinking water, irrigation etc. **taking into account the alternative water sources** for re-use that might be considered towards the future (are all necessary pollutants screened by the current legislation which were not designed for this alternative sources of water)
6. **Continuous research and development, following-up on the harmful substances** (PS and watch list) of concern, continuously evaluating and adapting the strategy to anticipate and tackle stormwater related pollution risks (i.e. PFAS, micro-plastics).
7. **Be part of a learning network on water re-use**

.

8 Annexes

Annex I: Interview with Rijkswaterstaat

(with Odin Haring - Advisor Soil Quality, Tristan Bergsma - Advisor Geohydrology and Miriam Aerts - Juridical advisor on water and soil)

1. *Which legislation on quality do we use in The Netherlands concerning roadwater of highways?*

Roadwater: rain water discharging from roads, incl. bridges, tunnels, viaducts and other engineering structures, and public areas.

For the Netherlands, which type of legislation applies, depends on **where** the roadwater is discharged into **(soil, surface water or sewer; drinking water protection zone or not);** and whether it is done with purpose **(for water abstraction immediately afterwards)** or not.

There is a **preferred pathway** of discharging rain water from roads.

Rainwater originating from national roads and provincial roads is preferably discharged to the soil. If discharge into the soil is not (or not completely) possible, discharge is (partly) allowed into a surface water body. Outside the urban area (i.e. in rural area), the discharge of runoff roadwater into a municipal sewage system is usually not possible, because there are no sewage systems there, or only sewage systems, which are not intended for stormwater drainage. But when discharging in a sewer system a **permit** is required. Discussion sometimes arises with permits and timeframes, and when to review them.

Within the relatively recent **"Omgevingswet"** 26 existing regulations are bundled. It also regulates roadwater discharge when it arrives into the soil (including SUD's, infiltration ditches not connected to surface water bodies), . The "Omgevingswet" replaced and bundled different types of legislation (i.e. Bewust lozen buiten inrichtingen; infiltratiebesluit…). Depending on the nature of the activity; it can be considered a water activity or a **"milieubelastende activiteit"** in **chapter 3**, by the **Bal ("Besluit Activiteiten leefomgeving")**. With the Omgevingswet the competences for provinces and municipalities and waterschappen is now decentralized from the national legislation and further regulated at the level of the provinces and municipalities via the so called **"Bruidsschat"**.

The Bruidschat delivers a framework that can be implemented differently within the "Omgevinsgplan" and hence, can differ between provinces and municipalities. Within the Omgevinsgplan there are restrictions to distance to and blends used in the roadsides; however, not to water quality. Projects can deviate, if motivated, and taking into account "duty of care".

This relatively new legislation is mostly applied when roads and road infrastructure are renovated; although in theory apply to all.

When the roadwater is discharge can be considered a **water activity** (infiltration meant for abstraction afterwards) or when discharged in a surface water body; it is regulated by the Waterschapsverordening nationally by Rijkswaterstaat or by Waterschappen in Bkl (WITtoets).

The "WITtoets" or Water Immission Test is a (model) tool which is part of the Manual and that is mandatory used when assessing a permit application for discharge activities into surface water and on a sewage treatment plant (Art. 8.88 Bkl) and environmentally harmful activities (Art. 8.9/8.10 Bkl). This tool tests whether the water quality resulting from the (potential)

discharge from the water bottom meets the **"no deterioration principle"** of the Water Framework Directive. An application excel and manual is developed.

For wateractivities Rijkswaterstaat (national) or waterschappen (province) are involved.

For "milieubelastende activiteiten" mostly it is regulated by the municipalities, unless large volumes are concerned (province).

Highways are classified separately within Bal, Omgevingswet and have to comply with standards for soil of class type 'industry'.

Projects could be blocked regularly by interest groups by Duty of Care (such as Greenpeace; i.e. A16, salty sand application; A15 nitrogen dossier). For Europe it is important to have no deterioration from the Water Framework Directive point of view. This implies no quality class can decrease. If you are in the lowest class no room for room for additional discharge is left. But the link between a project and deterioration is a difficult one to make and brings practice and legal aspects together: it must be clear, what is expected of the offender.

However, mostly the "Waterschappen" cooperate and Rijkswaterstaat on its turn investigates and implements mitigating measures as much as possible (cf. following Kader Afstromend wegwater): ZOAB cleaning, removal op top layer of shoulders etc.

2. *Which legislation on quantity do we use in The Netherlands concerning roadwater of highways?*

"Waterschappen" impose 0,15 m infiltration in shoulders for every meter of road installed. About 20 % is connected via sewers, the other 80 % follows the preferred pathway.

3. *How do we control whether we meet the quality legislation? Is there any monitoring related to it? Or are obligations included in building permits – follow up on basins?*

Only for ZOAB cleaners is there a requirement to determine the quality of soil (water). Some supporting field work did take place when the framework for Runoff Roadwater ("Kader Afstromend Wegwater") was drafted. Recent research on mitigation measures does confirm positive effect (Jelmer et al. 2025). However, no operational testing is done. The frequency with which the shoulders are scraped is done primarily for road user safety reasons.

If the activities have no impact on water bottom, the water immission (WIT) test is not needed.

Micro-plastics caused by tyre wear are another recent concern.

4. *What are the latest tests of roadwater quality and what where the results?*

Cautiously we can say the impact to groundwater appears limited by recent investigations.

5. *Do you know whether there is new national legislation coming up. Especially in relation to climate change?*

The obligations for infiltration are expected to increase as the normative rain fall events increase as well with climate change. Also the more strict regulations on overflow events from the irban waste water treatment are expected to impact the integrated rain water management, towards increased infiltration needs. Taking into Substances of Very High Concern (REACH). And it could also be influenced by the "Herijking Deltaprogramma" which is a programme to

anticipate climate change by adaptation increasing water safety, water availability, and spatial redeveleopment.

6. *Is the roadwater legislation also applicable for the rest areas or is there special legislation for these places? (i.e. near gas stations)*

There is a specific framework for rest places (Kader Verzorginsplaatsen).

7. *The roadwater is going to the shoulders. They are a filter. Is there legislation for the soil quality which we should take into account?*

The “Wet bodembescherming” is vervat onder de “omgevingswet” in Bal voor Milieubelastende activiteiten en instructies voor de bodem in het Bkl. Dit valt gewoonlijk onder de bevoegdheid van de gemeente als milieubelastende activiteit en wordt geregeld via het omgevingsplan (cf. hierboven). De waarden waaraan getoetst moet worden hangt af van de kwaliteitsklassen en bodemfunctieklassen en bepalen de toepassingen of terugsaneringseis. Vaak wordt de berm langs wegen als type industrie of woongebied ingedeeld.

The “Wet bodembescherming” is contained under the “Omgevingswet” in Bal for “Milieubelastende activiteiten” (Environmentally Harmful Activities)and instructions for soil ar included in the Bkl.

This falls under the competence of the municipality and is regulated through the Omgevingsplan (cf. above). The values to be tested and compared to depend on the quality classes and soil function classes and determine the applications or remediation requirement. Often, roadside shoulders are classified as industrial or residential types.

8. *Where the road is laying low we pump out groundwater mixed with roadwater to keep the road dry and safe. Is there present special legislation for these situations (quality and quantity)? If not do you expect this in the future in relation to climate change? What are the typical volumes when pumping tunnel water, and is it continuously?*

The possible re-use of water near tunnels is regulated by a specifi Kader Verzorginsgplaatsen. In Flanders there is specific regulation for so called “bemalingswater”.

ANNEX II Overview of available standards for substances that could be of concern when thinking of roadwater discharge, infiltration or re-use

Parameter	Type	Unit	Waste water	Surface Water (FL)	Surface Water (FR)	Bathing Water	Irrigation water	Drinking Water	Ground water
			(Nt & Pt standard related to tertiary treatment required for below 150k p.e.)	*(MKN abs; MKN gem*)*					
T	Basic	°C		25					
pH	Basic	-		8,5				6,5-9,2	*
BOD	Basic	mgO2/L	25	9	6		10		
COD	Basic	mgO2/L	125	45	30			5	
TOC	Basic	mgC/L	37						
DOC	Basic	mgC/L			7				
Turbidity	Basic	NTU					5		
TSS	Basic	mg/L	35	75	50		10		0,5
N t	Basic	mgN/L	0,7	12					
KjN	Basic	mgN/L		9					
NH4+	Basic	mgN/L			0,5			0,5	2,5
NO2-	Basic	mgN/L		0,6	0,3			0,5	
NO3-	Basic	mgN/L		15	50			50	5,6*
oPO4 f	Basic	mgP/L		0,14					0,4
P t	Basic	mgP/L	10	0,42	0,2				
EC (Electrical Conductivity)	Basic	µS/cm		900				2500	
Na o	Basic	mg/L						200	120*
Cl-	Basic	mg/L		180				250	200*
SO4=	Basic	mg/L		270				250	150*
HCO3-	Basic	mg/L							*

Perchloraat	Basic	µg/L						13	
Chloraat	Basic	µg/L						700	
Chloriet	Basic	µg/L						700	
Cyanide	Basic	µg/L						50	10
Fluoride	Basic	µg/L						1500	1000
Al o	Metals	µg/L						200	
As o	Trace metals (*)	µg/L		9	0,83			10	10
As t	Trace metals	µg/L		-					
B o	Metals	µg/L		2100				1500	
B t	Metals	µg/L		-					
Ba o	Metals	µg/L		180					200
Ba t	Metals	µg/L		-					
Be o	Metals	µg/L		0,24					
Be t	Metals	µg/L		-					
Ca o	Metals	µg/L		-					*
Cd o	Trace metals (*)	µg/L		0,08	0,15 (class 4 water hardness)			5	0,4
Cd t	Trace metals	µg/L		-					
Co o	Trace metals (*)	µg/L		1,5	0,3				20
Co t	Trace metals	µg/L		-					
Cr o	Trace metals (*)	µg/L		15	3,4			50	2
Cr t	Trace metals	µg/L		-					
Cu o	Trace metals (*)	µg/L		21	1			2000	15
Cu t	Trace metals	µg/L		-					
Fe o	Metals	µg/L		-				200	
Fe t	Metals	µg/L		-					
Hg o	Trace metals	µg/L			0,047			1	0,05
Mn o	Metals	µg/L		-				50	
Mn t	Metals	µg/L		-					
Mo o	Metals (*)	µg/L		1020					

Mo t	Metals	µg/L		-					
Ni o	Metals (*)	µg/L		-	4			20	15
Ni t	Metals	µg/L		-					
Pb o	Metals (*)	µg/L		-	1,2			10	15
Pb t	Metals	µg/L		-					
Sb o	Metals	µg/L		300	0,6				
Sb t	Metals	µg/L		-					
Sr o	Trace metals (**)								
V o	Trace metals	µg/L		12	2,5				
V t	Trace metals	µg/L		-					
Zn o	Trace metals (*)	µg/L		60	7,8			5000	65
Zn t	Trace metals	µg/L		-					
TPH C10-12	oil	%		-					
TPH C12-20	oil	%		-					
TPH C20-30	oil	%		-					
TPH C30-40	oil	%		-					
TPH C10-C40 (mineral oil)	oil	mg/L		-	5				0,2
Acenaft	PAH (x)	ng/L		60					
Acenaftyl	PAH (x)	ng/L		4000					
Ant	PAH (x)	ng/L		100	100				20
B(a)A	PAH (x)	ng/L		300					
B(a)P	PAH (x)	ng/L		0,17	0,17			0,01	
B(b)Flu	PAH (x)	ng/L		17	17				
B(ghi)Pe	PAH (x)	ng/L		8,2	8,2				
B(k)Flu	PAH (x)	ng/L		17	17				
Chr	PAH (x)	ng/L		1000					20
dBz(ah)An	PAH (x)	ng/L		500					
Fen	PAH (x)	ng/L		100					20
Flu	PAH (x)	ng/L		6,3					
Fluoreen	PAH (x)	ng/L		2000					

IP	PAH (x)	ng/L		-					
Naft	PAH (x)	ng/L		2000	2000				100
Pyr	PAH (x)	ng/L		40					
Sum 16 PAH (Clean Water Act)	PAH (16)	ng/L							
Sum of 6 PAH (Annex XIX Bkl, NL)	PAH (6)	ng/L							100
1,2-dichloor-ethaan		µg/L						3	
Acrylamide		µg/L						0,1	
Antimoon		µg/L						10	
Benzene	BTEX	µg/L			10			1	
Toluene	BTEX	µg/L							
Ethylbenzene	BTEX	µg/L							
Xylene	BTEX	µg/L							
Bisphenol A (BPA)	Alkylphenols (*)	µg/L						2,5	
Para nonylphenol (NP)	Alkylphenols (*)	µg/L			0,3				
Nonylphenol mo-noethoxylate (NP1EO)	Alkylphenols (*)	µg/L			0,3				
Nonylphenol diethoxylate (NP2EO)	Alkylphenols (*)	µg/L			0,3				
Nonylphenol mo-nocarboxylate (NP1EC)	Alkylphenols (*)	µg/L			0,3				
4-tertoctylphenol (OP)	Alkylphenols (*)	µg/L			0,1				
Octylphenol mo-noethoxylate (OP1EO)	Alkylphenols (*)	µg/L			0,1				

Octylphenol diethoxylate (OP2EO)	Alkylphenols (*)	µg/L			0,1				
Diethylphthalate (DEP)	Phthalates (PAE)	µg/L							
Dimethyl phthalates (DMP)	Phthalates (PAE)	µg/L							
Diisobutyl phthalate (DiBP)	Phthalates (PAE)	µg/L							
Dibutyl phthalates (DBP)	Phthalates (PAE)	µg/L							
Bis(2-ethylhexyl) phthalates (DEHP)	Phthalates (PAE)	µg/L			1,3				
Dinonyl phthalates	Phthalates (PAE)	µg/L							
Methyl tert-butyl ether (MTBE)									
Polybrominated diphenyl ethers (PBDE)									
Brominated diphenyl ethers (BDE)									
Bromaat		µg/L						10	
Broomdichloormethaan		µg/L						60	
Epichloorhydrine		µg/L						0,1	
Halegonated acids (HAA5)		µg/L						60	
Microcystine-LR		µg/L						1	
Total of organochloric pesticides		µg/L						0,1	0,1
Total pesticiden		µg/L	µg/L	µg/L				0,5	0,5
Endosulfan	organochloor pesticides	µg/L	µg/L	µg/L					0,05
α-HCH	organochloor pesticides	µg/L	µg/L	µg/L					0,05

-HCH (lindaan)	organochloor pesticides	µg/L	µg/L	µg/L					0,05
DDT (incl. DDD, DDE)	organochloor pesticides	µg/L	µg/L	µg/L					0,05
Dichloorpropeen	organochloor pesticides	µg/L	µg/L	µg/L					0,05
Aldrin	organochloor pesticides	µg/L	µg/L	µg/L					0,05
Dieldrin	organochloor pesticides	µg/L	µg/L	µg/L					0,05
Endrin	organochloor pesticides	µg/L	µg/L	µg/L					0,05
Heptachloor	organochloor pesticides	µg/L	µg/L	µg/L					0,05
Hepta-chloorepoxide	organochloor pesticides	µg/L	µg/L	µg/L					0,05
Hexachloorbuta-dieen	organochloor pesticides	µg/L	µg/L	µg/L					0,05
Hexacloorben-zeen	organochloor pesticides	µg/L	µg/L	µg/L					0,05
azinfos-methyl	organophosphoric pesticides								0,1
dichloorvos	organophosphoric pesticides								0,1
dimethoaat	organophosphoric pesticides								0,1
mevinfos	organophosphoric pesticides								0,1
parathion	organophosphoric pesticides								0,1
atrazine	trazines/triazinonen/aniliden								0,1
simazin	trazines/triazinonen/aniliden								0,1
metalochloor	trazines/triazinonen/aniliden								0,1
2-methyl-4-chloor-fenoxy-azijnzuur (MCPA)	chloorfenoxiherbicides								0,1
mecoprop	chloorfenoxiherbicides								0,1
2,4-dichloorfe-noxy-acid (2,4 D)	chloorfenoxiherbicides								0,1
chloortoluron	ureumherbicides								0,1
isproturon	ureumherbicides								0,1
metoxuron	ureumherbicides								0,1
linuron	ureumherbicides								0,1
trichloor phenols	chloorfenolen								0,1

tetrachloor phenols	chloorfenolen								0,1
pentachloor phenols	chloorfenolen								0,1
dichloor phenols	chloorfenolen								0,5
dinoseb									0,1
2,4 dinitrofenol									0,1
bentazon									0,1
PFAS total	PFAS	µg/L						0,5	
PAH's total	PAK	µg/L						0,1	
Seleen		µg/L						20	
Sum PFAS en per- en polyfluoralkylstoffen	PFAS & PFOS	µg/L				0,2		0,1	
Tetrachlooretheen en trichlooretheen	Halogenated PHC	µg/L						10	
Trichlooretheen	Halogenated PHC	µg/L							0,5
Tetrachlooretheen	Halogenated PHC	µg/L							0,5
Totaal trihalomethanen	Halogenated PHC	µg/L						100	2
Adsorbale organic halogens (AOX)	Halogenated PHC	µg/L							30
Uraan		µg/L						30	
Vynilchloride		µg/L						0,5	
Clostridium perfringens (incl. sporen)	Microbiological	#/100ml						0	
Colibacteriën	Microbiological	#/100ml						0,00	
Escherichia coli (E. coli)	Microbiological	#/100ml				1000	10	0,00	
Enterokokken	Microbiological	#/100ml				400		0,00	
Legionalla spp.	Microbiological	cfu/L					1000		

Intestinal nematodes (helinth eggs)	Microbiological	egg/L					1		
Carbamazepine	Pollutants of concern - quaterny treatment - new UWWTD - 80%removal								
Benzotriazole	Pollutants of concern - quaterny treatment - new UWWTD - 80%removal								
4-Methylbenzotriazole	Pollutants of concern - quaterny treatment - new UWWTD - 80%removal								
5-methyl-benzotriazole	Pollutants of concern - quaterny treatment - new UWWTD - 80%removal								

References

Most references are cross-linked within the document and within **Table 1 and Table 2** and within the text.

Other important references used, can be found in **D.1.1.1, and D1.1.3.**

And a (non-exhaustive) list of interesting additional links and articles related to this topic:

Additional links

- Kader Afstromend Wegwater: https://open.rijkswaterstaat.nl/zoeken/%4041070/kader-afstromend-wegwater-kaww/
- https://www.cerema.fr/fr/centre-ressources/boutique/pollution-origine-routiere (FR)
- Richtlinien für die Entwässerung von Straßen https://www.fgsv-verlag.de/rews (GE)
- Sanering wegwater (BE) https://vmm.vlaanderen.be/publicaties/sanering-wegwater-verkenning-technologische-mogelijkheden-case-studies/@@download/attachment
- Welke typen voorzieningen zijn er? (NL)
- https://www.vlario.be/ontwerprichtlijnen-infiltratievoorzieningen/ (BE)
- https://eur-lex.europa.eu/homepage.html?locale=nl
- https://www.vmm.be/water
- https://sgbp.integraalwaterbeleid.be/beheerplan/analyses-en-beschermde-gebieden
- https://ehne.fr/en/encyclopedia/themes/ecology-and-environment-in-europe/protecting-environment-and-managing-natural-ressources/water-policies-european-institutions-1970s-present
- https://environment.ec.europa.eu/strategy/zero-pollution-action-plan_en
- https://emis.vito.be/nl/erkende-laboratoria/water-gop/compendium-wac
- https://doc.cerema.fr/
- WHO Guidelines for the safe use of wastewater, excreta and greywater Volume 4 Excreta and greywater use in agriculture
- Home | AIX-Net-WWR Rubin-Bündis

Additional articles and/or studies

- Zandstra T. (2015). *Water Legislation – Cost of Non-Europe Report.* EPRS | European Parliamentary Research Service. 128p. url: https://www.europarl.europa.eu/RegData/etudes/STUD/2015/536369/EPRS_STU(2015)536369_EN.pdf
- Jelmer T.; Haring O.; Mies J. (2025). Bachelor Scriptie Water Management olv Rijkswaterstaat Nederland. *De milieu hygiënische impact van de beheersmaatregelen van het KAWW op de leefomgeving rondom rijkswegen.* I.o.v. Hogeschool Rotterdam, Instituut van de Bebouwde Omgeving. 49p.
- Vinck E.; De Bock B.; Wambecq T., Liekens E., Delgado R. (2023). [aquaSens tool] *A New Decision Support Tool for Evaluating the Impact of Stormwater Management Systems on Urban Runoff Pollution.* Water MDPI. 16p.
- Speijer L.; Six S.; Van der Grift; et al. (2024). *Enhancing groundwater recharge in drinking water protection zones in Flanders (Belgium): A novel approach to assess stormwater managed aquifer recharge potential.* Journal of Hydrology Regional Studies.
- Tedoldi et al. (2020). *Infiltrer les eaux pluviales c'est aussi maîtriser les flux polluants. État des connaissances et recommandations techniques pour la diffusion de solutions fondées sur la nature.* OPUR. 72p.url: https://www.leesu.fr/opur/IMG/pdf/guide_infiltration_d._tedoldi-2.pdf
- Vercauteren et al. (2021). *Onderzoek naar verspreiding, effecten en risico's van microplastics in het Vlaamse oppervlaktewater – kernrapport.* I.o.v. Vlaamse Milieumaatschappij. UGent & VITO. 133p. url: https://vmm.vlaanderen.be/publicaties/onderzoek-naar-verspreiding-effecten-en-risico2019s-van-microplastics-in-het-vlaamse-oppervlaktewater-kernrapport
- RIONED & STOWA (2025) *Milieuhygiënisch functioneren van infiltratievoorzieningen.* 31p. url: https://www.riool.net/media/cnlnu2dh/ter-visie-milieuhygienisch-functioneren-infiltratievoorzieningen.pdf
- Vlaams Agentschap Zorg & Gezondheid, Afdeling Toezicht Volksgezondheid (2013). *Verkennend onderzoek van de waterkwaliteit in waterspeeltuinen.* 16p.
- Departement Zorg. (2024). *LEIDRAAD BIJ DESIGN EN EXPLOITATIE WATERSPEELTUINEN.* 5p.