Transition plan circular water management 2020-2030

1. Framework and principles

Climate change is leading to more hydrological extremes: both longer dry periods and more intense rainfall. Flanders belongs to the regions with "extremely high water stress", according to the World Resources Institute. This is mainly due to our high population density. Other aspects such as a lot of paving, large-scale drainage of (agricultural) land, a lot of cut open space, the large number of water-intensive companies and poor water quality are all directly or indirectly related to it.

Flanders is not only highly vulnerable to drought and heat, but also to flooding. Calculations indicate that the number of sewer overflows will increase in the coming decades, possibly by a factor of 5 to 10 by 2100, if no measures are taken to adapt to the changing climate.

At the same time, we note that our tap water travels hundreds of kilometres every day, while more than enough falls on our roof. Our wastewater - after treatment - eventually flows into the sea through kilometres of sewers, as does a large part of our rainwater without any useful application.

We will have to adapt to the new reality of climate change. We now know how best to do this: softening, buffering rainwater and allowing it to infiltrate the ground, reusing more water and improving the interweaving of green areas and water in the landscape, the so-called 'blue-green network'; in short, a transition to a circular water cycle.

The Blue Deal (July 2020) of the Flemish Government, which works on six tracks, cannot be ignored in this.

- Public administrations setting a good example and ensuring appropriate regulation
- **Circular water use as a rule**
- Agriculture and nature as part of the solution
- Sensitising and encouraging private individuals to soften
- Increasing security of supply
- **Investing together in innovation to make our water system smarter, more robust and more sustainable**.

UGent can make an active and relevant contribution mainly on tracks 2 and 6. With this transition plan, UGent is outlining the path, alligning the objectives with the European objectives on climate and circular economy and the Flemish Blue Deal, demarcating the boundaries and making the actions concrete for the coming years.

The water policy plan is part of UGent's climate plan. Policy choices and concrete actions will always be carefully considered, without losing sight of the other sub-aspects of the climate plan (e.g. biodiversity plan, energy policy plan). This will prevent problems from being postponed.

2. Water policy at UGent: up to now

2.1 Water consumption

At UGent, efforts to reduce water consumption have been ongoing for about 20 years. Since 1998, the start of water accounting, the consumption of mains water has decreased by 41%. The cost price has since increased by 131%, mainly due to the sanitation contributions that have risen sharply and expanded (from 0.42 mio to 0.97 mio €/year) (figure 1). Water consumption per m² of building area has fallen by 56% since 1998 (figure 2), per UGent employee (staff + student) by 70% (figure 3).

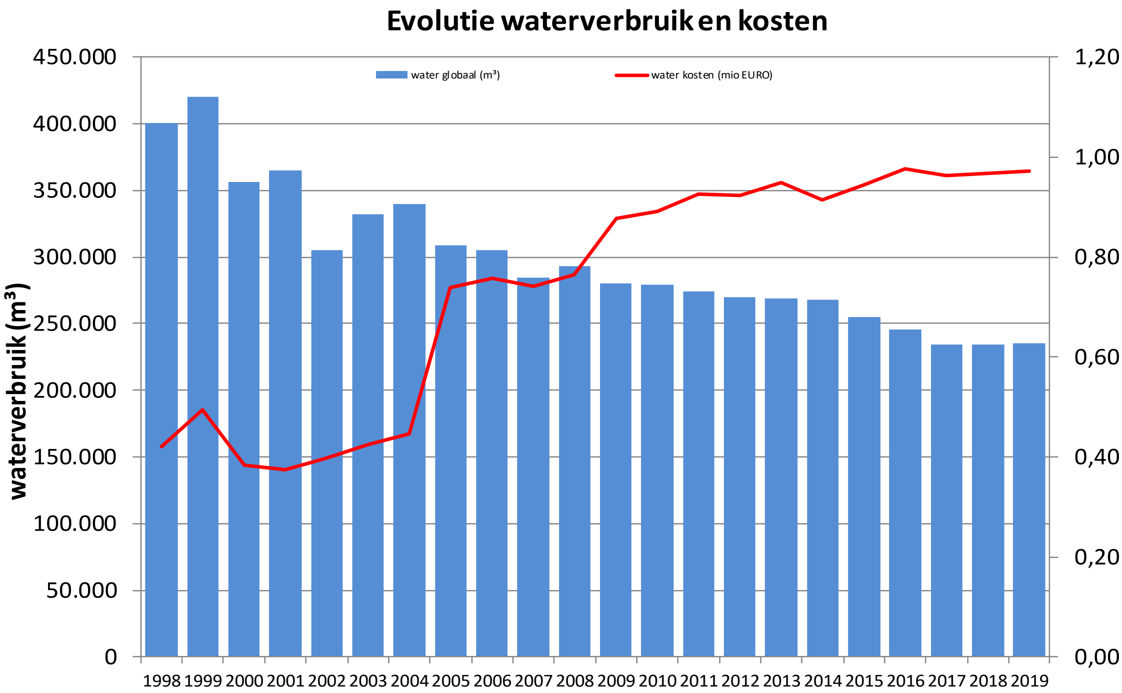

Fig. 1: Water consumption and costs from 1998 to 2019

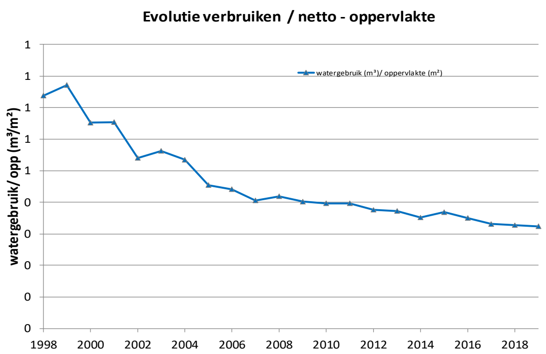

Fig. 2: Water consumption per m² of building area from 1998 to 2019

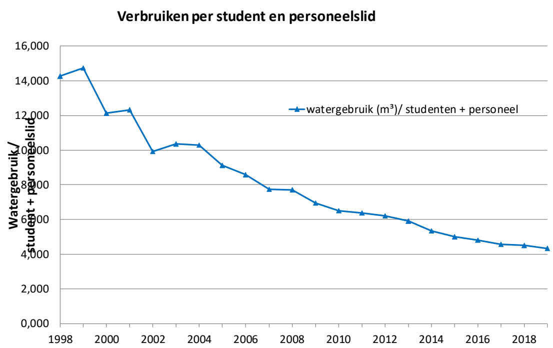

Fig. 3: Water consumption per person from 1998 to 2019

The reduction in mains water consumption was achieved by avoiding water wastage, adapting lab processes and switching to alternative water sources.

Water audits were conducted, campaigns launched and water jet pumps in the labs were replaced by vacuum pumps. The use of open cooling circuits is no longer allowed at UGent since 2010. When purchasing new equipment that requires cooling, a closed cooling circuit must be purchased immediately. Every month, all water meter readings are measured and in case of deviating use, the cause is sought.

2.2 Water sources

Figure 4 gives an overview of the origin of the water used. The majority is mains water, the proportion of alternative water sources is less than 10%.

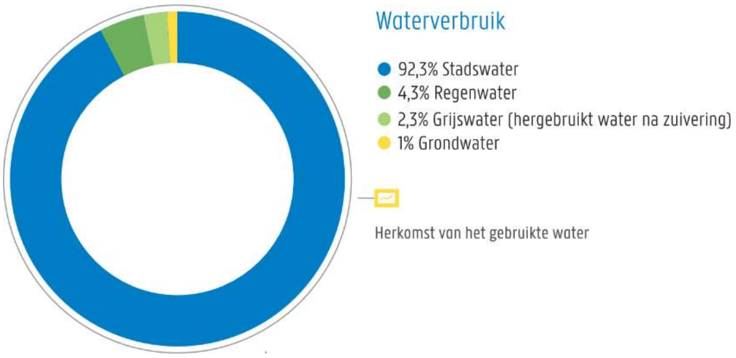

Fig. 4: Origin of the water used in 2019

The main alternative water source is **rainwater**. Since 2000, rainwater installations have been put into operation, as also required by the Rainwater Ordinance. Currently, 47 installations are operational. For each new building and relevant renovation project, a water balance was drawn up that also takes into account the supply and demand of rainwater from adjacent buildings, in order to optimise the use of rainwater. For example, the roofs of Block A on Campus Coupure and the clean rooms on Campus Ardoyen were also connected to the cisterns of the newly built Block F and the new VIB/Locus building respectively.

Table 1 gives an overview of rainwater consumption per campus. The erratic course of consumption points to various problems with the installations that were not remedied, or were remedied far too late. Occasionally, even 'negative' consumption is recorded, which means that mains water overflowed due to problems with the refilling. In the meantime, however, all installations are equipped with meters that allow monitoring of the consumption and the refilling with mains water, and faster reaction when errors are detected.

	Rainwater consumption (m³)		
	2018	**2019**	**2020**
Ledeganck Campus	603	272	67
University Street Campus, Braun School	155	202	104
Dunant Campus, HILO/GUSB/HIOW	758	474	171
Mercator Block B	161	296	74
Campus UFO, Veyrac and Coach House	158	106	43
Campus Tweekerken/Sint-Pietersplein	970	959	505
Campus Melle	377	231	258
Campus UPlateau library	265		105
Dunant Campus	negative	564	369
Campus UFO, building UFO	487	404	10
Campus Proeftuinstraat, building N1	33	28	37
Campus Coupure	1139	158	395
Sterre Campus	1.547	1.710	1.319
Campus Merelbeke, Heidestraat	58	70	42
Kantienberg	1.914	1.139	352
Ardoyen Campus	0	3.416	5.019

Campus Merelbeke	501	665	373
Heymans Campus, MRB II		514	
Total	9.126	11.208	9.243

Table 1: Overview of rainwater consumption per campus in m³/year

In addition, **groundwater** is used. Since the deep groundwater layers in the base are under severe pressure, UGent no longer uses groundwater at great depth. Although rainwater and purified wastewater are preferable to groundwater for low-value applications, in certain cases groundwater is the best choice, e.g. when the supply of rainwater or purified wastewater is limited or when a certain degree of purity is desired that cannot be guaranteed with rainwater. However, the use of groundwater for middle-grade applications should be carefully considered, so that overly intensive pre-treatments are avoided (e.g. in iGhent groundwater undergoes deferrization and nanofiltration before cooling, where considerable amounts of water are lost in both processes). Table 2 gives an overview of the available groundwater extraction wells and table 3 shows the evolution of their use.

Location	**Depth**	**Permitted flow rate**	**Applications**
Ledeganck Campus, botanical garden	38 m 48 m 52 m	5,000 m³/year	Refilling the pond, which in turn is used for watering the plants
Campus Melle, plant cultivation	42 m	250 m³/year	Irrigating plants, creating spray liquid
Ardoyen Campus, iGent	37 m	6,000 m³/year	Cooling
Campus Merelbeke, high-rise	18,5 m	4,000 m³/year	Cleaning of stables, drinking water animals

Table 2: Overview of available groundwater extraction wells (all in the Ypres Acquifer)

Location	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Ledeganck Campus, botanical garden	2.489	1.855	1.467	1.577	3.058	1.557	650	1.307
Campus Melle, plant cultivation	344	684	87	942	112	60	239	470
Ardoyen Campus, iGent				1.917	2.278	3.974	1.289	3.286
Campus Merelbeke, high-rise	2.674	2.738	892	5.110	2.276	1.539	146	49
Total	5.507	5.277	2.446	9.546	7.724	7.130	2.324	5.112

Table 3: Evolution of groundwater use expressed in m³/year

Purified tap water, i.e. **grey water,** is also increasingly being used. On the Veterinary Medicine campus and in the GUSB University Sports Complex, for example, grey water is reused for cleaning stables on the one hand and for flushing toilets on the other. Table 4 gives an overview of the consumption.

Location	**2016**	**2017**	**2018**	**2019**	**2020**
Campus Merelbeke, high-rise	4363	4485	5576	5946	4880
Campus HILO, sports complex GUSB	1402	1445	1432	1313	1456

Table 4: Overview of greywater used expressed in m³/year

In the ongoing new construction and renovation projects of the sanitation system, the possibility of reusing treated wastewater is always examined since 2020.

For example, aerated helophyte filters were installed at the Heymans campus and the Proeftuinstraat campus. The purified wastewater will be used for flushing the toilets, a first step towards circular water management. Options are being examined on the Sterre campus (S11 and home B), the Gontrode site, the Rommelaere complex (complete renovation) and the Ardoyen campus (new VTK building and disconnection of the Control Engineering building).

2.3 Water quality

In order to protect the receiving watercourse from the discharge of hazardous substances, ensuring the quality of the discharged wastewater is an important concern.

On almost all campuses, wastewater is discharged into the public sewer system, where it is discharged into the surface water after treatment in a WWTP. The environmental impact on the receiving surface water is therefore small. Only on the Proeftuinstraat campus is untreated wastewater still discharged into the surface water of the Scheldt; the sewage works are planned for2022 and are in the hands of the City of Ghent. The Veterinary Medicine campus has a water purification plant that discharges into the surface water.

Water emissions are monitored with measurement campaigns at the various lab sites. If emission limit values are exceeded, the cause is sought together with the relevant departments. However, the situation is not always so clear-cut for the discharge of micropollutants such as medicines, pesticides, microplastics, endocrine disruptors, etc. These pollutants are not included in the standard analysis packages of VMM, the self-monitoring programme, etc. When the departments report a potentially relevant discharge of such substances, this can be investigated on an ad hoc basis. Non-standard parameters are occasionally examined as a result of questions about the collection of liquid chemical waste.

There are no water quality standards for microplastics, some endocrine disruptors, pesticides and antibiotics, which makes an objective assessment difficult.

2.4 Water Adaptation

In recent years, awareness has grown that good water management is much more than using as little water as possible and striving for good water quality. Good water management can mitigate the effects of climate change and is becoming a crucial issue in climate adaptation. UGent can contribute to this by making space for water, reducing the paved surface area and managing the existing water features in such a way that water is supplied, captured and kept on site as much as possible.

For example, when constructing the outdoor space, an attempt is made to keep the amount of paving to a minimum. However, there is still a lot of superfluous surfacing, especially for streets that are too spacious and car parking. The biodiversity plan of Ghent University has already set a course for this.

2.5 Other water-related actions

Drinking **tap water instead of** bottled water has a clear impact on our ecological footprint. Belgians drink 150 litres of water per year per capita, making them one of the largest consumers of bottled water in the world (Belgians drink 6 times more bottled water than the Dutch). The ecological impact is great due to the production of the bottles, the transport, ... and perfectly avoidable: the quality of tap water is strictly controlled. The standardised chemical and microbiological parameters are checked, as well as a number of indicator and supplementary parameters (pesticides and non-standard substances such as medicines). UGent therefore stimulates staff and students to drink tap water and has concluded a framework contract for the installation and maintenance of drinking water fountains. In the meantime, 40 heavily frequented publicly accessible areas (foyers, entrance halls, study areas, etc.) have been equipped with a tap water tap and 130 tap water coolers have been installed in the kitchens.

Reducing the **water footprint** can also be done by taking other sustainability measures. The water footprint is determined by the total amount of fresh water needed to produce all the goods and services that are consumed. For example, a lot of water can be saved by drastically reducing the supply of meat and removing beef from the menu (water footprint of 200 g beef = 3,960 litres, 200 g poultry = 624 l, 300 g vegetables = 60-100 l).

Since this is covered in the sustainability report and the sustainability agenda of UGent, they are not considered in this transition plan.

3. Water policy objective

UGent is working on an integrated water policy that closes water cycles locally as much as possible and mitigates the effects of climate change.

This means that UGent:

- an additional 15% reduction in mains water by 2030 compared to 2020;
- make maximum use of alternative water sources in function of the application[1] and strive for 80% reuse in new building and renovation;
- make space for water by removing (superfluous) paving and converting it into a zone where water can infiltrate;
- actively contribute to improving the quality and quantity of groundwater and surface water;
- is now working on an integrated approach to water management in new buildings and renovations, and is joining forces with experts, students and policymakers;
- Pilot projects on circular water management to enable innovation.

4. Strategic framework

In order to realise the water policy plan with concrete objectives and actions, 6 strategic pillars are put forward:

1. Reduction of water consumption
2. Use of alternative water supply sources in function of the application
3. Space for water (link with biodiversity plan)
4. Increasing water quality
5. Working on an integrated approach in new building and renovation projects
6. Use of UGent expertise and commitment, for own projects and to enable innovation

In what follows, we describe the 6 pillars and give them application in a series of actions. This action list is a first step. Further supplementing and refining it is part of the dynamic that arises on the basis of the present plan. Additional initiatives will undoubtedly emerge '*en cours de route*'.

4.1 Pillar I: Reduction of water consumption

A reduction in water consumption is an important step in the transition to circular water management. **The water consumption in the various buildings is monitored monthly through the water accounts. In case of deviating consumption, the cause is sought. In addition, large**

[1] *High-quality applications: human consumption, kitchens, showers, hand washing, laboratory applications, water treatment (softening, filtration,...)*
Medium-value applications: washing machines, cleaning of offices, auditoriums, laboratories, drinking water for animals, refrigeration,...
Low-value applications: sanitation, cleaning of stables, watering of greenery

water consumption is detected via water audits and remedied where possible. Policy measures are also taken in a preventive manner. For example, appliances that run on cooling water must have a closed cooling water circuit.

Registration of water consumption

Water consumption is registered manually by recording counter readings. This is labour intensive, but often incomplete and prone to errors. By switching to a digital system (e.g. Shyap), the registration will be more correct and it will be possible to intervene more quickly in case of deviating consumption.

The following actions are proposed:

Action 1	First phase: installing digital meters on - critical and large-scale consumption installations (water treatment systems); - The different water systems in new buildings and renovations. Second phase: general changeover to digital meters with software for analysis and alarms, as will be done for electricity, natural gas and heat.
Action 2	Draw up water balances for entire campuses: - as part of master plans, environmental permits, etc; - to compare monitored consumption with theoretically expected consumption as a means of monitoring to detect excessive consumption ; - to dimension purification and reuse systems, infiltration facilities, water features, softening projects, etc.

Water audits

Water audits can identify the large water consumers and investigate the desirability of additional water-saving measures (e.g. closed cooling circuit).

A thorough analysis must also be made of the technical installations that use large amounts of water, such as installations for softening, deferrization, micro- or nanofiltration, RO, adiabatic cooling, etc. that consume a lot of water. It should be investigated whether the treatments are always (and everywhere) necessary, whether there are no alternatives available and whether the drain water can be put to a new use (e.g. for flushing toilets). At the moment, water consumption plays little or no role in the choice of an installation or in the determination of the number of distribution points.

The rainwater installations should also be critically examined during these audits. Malfunctioning solenoid valves often interfere with the control of the choice between rainwater and mains water, causing mains water to be used despite the availability of sufficient rainwater (Tweekerken, UFO, ...), or the mains water replenishment remains activated, causing pure mains water to be discharged into the sewer system (home Bertha, Coupure block E). Despite monthly meter readings, these problems are often addressed (too) late. As a first step in tackling this problem, alarms were placed on a number of installations.

The following actions are proposed:

Action 3	Performing water audits of technical installations, water appliances in laboratories and rainwater installations.
Action 4	Developing policy instruments to better adapt large water-consuming appliances (installations, distribution points, etc.) to actual needs, e.g. for: - cooling water: connection to a closed cooling system, either central or decentralised; the department must provide its own closed circuit; - softened water: the lab applications and devices for which softened water is needed must be mapped out; the decision on whether to provide softened water centrally or decentrally is made by DGFB in terms of management and energy

	consumption (central facilities are financed centrally, decentralised facilities decentrally); - demineralised water: this is provided decentrally as standard; the purchase and maintenance are paid for by the department (approx. EUR 3,000).
Action 5	Raising awareness on water efficiency, especially in the homes (very high water consumption compared to that of a normal family (100 m³ vs. 50 m³/y).

4.2 Pillar II: Use of alternative water supply sources depending on the application

92% of the water used is mains water. In many applications, this precious drinking water can be replaced by alternative water sources. Also, new technologies can increase the quality of a certain source, which enlarges the area of application. In the most far-reaching process, for example, waste water can be used as drinking water again. Especially in office buildings, a lot is already possible. In the longer term, there may also be more possibilities for lab buildings and student residences.

The following actions are proposed:

Action 6	Prioritising in order to most efficiently strive for 80% utilisation of alternative water sources without shifting the environmental burden to other compartments.
Action 7	In new building and renovation projects, split the supply pipes for different water quality types (drinking water, hygienic water, sanitary water) to enable a quick changeover.

<u>Rainwater</u>

Separating rainwater from wastewater and keeping rainwater on site for beneficial use, green roofs and infiltration are key factors in achieving an efficient and sustainable water policy. Separating rainwater prevents dilution of wastewater, allowing the water treatment infrastructure to function better. It prevents sewer overflows during heavy rainfall, which benefits the water quality of streams and rivers and prevents flooding. In the transition to a circular system, it is also important to completely separate water flows of different quality, in order to achieve an optimal treatment technique for each partial flow.

When new buildings are built or renovations are carried out at Ghent University, we always examine how roof water can be used optimally. Not only the new or renovated building is considered, but also the rest of the campus. Thus, buildings with low consumption can supply rainwater to buildings with high consumption but no or little storage possibilities. Collaborations with other parties (city of Ghent, private neighbours, neighbouring companies) are also being considered (cf.)

Despite this approach, only 4.3% of the water consumed is rainwater. This low percentage has several causes:

- Only non-polluted rainwater is eligible for reuse, which in practice means rainwater from (green) roofs;
- Often, the supply and return pipes in the outdated patrimony are mixed;
- buildings in the city centre have insufficient free space to install rainwater tanks;
- There is a limited supply of rainwater against a large demand (high-rise buildings);
- There is a lack of clear and up-to-date plans of rainwater drains and the actual discharge situation;
- Consumption points such as sanitary facilities, service taps, drain point for outdoor sprinkling, etc. are very scattered (e.g. there are 48 different sanitary facilities in the Volderstraat complex);

- The free space for installing rainwater tanks is not always in the vicinity of the consumption points.

But also in locations where rainwater is reused, problems with the installation are often identified (see pillar I Water audits). These problems are mainly in the area of:

- Follow-up (technician manually restarts the installation without addressing the cause of the problem);
- human intervention (in installations with manual switchover to mains water in case of shortage of drinking water, one forgets to switch back to rainwater if available);
- Maintenance (dirty gutters, clogged coarse filters);
- commissioning (installation is delivered without clear manual or specifications).

In recent years, action has already been taken on a number of points, but others need to be improved if we are to make maximum use of rainwater.

The following actions are proposed:

Action 8	Inventory and disconnection of buildings with mixed rainwater and wastewater discharges. The focus is on planned new building projects and renovations (required by law).
Action 9	Developing guidelines for the purchase and delivery of rainwater installations and drawing up a process flow for the management and intervention of the working installations.
Action 10	Research into the possibilities of using rainwater for a wider range of applications than is currently permitted (e.g. showers, dishwashing, etc.) in order to make the aim of 80% alternative water sources realistic in student homes and laboratory buildings as well.

<u>Purified waste water</u>

The use of treated wastewater (grey water) is necessary to achieve a fully closed water cycle. The rainwater remains available for maximum infiltration on the campus and replenishment of the groundwater table, or can serve as a source for upgrading to higher quality water.

The following action is proposed:

Action 11	Maximum use of greywater in construction and renovation projects for sanitary purposes.

<u>Groundwater</u>

Groundwater is scarce in Flanders. **The amount of groundwater that is extracted is many times the amount that is infiltrated.** The plinth system in parts of East and West Flanders is under serious threat.

Groundwater use at UGent is very limited. Yet, UGent also has to consider using it to replace tap water. **Groundwater can only be used for applications for which the quality of rainwater or purified waste water is not sufficient.** No water is pumped up from the Sock, so only water from the relatively shallow layers can be used.

Groundwater for cooling is possible, provided no pretreatment is required. Pre-treatment of groundwater (de-ironing, nanofiltration,...), as is done in iGent, is very expensive, difficult and wastes water.

Groundwater is also extracted from building sites to lower the groundwater level artificially (drainage water). It is already recommended that the extracted groundwater be returned to the ground (return drainage) via infiltration pits, basins or ditches. If return dewatering is not possible, the dewatered water should first be diverted to the nearest watercourse or, in the case of separate sewers, to the rainwater drain. Only if the above solutions are not feasible, can the water be discharged into the public sewer system. During longer periods of drought, the beneficial use of groundwater may be considered,

The following actions are proposed:

Action 12	Define the restrictions on groundwater use in the design guideline (no use of groundwater, except as a very last step if it can replace mains water).
Action 13	Developing a process flow to use drainage water to supplement water shortages during periods of drought (as part of climate adaptation).

4.3 Pillar III: Space for water

Space for water means that water becomes visible on campus and that infiltration and buffer basins are part of the public space. At UGent, more and more wadis are being constructed, such as on the Heymans campus, the Sterre campus and the Kortrijk campus. Ponds are present on the Merelbeke campus, the Proeftuinstraat campus and the Ledeganck campus.

But it also means that open space is not increasingly cut up for new construction or additional paving. Infilling rather than expanding is one of the priorities of the 2019-2028 real estate policy plan and can be done by using the available infrastructure more efficiently.

Giving space to water has many other benefits besides replenishing the groundwater table. In an urban environment, it provides cooling, less flooding, less heat stress, biodiversity, pleasant blue-green campuses and a higher quality of life, among other things.

Rainwater can serve as an alternative water supply source, but ideally treated wastewater should be reused for this purpose, allowing rainwater to infiltrate. Especially rainwater from roads, car parks and other paved surfaces, which cannot be reused, should infiltrate as much as possible on site. The ecosystem needs water, and run-off from roads is a necessary requirement for the surrounding green spaces.

This pillar has links with the biodiversity plan where the aim is to create more and more valuable green spaces. **In addition, the biodiversity plan, as well as the business transport plan, expresses ambitions to soften and green unnecessary infrastructure** (e.g. through more efficient use of underground car parks, ground level car parks can be redeveloped).

In addition to the actions in the biodiversity plan and business transport plan, these are also proposed:

Action 14	Estimate additional potential of infiltration (by infiltration tests) and implement where possible.
Action 15	Working with permeable materials for necessary surfacing, e.g. for bicycle sheds, footpaths, fire lanes, etc.

4.4 Pillar IV: Improving water quality

All wastewater discharges from UGent buildings are connected to the public sewer system, with the exception of the Proeftuinstraat campus and the Merelbeke campus. The Proeftuinstraat campus is expected to be connected by 2024 at the latest (depending on the city of Ghent). On the Merelbeke campus, the wastewater is purified to surface water quality in their own water purification plant.

Water emissions are monitored with measurement campaigns at the various lab sites. If emission limits are exceeded, the cause is sought together with the relevant departments. Exceedances of standards and incidental discharges, mainly due to student practices or new procedures in which staff are insufficiently familiar with good laboratory practices, must be avoided. The impact of the discharge of non-standard micropollutants (antibiotics, microplastics, pesticides, endocrine disruptors,...) by UGent is very small. However, we should not be blind to this problem and UGent should take a pioneering role in research on the presence of and technologies for the removal of micropollutants.

As long as the wastewater enters the public sewer system and can be processed at a sewage treatment plant, the environmental damage caused by incidental discharge of contaminated substances may be very limited. **However, when overflows occur, large quantities of untreated wastewater may end up in surface waters. This must therefore be avoided,** in particular at our own plant on the Ardoyen campus, but also by putting a strong focus on the complete separation of waste and rain water (see action 8).

The following actions are proposed for this purpose:

Action 16	Sustained attention to prevention, communication, training, sharing good working practices, etc. in lab environments.
Action 17	Avoidance of overflow on Ardoyen campus by fully disconnecting rainwater and wastewater (UGent and companies).
Action 18	Research on technologies for removal of micro-pollutants in effluent.

4.5 Pillar V: Integrated approach for new building and renovation

A water transition plan for each campus, based on the water balance (action 2), outlines the direction. This includes the four previous pillars, i.e. reducing water consumption, making maximum use of alternative water supply sources depending on the application, giving space to water and working on improving water quality. **Every new building or thorough renovation gives the opportunity to tackle part of the water transition plan.** (Student) research or experiments can also implement the plan step by step.

The following actions are pre-counted:

Action 19	Draw up water transition plans per campus and adjust planned renovations and new buildings accordingly. This means that the various consumption items and the desired water quality for renovation and new construction must be mapped out and measures must be coordinated with the water transition plan, together with experts. The study bureau's attention is drawn to this in the tender.
Action 20	Searching for resources and partnerships, experimenting with new technologies, implementing proposed actions, ...
Action 21	Incorporate new proven water-saving measures and measures to close the water cycle locally into the design guideline, so that this is included in all construction projects.
Action 22	Consultation with legislative and licensing bodies to give new techniques, for which there is no legal framework, a chance. For example, it should be possible to discharge partially treated wastewater into the public sewer system during the research phase. This can be done by applying for recognition as a 'low maintenance zone'.

4.6 Pillar VI: Deployment of UGent expertise and commitment

UGent expertise

The range of emerging, new technologies is growing every day. However, the flow to innovative application in water management is more difficult. The water transition still requires a lot of technical, process and social innovation. As a university, we can act as a living lab and investigate which technical, regulatory, administrative, financial and emotional barriers hinder innovation and how these can be removed.

Our own experts can help in the concrete translation of this water policy plan. We must connect the available expertise so that a powerful cooperation arises that helps shape water-robust and water-independent campuses. UGent as testing ground ensures that technologies and concepts gain the confidence of the market more quickly.

The following collaborations have already been set up:

Living Lab 1	Students from the 'integrated water management' course at the Faculty of EA are working on a water balance sheet for Sterre campus and will assess the improvement potential, as part of the Sterre campus master plan.
	Who: Prof. Renaat De Sutter, BOSAQ, DGFB, Environment Department *Where: Sterre campus*
Living Lab 2	The Department of Green Chemistry and Technology of the Faculty of BW follows the quality and control of a helophyte filter on the Pharmacy campus.
	Who: Prof. Diederik Russeau, DGFB, Environment Division *Where: Pharmacy Campus*
Living Lab 3	CMET (Centre for Microbial Ecology and Technology) of the Faculty of BW investigates the possibilities of recovering nutrients from the fraction of urine. These can be used as fertiliser and lead to a lower nutrient load for water purification.
	Who: Prof. Korneel Rabaey, DGFB *Where: presumably in N16*
Living Lab 4	The Building Physics research group of the Faculty of EA can provide support in the search for excessive and avoidable water consumption through innovative monitoring systems.
	Who: Dr. Elisa Van Kenhove, DGFB, Environment Division *Where: VIB research building, Kantienberg, ...*

The following action is proposed:

Action 23	Setting up a working group on 'circular water management' (cf. working group on energy policy, working group on biodiversity), where the link is made between project leaders and UGent experts. On the one hand, opportunities for living labs can be detected, on the other hand, UGent experts can point out new technological developments.

<u>Engagement and communication</u>

This water policy plan originated from a constructive engagement of UGent citizens and was further shaped in the participative context of 'Transition UGent'. The further roll-out and realisation of this plan in concrete actions must also take place in a strong co-creative mindset, with maximum effort being put into the active involvement of administrators, academics, policy officials, technicians, purchasers, students, ... and external partners, such as the City of Ghent, civil society organisations, local residents, external experts, ... Especially for the pillar 'space for water', but also for awareness campaigns about reducing water consumption, promoting tap water, reducing the water footprint, etc., a lot of people can be mobilised. **With a broad commitment and with the fiat and confidence of Ghent University, a number of things can even be realised without having to pay much.**

The following actions are proposed:

Action 24	Establishing collaborations by policy staff, students and teachers, external partners, within and outside existing learning pathways.
Action 25	Creating frameworks and space in which own, bottom-up initiatives can be realised. Actively encouraging staff and students to launch proposals to make their campus more water-robust and to start working on them themselves.

5. Funding

The transition to water-robust and water-independent campuses must become an **inclusive story**. The costs involved must be integrated in an investment plan, in a building project, ... However, investment plan 3 does not go that far yet. **The measures to be taken for infiltration and reuse of rainwater or reuse of grey water are anchored in the plan, but there is no extra experimental budget for innovative projects.** To finance this in the meantime, the budgets below can be used:

Commission sustainable measures:

The 'provision for sustainable measures' is supplemented annually with 'proven' savings [2]in energy and water use. This happened in the context of the 2010-2020 energy policy plan, where both energy and water saving measures were included in the action plan. Now that both themes are being followed up in their own transition plan, it is proposed to continue the financing mechanism not only in the energy policy plan 2020-2030, but also in the water policy plan 2020-2030. The provision can remain one.

Living Lab fee:

An action from the transition plan for sustainable travel policy concerns bringing the $_{CO2}$ contribution for air travel into line with the price of $_{CO2}$ on the international market (currently: EUR 40/tonne $_{CO2}$), which can be used to partly finance living labs as part of the climate plan (allocation on the advice of the Sustainability Committee).

Living labs related to circular water management could claim the living lab provision.

Grants and research funds:

By setting up pilot projects on circular water management in cooperation with UGent experts, research funds can be tapped. After all, various Flemish and European funded projects stimulate innovation in the field of integrated water management. Moreover, an open innovation platform will be set up within the 'integrated water policy coordination committee' in order to better coordinate innovative projects of companies and thus increase the chance of support.

Authors: Korneel Rabaey, Jan Arends and Ingmar Nopens of Capture, Diederik Rousseau of the department of Green Chemistry and Technology (FBW), Niko Verhoest of the department of Environment (FBW), Stijn Van Hulle of the department of Green Chemistry and Technology (FBW), Katrien Van Eerdenbrugh, guest lecturer of the subject 'water in the city' (FBW), Renaat de Sutter of the department of Civil Engineering, research group Integrated Water Policy and Environmental Management (FEA), Stijn Van de Putte and Elisa Van Kenhove of the department

[2] Guidelines for the provision of sustainable measures: see Energy Policy Plan 2020-2030

of Architecture and Urban Development (FEA), Benjamin Van de Velde, David Verschueren, Ruben Debeer, Tom Ceriez and Dries Vincke of the Buildings and Facility Management Department, Riet Van de Velde and Greet Persoon of the Environment Department, Tom Vandekerckhove of BOSAQ

Input from: DGFB, Transitie UGent, energy policy working group, biodiversity working group