



GRaBS Expert Paper 3 green and blue infrastructure exemplars from the city of graz

By Christine Schwabinger





GRaBS

The GRaBS (Green and Blue Space Adaptation for Urban Areas and Eco Towns) project is a network of leading pan-European organisations involved in integrating climate change adaptation into regional planning and development.

The 14 project partners, drawn from eight EU Member States, represent a broad spectrum of authorities and climate change challenges, all with varying degrees of strategic policy and experience. The GRaBS project partners are:

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GRaBS Expert Paper 3

green and blue

infrastructure

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Foreword

According to the UN Global Report on Human Settlements 2011, *Cities and Climate Change: Policy Directions*, an estimated 59% of the world's population will be living in urban areas by 2030. Every year, the number of people who live in cities and town grows by 67 million. According to the report, the world's cities are responsible for up to 70% of harmful greenhouse gases while occupying just 2% of its land.

What goes on in cities, and how they manage their impact on the environment, lies at the core of the problem. It is the combination of urbanisation's fast pace and the demand for development that poses the major threat. Mitigating the effects of reckless energy consumption is seen as the key action required to make cities more liveable, and adaptation, if addressed at all, is too often only associated with biodiversity and the survival of ecosystems.

And yet it is the human population of the cities that suffers most from the impact of climate change and extreme weather. The Austrian City of Graz is similar to thousands of other European cities and faces similar social, economic and environmental challenges. Yet it is relatively well-adapted to the impact of climate change already. Around 40% of its area is made up of green space, and it has an extensive green network and a pioneering approach to green infrastructure that dates back to 1980.

Through the GRaBS project, partners visited Graz to experience at first hand the Green Net system, described in detail in this Expert Paper, as well as the secret 'green' inner courtyards and the flood defences. The visit was inspiring and enlightening. This Paper describes the methods and policies used for the delivery and future development of the green area network of Graz.

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1 Introduction



A typical Graz courtyard

This Expert Paper showcases best practice examples of green and blue infrastructure in Graz, Austria. It is based on the GRaBS project's fourth steering committee meeting held in Graz in April 2010.

The City of Graz is the second largest town in Austria, with a population of approximately 250,000 people. It is the capital of the federal state of Styria, which is sometimes called the 'green heart of Austria' because of its vast number of forests and green areas.

Estimates suggest that 40% of the area of Graz is made up of green spaces. Planners and decision-makers have tried to retain this green infrastructure as the city develops. Building on green belt areas is restricted and the size of development is regulated.

Green infrastructure has always played a big part in the life of the citizens of Graz and there have been several studies on its importance, including its role in tackling climate change.

The Department of Spatial Planning and the Department of Construction and Building have used their understanding of the impacts and benefits of green infrastructure to develop and implement a range

of green infrastructure projects, which are explained in more detail below.

As a result of participating in GRaBS, a range of lessons from these case studies will be fed into the Province of Styria's Adaptation Action Plan (AAP) in 2011. This AAP will be a planning guide for communities and planners to drive the integration of green and blue infrastructure in spatial planning processes.

2 Case studies

2.1 The Green Net of Graz (Grünes Netz Graz)

The Green Net of Graz is 560 kilometres long, and extends over the entire urban area (see the map on following page). The network connects playgrounds and parks with the main residential areas, and the city centre with the surrounding countryside.

The idea of planning and implementing a 'green net' developed in parallel with an increasing pressure on open spaces due to development demands from a growing population. These pressures on green space are faced by towns and cities throughout Europe. In order to prevent a permanent loss of green spaces such as parks, play areas, open spaces, individual trees, avenues and even front gardens as the city expanded, Graz introduced a range of measures to protect green spaces as far back as 1980. During the mid-1990s the city incorporated a green space theme into its municipal policy work programme.

Green networks take many years to develop, and many sections of the network are yet to be established. However, the network serves as a framework for the long-term work of the city's urban planning department. The network consists of the city's green and open spaces, and the green routes between them. It has three green routes and uses the following hierarchy:

- (i) green corridor;
- (ii) green way; and
- (iii) green link.

The network has four key functions, which provide multiple benefits for the citizens of Graz:

- *Inter-linking:* walking and cycling along green routes, avenues, traffic-calmed streets and pathways alongside streams and meadows are safe and pleasant ways to get from home to work, shops, school and so on. They also provide cooler routes for walkers and cyclists and are therefore key to climate change adaptation in the city.
- *Recreational:* the green elements deliver recreation areas on the doorstep of Graz residents. People can use the parks, sport facilities, play areas, and green links and routes for walking, cycling or jogging without needing to drive out of the city. This is also a useful adaptation measure because the spaces provide a cool and pleasant venue for physical activity during times of extreme heat.
- *Ecological and climate-regulating:* in addition to its other functions the green net improves biodiversity by increasing the habitat area for animals and plants. It links together the city's 'green islands', improves air circulation and cools down the higher temperatures in the city centre (caused by the urban heat island effect). Even small green spaces have a positive impact on the surrounding climate: trees provide shade and filter dust particles and pollutants from the air. This approach reduces the amount of sealed surfaces and helps rainwater to

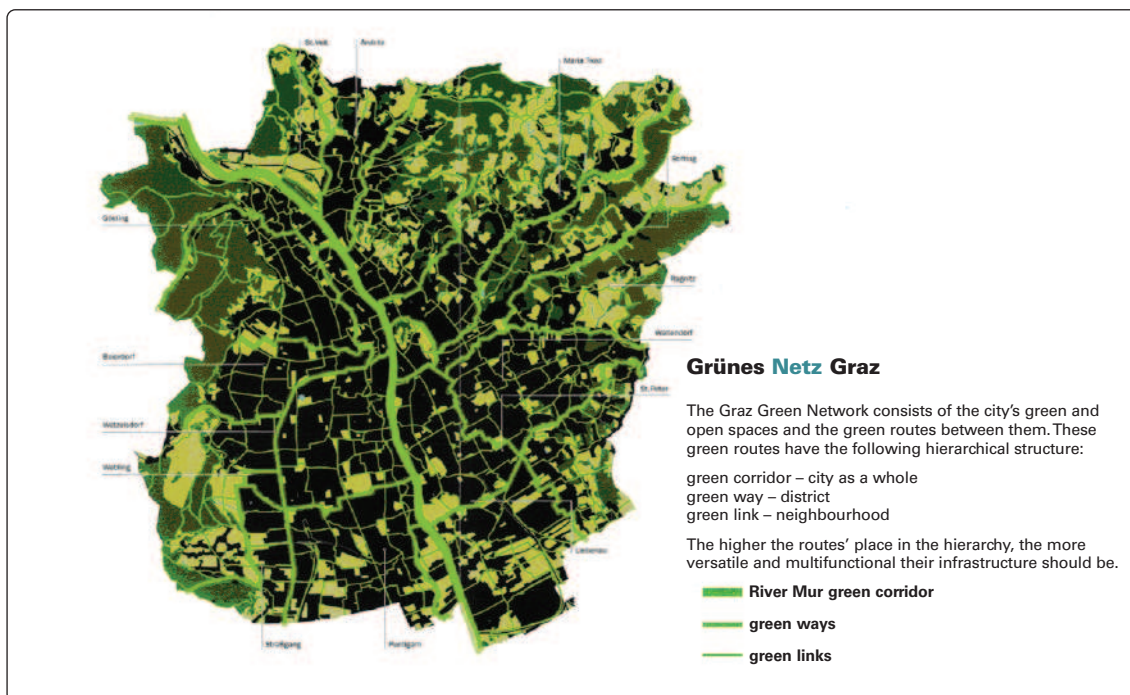
seep away rather than get trapped, which is a key adaptation benefit of the green infrastructure.

- *Urban design:* The green infrastructure creates unique local surroundings and enhances people's sense of belonging to their city. It also helps them to know where they are and to find their way around the city. Green infrastructure can also increase land and property values and bring another economic benefit – increased tourism.

Creating the network of green infrastructure is an ongoing process. Twelve projects have already been implemented, with several more either in development or planned for the future. An additional project focuses on extending the green net beyond the borders of Graz. This includes communities to the south of Graz, which has one of the region's highest rates of population growth.

2.2 Standards for open spaces (Freiraumplanerische Standards)

One of the main objectives of the city's development plan is to use green space to help facilitate a 'good quality of life'. This aspiration can mean many things: in the context of the GRaBS project it relates to the adaptation of urban areas to better cope with the



The Green Net of Graz, with descriptions of the main elements

impact of extreme weather. This objective is incorporated in the spatial concept (Räumliches Leitbild) of the City of Graz. Implementation will be achieved via zoning maps and master plans, and in construction appraisals carried out by experts. This continuing implementation builds on decades of development of the green infrastructure and awareness-raising of the benefits of doing this.

The planning department and the Department for Green Spaces and Water Bodies, together with external experts, calculated a set of standards for open spaces that can be used by the municipal authority. These standards are currently being evaluated and, if approved, will be included in the new development concept for the City of Graz (to be drafted in spring 2011).

The standards cover the following:

- front gardens;
- inner courtyards;
- greening of basement garages;
- protection of trees;
- street trees;
- enclosures;
- greening of roofs;
- greening of noise protection walls;
- surface sealing;
- changes of use;
- playgrounds; and
- parking areas.

Each of these elements has an open space standard that must be adhered to. Two of these standards are explained in more detail below.

2.2.1 Greening of roofs

This standard applies to development in the whole city. The standard states that there should be greening of all flat roofs up to an angle of 10° and 50m². The depth of the vegetation layer has to be at least 8cm.

This roof-greening process will increase the amount of green space in areas of the city where it has not been possible to have extensive green areas.

2.2.2 Parking areas

This standard also applies to the whole city. At least one broad-leaved tree has to be planted and maintained for every four new parking spaces. This

measure is taken not only because of the loss of green space, but also to retain the characteristics of the town and contribute to the landscape. This standard also includes requirements for bigger parking areas to minimise the degree of surface sealing.

2.3 Revitalising the inner courtyards of Graz (Grazer Innenhöfe beleben)

This initiative lies in the centre of Graz and is a good example of what can be achieved in the heart of many of the cities and towns of Europe.

Graz has many classic block border buildings of the pre-modernism period. With their green inner shared courtyards and front gardens they help give Graz the reputation of being a garden city. These semi-public and private open spaces, some of which are well planted, provide a good micro-climate as well as improving the quality of life for the people living there.

In the development concept of Graz, the conservation of these spaces is a key goal. Increasing the awareness of the owners and other private users of the significance of these green spaces is important to help motivate them to actively participate (including financially) in the revitalisation of these inner courtyards. To help do this we developed a strategy to influence owners' decisions concerning the future of these courtyards. This included:

- creating incentives for the private owners to participate in the initiative;
- conserving the intact inner courtyards;
- improving access to inner courtyards (overcoming legal issues to acquire shared space);
- eliminating disturbing fixtures and uses; and
- extending and improving green space in the inner courtyards.

The project began with a concept phase, followed by a participative planning process and the delivery of a pilot project and related community involvement (for example, a drawing competition for pupils).

The results include:

- **A strategy:** Called *Revitalising the Inner Courtyards of Graz*, this is the most important outcome of the participative planning process and will serve the City



Transforming inner urban courtyards into vibrant green spaces - barren spaces (above) are being turned into lush oases (left)



of Graz as a guideline for the future development of inner courtyards.

- **Pilot projects:** The participative planning process was carried out in seven courtyards. The owners and tenants drafted designs and long-term designs for the use of their courtyards. In two of them, these designs have already been implemented and a few more are in the planning phase.
- **Improvement of cross-departmental co-operation:** The departments involved in this project include urban planning, children and families, green spaces and water bodies, and housing.
- **Community engagement:** This included activities to engage the public with the initiative (such as a drawing competition for children), press releases, a project web homepage and a logo.

There is also now an Inner Courtyards Advisory Centre. The quality of life in the inner districts of the City of

Graz is closely linked to the initiative on inner courtyards and conserving them will remain an important objective of urban planning in the future. It is hoped that the awareness of the owners and inhabitants will steadily increase. The project is an example of how implementation of green infrastructure can be achieved, and is a model for other historical towns and cities.

2.4 Analysing the city's climate

As far back as 1990 the development concept of Graz concluded that climatic trends were an important element in spatial planning and urban development decision-making processes. The 1992 zoning plan established a maximum building density for some areas of Graz and also defined open spaces for producing cool air. Development masterplans limited the height of buildings and gave advice about the aerodynamic efficiency of the buildings.

In 2006, a joint project between the City of Graz, the Styrian Government and the Institute for Geography and Regional Studies of the Karl-Franzens University of Graz (Lazar/Sulzer) was set up to revise the 1994 analyses of the city's climate. The need for this revision arose due to the continuing development of the city and the availability of new climate data including a thermal scanner flight conducted in 2004 by a German association of aviation and space flight.

The review produced a variety of data including information on how much of the city's surface was sealed (pavements, tarmac and so on), vegetation and temperature distribution. Outputs included a map of sealed areas in Graz and a thermal scan, which highlighted how the south of Graz had become more built-up. These outputs will be helpful for continuing to plan the city's green infrastructure.

Another example of the usefulness of the climate zone map was the research conducted in the district of Mariatrost. This area is situated in one of the valleys – the Mariatroster Tal – where cold fresh air blows into the city. The city climate analysis highlighted that this area should be a restricted building zone.

However, there has been development in this area for some time, so some agreements had to be made in the master plan. After further climatic analyses in this area by the University of Graz the following guidance and solutions were suggested:

- construct buildings in a certain direction;
- implement more green roofs, and roofs with grit;
- minimise the amount of sealing of surfaces; and
- use 'lawn tiles' when building domestic driveways.

Implementing these solutions will help to maintain the necessary flow of cold air from this valley into the city.

2.5 The Streams of Graz programme (Sachprogramm Grazer Bäche)

Streams and flowing water bodies in urban areas tend to be neglected, and are no longer noticed by the local population. It is only with a flood event that they return to people's memories.

Documentation on flooding events in Graz can be traced back to the year 1573. In the past 30 years –



Floodwaters in Graz

and particularly in 1975, 1989, 1996 and 2005 – Graz was repeatedly the victim of major floods. The damage caused by the 2005 flood alone amounted to about 5 million euros.

These floods have led to a special programme called Sachprogramm Grazer Bäche (The Streams of Graz). The programme is a project of the Federal Ministry of Agriculture and Forestry, Environment and Water Management, the Provincial Government of Styria and the City of Graz, and is designed to run for ten years (2006-2015).

The programme has adopted a forward-looking approach. It seeks to ensure both the best possible protection against floods using technical measures and use state-of-the-art flood management from an early warning system to optimise disaster relief strategies.

The City of Graz has 52 streams and numerous small channels and ditches. They have a total length of about 270 kilometres, with 125 kilometres located within the urban area of the city. This means that only half of their entire catchment area of 140 square kilometres lies within the city.

In the past these streams were cheap and simple routes for the disposal of sewage and waste. As the municipal sewerage system developed these streams became increasingly built-up and narrow. Today, the streams are a mix of naturally flowing sections and concrete channels. Over time development has come closer to the banks of the streams and increased the potential flooding hazard.

Discharge measurements performed in 1997 showed that more than 1,000 buildings would be endangered

in the urban areas of Graz in the event of a flood with a return period of 100 years (referred to as HQ100).

The city has identified that the streams:

- are no longer able to fulfil their ecological functions, or they can fulfil them to a very limited extent only
- have an insufficient flood discharge capacity
- have limited value for the local population and do not offer space for recreational activities in the city
- are partly concealed in pipes and are partly fed into the public sewerage system.

To address these concerns, the programme has the following main elements:

- provide flood protection for risk zones in Graz based on a catalogue of measures, coordinated with spatial planning
- improve the ecological quality of the streams
- turn the streams and the adjacent space into recreational areas for the population, where they can reconnect with nature and improve their quality of life.

While the programme aims to protect vulnerable parts of the city up to an event of HQ100, space constraints do not permit this everywhere.

The following two examples show how streams and their catchment areas can be improved to prevent flooding.

2.5.1 The Schöckelbach Project

The Schöckelbach has a catchment area of about 34 square kilometres, is about 12 kilometres long (4.8 kilometres in the urban area of Graz) and flows into the River Mur. In 2005 water from the flooded Schöckelbach stream inundated the centre of the city district Andritz.

Currently the stream has the following characteristics:

- major space constraints: buildings and high-value infrastructure have been developed close to the stream and the necessary space to safely retain the floodwater is no longer available
- the partly elevated nature of the stream bed makes it impossible for the floodwater to flow back into the channel when it bursts its banks
- during hot summers the stream may run completely dry.

The main aim of the project is to at least maintain or extend the existing retention spaces/floodplains and

local discharge-improving measures (for example, widening the stream bed, raising the terrain and embankment level).

The construction stages include:

- planting the first section with around 850 suitable trees and shrubs
- sowing a flower meadow to create a colourful habitat, at least for the first years
- building a children's adventure playground where the stream's bed has been widened
- creating new habitats for fish, insects and birds using elements such as wood and rocks
- allowing the stream to develop its own channel in the zone where it has been widened, other than in exceptional circumstances (for example, in case of major bed load deposition).

It is also intended that four flood retention basins with a capacity of 300,000-500,000 cubic metres be constructed outside the urban area of Graz (currently at the planning stage).

Besides these active flood control measures, the following plans will be developed:

- water management plans
- flood forecast models, warning and alarm plans
- residual risk analyses and contingency plans.

The project also uses community engagement activities to inform the local population of the different projects and to raise awareness of the stream. Each individual who might be affected has to assume personal responsibility and should take protective measures such as constructing flood adapted buildings, using mobile flood-protection measures, preparing personal contingency plans and buying flood protection insurance.

2.5.2 The Gabriachbach Project

The Gabriachbach River has a catchment area of about 2.6 square kilometres, is about 6.8 kilometres long and flows first into the Andritzbach and then the River Mur. Along the Gabriachbach there are more than 30 residential buildings at risk of flooding, most of which were affected in the floods of 1989, 1996, 1998 and 2005.

In the year 2000, a flood control project for protection against a HQ100 event was formulated. The main aims were to address protective water management,



Green space acts as a retention basin for the Gabriachbach River

landscaping and ecological issues, and create a nearby recreation area along the watercourse. There have been two construction phases:

- build two flood retention basins with a total capacity of 40,000 cubic metres and open a section of about 120 metres of the river (complete)
- upgrade two reaches of the stream totalling 1.1 kilometres in length and establish a connection to the Andritzbach at the same riverbed level, which will allow unimpeded migration for aquatic organisms, particularly fish (planned).

While planning the retention basin 'Am Eichengrund', emphasis was placed on keeping the visual axes of the valley free. The natural vegetation along the brook was largely preserved and extends all the way to the dam. The dam slopes were kept as gentle as possible and connected to the surrounding terrain. Before the flood retention basin was built, the area was used as farmland (cultivation of field crops).

Landscaping in the first stage of construction involved planting about 1,200 woody plants which were native and suited to the site. This involved pupils of the local elementary school who were also taught about water ecology throughout the school year via various projects.

The project created a wet biotope, which provides a habitat to numerous plant and animal species, at the lowest point of the flood retention basin. It is replenished permanently with drainage water. The

recurrent filling of the basin has not caused any problems to date.

3 Further information

Green Net of Graz

<http://gis.graz.at/cms/ziel/1515118/DE/>

Standards for open spaces

www.graz.at/cms/beitrag/10080561/1552913/

Revitalising inner city courtyards

www.graz.at/cms/ziel/1248185/DE/

Streams of Graz

<http://gis.graz.at/cms/beitrag/10057802/1066929/>

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Green and Blue Infrastructure Exemplars, City of Graz



The GRaBS Project
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