



## 018530 - SWITCH

### Sustainable Water Management in the City of the Future

Integrated Project  
Global Change and Ecosystems

#### **DELIVERABLE TASK 2.2.1a: EVALUATION OF CURRENT STORMWATER STRATEGIES**

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## BRIEFING NOTES

<p><b>Evaluation of Current Stormwater Strategies</b> Prepared by J B Ellis, L Scholes, D M Revitt with contributions from P Sharp, J Eckart, W Holste, H Langenbach, N.Nascimento, L Heller, J-R Champs and S Knauer.</p>
<p><b>Audience</b></p> <p>Information base for operational management and strategic policy of urban surface water drainage infrastructure within SWITCH demonstration cities. Of relevance to municipal drainage engineers, urban water resource managers, regulatory agencies, drainage infrastructure planning at local/regional levels and vested interest groups/NGOs. Also forms basis for future SWITCH work on institutional mapping and drainage management as well as being of interest for LA collaboration.</p>
<p><b>Purpose</b></p> <p>The review identifies the legislative/regulatory structures and decision-making frameworks for urban drainage infrastructure currently operating within three SWITCH demonstration cities (Birmingham, UK; Belo Horizonte, Brazil and Hamburg, Germany). The review aims to identify and compare the principal legislative drivers and organisational structures that currently deliver surface water drainage under differing national and federal managing agencies. A principal objective was the evaluation of limiting factors and degree of stakeholder engagement operating in the decision-making process and structural arrangements as well as examining strategic policies taken to address the administrative/legislative issues involved in moving towards a more integrated, sustainable framework for drainage infrastructure management.</p>
<p><b>Background</b></p> <p>The report provides a background context for the regulation, organisational frameworks and strategic policy base associated with urban surface water drainage and the basis of regulatory targets and actions at federal, national/regional and local levels. The global predominance of integrated catchment scale approaches to future regulatory controls and planning is examined in the context of the EU Water Framework Directive (WFD) for European states and the “<i>Saneamento Ambiental</i>” programmes in Brazil. Three separate appendices provide detailed information on the generic legislative and strategic structures for the control and management of urban surface runoff in Birmingham, Belo Horizonte and Hamburg. These appendices separate out the hierarchical structures, duties and responsibilities deriving from, or operating at, federal, national/regional and local levels. The particular relation of drainage duties to urban land use planning is highlighted as a major issue of concern in all three demonstration cities.</p>
<p><b>Potential Impact</b></p> <p>The evolution of fragmented, unclear powers and responsibilities and institutional arrangements for urban surface water drainage is common to all three SWITCH demonstration cities. Legislative and organizational frameworks are principally structured for the control and management of wastewater flows and point discharges rather than for non-point, diffuse urban surface runoff. Urban flooding has traditionally been attributed to upstream land drainage and riparian overland</p>

flows rather than to the surcharging of hydraulically restricted surface water sewers. At the same time, surface water discharges have been traditionally perceived as unpolluted flows only requiring attenuation and storage facilities to protect downstream channel and habitat regimes.

The increasing awareness of the issues associated with impermeable surface water flooding and associated stormwater pollution is resulting in a re-thinking of legislative and regulatory controls. At the same time, the growth of integrated catchment philosophies for water resource management and the requirement for wider stakeholder participation in infrastructure decision-making processes, is placing increased emphasis on joined-up thinking, institutional interactions and enabling legislation. It is therefore imperative that there is a clear understanding of the barriers, limitations and uncertainties associated with prevailing institutional structures and strategic legislation which inhibit the delivery of sustainable solutions. Such understanding is essential to the identification, introduction and implementation of best practice. Until these institutional, impediments and legislative shortcomings are addressed, the technical uncertainties and stakeholder motivation required for successful and acceptable integrated urban drainage will not be achieved.

#### **Issues**

It is clear from the review that regulatory practice throughout the world recognizes the need for appropriate legislative and administrative frameworks to address the problems associated with impermeable surface runoff. However, non-point diffuse sources of urban flooding and pollution have only been recently recognized in contrast to the long standing arrangements and responsibilities established for the control and management of point discharges such as combined sewer overflows (CSOs). Thus the regulatory and structural frameworks for oversight and management of the former wet weather runoff flows are much less developed. It is clear that there is considerable fragmentation of mandatory responsibilities for surface water drainage with the boundaries of individual organisational duties being unclear; there are considerable “permissive” obligations and understandings which are frequently overlooked or ignored in practice.

Major barriers to the adoption of alternative technologies and integrated approaches are risk aversion and legal liability as well as the lack of reactive stakeholder engagement. The relationship between urban land use planning and surface water drainage has traditionally not been considered from a strategic, integrated policy perspective with the result that non-point discharge control has tended to develop in a piece-meal and unsustainable manner. The evolution of hierarchical and dispersed responsibilities (as distinct from mandatory duties) at various administrative and governmental levels has historically limited an integrated, holistic catchment-based approach.

The need for risk-based evaluation of surface water flooding and pollution is fundamental for the prioritization of operational funding and rehabilitation investment as well as asset management. Such evaluations are necessary for developing and implementing appropriate programmes of measures (PoMs) to achieve the objectives of integrated catchment management. However, there are common issues arising from the problem of delivering multi-functional schemes

through functional budgets as well as issues associated with the integration of local and regional/national planning processes.

### **Recommendations**

It is clear that surface water flooding and pollution cannot be looked at in isolation but must be addressed within the wider context of sustainable urban water management. This includes dealing with water demand management, pollution caused by runoff and the impact of flows downstream of the urban area as well as with the issue of both local community and environmental quality-of-life. Stormwater is now becoming viewed as an interdependent component of the larger urban water cycle and ecosystem.

There is increasing evidence of the establishment of wider stakeholder forums and consultation groups to facilitate community action planning for urban drainage management. However, the increasing public and wider stakeholder engagement is ahead of best practice on the ground as well as in terms of the development of robust analytical tools and theory to support the practice. This could destabilize the collaborative relationships and make them politically charged and thus the supporting theory needs developing and testing.

A clear priority need is to focus stakeholder engagement on the interface and interaction between urban land use activities and water management needs. This is fundamental to achieve sustainable and integrated water resources opportunities. This needs encouragement of engagement opportunities arising from:

- development of policy documents, guidelines and codes of practice
- preparation of strategic local development plans (Stormwater Management Plans; SMPs) and infrastructure provision
- public involvement in planning consents
- negotiations of agreement between authorities, agencies, organisations and developers.

In developing integrated urban catchment management, it will be necessary to deliver integration through a geographically overlapping, functional mosaic of legislation, institutions and organizations.

## ABSTRACT

The increased incidence of intra-urban flooding and pollution associated with impermeable surface runoff during wet weather conditions has led to widespread review and amendment of prevailing legislative and administrative frameworks to address the problem. Previous SWITCH deliverables (D2.1.1a, D2.1.1b, D2.1.2) have demonstrated that the basic issues of stormwater runoff are common to all demonstration cities and this current deliverable (D2.2.1a) is intended to review the administrative, organisational and legislative frameworks which deliver strategic drainage infrastructure practise in Birmingham, UK, Belo Horizonte, Brazil and Hamburg, Germany. The legislative and strategic structures governing the drainage of urban areas in each of the demonstration cities is described and examined in detail. Particular emphasis has been placed on identifying stakeholder groups and their responsibilities together with the structure and role of the planning system in relation to flood and pollution risk assessment and drainage provision.

The analysis demonstrates common sources of tension between local and central government authorities in strategic provision of urban drainage infrastructure schemes. There are similar issues in terms of identifying clear specifications and boundaries to institutional responsibilities and the translation of national/state legislative and administrative instruments down to the local municipal level. There are also common problems associated with delivering multi-functional drainage schemes through functional budgets as well as similar issues in relation to the development of strategic integrated planning processes to deliver sustainable drainage infrastructure. One apparent outcome of wider stakeholder participation in a more consultative planning process, is a growing emphasis on intra-urban flood control over receiving water quality.

A clear priority of future strategic approaches emerging in all demonstration cities, is an increasing focus on the interface (and inter-action) between urban land use planning and surface water management. The application of sustainable, best practice source control drainage for greenfield/brownfield development sites has a growing acceptance in all cities, but approaches and decision-making frameworks and design guidance for retrofit opportunities in existing high-density urban areas are still very much in their infancy and only weakly, if at all developed.

There is a growing recognition in all demonstration cities of the need to develop sustainable urban drainage within the context of (legislatively driven) integrated, catchment-based approaches. However, this strategic imperative serves to highlight the problems and tensions associated with differing objectives, responsibilities and budgetary priorities at local and regional/national levels. Nevertheless despite these reservations and limitations, it is clear that stormwater is becoming viewed as an inter-dependent component of the wider urban water cycle and there is a growing recognition that administrative/organisational planning structures for drainage infrastructure provision need to be delivered in a more integrated, holistic manner.

# 1 The Need for Regulation and Strategic Approaches

Regulatory practice throughout the world now recognises the need for legislative and administrative frameworks to address the environmental problems caused by rainfall-runoff from impermeable urban surfaces. However, the push for increased urban densities has also received central government endorsement in many nations without sufficient attention being paid to the impact of runoff discharges from these generally highly impermeable surface areas upon receiving water bodies. The problem of wet weather flows from combined sewer outfalls (CSOs) has long been recognised and subject to relevant and frequently strict standards and regulations. Such point sources have attracted considerable rehabilitation and maintenance investment over the past decades. The problems associated with separately sewered surface stormwater runoff however, have only been more recently recognised and the regulatory frameworks for such diffuse, non-point sources are variable and less well developed. Far too often the management of water supply, wastewater and stormwater are regarded as separate entities by national water industry structures and decision-making processes.

There is now little if any doubt about the flood and pollution potential of stormwater discharges to receiving water bodies in terms of physical, biochemical and ecological damage as well as community degradation of aesthetic and recreational benefits. In addition, most current regulation, standards and guidelines have been developed for conventional hard engineered urban drainage systems and as a result are not always appropriate for alternative, innovative design approaches which frequently adopt an integrated approach towards urban water resource management. Conventional approaches and, in particular drainage regulations can therefore be seen to lag behind leading edge best practice.

The current structures of water and planning authorities, government departments, municipalities and private industry have been largely shaped for the delivery of conventional water services and tend to have a strong technocratic framework for decision-making. They are often complex, fragmented, semi-autonomous and can differ at regional/local levels in terms of their decision-making processes. The application of source control technologies and best management practices (BMPs) within integrated management approaches often requires more flexibility and wider stakeholder involvement, which can present a major barrier to their adoption in legislative and regulatory terms. Tools and guideline processes for the selection, assessment and adoption of differing BMPs are considered by many to be insufficiently developed and tested. The variety of stakeholder interests required for their assessment and adoption can mean that administrative frameworks can be unwieldy as well as many decision-makers lacking experience in their use with few reported studies of their implementation available to draw on.

A major barrier to the adoption of alternative technologies and approaches is that of risk aversion and legal liability. Non-conventional systems tend to create new risk profiles that normally are not consistent or even compatible with existing organisational and planning structures. The issues of unclear regulations and guidelines as well as a possible lengthening of the development approval process, act

as conservative forces which can be difficult to address and overcome. In addition, the interpretation of codes of practice and guidelines can vary between regional offices of the same national regulatory agency, and this can act as a disincentive to developers. The relationship between urban drainage and land use planning has traditionally not been considered from a strategic, integrated policy perspective with the result that non-point discharge control has developed in a piece-meal and unsustainable manner.

## **2 Regulatory Targets and Levels**

Regulatory and administrative frameworks operate at national, regional and local levels and it is important that strategic environmental objectives have similar operational interpretations of how the outcome targets will be delivered at each of these organisational levels. This is best achieved through holistic, integrated policies developed at the catchment scale and which appropriately identify the spatial and temporal scales of receiving water impacts as well as the uncertainty and risks associated with control and management measures. Table 1 provides a brief outline of regulatory targets and priorities for the urban aquatic environment and the need for differing actions at varying levels.

It is evident that any regulatory regime must act within prevailing socio-economic conditions and regulatory agencies must seek to ensure that the regulated sector(s) are aware of and appreciate the legislative and administrative frameworks. Clearly, the more closely the socio-economic drivers are aligned and compatible with regulatory practice, the easier and lighter the management controls need to be. There should also be a hierarchical preference for regulation which is most cost-effectively targeted at source control (Figure 1).

**Table 1 Regulatory Actions and Organisational Levels**

<b>Environmental Problem</b>	<b>National/Federal Action</b>	<b>Regional/Local Action</b>	<b>Comment</b>
Urban surface water drainage and land use planning	Strategic policy and planning requirements; Financial incentives (and penalties) e.g stormwater tax on impermeable surfaces	Enforcement; Codes of practice; Mandatory guidelines; General Binding Rules (GBRs)	Need active community and other stakeholder involvement at local level. Target to Minimise Directly Connected Impermeable Area (MDCIA).
Illegal connections	Regulation for controlled activities.	Enforcement; Ordinances; GBRs	Liason between local authority and wastewater utility (with involvement of Environmental Health Departments)
Pollution from site construction	Regulations for development site controls (Including licences, permits etc)	Enforcement; Codes of practice; Licences/Permits	Use of on-site BMPs
Environmental damage from surface water drainage (including flooding)	Strategic policy and guiding legislation for flood and water quality. (Including permits, consents, licences etc); Regulation for controlled activities.	Setting receiving water objectives/targets; Enforcement; Codes of practice; guidelines/byelaws; GBRs	Also needs planning inputs and holistic, integrated approach to water resource management at both spatial and temporal scales; Community awareness
Chronic in-stream pollution	Legislation for persistent, low level discharges; Restrict usage rates and product substitution e.g Pb, Cd, PPCs	Inspection and policing of likely pollution sources; Company registration; BMP retrofitting	Identification of priorities and polluting substances; Capital and O&M programmes for severe problems
Oil & Chemicals	Oil & Chemical storage and disposal regulations	Company registration; Awareness campaigns, SME support and guidance; BMP retrofitting.	Need to continually engage relevant sectors e.g car washing/steam cleaning; Leaflets and signage campaigns.
Toxic traffic emissions and vehicle loss/wear	Legislation for traffic management; air emissions; GBRs; Mandatory guidelines; codes of practice	Traffic management; Driver awareness campaigns; BMP retrofitting.	Need for driver behavioural campaigns.

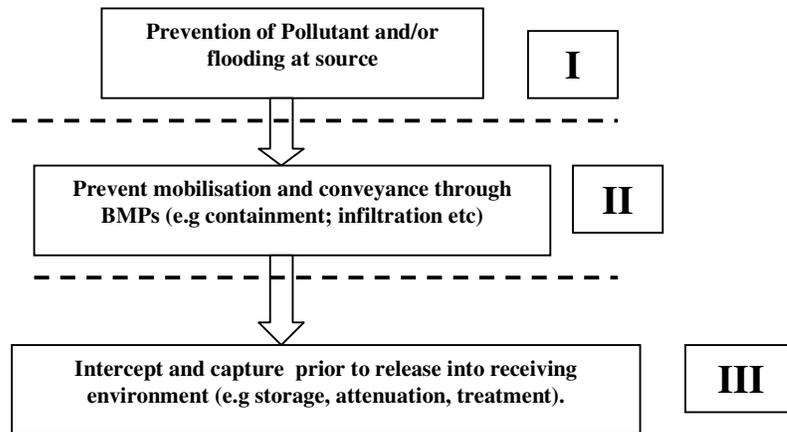


Figure 1 Regulation Hierarchy for Urban Stormwater Management.

### 3 Catchment Scale Approaches to Regulatory Planning

#### 3.1 The EU and the Water Framework Directive

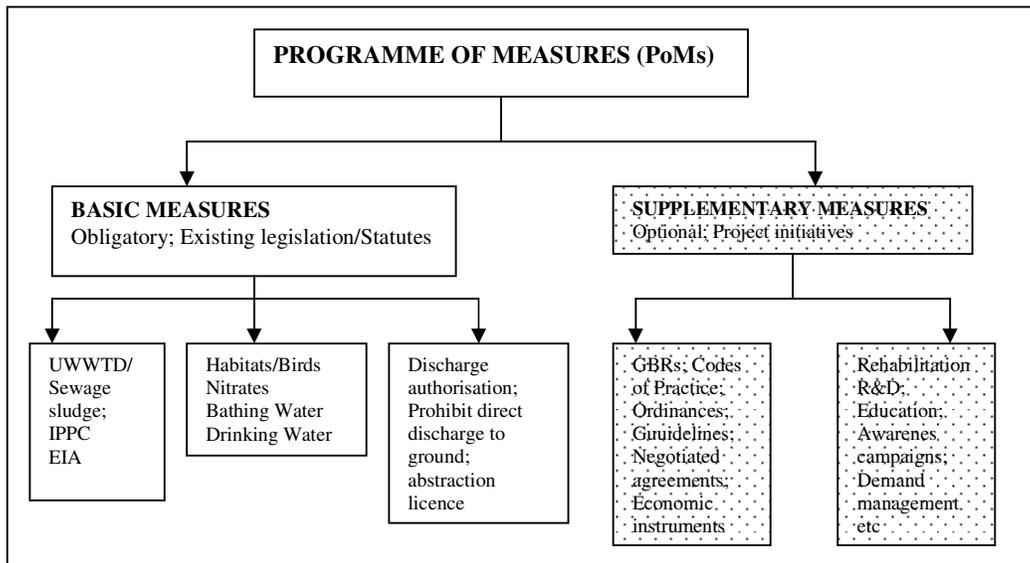
The EU Water Framework Directive (WFD) sets major and strategic policy goals for the future direction and implementation of urban drainage in all European member states. It will require the production of integrated catchment-based (or River Basin District, RBD) plans for dealing with diffuse sources, including those generated within urban areas. The legislative context of the WFD can provide substantial opportunities for the consideration and inclusion of alternative source control BMP/SUDS approaches within future urban land use planning programmes. The key objectives which are of relevance to urban surface water drainage as set out in Article 1 of the Directive include:

- protection and enhancement of artificial and heavily modified water bodies, with the aim of achieving “good ecological potential” (GEP) and “good” surface water chemical status within 15 years
- prohibition on direct polluting discharges, such as urban runoff, to groundwater
- reversal of any anthropogenically induced significant and sustained upward trend in particular pollutants.

The emphasis placed on diffuse pollution in the WFD is of particular relevance to the problem of regulation of urban surface water drainage as stated in:

- Article 11.2(h); “for diffuse sources liable to cause diffuse pollution, measures to prevent or control the inputs of pollutants” are required
- Article II requires the identification of “significant sources” of diffuse pollution
- Annex VII states that “estimates of diffuse pollution” are required in River Basin Management Plans (RBMPs)
- Annex IV requires operational monitoring for “water bodies at risk from diffuse pollution”.

Key administrative requirements within the WFD (under Article 13), will be the production of RBMPs, and under Article 11 an associated Programme of Measures (PoMs) which will be the main delivery mechanisms to achieve the Directive’s ecological objectives. Most EU member states are already familiar with water management strategies developed within the context of river basin planning. Following initial risk assessment and River Basin District (RBD) characterisation based on land use activities (see Annex I for an example of this Risk Assessment approach), waterbody classification based on ecological and chemical status will be identified, and the competent regulatory authorities must then use this information to develop an integrated PoM. Figure 2 illustrates the structural requirements for such a programme and in many member states such as the UK, urban surface water discharges might be principally dealt with under Supplementary Measures utilising General Binding Rules (GBRs) with accompanying codes of practice and guidelines. In the case of the UK, these would build on the existing Pollution Prevention Guidelines (PPGs) and Planning Policy Statements (PPSs).



**Figure 2 EU WFD RBMP Programme of Measures.**

The Scottish Environmental Protection Agency (SEPA) estimates as much as one-third of regulatory controlled activities are likely to fall within the GBR tier of control which are intended for “low risk” activities such as those generally posed by urban drainage. It is also the case that the worst urban receiving water reaches in member states might initially be designated as “*heavily modified water bodies*” (HMWBs) which would attract a reduced criteria of “*good ecological potential*” (GEP) rather than a requirement for a more stringent “*good ecological status*” (GES) classification.

As indicated in both the Birmingham (Appendix I) and Hamburg (Appendix II) descriptions of strategic regulatory frameworks and administrative structures, the German and UK agencies and organisations already have a basis for regional and catchment scale planning which incorporates elements of both Basic and

Supplementary Measures for the management of urban drainage. Nevertheless, there are clearly tensions between the federal/national levels of regulation and the operational delivery of infrastructure programmes at the local municipal level. The organisational distribution of responsibilities in respect of urban surface water drainage will undoubtedly become clearer as the RBMP process proceeds (Table 2).

**Table 2 WFD Timelines and Regulatory Requirements.**

<b>YEAR</b>	<b>Requirement</b>
2005	<ul style="list-style-type: none"> <li>• RBD pressures and impact characterisation (Article 5 risk assessment)</li> <li>• Identification of HMWBs</li> </ul>
2007	Interim overview of significant water management issues within RBDs
2008	Publish full RBMP draft for consultation
2009	<ul style="list-style-type: none"> <li>• Final RBMPs</li> <li>• Designation of HMWBs</li> <li>• Environmental objectives</li> <li>• PoMs</li> <li>• Monitoring networks</li> </ul>
2012	PoMs for improvements to be fully operational

The expectation is that much of the operational implementation of the PoMs in respect of urban drainage improvements for flood and water quality control will be primarily within the remit of local municipalities, with federal/national levels setting strategic directions and objectives for the master planning and decision making process. This devolution of urban planning guidance and control to the regional/local level is a feature of all the demonstration cities. However, the capacity and performance of the urban sewer network (for both stormwater and wastewater), has been unable to date to achieve central stage in the regulatory planning process.

### ***3.2 Integrated Catchment “Saneamento Ambiental” Approaches in Brazil***

Water and sanitation facilities present a major concern for Brazil with some 10 million households being affected by the absence of an adequate water system, although provision in Belo Horizonte is relatively good by comparison with the city having a contracted concession to the private sector through a basic state sanitation company (CESB). This means that the institutional and technical organisation of water and sanitation systems do not directly respond to the directives of urban policy which fall under municipality authority. The service concession essentially pursue a sector-based strategy which does not necessarily heed municipality master planning and determine their investment plans autonomously without a requirement for consultation with the municipality. With increasing numbers of urban poor, rising water and sanitation costs are effectively excluding increasing numbers of users from the public system leading to increases in the use of alternative supply modes such as well drilling. In these poorer urban areas there has also been an increase in illegal

water and stormwater connections and it is difficult for companies to identify and combat such illicit connections.

This has significance for both public and receiving water health and sustainability as well as increasing flood potential resulting from reflux of contaminated water into local channels. This raises the issue of the appropriate technologies and systems management in respect to pollution removal whereas the emphasis to-date has traditionally focussed on construction and enhancement of treatment plant capacity. However, better receiving water quality cannot be guaranteed because there is no real control of non-point source pollution which results from uncompleted, poorly maintained and antiquated systems of wastewater collection and from rainwater systems which are heavily contaminated by untreated household and industrial misconnections.

The new Ministry of Cities water bill will create a national sanitation system which will require the production of a strategic master plan involving local community input and which will define the relative roles and responsibilities of the public and private sectors in the management of water-based services. This will give much greater powers to the municipality which will govern the form of service delivery. This model of urban water resources management will be based on an integrated vision of water uses at the catchment level and will enable cross-subsidisation among different uses and users. Thus integrated, holistic measures for source control can be combined to manage downstream flooding and water quality. However, there is an absence of institutional integration for services management and water resources management at present and a critical lack of integration at the operational level. The strategic policies and programmes for “*saneamento ambiental*” (or integrated water resource and solid waste management) will need to have common objectives, plans and priority targets set within the context of the catchment scale. This is currently missing from the structural organisational and legislative framework. The 20<sup>th</sup> article of the 2001 Law which established a Municipality Sanitation Law (FMS) and Plan (PMS) for Belo Horizonte, identifies the “*water basin as the planning unit for actions related to sanitation services*” and set up a cross-sector municipality working group to elaborate a Drainage Master Plan (PDD). The integrated urban water management grouping (DRENURBS) is associated with both the PMS and PDD and is strongly catchment based in terms of its operational remit as well as being structured as a wide participatory stakeholder executive unit.

It is apparent from the Belo Horizonte (Appendix III) situation that the catchment scale unit therefore also provides the fundamental basis for the Brazilian regulatory framework with the various river basin agencies serving executive administrative functions. The new law represents a first step towards the construction of integrated management and the “*saneamento ambiental*” plans will need to be compatible with river basin plans and with the municipality master plan development planning. The city council will have decision-making oversight of water and sanitation services and will be responsible for strategic prioritisation within the municipal water and sanitation policy. However, they will be required to collaborate closely with the private sector companies and the public in developing, delivering and evaluating service provision. A major challenge will be to articulate sanitation with low income housing policies within sub-catchments of the city territorial boundaries.

## 4 Conclusions

The same issues of lack of clarity in terms of institutional responsibilities and the translation of legislative and administrative instruments to the local municipality level are identified in Brazil (see Appendix III) as in Europe (see Appendices I and II). One source of tension between central government and local authority is likely to be that of financing integrated urban drainage infrastructure schemes. Economic analysis is frequently undertaken under national economic efficiency terms and not necessarily in terms of the magnitude or severity of the local impacts of flooding and pollution or their downstream effects.

There is also the problem of delivering multi-functional schemes through functional budgets. Similar issues exist regarding the integration of the local and regional planning process with the development of sustainable drainage infrastructure. The new Brazilian 2005 public consortium law will be severely tested in terms of the need for several municipalities to agree and approve regional common planning and regulatory approaches within a catchment scale. The organisational consortia should provide however, a more open and public collaborative structure similar to the Flood Liaison Advice Groups (FLAGs) constituted within Scottish regulation to facilitate community action planning for urban drainage management. However, these Brazilian consortia are still in very formative stages and their initial priority concerns may legitimately focus on sanitation and water supply problems rather than on urban stormwater runoff. Unfortunately, the increasing public and wider stakeholder engagement in urban service provision is ahead of best practice on the ground as well as in terms of the development of robust analytical tools and theory to support the practice. This could destabilise the collaborative relationships and make them politically charged. It is also the case that the stormwater strategic plans of the local municipality have legislation and regulatory guidelines which emphasise the importance of intra-urban flood control over receiving water quality.

One clear priority need that emerges from a review of the legislative, administrative and strategic frameworks of the various demonstration cities is that of focussing stakeholder engagement on the interface and inter-action between urban land use and water management needs in order to achieve sustainable and integrated water resource opportunities. This can be encouraged through engagement opportunities arising from:

- development of policy documents, guidelines and codes of practice etc
- the preparation of strategic local development plans and infrastructure provision
- public involvement in planning consents
- negotiations of agreements between authorities, agencies, organisations and developers.

The concept of “*managed retreat*” as sacrificial flood (or water quality) protection along shorelines is now an accepted land management approach in coastal areas. However, its strategic application for urban areas is much more problematic even where the sacrificial area might constitute only temporary flood “meadows” on existing parks, playing field or urban open space. It is undoubtedly politically contentious and could lead to planning blight, with compulsory “purchase” powers by

local or regulatory authorities being fraught with difficulties. The same would be true if using residential cul-de-sacs and other low-trafficked suburban streets as temporary storage “ponds” during rainfall events. Such land management approaches may comprise best practice for stormwater runoff control when integrated with BMP retrofit for the more densely populated inner urban areas of major metropolitan cities.

In delivering integrated urban catchment management, it will be necessary to deliver integration through a geographically overlapping, functional mosaic of legislation, institutions and organisations and how this will be done is not at all clear in any of the demonstration cities. Equally, integration and multi-functional urban drainage schemes will need to be delivered through functional budgets, and reaching agreements on cost apportionment will not be straightforward. This also becomes more critical in terms of establishing lines of accountability. It is nevertheless apparent that restoration and enhancement targets for urban receiving waters are embedded in both Brazilian and European regulation and that wider collaborative stakeholder consultation will form an essential component of future planning decision-making processes. It is also apparent that future infrastructure planning frameworks within Europe and Brazil are being developed with a view towards sensitising more integrative and holistic approaches to urban water resource management. Stormwater is now becoming viewed as an interdependent component of the larger urban water cycle which must also consider water supply, wastewater and solid waste disposal as well as air pollution and traffic management as further vectors of the same life cycle regulatory framework.

## **Appendix I USWM in Birmingham: legislative and strategic structures**

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## 5.1 Legislation and Regulation of Urban Surface Runoff

In the UK, legislation governing the drainage of urban areas can be traced back over the past two centuries and has become established in complex statute and case law. This has given statutory and permissive powers to a variety of organisations, stakeholders, land owners and the public at large. It is also complicated by the regulatory process where responsive bodies may be public, private and regulated or private and unregulated. The principal stakeholders for urban drainage in England & Wales (Scotland has separate organisations and powers) are identified in Table 1 which also provides a summary of their flood management responsibilities (see also Chapter 3 “Planning SUDS” of the CIRIA, 2000, “*Sustainable Urban Drainage Systems: Design Manual for England & Wales*”).

**Table 3 Major Stakeholders Responsible for Urban Drainage**

ORGANISATION	FUNCTION	RESPONSIBILITIES
<b>Local Authorities (LA's)</b>	Drainage, flood alleviation and regulation of watercourses (non-river), apart from designated main rivers or more recently Critical Ordinary Watercourses (COW's).	Powers under the Public Health Act 1961 and particular responsibilities in drainage districts (as set out in Land Drainage Act 1991). Major incident coverage and recovery
<b>Highway Authorities (HA's)</b>	Responsibility to keep urban roads (except trunk roads and motorways) free from flooding and to make satisfactory provision for highway runoff.	Highways Act 190 and Land Drainage Acts 1991, 1994. Also responsibility for planning for, and managing recovery operations following major flood events under the Civil Contingencies Act 2004.
<b>Internal Drainage Boards (IDB's)</b>	Not for profit Supervisory duties over flood defence and drainage for low-lying land. More recently IDB's have been audited by DEFRA consultants and they are now being encouraged to amalgamate or join in Commissioner Groups to provide for administrative efficiencies and service improvements.	Land Drainage Acts 1976, 1991 and 1994, covering O&M, conservation and revenue-raising. Responsibility for drains, dykes and ordinary watercourses in low-lying land. Funding is through drainage levies via the Local Authority rates. Operate Land Drainage Bylaws through which they have a diverse range of powers over riparian and ordinary land owners.
<b>Water Companies (Sewerage Undertakers) (WatCO's)</b>	Responsibility for providing and maintaining a public sewerage system including sewers carrying surface water from impermeable building areas.	Water Industry Act 1991 and 1999 obliging companies to provide and maintain a drainage and sewerage system to ensure effective area drainage and to authorise and charge for discharge of trade effluent. Regulated by OFWAT
<b>Environment Agency (EA)</b>	Aims to protect and enhance the environment and make positive contributions towards sustainable development. Responsible for O&M and improvement of flood defences and 24 hour flood warning service with emergency response. Supervisory duty by consent over Local Authorities and IDBs. Reports to DEFRA on high level targets and sustainability indicators. The EA is primarily funded through government grants mostly through DEFRA and LA rates.	Powers and duties set out in Environment Act 1995 and related legislation. Regulation and executive action on water resources, land, water and air quality, flood and coastal defence, flood warning, waste management, navigation, conservation, fisheries and recreation. Responsibility for designated main rivers and COWs. (since March 2005) and production of Flood Plans and Warning systems.
<b>Department for Environment, Food and Rural Affairs (DEFRA)</b>	Sets central government policy (and transposed EU legislation) and provides strategic directions.	Formed by central government and reports directly to ministers. Has overall policy responsibility for flood risk and 2004 “ <i>Making Space for Water</i> ” strategy promoted a holistic approach to flood risk management. Is a fully Government Funded Body .

Landowners have responsibility for drainage within the curtilage of their property boundary with riparian owners having additional responsibilities for the maintenance and effectiveness of drainage channels and watercourses along their property boundaries.

In addition to drainage responsibilities, Local Authorities are also responsible for planning and emergency services. Planning responsibilities cover various levels e.g. district, county and unitary. Regional Planning Bodies can also have an important role to play in the planning process. However, as the principal planning authority, the local authority has the responsibility for the production and management of regional spatial strategies and local development plans. This process is key to ensuring that the spatial aspects of integrated urban drainage are properly accounted for; such plans should fully address flood risk and urban stormwater management. Local authorities are also often the highway authority with responsibility for local roads, public landscaping and local land drainage.

New development is controlled by local authority planning departments with allowable discharges and consents negotiated with the Environment Agency and appropriate water company (sewerage undertaker). In addition, local authorities have the role of implementing Agenda 21 and developing strategies to secure sustainability at the local level. Consideration of sustainable drainage systems is thus being increasingly included and considered in local development plans and regional planning guidance particularly following the very recent issuing of Planning Policy Statement (PPS) 25 "*Development and Flood Risk*" which replaces the former Planning Policy Guideline PPG 25. However, although more robust than the former PPG25 it should be noted that this is still at present only a guidance document carrying no mandatory or enforcement requirements although Local Planning Authorities must now consult the Environment Agency for England and Wales (EA) on all significant developments. There are intentions to extend these planning arrangements for new developments to take into consideration the implications of climate change with water recycling and use of renewable resources. The EA, in developing proposals for flood protection/ management schemes, requires a sensitivity allowance of 20% on design flood levels to accommodate climate changes.

Whilst the ownership and maintenance of conventional piped drainage networks is defined in "*Sewers for Adoption 6<sup>th</sup> Edition 2006*" (1996, Water Services Association), most BMPs systems can be considered to be either drainage or landscape elements and there is no clear guidance on responsibilities for their operation and maintenance. A particular legislative issue is that of the "right to connect" new building drainage to the public sewerage system as provided under Section 106 of the Water Industry Act which has been cited as a major inhibition to the provision of BMPs. The UK Water Regulator, OFWAT is currently considering the possible re-definition of a "sewer" and "drain" under the Act so that open surface water systems such as swales, infiltration trenches, wetlands etc., may be considered to be a "sewerage asset" for potential adoption purposes by the water companies (sewerage undertakers). A trial framework agreement on adoption, duties and responsibilities for BMP systems has been drawn up and implemented by the Scottish Environmental Protection Agency (SEPA) under the Water Environmental and Water Services (Scotland) Act 2003 for Scotland and a similar framework agreement is in consultation within England & Wales.

A generic outline framework for the regulatory management of urban drainage in relation to the position and responsibilities of a unitary or local authority such as Birmingham City Council is given in Figure 3. The specific responsibilities of DEFRA and the Highways Agency are not included in this diagram and the role of riparian and other landowners is also excluded. It is also the case that Water Companies and Internal Drainage Boards are currently not statutory consultees in the planning process. However, the powers of the EA have changed with the introduction of PPS25 which gives the Agency a statutory consultee role to all significant development proposals.

Figure 4 provides an outline of strategic planning legislation for urban development within England & Wales and the general detail of stakeholder involvement in the planning approval process is given in Chapter 3 (*Planning SUDs*) of the CIRIA 2000 Design Manual.

### **5.1.1 Birmingham City Council and Surface Water Management**

As part of its responsibility for surface water and land drainage, Birmingham city council provides a policy statement on its strategic approach to, and statutory responsibilities for, flood defence (see [www.birmingham.gov.uk](http://www.birmingham.gov.uk)). This public statement is part of the city council responsibility for assessing flood risk within their area and plans for reducing and managing such risks as required under government targets. A stated objective within the policy statement is “*to encourage the provision of adequate, economically, technically and environmentally sound and sustainable flood defence measures*”. In addition, to “*social and/or economic benefits*”, this objective will also “*take account of natural processes*” in “*accordance with best practice*”. This document is likely to be re-visited shortly in the light of recent changes in Planning Legislation, the introduction of PPS25 and the widened responsibility of the EA in respect of Critical Ordinary Water Courses within the City.

However, all flood defence work is undertaken under permissive powers which means that Birmingham City Council is not obliged to carry out such works on their 95 km of critical ordinary watercourses (COWs) or 45 km of “non-river” or less distinct ditch courses for which they have operating authority. As noted in Table 3, the responsibility for COWs now rests with the EA. The River Tame and River Cole (between Cole Hill Lane and the city boundary adjacent to Millfields) are designated “main” rivers and thus fall with the direct responsibility of the Environment Agency. It also should be noted that there are no IDBs (see Figure 3) operating within the council’s area. Under Section 3.8 of the council Policy Statement to reduce and manage the flood risk, the council, acting as the relevant planning authority, have adopted PPG25 (since 2<sup>nd</sup> October PPS25) as the key government guidance for development. This guidance “*includes measures for ensuring sustainable urban drainage systems to control surface water runoff*”. The Policy Statement (Section 4) also recognises the “*need to work in partnership with central government and other operating authorities*” as well as interacting with the public to minimise flood risks and damage.

This latter requirement for wider public and community involvement in the Sustainable Management of Urban Rivers and associated Floodplains was central to the SMURF project ([www.smurf-project.info](http://www.smurf-project.info)) which had a Birmingham base. The project is concerned with sustainable land use planning and water management within the Tame catchment and the development of two small-scale demonstration sites at Perry Barr. The main aim of the SMURF project was to develop a methodology for improved land use, planning and water management in a heavily urbanised environment and thus does have strong relevance to the current SWITCH project.

The generic framework for strategic planning outlined in Figure 4 is that which came into force in England & Wales in September 2004 under the Planning and Compulsory Purchase Act, although it was not formally adopted by Birmingham City Council until October 2005. Under this new planning system, the city council is required to develop and implement Local Development Frameworks (LDFs; see Figure 5), containing a range of Development plan Documents (DPDs). The general structure and components of the planning system and its relation to flood risk assessment is given in Table 4.

**Table 4 The Structure of the Planning System and Relation to Flood Risk Assessment**

Planning Document	Flood Risk and Water Management
Planning Policy Statement (PPS)	PPS25: “ <i>Development &amp; Flood Risk</i> ”
Regional Spatial Strategy (RSS)	Regional Flood Risk Assessment
Local Development Plan (LDP) <ul style="list-style-type: none"> <li>• Core strategy</li> <li>• Proposal maps</li> <li>• Area development plan</li> <li>• Site specific plan</li> </ul>	Strategic Flood Risk Assessment and Surface Water Management Plan
Supplementary Planning Documents	Supplementary planning guidance documents (including SUDS)
Development Control	Site specific flood risk assessment

The Planning and Compulsory Purchase Act 2004 (‘the 2004 Act’) makes a number of significant changes to the planning system, the most significant of which is a new development plan system that is less complex, more accessible and actively engages the community and stakeholders in the plan making process. The 2004 Act has brought about some important changes to the development plans system. The old system of Local Plans and Structure Plans are replaced with Local Development Frameworks (LDFs) and Regional Spatial Strategies (RSS). The West Midlands Regional Assembly is responsible for preparing the RSS.

LDFs can be described as a portfolio or ‘loose leaf’ series of documents, known as Local Development Documents (LDDs), which together provide the planning framework for development over a period of 15 and 20 years (Figure 5). There are a number of different types of documents that make up the Local Development Framework:

- Development Plan Documents (DPDs); these are statutory plans and are subject to independent examination by a Planning Inspector. DPDs replace existing local plan policies and proposals. DPDs may be in the form of a Core Strategy, the Proposals Map, Site Specific Allocations of Land and Area Action Plans (AAPs) as indicated in Figure 5;

- Supplementary Planning Documents (SPDs); these provide further details on the policies and proposals and are not subject to examination. SPDs may be in the form of design guides, found in the DPDs;
- Sustainability Appraisals (SA); need to be carried out for all DPDs and SPDs.
- Statement of Community Involvement (SCI); sets out the Council's arrangements for engaging with the general public, private sector businesses and services and other public services such as health and police authorities, in the planning process;
- Annual Monitoring Report (AMR); on the progress of plan preparation and implementation of policies and proposals; and the Local Development Scheme (LDS); set out the programme of work and timescales for preparing the documents that make up the LDF.

The LDS identifies the documents that will be prepared to comprise the LDF, the programme for delivering these documents including those times for public participation and the Council's overall approach to preparing each LDD. Figure 5 illustrates the Warwickshire County Council Local Development Frameworks and the Birmingham Regional Spatial Strategy (which guides regional planning practices), which provide the essential framework for planning in the region.

The revised Local Development Plan (LDP) recognises the need for water minimisation techniques and states (Section 3.72) that the "*full potential of sustainable drainage systems (SUDS) must always be reviewed before any rainwater runoff is diverted into sewers or stormwater drains*". It is expected that control devices will be required for new developments but there is a caveat in respect of direct discharges and infiltration to ground where there is the likelihood of a high water table and/or sensitive groundwater. Section 3.73 states that "*where feasible, surface runoff and contaminated water should be treated at source through the use of natural features such as reed beds*". Storm attenuation will require (Section 3.74) the installation of "*pipes, tanks and balancing ponds*".

The new planning framework allows flood risk and urban water quality management to be addressed at regional, area and local levels as illustrated in Table 4, although there are still issues remaining over catchment-scale planning. The new LDFs (Figure 5) and accompanying action plans provide opportunities for encouraging early liaison and on-going dialogue between developers, local and regulatory authorities, water companies and communities concerning the design and implementation of new developments within a particular area. However, what is not yet clear is the relationship between these local framework and strategic development plans and the RBMPs that will be developed within the context of the Water Framework Directive (WFD), and this may be an important issue for urban drainage planning. Master-planning can provide the basis for a more holistic and integrated approach to deliver strategic plans at local, regional and catchment scales. Consultation will be a founding basis for the achievement on an acceptable and sustainable master planning process and a pro-active template is already emerging for the collaborative stakeholder design process. This involves planning consultants and facilitators drawn from stakeholder groups (led by the developer and local authority) developing the outline master plan through collaborative technical and community Workshops and Advisory Groups enabling integration of infrastructure with other areas of the development life cycle. Drainage issues can then become an integral

component of the development process with building types/locations and site layout being appropriately amended to better manage flood and receiving water pollution risks.

### **5.1.2 The Water Framework Directive (WFD)**

The EC Water Framework Directive (WFD) which came into force in December 2000, establishes a new, integrated approach to the protection, improvement and sustainable use of Europe's rivers and groundwaters by introducing two key changes to the way the water environment must be managed in member states. The first relates to the types of environmental objectives that must be delivered. Previous EU legislation set objectives to protect particular water uses from the effects of pollution and especially against dangerous substances. These types of objectives are taken forward in the WFD provisions for Protected Areas and Priority Substances respectively. The Directive also introduces new, broader ecological objectives designed to protect and, where necessary, restore the structure and function of aquatic ecosystems themselves, and thereby safeguard the sustainable use of water resources.

The second key change is in the introduction of a river basin management planning system. This catchment-based planning system will provide the decision-making framework within which costs and benefits can be properly taken into account when setting environmental objectives, with proportionate and cost-effective combinations of measures implemented to achieve them.

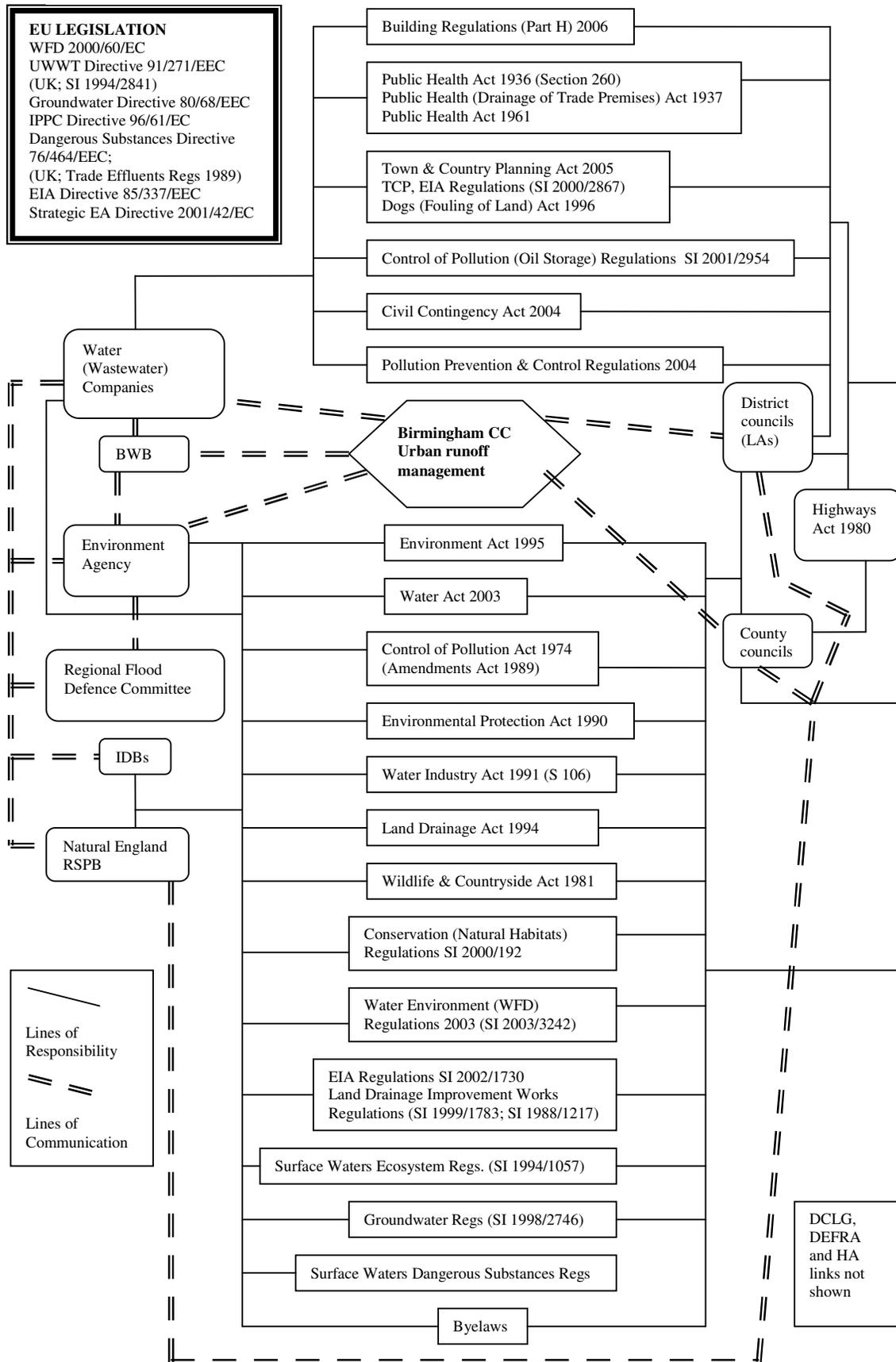
The emphasis placed on diffuse pollution (which includes that associated with urban runoff), under Article 1 of the WFD is of particular relevance to urban surface water drainage management. Although the Directive does not define diffuse pollution, it does specify within Articles II.3 (h) and Article II the need to identify and quantify diffuse sources, with Annex IV and VII requiring estimates and a Programme of Measures (PoMs) for monitoring and control of such diffuse sources within future River Basin Management Plans (RBMPs). These plans will be developed and delivered by the Environment Agency (EA) in conjunction with Local Authorities (LAs) under the aegis of central government led (DEFRA) strategic policy. With reference to Article 5 of the WFD, the UK regulatory agencies have undertaken preliminary characterisation (or basic risk assessment) of all water bodies in order to determine the most significant pressures and impacts on the receiving water environment and to assess the likelihood that water bodies will achieve the relevant Environmental Quality Objectives (EQOs). The Article 5 risk assessment map for the Greater Birmingham region is shown in Figure 6 which indicates that there are considerable lengths of receiving surface waters designated as being "at risk" or "probably at risk". Some of the worst channel reaches may receive designation as "heavily modified" and seek some element of derogation from the WFD ecological criteria within the forthcoming River Basin Management Plans (RBMPs).

The EA assessment framework uses land use activity, source pressure, exposure pressure and impact data in its characterisation with the outcome being expressed in a categorisation of high, moderate, low or no exposure pressure. Urbanisation is considered to constitute a prime source and exposure pressure, although both land use activity and impact data are uncertain at the current preliminary risk assessment stage

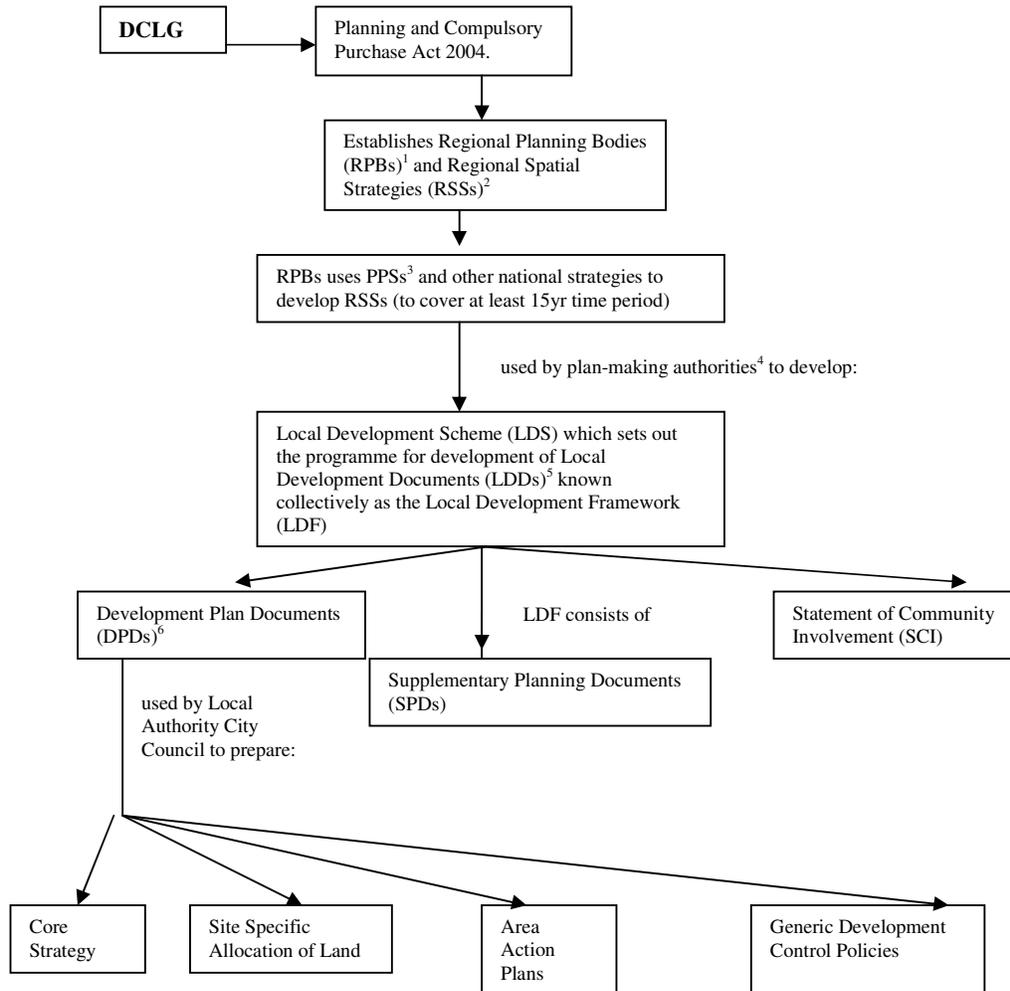
and will require further information to fully justify appropriate PoMs for the next RBMP1 stage.

Regulation based on technical performance and stipulated levels of service will undoubtedly require obligatory “Basic Measures” with statutes to conform to the EU Directive including discharge authorisations under approved licensing. However, it can be expected that a considerable number of measures relating to urban surface water runoff will be dealt with as “Supplementary Measures” embodied in General Binding Rules (GBRs), codes of practice and revised PPS guidance as well as negotiated agreements and awareness raising campaigns. This pattern is already emerging in Scotland where SEPA has introduced a range of GBRs to control diffuse source flood and pollution risks incorporated within and enhancing the 2005 Controlled Activities Regulations (CARs).

**Figure 3 Generic Framework for Urban Surface Water Management**



**Figure 4 The New Planning System in England & Wales**

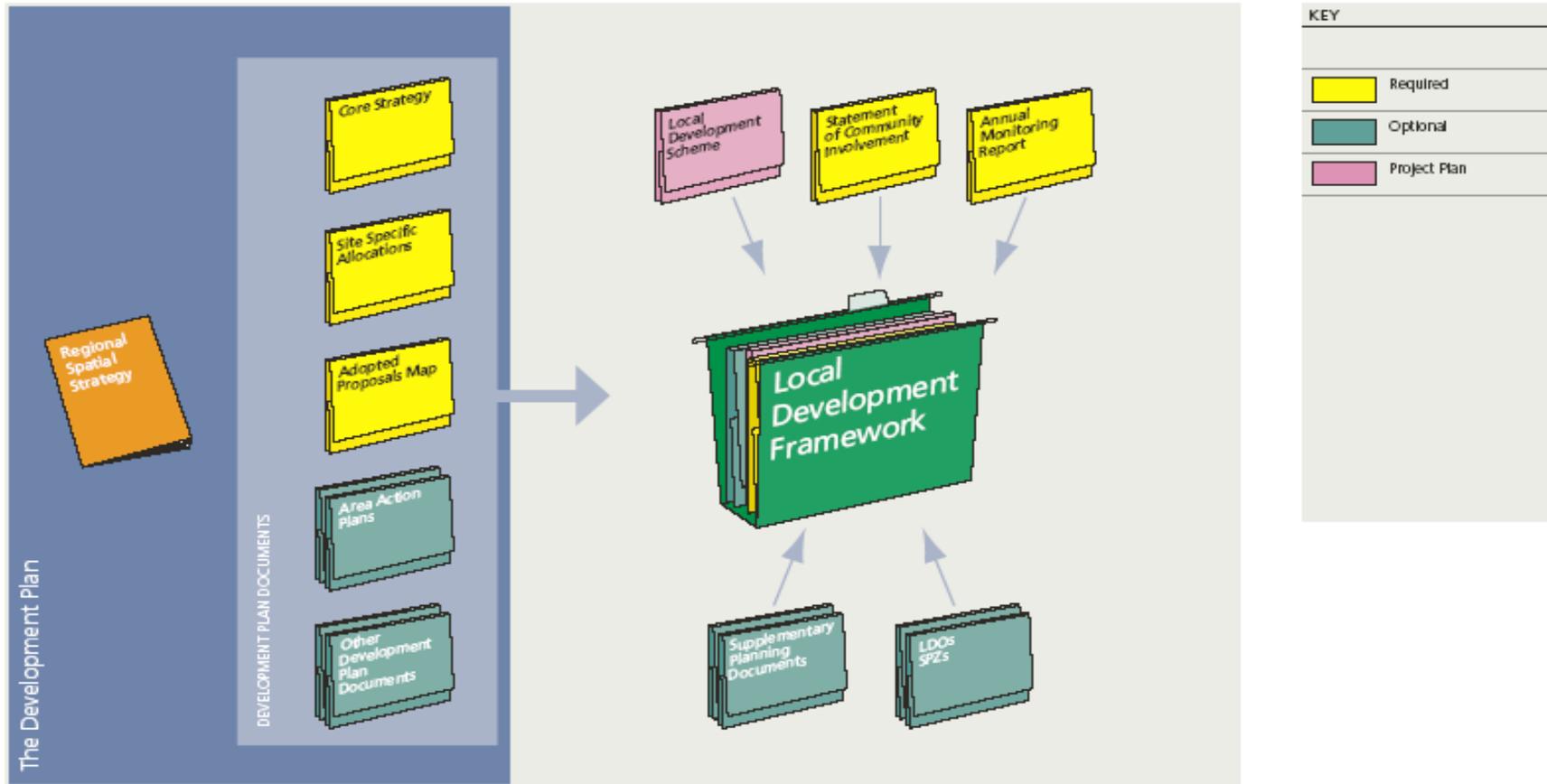


- Key:
- <sup>1</sup> RPBs are the regional chamber except in London where it is the Mayor
  - <sup>2</sup> RSSs replace Regional Planning Guidance (RPGs)
  - <sup>3</sup> PPS are Policy Planning Statements which will replace Policy Planning Guidance (PPGs)
  - <sup>4</sup> District Councils, Unitary Authorities, National Park Authorities, Broad Authorities and County Councils (mineral and waste LDDs only)
  - <sup>5</sup> LDDs replace Local and Unitary Development Plans
  - <sup>6</sup> RSS and DPDs form the Development Plan

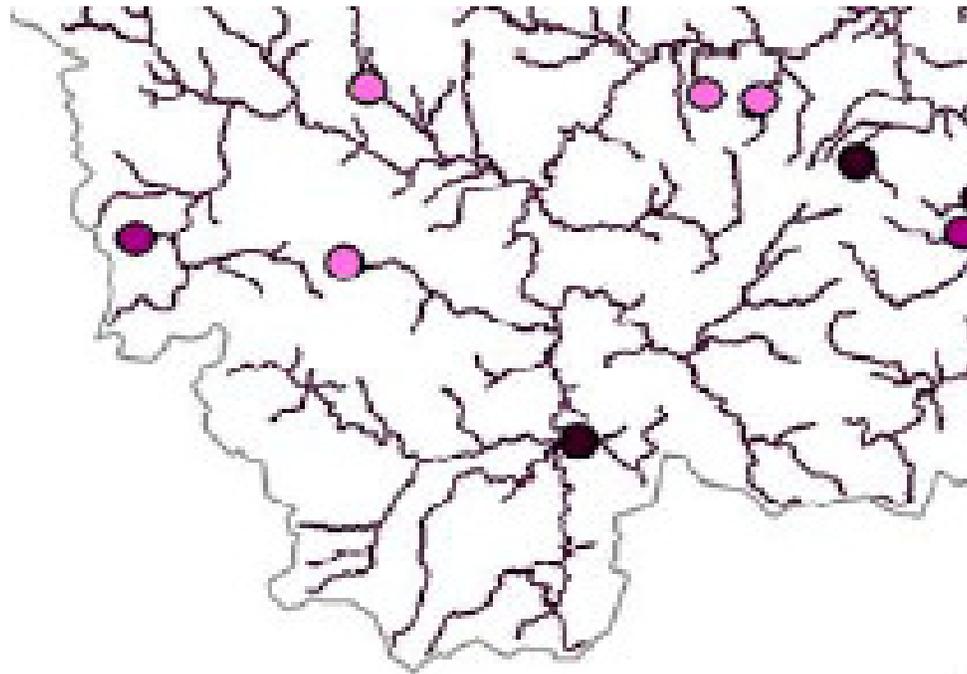
Abbreviations;

- 1. LA = local Authorities
- 2. HA = Highways Authorities
- 3. IDB = Independent Drainage Boards
- 4. EA = Environment Agency
- 5. SEPA = Scottish Environmental protection Agency
- 6. DEFRA = Department of Environment, Food and Rural Affairs.
- 7. OFWAT = Office of the Water Regulator
- 8. BW = British Waterways
- 9. BWB = British Waterways Board
- 10. SUDS = Sustainable (Urban) Drainage Systems

**Figure 5 The Local Development Framework**



Source: PPS12



Rivers	Lakes	Coastal	Transitional Area	Risk category
—	●	■	▲	At risk
—	●	■	▲	Probably at risk
—	●	■	▲	Probably not at risk
—	●	■	▲	Not at risk
—	●	■	▲	Not assessed

Figure 6 EU Article 5 Risk Assessment for the Greater Birmingham Region.

## **Appendix II USWM in Hamburg: legislative and strategic structures**

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The following paper provides a general overview of water management within Germany, with an emphasis on the SWITCH demonstration city of Hamburg. This paper is not a complete document, with for example, further research needed in compiling an inventory of decision making processes in Hamburg. A reorganisation of the municipality is currently in progress which will also have effects on the administrative level of water management. Further details of water management in Hamburg and the river island of Wilhelmsburg (selected SWITCH demonstration site) is available in the fact sheet 'Analysis of the Urban Water System 2006' at <http://www.switchurbanwater.eu/home/intranet/cities/hamburg>). The information provided will need to be updated as the SWITCH-project develops, in relation to WP 1, WP 2 and particularly WP 5.1.

## **6.1 Overview of the Planning System in Germany**

### **6.1.1 Introduction to the German planning system**

The German planning system covers the whole area of Germany. There is no specific spatial planning on national level (i.e. above the level of the federal states). Nevertheless the federal government has responsibilities in terms of spatial planning by providing framework legislation (cp. Art. 75 GG). The federal republic has to fulfil the basic conditions of town and country planning as designated in § 1 and 2 of the spatial planning act (Raumordnungsgesetz – ROG) which is bound to all legally binding spatial planning documents. Even though the Federal Republic does not provide a spatial plan, it aims to introduce its own perceptions of spatial planning through the development of the ‘Ministerkonferenz fuer Raumordnung’ (MKRO) which is an instrument of coordination at the level of the federal republic and the federal states (BECKMANN et al. 2001).

Regional plans are the concretisation of the federal state planning at a regional level (scales cp. Table 6). Regional planning manages the interaction of the structure plans on a municipal level and coordinates them with the superordinated goals and requirements of land use that are set out by the federal state planning. Regional planning ensures that municipalities do not only consider areas that are situated within their boundary in relation to planned development. Regional planning is set out in the laws of the federal states. Regional plans are not permitted to designate details on municipal level as local planning autonomy is set out in the German constitution (cp. Art. 28 (2) GG) (BECKMANN et al. 2001).

Regulations of urban land use planning are set out in the Federal Building Code (BauGB). As preparative stage the structure plan sets out which functions areas should comprise in the overall planning context of the whole municipal territory (cp. §§ 5 ff BauGB). Designated functions can be for example residential estates, commercial areas, industrial areas and public infrastructure as roads, schools or open spaces (e.g. parks or nature conservation areas).

In sections of the structure plan – mostly when allocated for settlement – the development plan rules the character of constructional and further usages and in which ways buildings are supposed to be integrated in their surroundings (cp. §§ 8 ff. BauGB). The municipalities have got a broad scope of steering (cp. § 9 BauGB) but urban land use planning has to be integrated in the goals of superordinated regional planning (cp. §1 (4) BauGB) (BECKMANN et al. 2001)

**Table 5 Legal requirements and instruments related to the spatial planning system, environmental planning and sectoral planning (exemplary water) of Germany**

	Spatial Planning (overall spatial planning)		Environmental Planning (e.g. landscape planning)	Sectoral Planning (e.g. water management)
	Supra-local	local		
Legal requirements	Spatial Planning Act (ROG)  Federal state laws for comprehensive regional planning (Landesplanungs-gesetze)	Federal Building Code (BauGB)	Federal Nature Conservation Act (BNatSchG)  Nature conservation acts of the federal states (Laender-Naturschutzgesetze)	National Water Act (WHG)  Water acts of the federal states (Laender-Wassergesetze)
Instruments of planning	Programme of land use for the federal state (Landesraumordnungs-programm)  Regional plan (Regionalplan)	Structure plan (Flaechen-nutzungsplan)  Development plan (Bebauungs-plan)	Programme of landscape (Landschaftsprogramm)  Landscape framework plan (Landschaftsrahmenplan)  Landscape plan (Landschaftsplan)  Open space plan (Gruenordnungsplan)	Level of Federal States: Overall plans of sewage disposal and drinking water supply  Regional and Local Level: Wasserwirtschaftlicher Rahmenplan  Bewirtschaftungsplan  Abwasserbeseitigungs-plan  Kommunale Abwasserbeseitigungs-konzepte
Legal approval process	Regional planning procedure (Raumordnungs-verfahren)	Planning permission (Baugenehmigung)		

(BECKMANN et al. 2001; BFN n.d.b: www., modified)

### 6.1.2 Landscape Planning ('Landschaftsplanung')

Parallel to the system of spatial planning, a system of landscape planning was developed in Germany. In addition to the divisions within the spatial planning system, the system of landscape planning is also split into four different levels (cp. Table 6) and theoretically covers the whole of Germany (cp. §§ 5 and 6 BNatSchG and the nature conservation acts of the federal states). The system of landscape planning supplements spatial planning as it provides information about matters of nature and landscape conservation (cp. § 1 BNatSchG) (BECKMANN et al. 2001). A key difference between these planning systems is that landscape planning is generally not legally binding (although this differs in some federal states e.g. North Rhine-Westphalia) (BECKMANN et al. 2001; BFN n.d.c: www.)

In Hamburg there is no Landscape Framework Plan ('Landschaftsrahmenplan') as the city has a simplified two-tier administration system which is different to the structure of federal states. (BFN n.d.a: www.). Landscape planning is, at least theoretically, construed as integrative planning. There are further aspects of environmental planning that are dealt with at sectoral level as for example water management (cp. Table 5) (BECKMANN et al. 2001).

**Table 6 Tab. 2: Levels and plans of town and country planning (including landscape planning as specific planning with emphasis on the conservation of the capability of the ecological balance)**

Level of planning		Spatial planning	Landscape planning	Scale of planning
Federal State		Federal programme of spatial planning (Landesraumordnungsprogramm*)	Landscape Programme (Landschaftsprogramm*)	1:500.000 to 1:200.000
Region	Regional district	Regional Plan (Regionalplan*)	Landscape Framework Plan (Landschaftsrahmenplan)	1:50.000 to 1:25.000
	County		Not available in Hamburg	
Municipality		Structure Plan (Flaechennutzungsplan)	Landscape Plan (Landschaftsplan)	1:20.000 to 1:5.000
Section of the municipality		Development Plan (Bebauungsplan)	Open Space Plan (Gruenordnungsplan*)	1:2.000 to 1:500

\*some of the German titles might differ in the federal states (BMU 1993: 7; BFN n.d.a: www.)

### 6.1.3 Planning in Hamburg

The metropolis of Hamburg developed outwards from the old centre of the city through a 'step by step' process which united the surrounding villages. In the present city the old villages still can be recognized as independent centres. The development follows the spatial planning concept of the 20<sup>th</sup> century, the so called 'axes concept'. The spatial planning concept contained several radial 'development axes' which started at the centre of the city. The

development axes include the villages and small towns around Hamburg. The space between the axes should not be settled, so that the landscape could be protected and used as farmland or forests. Most of the city lies on the north side of the river Elbe.

At present 1,745 Mio inhabitants live in the municipality of Hamburg (STATISTISCHES AMT FUER HAMBURG UND SCHLESWIG-HOLSTEIN, 2006), with the whole metropolitan region of Hamburg containing 4,3 Mio inhabitants. Since 1989 the number of inhabitants has continuously grown, to the extent that Hamburg is one of the fastest growing cities in Germany. The expected continued population growth and the changing demands on living conditions evoke a predictable need for the development of new housing. At the same time the Harbour site with its container turnover needs area to expand. To facilitate a qualitative and sustainable urban growth the key concept 'Metropolis Hamburg – Expanding City' was developed with the aim that Hamburg would grow within its defined boundaries. One objective of this plan is the reduction of the suburbanisation (peripheral urban development) by means of suitable offers within the city. The qualified immigration should be strengthened. A significant city development project is 'The leap across the Elbe'. This project offers a chance for inner city development, redevelopment of the waterfront and builds up a connection from the booming HafenCity via the island Wilhelmsburg to Harburg. The main emphasis is the island Wilhelmsburg, promoted through hosting of both the International Building Exhibition (IBA) and the International Garden Exhibition (IGS) in 2013.

## **6.2 Legislation and Regulation Water Management**

### **6.2.1 The European Level - The Water Framework Directive (WFD)**

With the Water Framework Directive (WFD) the European Union set out a new basis for water management and the ambitious goal of reaching a good condition within all water bodies by 2015. The directive follows a holistic approach that considers ecological aspects, habitats and well as the quantity and quality of water. For the first time all water bodies – rivers, lakes, coastal waters and ground water – are regarded collectively. Water bodies are considered in planning areas which are attached to catchment areas of the rivers. Therefore the protection of water bodies does not end at political borders but will be managed on an integrative and transboundary basis within the EU. Furthermore, the directive requires the engagement and participation of citizens within the development of water management plans (FHH 2006a: www, for additional information cp. Appendix I and the WFD).

The WFD (German: RL 2000/60/EG) became operative on the 22<sup>nd</sup> of December 2000. In Germany the European directive was implemented at national level by the alteration of the National Water Act (Wasserhaushaltsgesetz WHG) (see below). As the responsibilities for water management is delegated to the federal states, the directive had to be transferred to federal laws. In Hamburg this was done by the 11<sup>th</sup> alteration of the Hamburg Water Management Act (Hamburgisches Wassergesetz HWaG) in 2004 and further by the Hamburg regulation for the Implementation of the appendices II, III and V of the Water Framework Directive of 2004 ('Hamburgische Verordnung zur Umsetzung der Anhaenge II, III und V der WRRL', 29.06.2004)

Hamburg now faces the ambitious goals of the complying with WFD requirements within its various rivers (the Elbe, Alster and Bille), its harbour and a large groundwater reservoir. A

special challenge is the permanent use of the water bodies as most of the water bodies have been altered by harbour-related, urban or agricultural uses. The general principle and WFD aim for natural and unaffected water bodies has to be reconciled with the irreversible, historical legacy of these water bodies as well as with the economic needs of today's city of Hamburg (FHH 2006a: www).

Recent actions include the development of the 'Information of the public concerning the schedule and action plan' ('Information der Öffentlichkeit über den Zeit- und Arbeitsplan' 22.12.2006) and the Monitoring Programme 2007/2008 of the Urban Water Bodies in Hamburg ('Ueberwachungsprogramm 2007/2008 für die Hamburger Stadtgewässer' 22.12.2006) which are published under the direction of the BSU – Dept. U (see below) (FHH 2006a: www).

To fulfil the requirements of public information set out by the WFD:

- the BSU regularly provides up-dates about the directive and steps towards its implementation via the internet,
- all citizens of Hamburg have had the opportunity to contribute to the development of drafts of the reports concerning the development of an inventory for Hamburg ('Landesinterne Berichte'),
- 32 organisations and institution of Hamburg related to nature conservation, economics and recreation were asked to provide comments,
- At the ending of the 'taking of the inventory' information meetings were organised that partly involved the adjacent federal states of Niedersachsen and Schleswig-Holstein,
- Workgroups are established for the coordination of authorities in Hamburg, the adjacent federal states, as well as urban companies and organisations in Hamburg,
- A forum took place concerning public relations and the implementation of the WDF at the fifth conference of sustainability (06.09.2006, Hamburg) (FHH 2006b: www).

According to the schedule of the WFD, monitoring programmes had to be applicable until the end of 2006, with a goal of a comparison of national and international measuring systems and measuring networks also set. This implicates a follow-up process of up-dating and optimisation of monitoring. In terms of monitoring, surface water hydrology, physico-chemical characteristics, biological parameters and geomorphological parameters have been recorded as a basis for the evaluation of water bodies, the determination of trends and to enable the impact of any measures taken to be determined. The chemical and the quantitative conditions of groundwater are also monitored (FHH 2006c: www).

## **6.2.2 Water Management in Germany**

The constitution of the Federal Republic of Germany becomes apparent within its system of water management. To date, the Federation has provided a framework legislation called the Federal Water Act (Wasserhaushaltsgesetz – WHG) which must be enacted by all federal states. Each of the federal states has their own water management law (Landeswassergesetz) (UBA o.J.: 10), with each federal state owning executive rights concerning water management. This also comprises legal regulations of the Federation. Exceptions are national water ways (Bundeswasserstrassen). Their maintenance and construction is at the responsibility of the Federation (BMU (ed.) 2006c: 17). The facts mentioned above imply that regulations and laws as well as the functions and regulations mentioned for Hamburg are

specific for the municipality. Differences occur in relation to the inventory of decision making carried out in other federal states of Germany.

But with the implementation of federalism reform, as adopted by the national government on 30<sup>th</sup> of June 2006, the framework legislation (Art. 75 GG) regarding water and nature conservation will be abandoned. For the first time the Federation has the opportunity to provide a precise and detailed Water Act. After 31.12.2009 the federal states are allowed to provide their own regulations that can differ from the national law (Art. 72 sec. 3 GG). For certain topics in relation to principles of nature conservation law and demands concerning plants and substances within the Water Act the Federation is allowed to provide exclusive regulations that may not be deviated from (BMU 2006a: www).

### 6.2.3 Regulations and laws in Hamburg

Based upon European and national directives and regulations such as the **European Water Framework Directive** (Wasserrahmenrichtlinie – WRRL), the **National Water Act** (Wasserhaushaltsgesetz – WHG) and the **Federal Building Code** (Baugesetzbuch – BauGB) as well as further acts and regulations related to pollution control and environmental protection, waste, development and planning with importance for water management, there are – as already stated above – specific Hamburg related regulations.

The **Hamburg Water Management Act** (Hamburgisches Wassergesetz – HWaG) seizes the declaration of § 33 sec. 2 of the National Water Act (Wasserhaushaltsgesetz – WHG) concerning the need of permission in relation to the use of groundwater and the drainage of rainwater. Since the environmental policy program of the municipality of Hamburg (Umweltprogramm - Freie und Hansestadt Hamburg) in 1984, decentralised storm water management and open drainage systems have the precedence over the conventional sewerage system. Following certain restrictions inhabitants can drain off surface water on their own property without the need of legal approval (§ 32a; b HWaG). The restrictions that have to be met are set out within the **Rainwater Infiltration Regulation** (Niederschlagsversickerungsverordnung) (BSU (ed.) 2006: 15).

The **Water Protection Area Regulations** (Wasserschutzgebietsverordnung), as prepared for each of the areas in Hamburg, provide a statement of requirement concerning the drainage of rainwater. They determine, for example, prohibitions, restrictions to the utilisation or the obligations of acquiescence. In some of the water protection areas infiltration is permitted if direct drainage to a receiving water is not possible. Information about the water protection areas can be viewed on the internet (FHH 2006b: www). There exist further regulations in relation to the drainage of surface water from roads in water protection areas.

The **Hamburg Sewage Water Act** (Hamburgisches Abwassergesetz – HmbAbwG) defines rainwater run-off from the built environment in §1 sec. 2 HmbAbwG as sewage water. There are bondages to affiliate built properties to the public sewage network and to use the sewage system. Exceptions can be made for rainwater run-off (BSU (ed.) 2006: 16).

The **Hamburg Building Code** (Hamburgische Bauordnung – HBauO) controls the construction, modification and demolition of property drainages. Of further importance within the context of surface water management are the fees in relation to sewage water (BSU (ed.) 2006: 16f).

Also of interest within the context of water management are the sewerage regulation (Abwasserverordnung – AbwV), the sewer rates law (Sielabgabengesetz), the regulation relating to the level of charge for using sewers (Verordnung über die Höhe der Sielbenutzungsgebuehr) and the regulation concerning the notification of development (Bauanzeigeverordnung – Verordnung über anzeigebeduerftige Bauvorhaben)

### **6.3 Administration Units related to Water Management: Municipality of Hamburg**

The general structure of administration in Hamburg are organised in a centralised way (KUTZ-BAUER & FUCHS 2003: 128). Following article 4 of the Hamburg constitution, there are no separation of national and municipal tasks. Therefore the city districts of Hamburg are only administrative units and perform tasks devolved by the senate. Decisions made by the city district assembly are not autonomous. They underlie the senate as the highest administration level and can be abolished by it (KUTZ-BAUER & FUCHS 2003: 125). § 3 BezVG defines tasks of the city district as administrative duties that do not need to be implemented in a unitary way because of their minor importance or because of their character. The senate is responsible for the classification and takes over charge of the city districts (KUTZ-BAUER & FUCHS 2003: 125f). The responsibilities for water management are split between the senate and the city districts and therefore are already widely spread in the municipality of Hamburg (ANORDNUNG ÜBER ZUSTAENDIGKEITEN 2006). However, the following list indicates that in reality the system is much more complex.

The various and most important authorities and associations directly related to water management in Hamburg are

- BSU (as part of the FHH (Free and Hanseatic City of Hamburg)); within the BSU there are various departments that play a role in terms of water management: B, U, IB, further LP (cp. Figure 7)
- The authorities of the seven city districts (with 104 quarters) by name Altona, Bergedorf, Eimsbüttel, Hamburg Mitte, Hamburg Nord, Harburg, Wandsbek (cp. Figure 8)
- Hamburg Water Inc. (conglomerate of HSE and HHW)
- Hamburg Port Authority (HPA)
- Water and soil associations for particular housing projects (e.g. Dorfanger Boberg) or areas as for example for the East of Wilhelmsburg



### **6.3.1 BSU – State Ministry of Urban Development and Environment Hamburg**

The emphasis of the work of the BSU relates to the overall concept of the ‘Metropolis Hamburg - Expanding City’ which is the top objective of the government program (FINANZBEHOERDE et al. 2006: 96). The four central goals of this concept are: the above-average growths of economics and employment; the increase of population; the quality of life and sustainability of Hamburg to be realised and to always bear in mind the typical character of Hamburg as a ‘green’ metropolis at the waterfront (FHH 2005: www).

Concerning water management, various departments of the BSU have diverse responsibilities. The most important departments and sections in relation to water management are named and their responsibilities described below. Figure 7 gives an overview of the organisation of the BSU (the red mark denotes departments which are further described within the following text).

The BSU - B (Department of Construction and Service) is the public service provider for matters of infrastructure in Hamburg and realises the central municipal projects concerning civil and hydraulic engineering (Finanzbehoerde et al. 2006: 103). Section B5 and B6 deal with water related topics mainly concerning the regulation of water quantity (FROMM & GROSS 2006). Section B5 ‘Waterbodies’ of the Department of Construction and Service (BSU – B) deals with the overall water management. Section B6 ‘Flood Management’ of the BSU – B deals with all matters of flooding and flood protection in Hamburg. This section combines planning, construction and control as well as the defence and maintenance of dikes (FINANZBEHOERDE et al. 2006).

The BSU – U (Department of Environmental Protection) is responsible for ministerial and central municipal tasks concerning soil protection/ contaminated land, the waste management, the geological State Office and has major importance for SWITCH concerning the protection of water bodies. This is within the responsibility of section U1 ‘Protection of Water Bodies’ as the highest municipal authority regarding the implementation of the water law. Further responsibilities include the control of Hamburg water bodies, the implementation of guidelines as provided by the EU Water Framework Directive, the protection and the cultivation of water bodies, the planning of water management and permissions based upon topic related information systems (FINANZBEHOERDE et al. 2006: 106). In comparison to the work of B5 the work is primarily quality-related, dealing less with the matters of water quantity (FROMM & GROSS 2006).

The BSU – IB (Department of Immission Control and Enterprises) is responsible for the environmental approval and control of enterprises, facilities and construction. Their work comprises noise control, air pollution control, saving of water and energy and support programmes (FINANZBEHOERDE et al. 2006: 108). Section IB 5 ‘Sewage Technology’ is responsible for the sewer interface of properties in private ownership. They deal with general issues, permissions and site-orientated protection of water bodies, direct discharge, waste water charges, sewage plants and sample taking (FINANZBEHOERDE et al. 2006: 109). They are not directly involved within the planning process itself and have so far only played a minor role within the context of WP 5.1 of SWITCH.

The BSU - LP (Department of Land Use and Landscape Planning) has overall responsibilities for matters relating to urban and landscape planning in Hamburg. The department prepares overall concepts for the whole city of Hamburg (e.g. Metropolis Hamburg – Expanding City) as well as plans for defined spatial areas. (FINANZBEHOERDE et al. 2006: 105). Matters of water management have to be taken into account in every development project not only regarding the typical character of Hamburg as a ‘green’ metropolis at the waterfront but also taking into account the significance of everyday problems.

### 6.3.1.1 The seven city districts: Altona, Bergedorf, Eimsbüttel, Hamburg Mitte, Hamburg-Nord, Harburg, Wandsbek

The municipality of Hamburg is subdivided into seven city districts (cp. Figure 8) with each having its own authority. City district authorities are responsible for works that need to be dealt with locally. In terms of SWITCH, the departments of urban planning and civil engineering are of most importance as they deal with the matters of water management on a local level. These city districts work under the direction of the BSU meaning that they have restricted powers and independence. Superordinated planning issues and matters of permissions are the responsibility of the BSU whereas the departments of each city district manage the local implementation of existing guidelines (planning and water acts, construction and development) (BezVG).



Figure 8 City Districts of Hamburg (LEXIKON n.d.: www)

The research of different small-scale case studies as part of the deliverables in WP 5.1 (D 5.1.1R due date 31<sup>st</sup> January 2007) provides an insight into the work and self-conception of some of the district authorities. Due to the reorganisation of the municipality of Hamburg, the responsibilities concerning water management have ‘officially’ changed. These changes include the distribution of responsibilities within the municipality and the city districts. The reorganisation and the shift of responsibilities are currently in progress.

### 6.3.1.2 Hamburg Water Inc. (Hamburg Wasser)

In January 2006 the Hamburger Stadtentwaesserung (HSE) and the Hamburger Wasserwerke (HWW) merged to form Hamburg Water Inc. This is the biggest municipal water supply and sewage disposal company in Germany (HSE n.d.: www). The affiliated group is organised as the municipal utility (Eigenbetrieb der Stadt) meaning the operation is dealt with by the municipal administration as a separate estate with independent accountancy (UBA n.d.: 14; WEUSTHOFF 2006). The following table gives an overview of the main responsibilities of Hamburg Water Inc.

**Table 7 Key data related to the work of Hamburg Water Inc.**

Groundwater well/ plant	Number	18
Sewage treatment plants	Number	2
Water delivery into the net	Mio. m <sup>3</sup>	122
Treated sewage water	Mio. m <sup>3</sup>	146
Length of the pipe net (fresh water)	km	5.486
Length of the sewage network	km	5.397
Supply (water)	Number	516.477
Service pipes (sewage)	Number	200.801
Water meters	Number	809.702

HSE n.d.: www

In terms of sewage water (as defined by the Hamburg Sewage Water Act (HmbAbwG)) the company is responsible for the subsurface sewer system. Surface water run-off and aboveground drainage or infiltration are not primary issues as they are the responsibility of the BSU. Nevertheless they are dealt with within the context of the overall water management and capacity of the existing sewer system as the coordination of the different issues is of major importance for qualitative growth of Hamburg (HSE n.d.a: www.; HSE 2006a: www.; WEUSTHOFF 2006). Concerning water quality, one of the goals is to minimise overflows from combined sewers. Further to the modernisation of the sewer system, Hamburg Water Inc. has developed special concepts concerning water pollution control for Hamburg's rivers (HSE o.J.b: www.).

### **6.3.1.3 Hamburg Port Authority (HPA)**

Per 'Directive for Responsibilities concerning the Area or Water Law and Water Management' (Anordnung über Zuständigkeiten auf dem Gebiet des Wasserrechts und der Wasserwirtschaft vom 07.April 1987 (zuletzt geändert durch die Anordnung vom 04.10.2005, Amtl. Anz. 2005, S. 1810)) the Hamburg Port Authority is the water authority responsible for the following areas:

- Hamburg Harbour,
- National Water Ways and attached water bodies and areas of land,
- The island Neuwerk including groundwater, flood protection and acting as inspecting authority for the dike association of Neuwerk.

The Hamburg Port Authority has its own sectoral planning. In relation to the concept 'Leap across the Elbe' the Port Authority was forced to come to a statement about future development of the harbour area (BAHR 2006).

### **6.3.1.4 Water and soil associations**

Water and soil associations can be built up voluntarily or as a pooling of municipalities at the state's instance. They can take over responsibilities regarding water supply, waste water treatment and the maintenance of water bodies (BMU (ed.) 2006: 20). The law about water and soil associations, and the Hamburg act for the implementation of this law, provide guidance covering the purpose, tasks and legal form of water and soil associations. In Hamburg water and soil associations exist for particular housing or commercial projects, for example, the 'Dorfanger Boberg', 'Heidberg Villages', Rahlstedt 'Merkur Park' (cp.

Deliverable 5.1.1 R; due date 31<sup>st</sup> of January 2007) or for certain areas as the East of Wilhelmsburg.

## **Appendix III USWM in Belo Horizonte: legislative and strategic structures**

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## **7.1 Introduction to stormwater management in Brazil**

Traditionally in Brazil, all services related to surface runoff control and stormwater management are under the responsibility of municipal authorities. City councils state laws and urban criteria that control land use (usually by a zoning framework derived from the urban development master plan) as well as design guidelines and building standards for stormwater systems implementation. Private or public organisations leading new urban developments must comply with the legislation on land use and with the guidelines and standards regarding the stormwater system. Therefore, a new development is only approved after verification of conformity by the local authorities.

The adequacy of guidelines and standards and their conformity with the best-confirmed new technologies on urban drainage vary a lot from municipality to municipality. Many towns with less than 100.000 inhabitants do not have adequate organisations and legal bases to regulate and manage stormwater and in many cases just reproduce standards adopted in bigger cities and then face huge difficulties in enforcing these laws and regulations (Gomes, 2005). Usually, most of the big cities and state capitals are well equipped and organised in these terms. At the current time, many municipalities are expending significant efforts to improve services and to develop or adopt new drainage technologies better fitted to meet the objectives of flood and pollution control, health and environmental standards. Concerning the case of Belo Horizonte city, a description of institutions, laws and regulations on stormwater management is given below, in the section “Local Authority Organisation”.

As a federal republic, Brazil is composed of three federative entities, the union, the states and the municipalities, and conformity, non-conflict and coherence must be ensured by the legislation at the state and municipal levels with respect to the federal law. At the federal sphere, legislation having impact on the drainage of urban areas are the environment and the water resources laws as well as the very recently promulgated environmental sanitation law, as described in the following section.

## **7.2 Legislation and regulation of urban surface runoff at the federal and state levels**

At the federal level, the national systems of (i) environment, (ii) water resources and the recently created (iii) national system of environmental sanitation constitute the legal and institutional framework governing the use of water and the water pollution control in Brazil. The existing legal and institutional frameworks count on a variety of instruments that may influence the urban stormwater management, although they are seldom applied in all their extension and potential at the local level, mainly due to the lack of institutional development and of the translation and regulation of these instruments within the municipal sphere.

The National Policy and the National System of Water Resources Management were created by the federal law n. 9433 from 8<sup>th</sup> January 1997. The National System of Water Resources Management is composed by:

- The National Council of Water Resources (CNRH);

- The National Water Agency (ANA);
- The State Councils of Water Resources;
- The federal, state and municipal organisations have legal responsibilities of water resources management;
- The river basin committees;
- The water or river basin agencies created at the river basin scale.

The CNRH, its equivalents in the states, and the river basin committees are deliberative institutions. The CNRH has as main responsibilities: (i) to state guidelines for the application of National Policy of Water Resources Management; (ii) to evaluate, and approve the National Water Resources Plan; (iii) to monitor its implementation and to approve general criteria for the application of water resources instruments related to the concession of water use rights and the charges for the use of water. The CNRH has also the responsibility of facilitating the integration of the water resources management with the environmental management. The State Councils have similar ascriptions at their respective states. River basin committees have duties of (i) approving and monitoring the implementation of the river basin water resources plan; (ii) proposing values and mechanisms for the water use charging at the basin level; and (iii) arbitrating conflicts related to water uses.

Integrative aspects for water resources management appear in the law 9433/1997 by the statement that executive powers at the municipal sphere shall make efforts to integrate local policies on environmental sanitation, land use, soil conservation, environmental conservation with the water resources state and federal policies.

ANA is an independent autarchy at the federal government sphere. It is a federal state organisation with responsibilities of regulation, i.e. concession and control of water use rights; and management, i.e. promote, facilitate and monitor the setting up of the National Policy of Water Resources.

The river basin agencies act as executive secretariats of the river basin committees; as so they have duties of (i) preparing and updating the river basin water resources plan, (ii) developing studies on water availability, water use and projections on water demand at the river basin; (iii) charging for water use (by delegation); (iv) planning and monitoring the use of financial resources generated by the charges for water uses at the basin scale. The water resources management instruments defined by the law are the following:

- National and state plans of water resources;
- Water body classification according to present and foreseen uses of water;
- Concession of water use rights;
- Charging for the right of using water;
- Water resources information system.

According to the Brazilian Constitution, water is a public good only to be utilised under concession of rights of use granted by the Union or by the states, depending on the domain of the water bodies, irrespective of whether the user is a public or private entity. Bodies of water are under the Union domain if they drain more than one state or country or define a border between states or countries; otherwise they are a state domain.

The water body classification is an instrument in common between the Environment and Water Resources National Policies. The National Council of Environment (CONAMA), a

deliberative organism of the National Environmental System, released a resolution, the CONAMA Resolution n. 357, from 17<sup>th</sup> March 2005, which substitutes the CONAMA Resolution n. 20 (18<sup>th</sup> June 1986), and defines a system for classifying water bodies (surface water) according to the main uses of water and establishes water quality standards for each of the water quality classes. There are four classes of fresh water and three classes of brackish and salt waters. The dumping of effluents into water bodies is also regulated by this resolution, which states limits for the concentration of different substances in the effluents and imposes the relevant water quality standards at each receiving waters according to its class.

Organisations in charge of classifying water bodies are the National Council of Water Resources (CNRH) and its equivalent within the states. Classes are established according to water uses that require the highest quality standards for a specific water body. If, in a particular river basin, the water quality of rivers and lakes is not in conformity with the required class, then progressive targets for water quality improvement must be defined in order to reach conformity to all the water quality standards required for that class, in the future. For a particular river basin where this is the case, all the instruments of water resources (e.g.: plans of water resources, concession of water use rights, charges for the right of using water resources etc) and environmental management must be oriented and applied taking into account the targets for water quality improvement previously stated.

The regulation of water uses is granted by the concession of water use rights, including concession for water withdrawal, discharging effluents to water bodies and for changing the hydrologic regime (e.g.: the construction of reservoirs for hydropower plants). Therefore, there is a close relationship between the instruments for the concession of water use rights and for water body classification and they must be applied in a coherent and integrated way. It is also the case for the instruments for concession and for charging for water use, as charges of water use are also based on the concession of the right to use water.

Although all water resources management instruments in Brazilian legislation are to be applied at the local level to govern the drainage of urban areas, some legal particularities must be taken into account such as, for instance, the fact that there are no, according to the law, water bodies defined as being of municipal domain or the fact that land use regulation is a prerogative of the municipalities. The implication of these particularities is, for instance, that the use of the concession of water use rights for modifying the hydrologic regime or for regulating the use of receiving waters as a final destination of runoff-polluted waters is only possible provided that the urban area is taken as a unit. It is therefore up to the municipality to develop appropriate urban policies and to take management and regulatory measures to comply with the concession requirements.

The recently promulgated environmental sanitation law (Law n. 11445, from 5<sup>th</sup> January 2007) clearly states the concession of water use right as a mandatory instrument to be employed in the cases of water withdrawal for drinking water supply as well as for the discharge of effluents having origin within the urban area, i.e. wastewater and runoff from urban areas. This new legislation also states the charge for the provision of stormwater management services, based on the impermeable area of the lot and taking into account the possible use of source control measures by the owner. Charging for drainage services on the basis taxes relating to impermeable areas and incitation for the adoption of source control

measures may promote the use of BMPs, contributing to a future reduction of runoff volume and diffuse pollution in the urban areas<sup>1</sup>.

Law n. 11445 also states the basic framework for the organisation of regional environmental sanitation services, allowing that several municipalities gathered by a consortium agreement can provide these services in a regional territorial base under common planning, management, funding and regulatory bases. The public consortium law (Law n° 11107, from 6<sup>th</sup> April 2005) regulates municipal association for providing public services at regional territorial scales. The major interest of this legal framework for water resources management is to facilitate integrated urban water management in metropolitan areas as well as in regions where scattered small towns may benefit from the effects of providing public services on an associated regional base. In the case of the Belo Horizonte Metropolitan Area, a consortium for providing environmental sanitation services so far does not yet exist<sup>2</sup>.

Land use at the local sphere is regulated by the Federal Law n. 10257 from 10<sup>th</sup> July 2001 called the Cities' Code. It is an innovative urban code, which includes a range of different urban development policy instruments such as:

- Socio-economic and territorial development master plans at national, regional at state territorial spheres;
- Urban development master plan;
- Land use law based on zoning instruments;
- Environmental zoning;
- Budget participatory policy and management;
- Urban property local taxes;
- Environmental protection areas;
- Onerous building right;
- Building transfer right;
- Pre-emption right.

Municipalities may employ this set of instruments in their urban development policy focusing on the control of (i) flooding area land occupation; (ii) the use of environmental sensitive areas; (iii) the increase of impermeable surface and other urban land use policies with impact on stormwater management. Hydraulic works, including lining creeks and rivers or building channels with drainage purposes are subjected to environmental impact assessment and environmental licensing (CONAMA Resolution 001, from 23<sup>rd</sup> January 1986). Water supply, sanitation, stormwater and solid waste infrastructure works are also subjected by environmental licensing (CONAMA Resolution n. 005, from 15<sup>th</sup> June 1998). The protection of creeks, lakes and rivers is regulated by the CONAMA Resolution 303 (20<sup>th</sup> March 2002) which states parameters for defining the limits of permanent protection areas in urban as well as in rural environments. According to this resolution, a green corridor having a width varying from 30 m to 500 m at each border must be kept along creeks and rivers, depending on the width of the river cross section. This resolution is inspired on the Brazilian Forest Code (Law n. 4771, from 15<sup>th</sup> September 1965), which previously stated criteria for the limits of permanent protection areas along riparian areas. Municipalities seldom respect this law, arguing for special social interests of occupying valleys with urban infrastructures.

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<sup>1</sup> For a simulation of the use of this kind of drainage tax see Nascimento et al (2005).

<sup>2</sup> It is one of the major objectives of the SWITCH learning alliance in Belo Horizonte to investigate interest, possibilities and difficulties for IUWM at the metropolitan territorial scale.

Nevertheless, one can observe a trend on policy change in this domain, an example being the Belo Horizonte's DRENURBS program.

The Minas State Council of Environment (COPAM), a deliberative organisation of the Minas Gerais State Environmental System, also regulates interventions on creeks, lakes and rivers specifically in urban areas by means of the COPAM Normative Deliberation n. 95, from 12<sup>th</sup> April 2006. This norm allows different intervention measures according to an impact classification system. It may allow structural interventions, e.g. lining creeks or rivers, in consolidated urban areas, if justified by an effective reduction on very frequent floods. COPAM Normative Deliberation n. 07/1994 states criteria for licensing environmental sanitation infrastructure implementation. The environmental sanitation policy at Minas Gerais state is formulated according to the Law n. 11720/1994. Nevertheless, the Minas Gerais government so far has not promulgated the decrees that will allow this law implementation and therefore, it is not currently applicable.

Flood emergency planning (emergency preparation), response and recovery are part of the Brazilian Civil Defence organisation duties. Civil Defence in Brazil is organised according to diverse territorial scales in a system called the National System of Civil Defence (SINDEC). At the national level, the National Secretary of Civil Defence, an organisation of the Ministry of National Integration, is responsible for coordinating all the civil defence actions throughout the country. The formulation and updating of the national policy for civil defence (as well as the statement of civil defence general guidelines are duties of the National Civil Defence Council (CONDEC)), a deliberative institution integrated by representatives from ministries and other federal administration organisations.

At the Brazilian regional (North, North-East; Central-West, South and South-East), state and municipal level, civil defence preparation, response and recovery actions are respectively coordinate by Regional (CORDEC), State (CEDEC) and Municipal (COMDEC) Civil Defence Coordination organisations. The major role in relation to flood emergency actions is performed at the municipal scale by the COMDEC and the defence civil nucleus (NUDEC). Responsibilities of COMDEC are:

- To articulate, coordinate and manage defence civil actions at the municipal level;
- To promote and facilitate public participation in defence civil actions, particularly in terms of preparation, response and recovery;
- To promote and facilitate public participation in the setting up of defence civil nucleus (NUDEC) at neighbourhood level, particularly in risky areas, including efforts on voluntary training and capacitating for emergency actions;
- To articulate with other defence civil organisations, at regional and national levels, and to participate to the Plans of Mutual Support (PAM) according to principles of reciprocal support among municipalities;
- To promote the development and implementation of disaster forecast and warning systems, in cooperation with forecast and operational centres.

Main duties of NUDEC include:

- Developing risk assessment studies and thematic maps of risk, threats and vulnerability;
- Promoting the adoption of structural and non-structural measures for disaster alleviation;

- Elaborating emergency planning for effective response to threats, including simulation of emergency actions;
- Training of volunteers and technical staff to act under disaster circumstances;
- Articulating to organisations in charge of disaster forecasting and warning in order to optimise emergency actions.

The Minas Gerais State Government promulgated a law (Law n. 15660, from 16<sup>th</sup> July 2005) which states the Minas Gerais Flood Emergency Policy, defining institutional organisations and actions for flood emergency planning, response and recovery. This law takes into account and integrates the existing civil defence legislation and institutional organisation of the different federative entities (union, Minas Gerais state and municipalities).

Flood emergency actions concerning health vigilance are also part of the National Secretary of Health Vigilance (SVS) responsibilities. The SVS, a secretary of the Ministry of Health, elaborated an Emergency Plan for Health Vigilance under Inundation Conditions (SVS, 2005) where guidelines for health vigilance, coordinated strategies and preparation measures are stated to handle health issues during floods.

Table 8 summarises the legal and institutional framework previously described.

**Table 8 Legislation and regulation of urban surface runoff at the federal and state levels**

<b>Administrative level</b>	<b>System</b>	<b>Legal framework</b>	<b>Interest for stormwater management</b>	<b>Institutions</b>	<b>Nature</b>
Federal	National System of Water Resources Management	Law n. 9433/1997 (Federal)	Water resources management instruments may be applied with purpose of reducing runoff and diffuse water pollution at the urban context	National Council of Water Resources	Deliberative
				National Water Agency	Regulation
				River basin committees (rivers at federal domain)	Deliberative
				River basin agencies (rivers at federal domain)	Executive
				State and local organisms	(see below)
	National Environmental Management System	Law n. 6938/1981, modified by the Law n. 7804/1988 Decree n. 99724/1990	Impact assessment studies required for hydraulic works (CONAMA Res. 001/1986). Hydraulic works licensing required for drainage works (CONAMA Res. n. 005/1998) Classification of water bodies according to water uses and water quality standards (CONAMA Res. n. 357/2005). Parameters for defining permanent protection areas, including riparian areas (CONAMA Res. n. 303/2002).	National Environmental Council	Deliberative
				Ministry of Environment	Executive
				Brazilian Institute of Environment and Renewable Natural Resources	Executive
				State and local organisms	(see below)
Federal	National Policy of Environmental Sanitation	Law n. 11455/2007. Law n. 11107/2005	Regulates the implementation of water use rights and charge for the provision of stormwater management services. Allow regional environmental sanitation service organisation.	Ministry of Cities	Executive
				Social Control Boards	Deliberative

<b>Administrative level</b>	<b>System</b>	<b>Legal framework</b>	<b>Interest for stormwater management</b>	<b>Institutions</b>	<b>Nature</b>
Federal	Cities' Code	Law n. 10257/2001	Define policy, guidelines and instruments for urban development and land use control. The plethora of instruments available may have considerable impact on flood risk and stormwater management, by means of non-structural measures.	Ministry of Cities	Executive
				Urban Policy Boards at national, state and local levels	Deliberative
	National System of Civil Defence	Decree n. 895/1993 Decree n. 5376/2005 Resolution n. 3/1999	Define policy and guidelines for civil defence, including flood emergency planning, response and recovery	Ministry of National Integration	Executive
				National Secretary of Civil Defence	Executive
				National Civil Defence Council	Deliberative
Regional Civil Defence Coordination				Executive	
State and local organisms	(see below)				
Minas Gerais State	Minas Gerais State System of Water Resources Management	Law n. 13199/1999	Water resources management instruments may be applied with purpose of reducing runoff and diffuse water pollution at the urban context	State Council of Water Resources	Deliberative
				Minas Gerais Water Resources Management Institute	Regulation and execution
				River basin committees (rivers at Minas Gerais state domain)	Deliberative
				River basin agencies (rivers at Minas Gerais state domain)	Executive

<b>Administrative level</b>	<b>System</b>	<b>Legal framework</b>	<b>Interest for stormwater management</b>	<b>Institutions</b>	<b>Nature</b>
Minas Gerais State	Minas Gerais state Environmental Management System	Law n. 7772/1980 Law n. 9514/1987 Law n. 9525/1987 Law n. 11903/1995 Law n. 12581/1997	Licensing required for hydraulic works, drainage works (COPAM Normative Deliberation n. 95/2006) and sanitation works (COPAM Normative Deliberation n. 07/1994). Licensing required for urban developments – regulates urban land use at protected and flood prone areas (COPAM Normative Deliberation n. 58/2002). Classification of water bodies according to water uses and water quality standards (COPAM Normative Del. n. 10/1986).	State Council of Environmental Policy	Deliberative
				State Secretary of Environment and Sustainable Development	Executive
				Minas Gerais State Environmental Foundation	Executive
				Regional Environmental Boards	Deliberative)
	Minas Gerais State Policy of Environmental Sanitation	Law n. 11720/1994.	Adopts instruments as the Minas Gerais Environmental Sanitation Master Plan and the Environmental Sanitation State Fund	This law has not yet been regulated by application decrees. Today it is dated in respect to the Federal Law of Environmental Sanitation.	
	Minas Gerais State Policy of Flood emergency planning	Law n. 15660/2005	Define policy and guidelines for flood emergency planning, response and recovery	Follow the same structure of the Civil Defence System at state and municipal spheres.	
	Minas Gerais System of Civil Defence	Decree n. 19077/1978 Decree n. 43424/2003	Define policy and guidelines for civil defence, including flood emergency planning, response and recovery	Military Secretary of the Minas Gerais' Governor	Executive
State Civil Defence Coordination				Executive	

### **7.3 Legislation and Regulation of Urban Surface Runoff at the Municipal Level: Local Authority Organisations**

#### **7.3.1 SMURBE – Urban Policies Municipal Secretariat**

SMURBE is a 1<sup>st</sup> level administrative secretariat directly subordinate to the Municipal Mayor of Belo Horizonte, created by Municipal Law no. 9011/2005. According to Law no. 9011/2005, the SMURBE mission is “to articulate the definition and the implementation of the urban and environmental development policies at the municipal level following an integrated approach and seeking to ensure that the urban development meets the social functions of the City”. Through 2<sup>nd</sup> level secretaries, autarchies and other institutions, SMURBE is responsible for the following issues of urban policy: housing (Municipal Housing Secretary), urban (land use) regulation (Municipal Secretary of Urban Regulation), slums upgrading and land regularization (URBEL), works (including drainage (SUDECAP)), transport and mobility, solid waste management (SLU: autarchy responsible for garbage collection) and the environment (Municipal Environmental Secretary).

##### **7.3.1.1 SUDECAP – Superintendence for the development of the Capital**

SUDECAP is a municipal autarchy created by the Law n° 1747 of December 9, 1969, with alterations introduced by subsequent legislation. It is a local organisation subordinated to SMURBE with the mission of (i) implementing the government policies on infrastructure, stated by the Municipal Plan of Works and of (ii) planning and executing water supply, sanitation and stormwater management services, according to the Agreement of Shared Administration stated by the Belo Horizonte Municipal government and the Minas Gerais State government. The following are the SUDECAP legal competences:

- To elaborate projects and to execute works (e.g. roads, municipal buildings, drainage systems) in collaboration with the SMURBE and other organisms of the Municipal Administration;
- To execute maintenance works on municipal public buildings and on the road system, including the drainage system;
- To provide technical and administrative support to the Municipal Environmental Sanitation Council - COMUSA;
- To manage, by specific delegation, the contracts of works and engineering services stated by the SMURBE.

SUDECAP has been leading the development of the municipal Storm Water Strategic Plan (SWSP) since 1999. As part of the SWSP, SUDECAP has already implemented the following actions:

- A survey programme on land use and on stormwater existing infrastructure, assessing the physical characteristics of all the existing system components;
- A stormwater maintenance programme focusing on the present BH storm water infrastructure, involving structural renovation of drains, culverts, lined channels, natural channels, etc;

- The implementation of a GIS database system gathering data about the storm water system. This GIS database is compatible with the previous and more general municipal GIS which contains a substantial amount of data including layers on land use, the road system, public buildings and health care system, etc.

Currently, the on-going Storm Water Strategic Plan and the Water Supply and Sanitation Strategic Plan focus on the following programmes:

- a) the DRENURBS programme: creek restoration in the urban area, which involves not only the restoration of polluted creeks but complete sanitation, risk management (risk of flooding, risk to public health etc), and a housing programme addressed at people living in risk prone areas (improvement of housing conditions, removing people from flood risk areas);
- b) the stormwater monitoring programme: establishing and operating a rainfall, discharge and water quality measurement network to allow the identification of BH stormwater problems at the present time and to contribute to the future evaluation of the efficiency of control measures implemented according to the stormwater plan. This programme will also contribute to an impact assessment of urbanisation on water resources and the development of a statement of land use regulatory measures aiming at the mitigation of those kinds of impacts.
- c) the rainfall-runoff and hydraulic modelling programme: data generated by the monitoring programme will feed models that will be employed to diagnose the functioning of the storm water system to devise the main causes of system operational problems and to simulate of different control measures scenarios. The first phase of this programme will start in 2006. In this phase, modelling will be performed prior to the monitoring programme, using data from the existing rainfall measurement network and from detailed surveys on land use and on the stormwater sewerage system characteristics, already concluded. Modelling results from this phase will be useful in devising actions to deal with critical and urgent problems and in designing the monitoring network.
- d) the research and technological development programme: the main programme goal is the development of stormwater management technologies to solve the main stormwater problems. Although the final scope of the programme has not yet been concluded, the following themes will certainly be part of it:
  - physical modelling of specific hydraulic structures such as gutters, culvert entrances and confluences with the purpose of efficiency evaluation under particular conditions that prevail in BH (e.g. steep channels, high flow velocities, frequent changes in water flow regimes) and design criteria statements;
  - evaluation of the volume of solid waste transported by the storm water system during storms and assessment of the waste typology (this is a common problem in many Brazilian towns, due to failures in solid waste management);
  - experimental investigation through pilot experiments of the efficiency of source control devices (BMP: infiltration trench, pervious pavement, detention facilities) in terms of runoff and pollution abatement, maintenance requirements, building and operational costs, design criteria statement assessment of the benefits of flood control measures by an economic evaluation of direct and indirect flood damages.

- e) the institutional and managerial development programme: this programme aims to provide a statement of legal, economic, institutional and managerial measures in order to improve storm water management in the BH municipality.

According to the Municipal Environmental Sanitation Policy, stated by the Law no. 8260 from December 3, 2001, environmental sanitation encompasses the provision and management of services for the water supply, wastewater, solid waste, stormwater sectors, as well as the control of disease transmitter vectors.

Chapter I, Section VII of this law states the following guidelines for the stormwater management:

- I. to elaborate and to implement the Storm Water Strategic Plan at Belo Horizonte municipal area, comprising the Arrudas creek and Onça creek catchments;
- II. to guarantee all Belo Horizonte inhabitants have appropriate urban drainage infrastructure and services, as a condition of ensuring adequate health conditions, environmental quality and protection of natural resources;
- III. to prioritize the solution of urban drainage problems for which a high risk of loss-of-life and/or material losses have been identified ;
- IV. to promote the adoption of creek restoration approaches, in the case of non-lined creeks, leading to a minimum intervention on natural riparian environments, the creation of permanent preservation areas along creek corridors, and to adequately deal with questions such as the risk of land-sliding, the risk of flooding and the lack of sanitation;
- V. to establish a water quality classification scheme for all perennial creeks which are tributaries to the Arrudas and Onça creeks at the municipal level according to previously stated water potential uses by a participatory decision process;
- VI. to eliminate the discharge of wastewater to receiving waters without treatment and the cross-connection between the wastewater and the stormwater sewerage systems, as well as to control the pollution of urban surface runoff and receiving waters by solid wastes, in order to establish adequate environmental and public health conditions;
- VII. to look for ways of making possible the naturalisation of lined and culverted creeks, starting by the conception and execution of culverted channel recovery and evolving to projects of creek integration to the urban landscape, the mitigation of environmental impacts and the improvement of creek maintenance actions;
- VIII. to promote environmental education with a focus on stormwater processes in order to raise awareness of concepts of urbanisation impacts and the use of source control measures to mitigate them;
- IX. to develop and implement concepts of green corridors in the urban planning as an alternative for the development on flood prone areas;
- X. to control the expansion of impermeable surfaces in urban areas.

According to Article 29 of the same law, the Belo Horizonte City Hall is responsible for the implementation of environmental sanitation actions (i.e. water supply, wastewater, stormwater, solid waste and the control of disease transmitter vectors).

### **7.3.1.2 URBEL – Belo Horizonte Urbanisation Company**

URBEL is a municipal autarchy created by Law n° 899 of October 30, 1961, with alterations introduced by subsequent legislation. It is a local organisation subordinated to SMURBE with the following functions:

- To coordinate and execute projects and works of urban infrastructure in low-income neighbourhoods and slums, in collaboration with other organisations of the Municipal Administration;
- To develop programs of housing (house building, house upgrading) in low-income neighbourhoods and slums;
- To coordinate risk management in low-income neighbourhoods and slums located in flood prone and land slide risk areas;
- To coordinate urban development programs addressing low-income neighbourhoods and slums;
- To administrate public buildings and public areas in low-income neighbourhoods and slums.

URBEL is responsible for the design, implementation and maintenance of drainage systems within the slum areas of Belo Horizonte.

### **7.3.1.3 SMARU – Municipal Secretary of Urban Regulation**

The Municipal Secretariat of Urban Regulation has two main functions:

- To guide and to enforce the Belo Horizonte land use legislation (Law. n. 7166, of 27<sup>th</sup> December 1996) according to the local zoning principles and criteria;
- To assure adequate quality of life for the population of Belo Horizonte, through the use of updated town planning and regulation instruments.

In the execution of its mission, SMARU shall evaluate new urban development projects for approval. In this context, SMARU is also responsible for the analysis and evaluation of adequacy of drainage projects of new urban developments. The Belo Horizonte land use law is based on comprehensive socio-economic, demographic, environmental and risk assessment studies and incorporates instruments and criteria for regulating land use in Belo Horizonte taking into account those issues identified within these studies. According to this law, the landowner should adopt source control measures for reducing direct runoff if more than 80% of the lot surface is made impermeable.

### **7.3.1.4 Municipal Environmental Secretary and the Municipal Council of Environment**

The Municipal Environmental Secretariat is a municipal organisation created by Law n° 3.570 of June 11, 1983, with alterations introduced by subsequent legislation. It is a local organisation subordinated to SMURBE with the mission of (i) defining priority areas for environmental control or environmental recovery actions; (ii) supervising the application of environmental



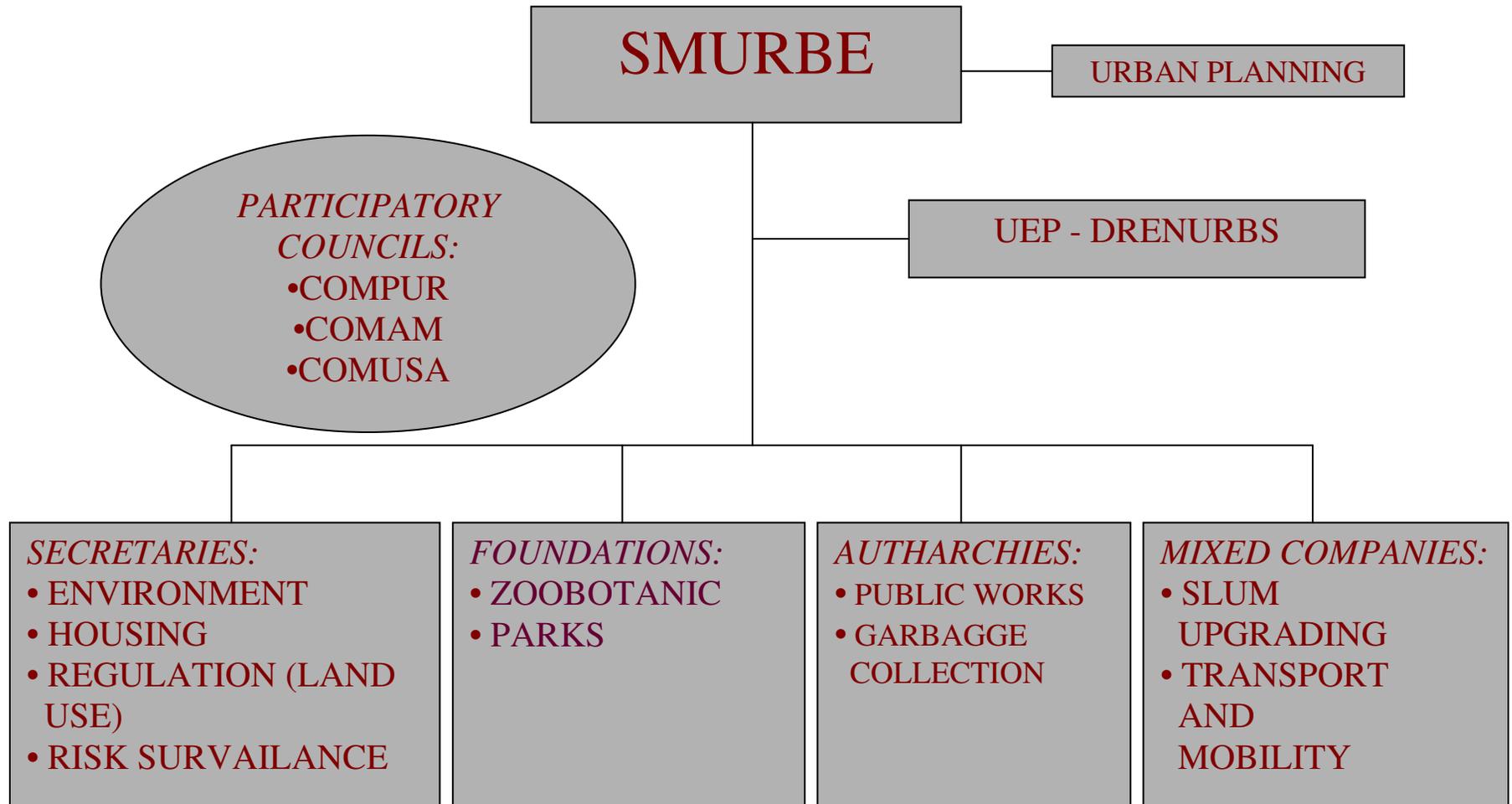
legislation; (iii) enforcing environmental legislation; (iv) developing the general population's awareness of the importance of environmental protection.

Law no. 4235 of December 4, 1985, created the Municipal Council of Environment (COMAM), with the following mission:

- I. To formulate the guidelines for the municipal environmental policy;
- II. To promote the enhancement of environmental quality in municipal areas;
- III. To state the municipal environmental legislation, including technical norms and standards in conformity with the Federal and State environmental legislation;
- IV. To advise the Municipal Environmental Secretary in the formulation of its annual and long term action plans;
- V. To decide on the authorisation of new developments and the application of fines and other penalties in the case of non-conformity with environmental legislation.

Stormwater management actions, structural flood control measures and related initiatives must be presented to the Municipal Council of Environment for evaluation and authorisation for implementation (Law no. 7.277 of January, 17 1997). Figure 9 illustrates the administrative structure previously described. Table 9 summarises the legal framework of the urban surface runoff at the Belo Horizonte municipal level.

For a further evaluation of environmental sanitation governance in both Belo Horizonte and Brazil in general see Heller, L. (2007), *Different approaches in analyzing water governance: implications to the case of Belo Horizonte, Brazil*, Switch First Scientific Meeting, Birmingham and Britto, A.L.P. and Silva R.T. (2006), *Water management in the cities of Brazil: conflicts and new opportunities in regulation*, in *Urban Water Conflicts: an analysis of the origin and nature of water related unrest and conflicts in urban context*, UNESCO working series SC-2006/WS/19, UNESCO/IHP, pages 39-52.



**Legend:**

SMURB: Urban Policies Municipal Secretary  
 COMPUR: Urban Policy Municipal Council  
 COMAM: Municipal Council of Environment

COMUSA: Municipal Environmental Sanitation Council  
 CMH: Housing Municipal Council

**Figure 9 SMURB administrative structure (Costa & Costa, 2007)**

**Table 9 Legislation and regulation of urban surface runoff at the municipal level**

<b>Institution</b>	<b>Legal framework</b>	<b>Interest for stormwater management</b>	<b>Nature</b>
Urban Policy Municipal Secretary (SMURB)	Law n. 9011/2005	SMURB articulates the definition and the setting up of the urban and environmental development policies.	Executive
Superintendence for the Development of the Capital (SUDECAP)	Law n. 1747/1969	Storm Water Strategic Plan and Water Supply and Sanitation Strategic Plan development and implementation. DRENURBS program development and implementation. Storm water monitoring and modelling. Research and development leading on storm water.	Executive
	Law n. 8260/2001	States the Environmental Sanitation Policy	
Municipal Environmental Sanitation Council (COMUSA)	Law n. 8260/2001 Law n. 8293/2001	COMUSA has as main duties the regulation, control and evaluation of the environmental sanitation policy application and the definition of guidelines and criteria for the use of the Municipal Environmental Sanitation Fund resources.	Deliberative
Belo Horizonte Urbanisation Company (URBEL)	Law n. 899/1961	URBEL is in charge of housing and infrastructure design and building in low-income neighbourhoods and slums. It is also responsible for the coordination of risk management actions in those neighbourhoods.	Executive
Municipal Secretary of Urban Regulation (SMARU)	Law n. 7166/1996	SMARU is responsible for guiding and enforcing the municipal land use legislation.	Executive
Urban Policy Municipal Council (COMPUR)	Law n. 7165/1996	COMPUR is a deliberative council responsible for monitoring the enforcement of the Urban Master Plan and of the Land Use legislation.	Deliberative
Housing Municipal Council (CMH)	Law n. 6508/1994	This council is responsible for evaluating and deliberating the Municipal Housing Policy. This policy may have influence on land use, exposition to floods, ...	Deliberative

Municipal Environmental Secretary	Law n. 3570/1983	Its mission is to supervise the application of the environmental legislation and to define priority areas for environmental protection and recovery actions, among others.	Executive
Municipal Council of Environment (COMAM)	Law n. 4235/1985 Law n. 7277/1997	Its mission is to formulate guidelines for the municipal environmental policy, to state the municipal environmental legislation, including technical standards, to decide about licensing new developments. Stormwater management actions are evaluated by COMAM for implementation licensing.	Deliberative
Municipal Civil Defence Coordination (COMDEC)	Law n. 3135/1979 Decree n. 3651/1979 Decree n. 4539/1983	Define policy and guidelines for civil defence, including flood emergency planning, response and recovery at the municipal sphere.	Executive

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GESETZ ZUR ORDNUNG DES WASSERHAUSHALTS (WHG) in der Fassung der Bekanntmachung vom 19.08.2002 (BGBl. I S. 3245) zuletzt geändert am 25.06.2005 durch Artikel 2 des Gesetzes zur Einführung einer Strategischen Umweltprüfung und zur Umsetzung der Richtlinie 2001/42/EG (SUPG) (BGBl. I S. 2625)

RL 2000/60/EG DES EUROPÄISCHEN PARLAMENTS UND DES RATES vom 23.10.2000 zur Schaffung eines Ordnungsrahmens für Maßnahmen der Gemeinschaft im Bereich der Wasserpolitik, ABl. EG Nr. L 327

## **8.4 Websites of Brazilian legislation**

- Brazilian Ministry of Environment: [www.mma.gov.br](http://www.mma.gov.br)
- Brazilian Ministry of Cities: [www.cidades.gov.br](http://www.cidades.gov.br)
- Brazilian Ministry of National Integration: [www.integracao.gov.br](http://www.integracao.gov.br)
- Brazilian Ministry of Health: [www.saude.gov.br](http://www.saude.gov.br)
- National Agency of Water: [www.ana.gov.br](http://www.ana.gov.br)
- Civil Defence:
  - at Federal level: [www.defesacivil.gov.br](http://www.defesacivil.gov.br)
  - at Minas Gerais state level: [www.defesacivil.com.br](http://www.defesacivil.com.br)
- Minas Gerais State Secretary of Environment and Sustainable Development: [www.semad.mg.gov.br](http://www.semad.mg.gov.br)
- Belo Horizonte City Council: [www.pbh.gov.br](http://www.pbh.gov.br)