CATCHMENT MANAGEMENT PLANS: A COMPARISON OF APPROACHES IN THE UNITED KINGDOM AND NEW ZEALAND

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ABSTRACT

Integrated Catchment Management Plans (ICMPs) in New Zealand identify potential issues associated with stormwater and prepare options to mitigate them. There is a strong Planning context, with environmental effects assessed and mitigated.

Strategic planning for water management in the UK is different. Separate studies are often undertaken to assess flood risk, drainage and water supply issues. Recently, more attention has been given to integrating these approaches and recent legislation has given this more weight in the planning context.

These approaches respond to different drivers in the two countries. These drivers are reviewed, particularly with regard to targets for flood risk management and water quality. The drivers result in the application of different solutions during the development of both greenfield and brownfield sites. A key component of this mitigation in both countries is the application of Low Impact Design techniques. The paper compares and contrasts different approaches and how they can be integrated as part of the Catchment Management Planning process.

KEYWORDS

Catchment management, United Kingdom, New Zealand, SUDS, LID

PRESENTER PROFILE

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1 INTRODUCTION

This paper sets out a review of the approaches to the development of plans and policies in relation to Catchment Management Plans, in the United Kingdom (UK) and New Zealand

(NZ). Both countries are subject to very different legislative requirements and drivers, which leads to different approaches to catchment management.

Rainfall patterns are also different in both countries. Perhaps the greatest similarity is the extreme variations across both countries, although in general New Zealand is subject to more intense rainfall than the United Kingdom. A review of rainfall patterns is beyond the scope of this paper, although it should be remembered that rainfall patterns do influence decisions as to how catchments are managed.

The paper reviews the legislative background to catchment management in both countries, and then considers surface water drainage issues in more detail. Key differences and similarities are considered, using case studies from both countries as illustrations. The UK focus is on England and Wales, as some of the policy and its implementation is different in Scotland and Northern Ireland.

2 THE EXISTING SITUATION

2.1 NEW ZEALAND

Historically, catchment management policy has been developed to manage the effects of flooding and erosion, with water allocation and water quality becoming a focus more recently.

Early legislation governing the management of stormwater included the Land Drainage Act of 1908, which required consent to take or discharge water or modifications to an existing waterway. Town planning in the 1950's introduced a greater focus on district schemes and their effect on local resources, and catchment boards evolving form the 1941 Soil Conservation and Rivers Control Act.

Integrated Catchment Management Plans (ICMPs) evolved in response to 2 key statutes; the Local Government Act 2002 (LGA) and the Resource Management Act 1991 (RMA).

The RMA originated from a recognised need to review key environmental legislation in New Zealand and provide a single act covering the management of land, water, soil and air in New Zealand. Listed below are a few of the key problems identified for which the RMA was designed to overcome (EDS, 2011):

- There were arbitrary differences in management of land, air and water;
- There were too many agencies involved in resource management with overlapping responsibilities and insufficient accountability;
- Pollution laws were ad hoc and did not recognise the physical connections between land, air and water; and
- Maori interests and the Treaty of Waitangi were frequently overlooked.

The RMA was passed by Parliament in August 1991 and on its enactment repealed 78 statutes and regulations and amended numerous others to provide a single piece of legislation for the management of land, water, soil and air (Feeney et al, 2010).

The purpose of the RMA is set out in section 5 of the Act as providing the means to "…manage the use, development, and protection of natural and physical resources in a way, or at a rate, which enable people and communities to provide for their social, economic, and cultural wellbeing and for their health and safety."

The RMA sets out to define a sustainable framework for the management of New Zealand's resources and defines sustainable management as "managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural

wellbeing and for their health and safety while sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and avoiding, remedying, or mitigating any adverse effects of activities on the environment."

The RMA is implemented by the district/city and regional councils under the LGA. The LGA provides local government with the necessary power to determine the appropriate use of resources within their region. This is enabled through the production of Regional and District plans, which specify the use of resources and controls in the region. The LGA promotes a sustainable development approach by requiring councils to take social, economic, environmental and cultural well-being into account in their decision making.

In the implementation of the RMA, authorities responsible for stormwater and wastewater discharges (dischargers) were given a 10 year period during which these discharges could continue unconsented as per previous conditions. By the end of that 10 year period, dischargers were required to apply for a Consent for all stormwater and wastewater discharges to the environment. ICMPs have been developed by many councils as supporting documentation to the discharge applications, as they provide many of the required studies, assessments of effects and mitigation considerations required.

As an example, Figure 1 demonstrates the relationship between Auckland regional and district planning documents affecting stormwater and wastewater management prior to November 2010. While the organisational structure has changed subsequent to this, many of the policies and plans have been maintained.

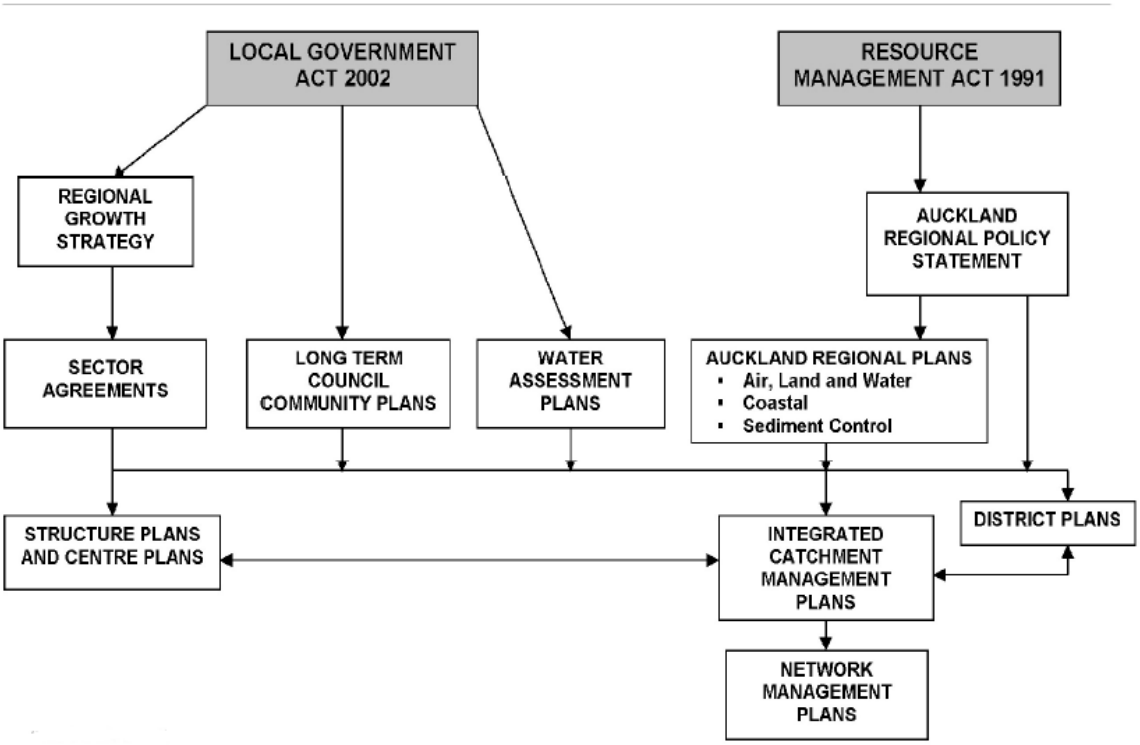

Figure 1: Relationship between the different planning document for the management of stormwater discharge in the Auckland Region (source: ARC, 2004).

Within the Auckland region, additional policies that influence the development and outcomes of ICMPs are as follows:

- Auckland Regional Policy Statement
- Transitional Regional Plan (1999)

- Proposed Auckland Regional Plan: Air, Land and Water (PARP: ALW) (2010)
- Auckland Regional Plan: Coastal (2004)

ICMP objectives are developed through a combination of studies to identify issues within the catchment, both current and future along with consultation with the community and local Iwi. Options are identified to mitigate the effect of future development and remediate existing issues identified within the catchment. Indicators and monitoring programmes are developed in order to ensure outcomes can be tracked and management policies updated as required.

ICMP outcomes are implemented through plan changes to the District Plan for each region. This sets up the rules that have been established to ensure positive outcomes for the water cycle and also provides the financial resources through development levies to implement the recommendations of the ICMPs.

Regional outcomes are influenced by local policies on 3 waters management. For example in Auckland, stormwater discharges from new developments must meet the requirements set out in TP10 (ARC, 2003). For the Auckland region, this recommends that stormwater management devices are designed to remove 75% of suspended solids on a long term average basis. A similar approach has been adopted by Christchurch City Council (CCC), with treatment focusing of first flush volumes and sediment removal.

CCC has developed a guidance and design manual covering the regional best practices and policies applicable to Christchurch. The Waterways, Wetlands and Drainage guide (CCC, 2003) provides guidance on local rainfall and runoff calculations, stormwater management and treatment, flood management and groundwater management.

Statutory documents that influence the development of ICMPs within the Christchurch region include:

- Transitional Regional Plan (TRP) for Canterbury;
- Proposed Natural Resources Regional Plan (NRRP) for Canterbury; and
- The Christchurch City District Plan.

As a result of ICMPs being influenced by regional policy and legislation, there is not a consistent approach to the development of ICMPs. Regional policies allow for local drivers and priorities to be promoted within the ICMP process, however this may result in inconsistencies between regions, particularly relating to flood risk management and water quality outcomes.

2.2 UNITED KINGDOM

While many of the policies within the UK apply to England, Wales, Scotland and Northern Ireland, some legislation and plans are specific to each country. In order to simplify this paper, we only refer to policies and legislation that affect England and Wales.

Overall catchment management policy is driven by a combination of European Directives and national policy. Legislation has evolved over many years, with substantial change following the Second World War. Most recently, water related legislation follows the requirements of European Directives, which include:

- The Urban Wastewater Treatment Directive (1991);
- The Nitrates Directive (1991);
- The Water Framework Directive (2000);
- The Groundwater Directive (2006); and
- The Floods Directive (2007).

European Directives are then implemented through primary or secondary legislation.

A number of national strategies have also been developed to define approaches to catchment and flood risk management. These include, for example:

- The Flood and Coastal Erosion Risk Management Strategy (FCERM), which is currently being developed by the Environment Agency, the environmental regulator in England and Wales. The strategy will describe what needs to be done by all involved in flood and coastal risk management (Environment Agency, Local Authorities, Internal Drainage Boards, water and sewage companies and highways authorities) to reduce the risk of flooding and coastal erosion, and to manage its consequences. The strategy will set out long term objectives and how these will be achieved, particularly focusing on prioritisation of investment to manage risk effectively, setting out clear plans for risk management and ensuring that emergency response to flood events are effective.
- Future Water (Defra, 2008) – this strategy sets out an integrated approach to the sustainable management of all aspects of the water cycle, from rainfall and drainage, through to treatment and discharge. It focuses on practical ways to achieve the vision to ensure sustainable use of water from the perspective of people, businesses and the environment.
- Making Space for Water (Defra, 2005) - strategy for the next 20 years to implement a more holistic approach to managing flood and coastal erosion risks in England.

Legislation tends to drive a focused investment in infrastructure within specific technical areas. For example, the Urban Wastewater Treatment Directive drove significant investment to reduce the frequency of operation of combined sewer overflows to improve urban water quality. Similar drivers to improve bathing water quality required investment in coastal wastewater treatment works and outfalls. The Flood and Water Management Act (2010) introduces new requirements in relation to surface water drainage, reservoirs and Water Companies. Legislation therefore tends to drive investment which is focused in certain areas, rather than a wider catchment based approach.

At a regional or catchment scale requirements are addressed through further plans and policies. These include, for example:

- Catchment Abstraction Management Strategies (CAMS) and Catchment Flood Management Plans (CFMPs) which are developed at a regional level by the Environment Agency;
- Strategic Flood Risk Assessments (SFRAs) and Surface Water Management Plans (SWMPs) which are developed at a local level by Local Authorities; and
- Water Resource Management Plans (WRMPs) which are developed at a regional level by Water Companies.

These plans set the regional or local context for the management of water within catchments, either to address flood risk, water available for abstraction or water quality issues. These plans are developed through a combination of technical work and consultation with stakeholders in the local area. Whilst these set policy boundaries, they are open to review and refinement with respect to individual applications. For example, a Strategic Flood Risk Assessment is used to assess broad floodplains and set planning policy, which is then refined for an individual development.

Any individual development must comply with the requirements of planning policy. In this case, Planning Policy Statement 25 (PPS25) (Communities and Local Government, 2010) is relevant which sets guidance in relation to development and flood risk. Essentially, any development must meet these requirements to be awarded planning permission. This

requires a comprehensive assessment in relation to flood risk and recommends the use of Sustainable Drainage Systems (SUDS) for surface water drainage.

However, the key missing element is any form of integration between flood risk, surface water management, water quality, discharges and water abstraction. As described above, legislation and strategies tend to be focused on certain technical areas, without addressing higher level effects across the water cycle. At the planning stage the key driver is to comply with PPS25, which focuses on flood risk management. When development is considered, this is the key water related driver; if an application complies with PPS25 no other water related requirements are likely to be considered.

To overcome this, the Environment Agency promoted the development of water cycle studies, which aim to integrate all issues across the water cycle. They focus on the integration of land and water planning in relation to growth and identify any critical infrastructure that may be required. These water cycle studies are usually focused on areas of strategic housing development to determine how and when critical water infrastructure should be developed.

The aims of a water cycle study are to plan for water more sustainably by:

- *Bringing together all partners and stakeholders existing knowledge, understanding and skills;*
- *Bringing together all water and planning evidence under a single framework;*
- *Understanding the environmental and physical constraints to development;*
- *Working alongside green infrastructure planning to identify opportunities for more sustainable planning; and*
- *Identifying water cycle planning policies and a water cycle strategy to help all partners plan for a sustainable future water environment.*

Its aim is therefore to bring together different stakeholders and integrate water issues as part of land use planning. This can be undertaken at a strategic level, but when applying for planning permission, usually the only requirement is to comply with PPS25.

3 LOW IMPACT DESIGN (LID) OR SUSTAINABLE DRAINAGE SYSTEMS (SUDS)

There is a significant difference in the legislative backgrounds and drivers between NZ and England & Wales as described above. This leads to different types of approaches and solutions to be implemented. This section of the paper concentrates on the drivers for surface water drainage and how these affect the solutions that are implemented.

3.1 NEW ZEALAND

Within the Auckland Region, applications for stormwater discharge consents must meet the design guidelines set out in TP10 (ARC, 2003). Additional guidance is provided on low impact development is provided in TP124 "Low impact design manual for the Auckland Region" (Shaver et al, 2000).

The Waterways, Wetlands and Drainage guide (CCC 2003) provides guidance on design to minimise and mitigate the effects of development on stormwater runoff and groundwater within the Christchurch region.

Key principles of the low impact design manual are to reduce the impact of development through working alongside natural systems to maximise the benefits these systems offer and maintain as much as possible the natural character of the area.

While compliance with TP10 is a legislative requirement for developments within the Auckland Region, low impact design is not enforced. This results in end of pipe solutions being commonplace in new developments, with wetland treatment devices being the main focus as this is the preferred method outlined in TP10.

There is some increasing acknowledgement of how low impact design within residential subdivisions can provide improved character and living standards within a community, with good examples of how it can be applied in developments around New Zealand.

3.1.1 ENGLAND & WALES

The control of surface water runoff has been recognised as a key impact of development for many years, for both its hydrological and water quality effects. Since the mid-1990s, policy and guidance documents have promoted SUDS to minimise the effect of development. Key principles of SUDS are:

- The control of runoff at source;
- Applying the philosophy of the 'surface water management train'; and
- Considering water quantity, quality and amenity issues as part of land use planning.

Much information has been produced, particularly by the UK's Construction Industry Research and Information Association (CIRIA), to promote the use of SUDS and provide design guidance. However, the legislative situation provides two obstacles to their implementation.

The first issue is that of long term maintenance and adoption. Either Water Companies or Local Authorities would normally adopt surface water sewers. However, many of the SUDS techniques do not fall into the legal definition of a sewer, preventing Water Companies from adopting them. Many Local Authorities, although with the powers to adopt SUDS, avoid this due to the financial risks involved and a perceived lack of skills. CIRIA (2004) developed legal agreements to enable different statutory authorities to adopt SUDS, although these were not widely used. The 2010 Flood and Water Management Act finally provided a legal mechanism for the adoption of SUDS, which will shortly come into force.

The second issue is related to how surface water discharges are approved. There is no specific consenting of surface water discharges in the UK; control is only exercised as part of the planning process. Requirements are made in relation to the mitigation of surface water flood risk, but water quality is rarely considered. It is usual for both peak flowrates and volumes to be controlled. This means that either:

a) The peak flow rate must not exceed the pre-development flow rate up to the 1 in 100 year return period (including climate change), and any additional volume of runoff following development must be discharged via infiltration or other techniques; or
b) Where the additional volume of runoff following development cannot be discharged by infiltration, the peak runoff from the site for all events up to the 1 in 100 year return period (including climate change) must be limited to the peak flow rate from a 1 year return period storm.

This approach leads to a significant focus on attenuation within stormwater design, in order to accommodate the required standards for both peak flow rates and volumes. Water quality is not considered in detail, with water quality mitigation being provided on an ad hoc basis depending on the type of drainage solutions implemented.

4 KEY DIFFERENCES AND SIMILARITIES

There are a number of differences between the UK's and NZ's approach to catchment management. The most significant difference is in relation to the level at which the water environment is governed. European and national legislation and regulation require improvements or management of different aspects of the UK's water environment, across the whole spectrum of catchment management. This is focused on achieving policy objectives that are also set at either a European or national level. A comparison of some of the key differences and similarities is set out below.

4.1 CATCHMENT MANAGEMENT

Key differences in relation to catchment management are focused around flood risk management and stormwater. With the backing of national level strategies and policies, the approach to flood risk management is more consistent and more comprehensive in England & Wales than in New Zealand. New Zealand's approach is more regional, with less in the way of national level planning policy related to flood risk management. This may lead to inconsistencies between regions or, equally, allow different regions to implement effective local solutions.

Flood risk management is generally more sophisticated in England & Wales than in New Zealand. The majority of catchments have been mapped by the Environment Agency at least once and it is usual now to develop sophisticated 2 dimensional computational models that define both flood risks and flood hazards (by considering depths and flow velocities). In large catchments in England & Wales there is also a reasonably sophisticated approach to flood forecasting. For example, in 2010, the Flood Forecasting Centre was initiated. This is a partnership between the Environment Agency and the UK's Met Office to combine their meteorological and hydrological expertise. This approach should enhance the forecasting of tidal, fluvial and surface water flooding on a real time basis.

Detailed site specific Flood Risk Assessments (FRAs) are also required by PPS25 for most developments in England & Wales to demonstrate that they are outside of the 1 in 100 year plus climate change floodplain. Depending on the site related risks, the FRA may require floodplain and flood hazard modelling, flood defence breach modelling and surface water drainage assessments. This must consider both the proposed development site and areas downstream. For many sites these are simple assessments, for others the FRA is one of the key factors driving development principles.

The second key difference in the approach to catchment management is that specific stormwater consents are not required in the UK. Stormwater discharges are addressed through the planning process and subsequent implementation. Additionally, surface water discharges from Highway Authorities and the Highways Agency are exempt from planning permission as they are 'competent authorities', with the required experience to control surface water runoff effectively. Overall, there is far less of a focus on the water quality effects of surface water runoff than in NZ.

4.2 LOW IMPACT DESIGN

There is a whole suite of low impact design techniques available that can be implemented by developers. Each has particular characteristics in relation to conveyance, attenuation and water treatment. Project drivers define which techniques are selected for implementation based on factors such as cost, performance or maintenance.

As described above, attenuation is the key driver for surface water drainage techniques in the UK. Other factors that heavily influence SUDS design is the layout of developments, with higher densities and land values. Densities of 40 - 50 dwellings per hectare are common, which is slightly higher than usual 'medium density' housing in New Zealand

(Turner et al, 2004). As a result, the SUDS approaches adopted tend to focus on 'dual use' such as:

- Swales integrated within landscaping;
- Permeable paving overlying geo-cellular storage; and
- End of pipe storage in stormwater ponds or detention basins.

The focus in the UK is therefore the storage of surface water during all rainfall events.

Drivers in NZ tend to be focused on water quality and detention of peaks, rather than volumes. Guidance sets out solutions to achieve long term removal of suspended sediments as a proxy for a range of contaminants. This drives stormwater ponds and wetlands in the majority of solutions, most of which are developed as end of pipe solutions. Whilst some schemes include a range of different LID solutions in series, many adopt conventional drainage which discharge to a stormwater pond or wetland. This complies with guidance but does not necessarily achieve a holistic approach to surface water management.

It is important to note that despite different legislative approaches, rainfall patterns and design of housing, neither England & Wales or New Zealand achieve the implementation of LID / SUDS on a consistent basis. Both countries recommend the inclusion of the management train approach and a balanced approach to water quality, amenity and attenuation as part of surface water drainage design. However, in neither country is this achieved on a consistent basis. There tends to be a 'business as usual' approach that focuses on single aspects of surface water management, being water quality in New Zealand and attenuation in England & Wales. This reflects both the legislative and policy drivers, and particularly issues with regard to long term maintenance.

5 CASE STUDIES

5.1 NEW ZEALAND: OREWA WEST STRUCTURE PLAN

Orewa is a coastal town north of Auckland that has several major developments planned within the catchment. The Orewa West Structure Plan area covers an area of 223ha which will make up the new green fields development. The catchment is currently primarily pasture and discharges to the Orewa estuary which has been identified as a waterway of significance, providing significant habitats to wildlife (Rodney District Council, 2010).

There are a number of key drivers that have been identified that must be considered in the development of this area, the keys drivers are listed below:

- Ecologically significant receiving environment, coastal protected area 2;
- High amenity value of receiving environment;
- High erosion risk for exposed soils;
- High cost of water supply to the area with reduced additional capacity available; and
- Increased risk of flood issues due to increased stormwater runoff.

An ICMP was developed for the catchment, identifying the existing and future environmental effects of the catchment and identifying the methods available to mitigate development impacts. Key areas investigated included contaminant loading from the catchment, flood risk due to the new development and sedimentation and erosion risks during construction. Some of the key recommendations are as follows:

- Utility reserves should be developed following natural gullies to enhance natural flow paths and provide connected amenity value for the development;

- Hydraulic neutrality should be maintained for up to the 1 in 2 year ARI storm, with peak discharge rates maintained at pre-development rates for storm events below this;
- Use of inert building materials is recommended to minimise contaminant runoff;
- Low impact design is recommended for this development, with reduced carriageway widths, raingardens and rainwater tanks suggested as possible means to reduce runoff volumes and contaminant loads; and
- Stormwater treatment through wetlands/ponds is recommended.

This study identified that the key areas of concern are contaminant discharges to the receiving environment and ensuring development is appropriately placed and does not encroach on the 100 year floodplain.

Applications for development within this catchment will be required to meet the stormwater discharge requirements as set out in TP10 (ARC, 2003), however the use of low impact design techniques to improve stormwater outcomes for the catchment is recommended rather than enforced.

The potential for rainwater tanks to both reduce stormwater runoff and water demand for the catchment provides a good example of benefits that can be achieved through consideration of the water cycle for the catchment. Difficulties in implementing this as a solution include enforcement of the implementation of rainwater tanks and long-term maintenance.

5.2 ENGLAND & WALES: ASHFORD GROWTH AREA

Ashford is a town in Kent, south-east England. Selected for growth, it is now planning how to deliver 31,000 new homes and 28,000 new jobs by 2031. This represents almost a doubling of the population in 2001. The town has excellent transport links, being on the high speed rail link to London and Paris and adjacent to the UK's motorway network.

There are a number of key water related drivers that constrain development, including:

- The town lies within the floodplain of the River Stour, where additional runoff from proposed development could increase flood risk to properties;
- Additional water supplies are required to meet future demand, with no availability from current sources;
- Fragmentation of green spaces will affect connectivity of habitats;
- Water quality in the River Stour is marginal, partly due to seasonal low flows. Additional wastewater discharges and diffuse pollution may lead to deterioration of water quality below statutory limits; and
- Much of the area proposed for development is clay, with little opportunity for infiltration of surface water runoff.

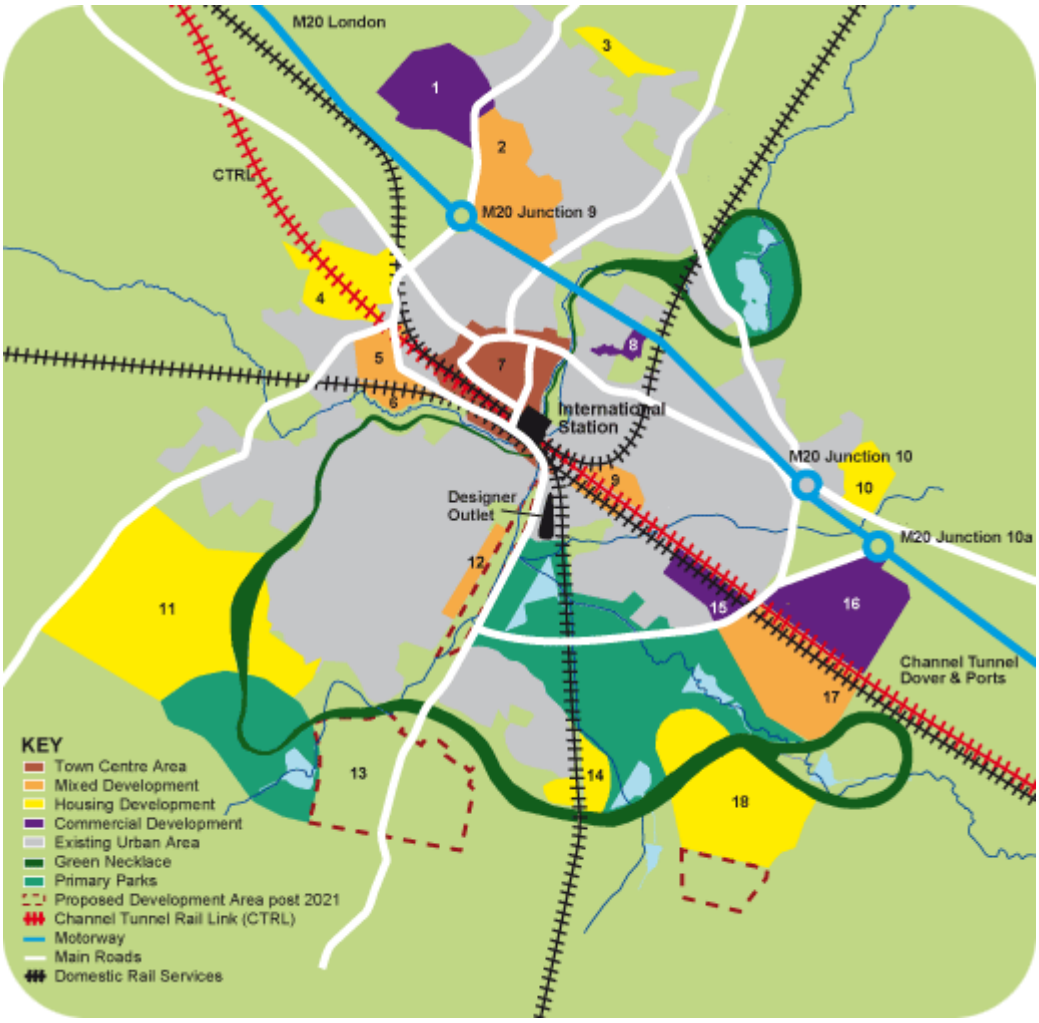

Figure 2: Proposed growth in Ashford (source: Ashford's Future)

In order to address these issues, an Integrated Water Cycle Study (EA, 2007) was carried out to set requirements for both housing and commercial development in the area. This developed a number of different 'systems based' approaches to water management, which were then integrated to establish the preferred strategy. This strategy includes:

- The optimisation of existing groundwater resources and development of additional sources;
- Implementation of high levels of water efficiency;
- Large scale wastewater improvements to convey and treat flow at the existing wastewater treatment works;
- Implementation of SUDS by developers to control the volume and rate of runoff to the River Stour;
- Limited improvement to existing flood defences; and
- The development of a strategic approach to SUDS to maximise ecological and recreational benefits.

This was a major study to enable development where there were a number of significant water related constraints. Two key lessons learned were the importance of water quality, one of the most critical constraints to growth and the importance of incorporating water in spatial planning. In this case, water quality tied together all the different elements of the water cycle. Water quality objectives downstream of Ashford were potentially affected by diffuse runoff, reduced baseflow, increased abstraction for water supply and increased wastewater discharges. The strategy set out policy recommendations to ensure the

appropriate infrastructure and planning recommendations could be implemented, therefore minimising the potential effects on water quality downstream.

6 CONCLUSIONS

Both the United Kingdom and New Zealand experience problems with flood risk, water supply and water quality. Both countries recommend a catchment based approach to the management of all water resources. However, legislation, organisational barriers and other drivers frequently focuses effort on achieving only some of the objectives to manage catchments effectively.

England & Wales is more heavily regulated and legislated than NZ. International requirements and national legislation and policy drive investment. This ensures that there is on-going investment in catchment management related activities. However, the process can often be one dimensional; investment focuses on one single area without taking a wider catchment based approach to decision making.

Key learning points from New Zealand include the focus on the management of water quality and the minimisation of erosion. New Zealand also requires consents for stormwater discharges; a significant difference from England & Wales where all surface water discharges are approved as part of a planning consent. This gives the process of obtaining a surface water discharge consent greater weight in the planning process, and hence there is more focus on ensuring that water quality is considered as part of surface water discharges.

Both countries make recommendations in policy to promote the use of sustainable surface water management techniques. However, neither country achieves this goal; both focus on different elements of surface water management which strongly influences the solutions that are implemented.

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ABBREVIATIONS

ARC	Auckland Regional Council
CIRIA	Construction Industry Research and Information Association
EA	Environment Agency (UK)
LID	Low Impact Design
LGA	Local Government Act
NZ	New Zealand
PPS25	Planning Policy Statement 25
RMA	Resource Management Act
SUDS	Sustainable Drainage Systems
UK	United Kingdom