- Transfer of surface runoff from one place to another
- Through grassed channels/trenches and pipes
- Transfer essential for managing flows and linking SuDS components
- Uncontrolled conveyance to a point of discharge in the environment not considered sustainable

d) Water Harvesting

- Direct capture and use of runoff on site for domestic or irrigation, overflowing/discharging to adjoining SuDS component(s)
- Contributes to Flood Risk Management

7.3.2 Quality Control Processes

A number of natural water quality treatment processes can be exploited within SuDS design. Different processes will predominate for each SuDS technique and will be present at different stages in the treatment train.

a) Sedimentation – reducing flow velocities to a level at which the sediment particles fall out of suspension;

b) Filtration & Biofiltration – trapping pollutants within the soil or aggregate matrix, on plants or on geotextile layers;

c) Adsorption – pollutants attach or bind to the surface of soil or aggregate particles;

d) Biodegradation – Microbial communities in the ground degrade organic pollutants such as oils and grease;

e) Volatilisation – transfer of a compound from solution in water to the soil atmosphere and then to the general atmosphere;

f) Precipitation – transform dissolved constituents to form a suspension of particles of insoluble precipitates;

g) Plant Uptake – removal of nutrients from water by plants in ponds and wetland;

h) Nitrification – Ammonia and ammonium ions can be oxidised by bacteria in the ground to form nitrate which can be readily used as a nutrient by plants;

i) Photolysis – The breakdown of organic pollutants by exposure to ultraviolet light.

7.3.3 Amenity & Biodiversity Processes

SuDS provides opportunities to create attractive landscaping features which offer a variety of amenity/biodiversity. The following are the main SuDS components offering aesthetic, amenity and ecological benefits.

Primary Processes:

a) Blue/Green Roofs

b) Grassed channels/Swales

c) Filter strips

d) Bioretention Areas

e) Vegetated swales and detention basins

f) Infiltration Basins

Benefits subject to design:

a) Ponds

b) Wetlands

7.3.4 Water Quality

The implementation of SuDS as part of future development within the SDCC CDP lands should ensure that the quality of discharge from future development to the surrounding watercourses, through the removal of sediments and contaminants, will not negatively impact the existing condition of the watercourses. The quantity of discharge from future developments to surrounding watercourses will also not negatively impact the existing condition of the watercourses, as discharge rates will be limited to an approximate greenfield rate. Moreover, the adoption of SuDS systems in all new developments and the protection of existing floodplains shall assist in the attainment of our objectives under the Water Framework Directive as downstream watercourse conditions will be improved as a result of a better quality and quantity of discharge from upstream developments.

7.3.5 Effects of Climate Change

The effects of climate change need to be considered when designing and preparing maintenance regimes for SuDS features. Sedimentation is one of the primary removal mechanisms in SuDS. As discussed above, this is achieved through the reduction in flow velocities to a level at which particles fall out of suspension. However, care must be taken through design and appropriate maintenance regimes to ensure the risk of re-suspension is minimised during extreme rainfall events.

The level of biodegradation activity that occurs within SuDS features will be affected by environmental conditions such as temperature and the supply of oxygen and nutrients. It is also depending on the physical conditions within the ground such as the suitability of the materials for colonisation.

7.4 SuDS Techniques

In addition to the objectives above, in order to replicate the natural drainage system, a 'Management Train' is required. The Management Train sets a hierarchy of SuDS techniques which should be implemented in series as follows:

- Prevention – prevent runoff and pollution
- Source Control – control runoff at or close to the source
- Site Control – management of surface water in the site/local area
- Regional Control – management of surface water from a number of sites together

Various SuDS components have different capabilities regarding the objectives outlined above and are more suited to certain stages of the Management Train. The principle of the Management Train is that wherever possible, surface water should be managed locally in small, sub-catchments rather than being conveyed to and managed in large systems further down the catchment. Table 7.1 below contains examples of SuDS techniques for Source, Site and Regional controls.

Table 7.1 SuDS Techniques for Source, Site & Regional Control

Source Control	Site Control	Regional Control
Rainwater Harvesting	Permeable Paving	Detention Ponds/Basins
Green Roofs	Bioretention Strips	Retention Ponds/Basins
Permeable Paving	Infiltration Trenches	Wetlands
Bioretention Strips	Filter Drains	Infiltration Basins
Filter Drains	Filter Strips	Detention Basins
Infiltration Trenches	Swales	Petrol Interceptors*
Filter Strips	Sand Filters	
Soakaways	Infiltration Basins	
Blue Roofs	Detention Basins	
Swales	Petrol Interceptors*	

*Use of Petrol Interceptors should be avoided except where the potential for hydrocarbons entering the surface water drainage network is particularly high. Treatment of surface water runoff should be provided through the use other SuDS techniques.

7.5 Modular SuDS Components

Management trains for new and existing developments should facilitate the construction of future SuDS components and/or provide for future enhancements to existing SuDS components – to mitigate the risk of flooding caused by more extreme rainfall events and risk of pollution due to lower baseflow in receiving waters.

Modular components can include:

- Additional physical SuDS features e.g., swales, basins and ponds and/or;
- Enhancements to existing SuDS features by upsizing and/or;
- Introducing vegetation and/or;
- Management actions e.g., changing the maintenance regime in response to findings of a monitoring regime.

7.6 SuDS Protocol for New Development

As part of any future development within the SDCC lands, the developing authority should adapt the following protocol. This protocol will provide guidance for assessing the resilience of SuDS to climate change during periods of drought, flash flooding, temperature extremes and periods of persistent rainfall and to propose appropriate resilient SuDS strategies to manage stormwater runoff arising from severe rainfall events now and into the future. An overview of this protocol is outlined in Figure 7.1 below.

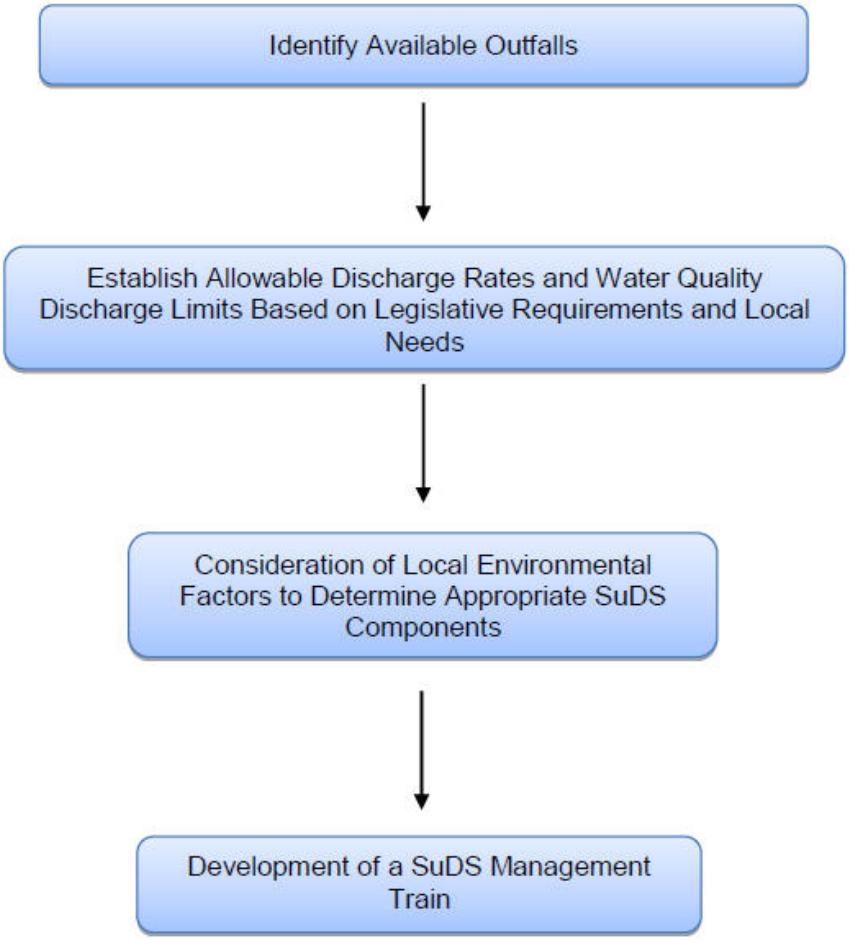

Figure 7.1 Recommended SuDS Protocol to Be Adapted

7.7 Management Train

A Management Train is usually required when developing a SuDS strategy. A Management Train sets a hierarchy of SuDS techniques which are subsequently linked together. Each technique employed contributes in different ways and degrees to the overall drainage network. The scale and number of components required will depend on the respective catchment characteristics and likely concentration of pollutants in the inflow. Considering the scale of proposed developments, a combination of carefully designed and appropriately maintained source controls, site controls and possibly regional controls are required as part of the surface water drainage system to ensure high water quality from runoff into these areas.

7.8 Quantity and Quality Performance

In selecting suitable SuDS components for a SuDS management train, the quantity of runoff and quality performance for various SuDS techniques should be assessed:

- Source Control techniques are most effective in reducing run off volume.
- Open Channels and Detention Basins provide the best hydraulic control for large flows (1% AEP), and water quality benefits.
- Permeable paving, Infiltration and Filtration techniques (filter strips, swales, grassed channels) are most effective for water quality treatment.
- Subsurface storage systems offer limited potential for water treatment.

7.9 Community, Environmental and Amenity Performance

Community and environmental factors for various SuDS techniques include Maintenance Regime, Community Acceptability, Construction and Maintenance Costs and Habitat Creation Potential.

Detention Basins and Swales (particularly Conveyance Swales) typically provide the most cost-effective SuDS solution while also incorporating the potential for habitat creation.

The implementation of wetlands will typically promote habitat creation and are generally accepted by communities as they provide valuable open space for visual and recreational enjoyment, however capital and maintenance costs can be relatively high.

There may be some public safety concerns associated with SuDS techniques involving open water, however good design and education can help minimise these concerns. This can be achieved through 'demonstration projects' and initiatives to educate local residents of the benefits of SuDS systems and natural floodplain management approaches as a means to tackle flood risk, particularly in response to climate change and the adverse environmental effects of uncontrolled contaminated stormwater runoff from urban developments. It is also recommended that developers make the proposals and advantages clear to future prospective buyers of the lands at the time of sale. The SuDS approach also offers benefits to the health and wellbeing of citizens.

7.10 SuDS Retrofitting

There are opportunities for SuDS retrofitting throughout the CDP lands, however, this would be difficult to implement on existing private development. This is due to a lack of knowledge on the societal benefits of SuDS (economic, ecological, health and wellbeing, amenity etc.) by the general public. SuDS measures that could be implemented on existing private development include permeable paving on driveways, installation of rainwater harvesting systems and the provision of vegetated systems such as swales and bioretention areas within private gardens.

7.11 Recommendations

1) New surface water drainage networks will be required as part of development within the plan lands. These networks should be designed in accordance with South Dublin County Council's *Sustainable Drainage Systems (SuDS) Explanatory, Design and Evaluation Guide* and current Health & Safety Legislation. Where the Local Authority is to take-in-charge SuDS features within developments, the Safety File will be required.
2) Protect existing floodplains and ensure no development occurs on flood-plains along the existing watercourses that flow through the lands. These flood-plains shall accommodate flood waters during extreme flooding events through the provision of Riparian Corridors.
3) A Management Train should be incorporated during the design stage whereby surface water should be managed locally in small sub-catchments rather than being conveyed to and managed in large systems further down the catchment.
4) Management trains for new developments should facilitate the construction of future SuDS components – to mitigate the risk of flooding caused by more extreme rainfall events and risk of pollution due to lower baseflow in receiving waters.

8. SUMMARY

This SFRA report for the South Dublin County has been carried out in accordance with the requirements of the OPW Flood Risk Assessment Guidelines for Planning Authorities (2009) and Circular PL02/2014 (August 2014). The SFRA has provided an assessment of flood risk within the County to assist SDCC to make informed strategic land-use planning decisions. The flood risk information has enabled SDCC to apply the sequential approach described in The Guidelines and a Justification Test.

8.1 Flood Zones And Flood Risk

South Dublin County is susceptible to several types of flood risk. The flood zone extent mapping have been prepared (presented in Appendix A) in accordance the Planning System and Flood Risk Assessment Guidelines identifying Flood Zones A, B and C. The flood zone maps are primarily derived from the Eastern CFRAM and the Dodder CFRAM mapping. These maps are the most comprehensive flood maps produced for South Dublin since the introduction of the Guidelines and the Floods Directive. Flood extents for areas that are outside of the scope of the CFRAM Studies and are supplemented by fluvial mapping from the earlier OPW Preliminary Flood Risk Assessment (PFRA) Report. Additionally, pluvial flood extent mapping has been prepared for the 1% and 0.1% AEP events as derived from the PFRA study. The Flood Zone mapping is based on the best currently available data and a more detailed, site specific FRA may generate localised flood extents.

8.2 Flood Management Objectives

The County Development Plan outlines flood risk management strategies and objectives that incorporate Flood Risk Management into the spatial planning of the County, to meet the requirements of the Floods Directive and the Water Framework Directive. Appropriate Flood Risk Management objectives are detailed in Section 5. Flood risk management will be carried out in accordance with the Flood Risk Management Guidelines for Planning Authorities, DOECLG (2009) and Circular PL2/2014.

The CFRAMS (www.floodinfo.ie) and South Dublin Strategic Flood Risk Assessment provide information in relation to known flood risk in South Dublin County. Development proposals on lands that may be at risk of flooding should be subject to a Site Specific Flood Risk Assessment, prepared by an appropriately qualified Chartered Engineer, in accordance with the Flood Risk Management Guidelines. Detailed flood risk assessments should be cognisant of possible pluvial / surface water flood risk and appropriate drainage proposals should be implemented to reduce the risk of pluvial flooding.

There is an increasing likelihood that Irelands climate will be similar to that depicted in the High End Future climate change scenario by the year 2100. Therefore, it is prudent to consider the HEFS parameters when planning for vulnerable infrastructure and developments. This approach will also assist in achieving our obligations under the Water Framework Directive (WFD).

8.3 Riparian Corridors

A Strategic Hydromorphological Assessment of Riparian Corridors has been completed and Riparian Corridors have been delineated for the major rivers within the County. Maintaining and enhancing Riparian Corridors creates "room for the river" and the benefits that entails including reducing risk to persons and property from flooding and resilience to future shocks such as climate change. The

sustainable management of riparian zones is crucial to meeting our objectives under the Water Framework and Floods Directives. Objectives to maintain and enhance Riparian Corridors and the benefits they entail have been described in Section 7.

8.4 SFRA Review And Monitoring

The SDCC SFRA will be reviewed and updated every six years in line the County Development Plan review process. Additionally, outputs from future studies and datasets may trigger a review and update of the SFRA during the lifetime of the 2022-2028 Development Plan. With regard to Climate Change, the OPW is currently transitioning to regional based climate models that reflect the likely varied impacts throughout the island of Ireland. This is likely to be implemented during the lifetime of the proposed county development plan. Proposed developments should take account of the most up to date OPW guidance on climate change as part of Site Specific Flood Risk Assessments.

8.5 SFRA Objectives

- To undertake site specific flood risk assessments for all new developments in accordance with The Planning System and Flood Risk Management – Guidelines for Planning Authorities (2009).
- Ensure that future developments are designed and constructed in accordance with the "Precautionary Principle" detailed in The OPW Guidelines.
- To ensure that hydromorphological assessments are undertaken where proposed development is within lands which are partially or wholly within the Riparian Corridors identified as part of this Development Plan.
- To require development proposals that are within riparian corridors to demonstrate how the integrity of the Riparian Corridor can be maintained and enhanced having regard to flood risk management, biodiversity, ecosystem service provision, water quality and hydromorphology.
- To promote and protect native riparian vegetation along all watercourses and ensure that a minimum 10m vegetated riparian buffer from the top of the riverbank is maintained/reinstated along all watercourses within any development site.