

GUIDELINE DOCUMENT GD 04 - LOW IMPACT DESIGN PRACTICE

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ABSTRACT

Over the past two years, the Auckland Council has been updating Technical Publication 124 'Low Impact Design Manual for the Auckland Region'. The new document, Guideline Document 04, is made up of 3 volumes relating to Policy (Volume 1), Practice (Volume 2) and Case Studies (Volume 3).

This paper focuses on Volume 2, the practice of Low Impact Design (LID). The document leads the developer and their consultants through the land development process, including site assessment, spatial planning, concept design, and concept assessment to achieve the most from LID approaches.

KEYWORDS

Low Impact Design, Guideline Document 04, LID Practice, Land development

PRESENTER PROFILES

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Mark is an Associate Principal at Boffa Miskell Ltd and has been employed in the fields of landscape architecture, landscape planning, and restoration ecology in NZ and the United States for over ten years. Mark works with land developers, infrastructure services, and councils in the areas of stream and wetland restoration, and LID design approaches.

1 INTRODUCTION

The mayor of Auckland has established a vision of making Auckland the world's most liveable city. To provide a mechanism to achieve this, the Auckland Council has prepared a plan (the Auckland plan (Auckland Council, 2011)), which sets a strategic direction for the next 40 years. Specifically, for the future of land development within the region, the Auckland Plan states that 'Low Impact Design (LID) is expected to be taken into account as a guiding environmental design principle for stormwater management' (Auckland Council, 2011). This formative direction has now led Auckland Council stormwater consenting staff to seek application of LID principles within proposed land developments within the region (J. Anthony *pers comm.* 2012).

The Auckland Council has provided guidance for LID through Technical Publication 124 (TP 124) 'Low Impact Design Manual for the Auckland Region' (ARC, 2000). TP 124 outlined the LID philosophy, provided principles for LID, and guided practitioners as to how to implement LID within development.

Over the past two years, the Auckland Council has been carrying out further assessment work to enable TP 124 to be updated. The updated document will be referred to as Guideline Document 04 (GD 04), with the same title as the previous TP 124. The rationale for updating TP124 was:

- TP 124 was published in 2000. Since this time, research and knowledge of LID has increased significantly.
- The application of TP 124 guidance to brownfield environments was previously perceived to be difficult to implement by LID practitioners, but is now becoming more common practice.
- The definition of LID within TP 124 led numerous practitioners to believe that LID was primarily the installation of 'green' stormwater devices, rather than an integrated design approach.
- Practitioners had requested recognition of challenges to LID and identification of the potential mechanisms to improve the ease of LID implementation.
- There was a need to incorporate other advancing urban design disciplines such as urban design, and crime and injury prevention within the principles of LID.

GD 04 will be structured in three distinct volumes. Volumes will not be released to the public independently. The proposed volumes are:

- Volume One - Principles
 - Includes LID principles, drivers, and challenges and solutions.
- Volume Two – Practice
 - Parallels the design process to implement LID in across a range of environments.
- Volume Three – Case Studies
 - LID case studies.

The audience anticipated for each volume may differ, therefore guidance provided in each volume will be tailored to suit.

The following provides specific discussion focused on content contained within Volume Two.

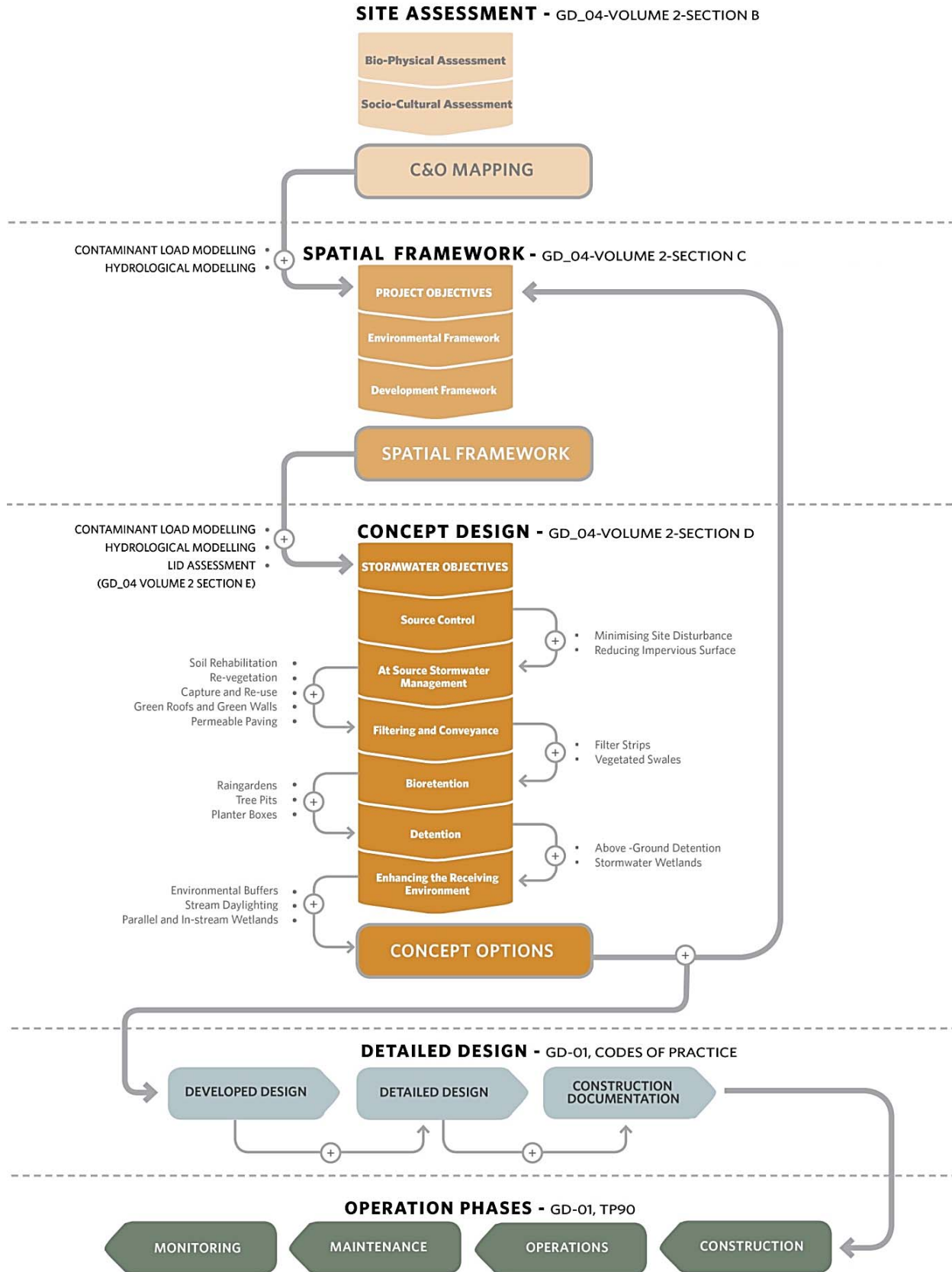
2 VOLUME TWO – LID PRACTICE

The purpose of Volume Two is to provide a methodology to guide land developers and their associated consultants through the land development process. The methodology provides a pathway to ensure that LID principles can be integrated early within the land development process. Volume Two achieves this by disseminating and discussing the method into four individual stages, these are;

1. Site Assessment
2. Spatial Framework
3. LID concept design
4. Assessment of LID concepts

Discussion of each stage is provided below, but is also represented pictorially by Figure 1.

Figure 1: Volume Two - land development methodology



2.1 PROJECT TEAM

To ensure that project objectives are satisfactorily achieved and project risk is minimised, it is critical to ensure that a skilled, multidisciplinary project team is in place for the duration of the entire project. The project team may vary in size with the scale and complexity of the proposed development. However, members who carry out development assessment and planning should have the appropriate expertise to assess site conditions and have the ability to foresee LID opportunities and ensure that they are captured. At a minimum, GD 04 outlines that the following disciplines are critical to ensure successful LID development is achieved;

- Planning, project management and legal advice.
- Design – with particular regard to landscape architects, engineers, architects, and urban designers. There may also be benefit in having specialist expertise in LID approaches.
- Specialist advice – depending on site attributes, including arborists, environmental scientists, terrestrial and freshwater ecologists, transport planners, geomorphologists etc.
- Building partners and operations personnel to inform design function and market drivers.

Volume One of GD 04 identified a range of challenges that face project teams when implementing LID principles within land development. Two of these challenges were; policy and planning; and skills, knowledge and collaboration. In response to these challenges, GD 04 highlights the need for the project team to continually seek council involvement throughout the planning of LID development. Whilst this can be perceived as time consuming, many benefits can also be achieved in doing so, such as providing efficiency in the consenting process through the involvement of council in the developments LID concept design rationale and identifying and managing regulatory constraints that may slow rate of development progression.

2.2 SITE ASSESSMENT

Once a project team is in place, the first stage of the presented GD 04 methodology is to carry out a comprehensive site assessment. A comprehensive site assessment is critical to ensure sufficient robust data is obtained. The site assessment involves the capture of the attributes and broader context of the site to map constraints and opportunities and determine appropriate land use patterns.

The components that make up a comprehensive site assessment include;

- An inventory of the bio-physical attributes of a site.
- Identification of socio-cultural issues and relative values of a site.
- Preliminary constraints and opportunity mapping to reveal land use typologies.

2.2.1 BIO-PHYSICAL ASSESSMENT

Bio-physical assessments involve the interpretation of a site's physical nature. This is provided by assessing the site's geology, hydrology, and ecology. To provide an initial guide to achieve a bio-physical assessment, GD 04 provides tables which act as a guide to ensure core bio-physical assessment is undertaken. Core attributes assessed are;

- Geology – topography and soils.
- Hydrology – groundwater, existing impervious extent, catchment management, water quantity, water quality.
- Ecology – terrestrial ecology, freshwater environments, coastal environments.
- Services and structures – drainage systems, existing services, existing structures and materials, hazards, and access.

With each of the above attributes, rationale for the assessment and how it relates to land use planning is provided within GD 04. Also provided are potential information sources that may assist project teams with data collation.

2.2.2 SOCIO-CULTURAL ASSESSMENT

The majority of socio-cultural assessments presented in GD 04 are more applicable to Brownfield development or where Greenfield development is either adjacent to existing development or public spaces. However, for all development, it is still important to carry out the socio-cultural assessment and provide consideration for the future population that will live, work, and play in the development.

Similar to the bio-physical assessment, GD 04 provides a set of core assessments and related attributes. Whilst not an exhaustive list (as individual developments will have differing socio-cultural attributes), a set of core assessments and related attributes are provided. The intention of providing the list of core assessments and attributes is to provide an initial direction for the project team. GD 04 provides the following socio-physical assessments;

- Landscape values - landscape and natural character values, neighbourhood character values.
- Community infrastructure - education facilities, transportation, useable open space, community facilities.
- Cultural values - heritage sites.
- Community planning – land values, demographics, future potential projects.
- Existing development form – cadastral, existing density, land tenure, transport.

Again, rationale for each socio-cultural assessment and how it relates to land use planning is provided within GD 04, as well as potential information sources that may assist project teams with data collation.

2.2.3 CONSTRAINTS AND OPPORTUNITY MAPPING

A comprehensive site assessment will identify; sensitive or valuable areas which require protection or management; areas available for extractive uses or environmental services; and ideal locations for development. These attributes can be overlain in order to derive the inherent opportunities and constraints for potential development. This constraint and opportunity mapping is utilised as the basis for initiating the spatial framework.

2.3 SPATIAL FRAMEWORK

The spatial framework provides for preliminary design layout and potential land-use typologies. This is based on provision of an appropriate development form and a supporting environmental framework.

To prepare a spatial framework, the constraints and opportunities mapping developed from the site assessment are used to prepare an indicative layout of potential land-use patterns. This usually includes the preparation of an 'environmental framework' to support the development with an appropriate level of ecosystem services and landscape amenity values, and a 'development framework' which describes permissible building typologies and densities. The steps to achieve a spatial framework include:

1. Determining project objectives based on preliminary site assessment and development desires.
2. Establish an environmental framework appropriate to a site's values and functions.
3. Prepare a development framework that responds to site conditions with appropriate development densities, building coverage, and infrastructure services.

4. Finalise the spatial framework by adjusting the environmental and development approaches to balance regional, catchment, and community requirements.

2.3.1 PROJECT OBJECTIVES

The need for clearly defined, achievable, and measurable (as required for LID development assessment, as discussed further in section 2.5) objectives is paramount for any project. Without project objectives, project success is difficult to define or measure.

Project objectives are determined after the site assessment to ensure that proposed project objectives are both realistic and achievable.

To provide guidance on how project objectives can be formulated, GD 04 leads the reader to utilise LID drivers to form basic content. Discussion of LID drivers is provided in GD 04. However it must be noted that the LID drivers presented in GD 04 are not an exhaustive list. If a project team wishes to identify further LID drivers that are not provided in GD 04, it is imperative that they be aligned with the principles of LID. If they are not, the inherent inclusion of LID within a development will not be achieved.

2.3.2 ENVIRONMENTAL FRAMEWORK

Two of the four principles for LID (as provided in GD 04) refer to natural systems, and specifically, their values and functions in supporting land development as follows:

- Protect the values and functions of natural ecosystems.
- Utilise natural systems and processes for stormwater management.

An 'environmental framework' integrates natural systems within a proposed framework of open space networks, ecological corridors, restored receiving environments, and enhanced landscapes. The framework optimises the functions and values of environmental systems, for example, in the following ways:

- A cohesive pattern of landscape and natural character values that contribute a 'sense of place' to a development.
- Protection of ecosystem functions, including soil and riparian systems, to deliver environmental services, including the moderation of dust, noise, and heat, and the management of air pollution and stormwater effects.
- Protection and enhancement of biodiversity values to ensure native species resilience.
- Ecosystem connectivity to transport species, material, and trophic energy (food webs) to ensure ecosystem integrity.

2.3.3 DEVELOPMENT FRAMEWORK

Constraints and opportunity mapping provides an initial indication of land areas that are preferable to develop, and also land areas that are regarded as too sensitive. The development framework progresses this assessment further by examining the layout of the built form. For example, land areas that are regarded as preferable may be permissible for higher density clustered development. Areas that are regarded as less preferable, but still have opportunity for development, may explore more creative building layouts.

GD 04 provides discussion regarding a selection of building typology that can be applied in a range of development types. This selection includes; clustered development; infill and brownfield development; and mix use development.

For each of the above building typologies, benefits that can be achieved through implementation of the particular building typology are discussed in GD 04.

2.3.4 FINIALISING THE SPATIAL FRAMEWORK

The final step to prepare a spatial framework for a site is to evaluate the balance of proposed environmental and developmental elements. The means to consider this includes:

1. The relative values of a site's resources in the context of the catchment and region.
2. The integration of environmental and development frameworks to provide multi-functional capacity and added value to a site.

Whist GD 04 does provide discussion on how balance of environmental and development frameworks at a range of development scales can be achieved, greater discussion and detailed information is provided in the Auckland Regional Council Technical Report 2010/013 'The integration of LID, urban design and urban form' (Lewis *et al.* 2010). Project teams should therefore also refer to this document when attempting to finalise the spatial development framework.

To paraphrase, the overarching principles to complete the spatial development framework are to;

- Recognise and integrate how the proposed development fits and relates to surrounding context of the site, catchment and region in terms of strategic planning and the values and sensitivities of receiving environments
- Acknowledge that there will be conflicting outcomes between the environmental and development frameworks are merged, and then,
- Once such conflicts are identified, the project team should seek resolution by adjusting the sustainable framework so the outcome complies with the project objectives (as discussed earlier these should be based from LID drivers). The project objectives provide the long term vision for the development, and therefore should direct the approach(es) in which the conflict can be resolved. This is important, as the resolution should always ensure that the vision for the development is never compromised.

2.4 LID CONCEPT PLANNING

Once the spatial framework is finalised, the preparation of concept plans can commence. A significant emphasis that GD 04 directs project teams to undertake whilst carrying out concept planning is the implementation of a treatment train management approach for stormwater management. Specifically, GD 04 promotes the following treatment train order;

1. Source control.
2. At-source treatment.
3. Filtering and conveyance.
4. Bio retention.
5. Detention.
6. Enhancing the receiving environment.

This treatment train order is proposed based on a logical sequence of stormwater flowing through a catchment, beginning firstly with the intention of prevention of excess stormwater volume and contaminant generation, then the provision of on site controls for stormwater runoff at-source. This is then followed by the detention/treatment of overland flows, and finally the enhancement of receiving environments to optimise stormwater management functions.

For each approach contained within the treatment train above, various methods by which each approach can be achieved is discussed within GD 04. Discussion is also given on how the method (where appropriate) can be implemented in a range of development types.

In instances, challenges are faced when attempting to plan and implement certain treatment train approaches. To facilitate the learning and expectations of project teams, GD 04 provides a listing of common challenges faced when implementing LID design. Parallel to these challenges, a list of potential solutions to manage the identified challenge is provided. Not all solutions may directly respond to the challenge itself, but they do provide direction for projects teams to identify alternative discussion that can be used to compensate for that particular challenge. An example of this is the typical challenge faced by project teams when attempting to persuade stakeholders to implement living roofs. For the purposes of this example, a common challenge faced is the construction cost of a living roof. Whilst the construction cost in the near future is unlikely to change (more so due to limited competition), project teams can compensate this by directing the stakeholders to understand the long term cost savings that a living roof can provide, such as; reduced energy use, extended roof life, and the potential land loss of having to include an alternative stormwater device.

By applying the treatment train approach proposed by GD 04 to LID concept planning, and also through the provision of tools to manage known challenges faced by project teams, development concept plans would be anticipated to be (in majority) aligned to LID principles.

At the completion of an LID concept plan, GD 04 guides the project team to determine if the developed LID concept plan is achieving the project objectives. To do this, GD 04 proposes that the LID concept plan be assessed.

2.5 ASSESSMENT OF PRODUCED PLANS

GD 04 advocates for all LID concept plans developed to be assessed against a set of defined criteria. Rationale for this is to:

- Track LID performance against project objectives.
- Monitor, assess, and adjust LID approaches for later development stages.
- Qualify LID outcomes for exemplary projects.
- Provide performance standards to inform LID specific policy.
- Assure markets of a legitimate LID product.
- Assure appropriate land development responses are provided for within sensitive catchments.

Furthermore, assessment of LID concept plans may indicate a project team's development intent and decision making processes. Therefore, as well as the above listed reasons for doing LID concept assessment, a key benefit is it can provide a vehicle to collaborate and undertake consultation with key project stakeholders.

GD04 outlines that LID concept plan assessment can be achieved using two methods; either directly assessing the LID concept plan as to whether it conforms to the project objectives and LID principles, or alternatively, utilise existing assessment tools. These existing assessment tools do include elements that conform to LID principles, and they also can offer industry accreditation. Such existing assessment tools discussed within GD 04 are; Green Star NZ; Leadership in Energy and Environmental Design (LEED); Sustainable Sites Initiative (SSI); or the Building Research Establishment's Environmental Assessment Method (BREEAM). GD 04 provides brief discussion as to how each of these assessment tools can be applied for LID concept design assessment.

To provide assistance to the project team to assess an LID concept plan for alignment to LID principles, GD 04 provides a series of questions that prompt the project team to analyse the LID concept plan in detail. It is anticipated that the project team will not be able to positively align the LID concept plan to all questions posed for a particular LID principle, but a majority of positive confirmation would be expected.

Due to LID concept planning assessment, LID concept plans are likely to take multiple iterations to achieve the desired project outcomes and have LID principles integrated throughout the entire LID concept plan. In some instances however, it may also be realised that a project objective may not be conducive to alignment with a LID principle. This is often as a result of unforeseen site constraints. As a consequence, either the project objective may have to be altered so to achieve alignment with the LID principle, or alternatively, the project objective would remain knowing that as a consequence, the LID principle would not be achieved. If the latter were chosen, it is anticipated that the project team would do so with the understanding that increased consultation and increased development mitigation may be required. This statement is supported in the Auckland region specifically by the Auckland Council now referring to LID as the preferred design approach to land development (Auckland Council, 2011).

2.6 FINALISING THE LID DESIGN

Once LID concept plan assessment has identified a preferred design for the proposed development, the design can be further developed to provide sufficient detail to consider financial viability, staging, and to inform resource consent materials. Typical details may introduce materials, construction techniques, operational strategies, and provide schedules of quantity and specifications.

Guidance to project teams to assist in carrying out detailed and operational design is provided by other documents such as; NZS 4404:2010 (New Zealand Standards, 2010); Technical Publication 10 (ARC, 2003)(soon to be updated to Guideline Document 01); and Technical Publication 90 (ARC, 1999). As such, GD 04 provides direction to these documents and only limited discussion is within GD04.

3 CONCLUSIONS

The Auckland Council are soon to release GD 04. This new document will supersede Technical Publication 124. The purpose of this paper was to provide a summary of Volume Two – LID practice, one of three volumes contained in GD 04.

GD 04 Volume Two provides a methodology to project teams that emulates the design process of land development. Early chapters focus on site assessment and preparing a spatial framework to guide development. Later chapters develop LID responses and provide methods in which LID concepts can be evaluated.

Whilst each form of land development is unique, the methodology includes a range of LID related criteria and questions that are applicable for any development type. These are set to prompt and direct the project team to consider alternative approaches throughout the preparation and evaluation of LID concept designs. The purpose of these questions is to ensure the final development design encapsulates the maximum integration of LID principles it can.

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