SETTING THE STANDARD: UPDATING WAKA KOTAHI'S P46 STORMWATER MANAGEMENT STANDARD

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LONG ABSTRACT

1 INTRODUCTION

Stormwater management is a critical aspect of resilient highway design. Recent weather events around the country have highlighted the climate resilience challenge we face, which is only expected to escalate as the climate changes and risk increases over the coming decades. Most recently Waka Kotahi New Zealand Transport Agency's (Waka Kotahi) has begun works on recovery projects such as SH25a Taparahi Slip in the Coromandel, SH1 Brynderwyn Hills and the Transport Rebuild East Coast (TREC) project responding to Cyclone Gabrielle.

P46 Stormwater Management Standard (P46) is a contractual document providing the minimum standards for stormwater management on all Waka Kotahi projects. The role of P46 is to drive and enforce well-considered stormwater design and management practices to ensure road safety, climate and flood resilience and to contribute to Te ao Māori, environmental and sustainability outcomes.

The document was originally published in 2016. This abstract outlines the stormwater management challenges Waka Kotahi are facing, and how these challenges are addressed in the recently updated P46 document, which also incorporates industry feedback. A P46 Guidance Document has also been created to provide clarity on expected outcomes and processes to follow.

2 KEY CHALLENGES FACING WAKA KOTAHI

Waka Kotahi's roads are the arteries of our nation, vital lifelines connecting communities and driving economic growth. Ensuring their resilience in the face of a changing climate and extreme weather events demands urgent action. This is why stormwater management is not just an operational necessity, but a strategic imperative.

In the latest 2021-24 National Land Transport Programme (NLTP) $240m was allocated for emergency works. The government has now topped up that fund with an extra $525m as well as providing $567m for recovery works across the affected regions and created a Transport Resilience Fund in the 2023 Budget. The newly established Transport Resilience Fund demonstrates the commitment to safeguarding infrastructure.

Waka Kotahi is facing similar challenges to many other organisations, the following of which are central to the P46 updates:

- Responding to climate change by both increasing resilience (adaptation) and decreasing carbon emissions (mitigation)
- The need to respond effectively and recover swiftly from significant weather events, ensuring minimal disruption to people and movement of goods
- Optimising resource allocation and delivery methods to ensure efficient and consistent infrastructure development, maximising value for every dollar spent
- Staying abreast of evolving legislation, standards, and industry best practice is crucial to continuously improve our approach to resilience.

3 HOW P46 ADDRESSES THESE CHALLENGES

The P46 Stormwater Standard will apply to all projects and will be a stand-alone document. Any additional project-specific stormwater requirements will be included as project Minimum Requirements.

3.1 CLIMATE CHANGE AND SIGNIFICANT WEATHER EVENTS

Several updates have been made to respond to climate change and significant weather events including:

- Updated hydrological and hydraulic criteria to reflect the most recent climate predictions
- An updated process for assessing existing assets to reduce carbon emissions (i.e. repair vs replace)
- Requirements to include nature-based solutions to reduce runoff, improve stormwater treatment and reduce carbon emissions
- Introduction of a risk-based approach for assessing existing culverts to avoid unnecessary upgrades where risk-appropriate.

3.2 IMPROVED EFFICIENCY AND CONSISTENCY

The following changes have been made to improve efficiency and consistency:

- More pragmatic requirements to reduce regular departures (as appropriate)
- Improved clarity on requirements informed following industry feedback from designers, constructors, and Waka Kotahi
- Addition of the P46 Guidance Document to improve clarity on processes and expected outcomes
- Standard details drawings have also been added to Guidance Document to drive consistency.

4 SUMMARY OF KEY CHANGES

Historically, project-specific Minimum Requirements were being re-written by designers for each new Waka Kotahi project. This P46 update will stop this unnecessary rework and will drive better consistency and efficiency across projects, facilitating a "no surprises" approach for designers and reviewers.

The document has been changed from a template to a stand-alone document. P46 has been updated to better suit road safety improvement projects and to reflect updates to legislation, other standards, guidelines and best-practice.

Some of the key changes are outlined below.

4.1 DEPARTURES

If the requirements of P46 cannot be met, a formal request for departure approval needs to be submitted to Waka Kotahi. The process requires a description of the departure including the options considered and the rationale for the request. It also needs to set out the benefits and costs/dis-benefits for safety, environmental, performance, reputation, cost, and maintenance. Prior to the updates this could be a lengthy and detailed process.

In developing the updated P46 standard, departure requests for several recent projects were reviewed to identify reoccurring or common requests. Where considered appropriate, we have updated P46 to reduce future departure requests through more pragmatic requirements. Some of the issues addressed include:

- Clearer durability requirements for existing assets
- Minimum spill isolation capacity of 20 m^3 for all stormwater devices, which can now be omitted with Waka Kotahi approval
- Culverts conveying the 10-year ARI storm without surcharge, which is no longer a requirement.

4.2 HYDROLOGICAL AND HYDRAULIC CRITERIA

Hydrological and hydraulic criteria have not always been applied consistently in the past for Waka Kotahi projects. P46 has been updated requiring designers to follow local or regional standards where available for rainfall depths and intensities. Where local approaches are not available, designers are instructed to use NIWA's HIRDS (High Intensity Rainfall Database).

Climate change guidance has been updated specifying the use of either RCP 6.0 to 2110 or the RCP specified in the Resource Consents, if higher. Sensitivity assessments for RCP 8.5 to 2110 (or SSP3-7.0) have also been introduced for culvert crossings with less than one metre of freeboard.

Tailwater assumptions including allowance for sea level rise, storm surge etc. for hydraulic design are also clarified.

4.3 MATERIALS AND DURABILITY

Durability and material selection is extremely important to ensure high-quality resilient assets. A 100-year design life without any major maintenance is required for most new drainage elements, however this is not always achievable. The design life for treatment/attenuation devices, swales and open channels have been reduced to 50 years, and components of stream diversions such as rootwads and logs are acknowledged to have a shorter design life.

For existing assets, having clear criteria to assess and determine when and what level of renewal is critical. An assessment method for defective existing assets has been developed and included in P46 which requires consideration of:

- Criticality of the asset
- Seriousness and extent of defect(s)
- Risk and consequence of failure (or partial failure)
- Cost of repair or replacement

- Hydraulic capacity
- Location and ease of repair/replacement (e.g. disruption to road user).

The assessment's outcomes need to be discussed with Waka Kotahi to determine the requirements (if any) for repair or replacement. The method is intended to drive better and more consistent decisions, avoiding the unnecessary replacement of assets where repair may be more appropriate.

4.4 UPGRADING CULVERT CROSSINGS

Waka Kotahi has thousands of existing culverts throughout their network. In addition to the introduction of sensitivity assessments using RCP 8.5 for culverts with less than one metre freeboard, we have introduced a risk-based assessment for determining the need for upgrading an existing culvert.

The risk-based assessment is to be used for existing culverts where the headwater level requirements cannot be met. The assessment will need to be agreed with Waka Kotahi and will require consideration of:

- Level/extent of upstream ponding with regard to designation boundaries, adjacent properties and relevant resource consent conditions
- Culvert ownership
- Secondary flow paths
- Outlet velocities and scour risk
- Freeboard to the road and consideration of pavement layers
- Embankment stability
- Flood hazard to people or stock
- Road network resilience (e.g. alternative routes)
- Access for ongoing inspection and maintenance.

The assessment criteria are intended to avoid the unnecessary upgrade of existing culverts where non-compliance with P46 is demonstrated to be risk appropriate.

4.5 GUIDANCE DOCUMENT

A P46 Guidance Document has been added to provide clarity and direction on how to achieve the contractual requirements of the P46. It also documents how to use P46 at different project stages.

It includes the process for the approval of proprietary treatment devices as well some standard drawings. Standard drawings will reduce repetition and drive consistency of asset type. The document includes standard drawings for:

- Pipe bedding
- Manholes
- Catchpits
- Catchpit manholes
- Culvert inlets and outlets
- Wetland outlets
- Swales

5 CONCLUSIONS AND NEXT STEPS

Waka Kotahi is facing significant challenges including responding to climate change and significant weather events as well as improving affordability, efficiency, and consistency of design and delivery. There is also the need to stay up to date with with relevant legislation, standards, guidelines, and industry best-practice.

P46, which specifies the minimum requirements for stormwater management, has been updated to help address these issues as outlined above.

Looking forward, P46 and other key documents (e.g. specifications, design notes and guidance documents) are likely to be more frequently reviewed and updated with industry engagement. Waka Kotahi is currently preparing a nature-based solutions design note and the P46 Guidance Document is likely to be expanded with additional standard drawings.

KEYWORDS

Stormwater Management, Design standards, Resilience, Waka Kotahi NZTA, Highway, Drainage