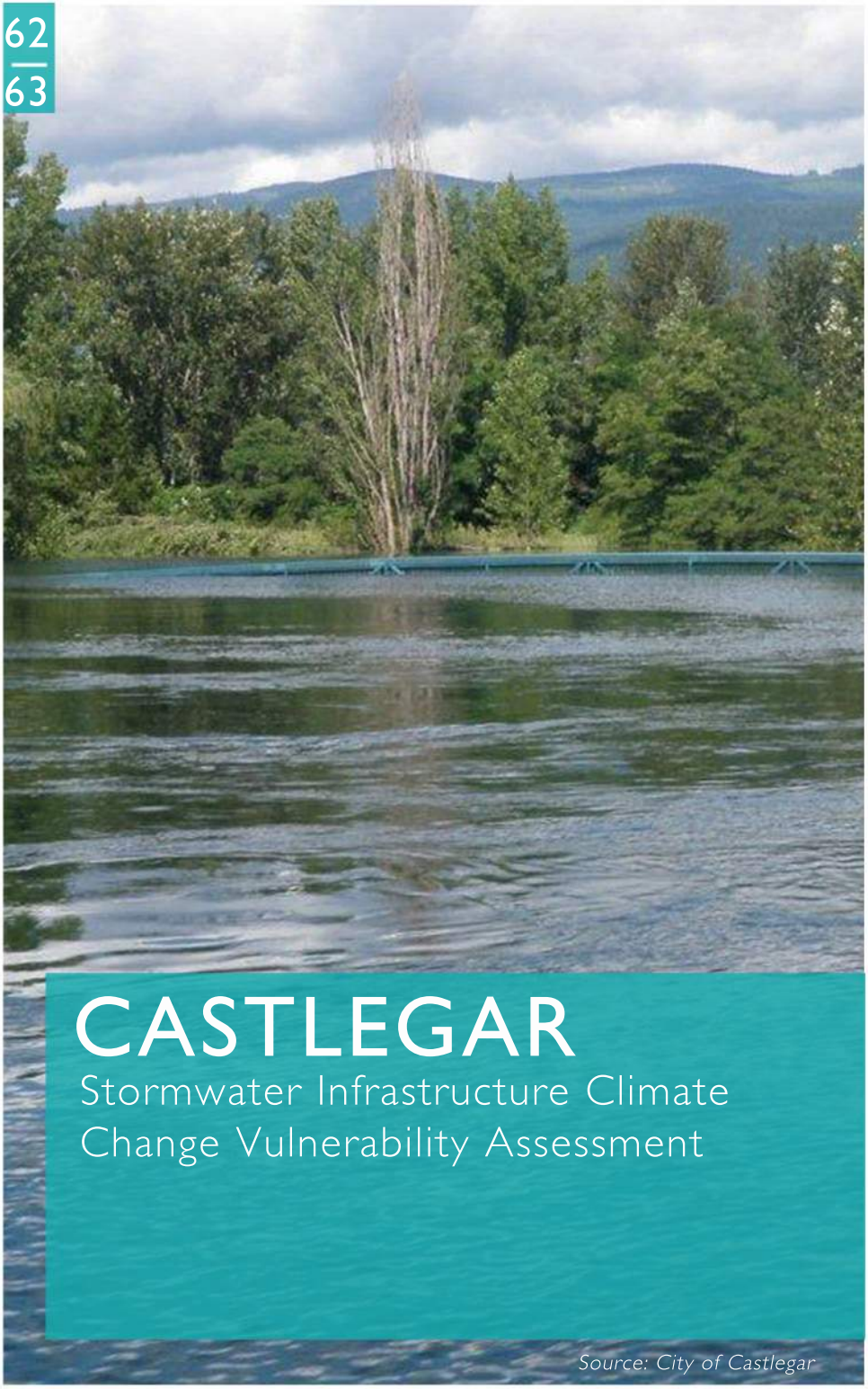

CASTLEGAR

Stormwater Infrastructure Climate Change Vulnerability Assessment

Source: City of Castlegar

THE SCIENCE

Traditionally, local government best practices have used historic local weather data as the guide for the design and maintenance of waste and stormwater infrastructure. Lengthy delays by Environment Canada to update intensity, duration and frequency (IDF) rainfall records, combined with growing evidence of change in extreme rainfall patterns, indicate that traditional approaches to waste and stormwater infrastructure management are slow to evolve.

The expectation that waste and stormwater infrastructure may be in place for 50 to 100 years or more further increases the importance that both historic and future climate considerations are addressed. Climate models have emerged in recent years as a new tool available to local governments to manage the impact of extreme rainfall on waste and stormwater infrastructure.

Climate projections combined with historical data are now available to help municipal governments anticipate local extreme rainfall risks. Tools have been developed, including Engineers Canada's PIEVC assessment protocol, assessing how extreme rainfall risks can be accommodated in stormwater management design, maintenance and operations. Municipal infrastructure that can cope with, say, a 15 to 20 percent increase in the volume of waste and stormwater flows may add one percent to the initial cost of construction while avoiding the risk that waste and stormwater infrastructure becomes prematurely obsolete and needs to be replaced in 20 or 30 years because it is unable to cope with the predicable increase in flows.

A small additional initial investment in waste and stormwater to use available information about the expected change in the climate will also reduce the local government's exposure to liability for damage to homes from sewers backing up.

THE TRIGGER

In 2009, the City of Castlegar became part of a case study evaluation of various types of infrastructure in different climate settings throughout the country. The Columbia Basin Trust provided funding to apply Engineers Canada's Public Infrastructure Engineering Vulnerability Committee (PIEVC) Engineering Protocol for Climate Change Infrastructure Vulnerability Assessment. The study focused on the impact of climate change on the city's stormwater infrastructure.

Local officials and other stakeholders were concerned that watersheds surrounding Castlegar were changing and that these changes could eventually affect the reliability of local stormwater infrastructure. Under the PIEVC protocol, a vulnerability risk assessment of Castelgar's stormwater infrastructure was developed to identify the components most vulnerable to future climate events. Three years after specific recommendations emerged from this study, the City of Castlegar faced a spring marked by heavy rainfall events that caused widespread flooding and heavy erosion throughout the City. The recommendations made through the PIEVC assessment provided timely advice to support implementation of a number of actions to rehabilitate the most vulnerable stormwater infrastructure.

Figure 17: *Following the publication of the study and the extreme rainfall events in 2009, Castlegar installed storm sewers in areas that were washed out.*
(Source: City of Castlegar)

THE APPROACH

The protocol used for the study was divided into five distinct steps: project definition, data gathering and sufficiency, risk assessment, engineering analysis, and recommendations. For the first step, the team developed system boundaries for an adequate assessment of infrastructure vulnerabilities. In order to achieve this, the City first considered stormwater infrastructure in a broader context by looking at catchment and various drainage areas, physical infrastructure and operations, maintenance and resource requirements for stormwater management. The City then decided to focus the study on the infrastructure draining five upland catchments since they were the most likely to be impacted by climate change.

A team from the Pacific Climate Impact Consortium was brought into the project to help assess the local probabilities of climate change, including changes in the intensity, duration and frequency of extreme rainfall events. For the City of Castlegar, climate models projected more rain and less snow, with an increased risk of extreme rainfall events that could result in more frequent and larger flow events in streams and stormwater management systems.

THE OUTCOME

The study conducted under the PIEVC protocol indicated that the City of Castlegar is vulnerable to climate change. Over the course of the study, 11 climate change events were applied to 35 infrastructure elements and 313 interactions were considered to have a cause-and-effect relationship necessitating further assessment. This assessment revealed that 34 of the 35 stormwater infrastructure elements studied were at medium or high risk, including 10 at high risk.

The study recommended that the City review the 10 high risk infrastructure elements, develop an action plan to address these issues and explore funding opportunities that might be available at the provincial level to quickly fix these elements. In order to address the 10 high risks elements, actions such as the development of a mitigation strategy to prevent erosion for a creek, resizing certain culverts and storm sewer trunks and improving sections of a stream channel to carry expected peak flow were deemed necessary.

When Castlegar faced heavy rain events in the spring of 2012, the City conducted infrastructure workshops with the City's Public Works Department in order to explain which infrastructure elements were identified as the most vulnerable and to have a discussion about which other elements might have been identified as vulnerable by the workers. "Some of the projects we decided to work on were related to the study and some others were things we noticed by looking closer in the field by looking at specific elements and wondering how much of a risk they were. This process brought up things we never questioned before and encouraged us to do more preventative work," said Chris Barlow, Director of Transportation and Civic Works for the City of Castlegar.

The study also brought a change in the way the City was monitoring extreme rainfall events. As an example, it was identified in the PIEVC report that inlets and outlets were an issue.

Altough there was no budget available to conduct rehabilitation work, the City started to monitor weather forecasts more closely and sent a crew to check inlets and outlets every time a heavy rain event occurred. Since 2012, several large stormwater infrastructure projects were also completed such as the installation of storm sewers in areas that were washed out during previous storm events and the addition of curb gutters.

The Stormwater Infrastructure Climate Change Vulnerability Assessment also contributed to the development of a comprehensive climate change adaptation strategy for the City of Castlegar. In addition, it became part of a learning network established by the Columbia Basin Trust to support other Basin communities with climate change adaptation.

A WORD FROM CASTLEGAR

When asked for his thoughts on the Stormwater Infrastructure Climate Change Vulnerability Assessment, Mr. Barlow mentioned that one of the aspects that made this project successful was the involvement of multiple stakeholders. "When we first looked at vulnerabilities, we brought in our Public Works Department. They are the front line guys and the ones that are the most aware of what is really happening in the field. Bringing these people into this training helped a lot." Mr. Barlow also mentioned the importance of including elected officials early on in the process since funding is always necessary for the successful completion of infrastructure rehabilitation projects.