

Technical Note 02 – The Basis for Defining Post-Event Levels of Service (LOS)

Background

This technical note provides context and background to the approach set out in the *Levels of Service Performance Measures for the Seismic Resilience of Three Waters Network Delivery*. The technical note supplements the report and is intended to be read in conjunction with the report. The report is available through <https://www.waternz.org.nz/>

The Levels of Service Performance Measures for the Seismic Resilience of 3 Waters Network Delivery provides a framework which may be used by engineers and asset managers to define the current or potential operating stage of any part, or parts, of a 3 waters network in the event of, or planning for, a significant earthquake. They are designed to be used in a number of ways:

- As a communication tool to explain the network status to communities and their leaders.
- As an aid to tracking recovery to normal Levels of Service after damage caused by a seismic event.
- A management tool to assist engineers and asset managers to explain the investment needs to improve the resilience of networks.

This document provides guidance on definitions of different stages of recovery and how to use the guidelines to develop target Levels of Service related to these stages.

When defining post-event LOS it is important to recognise:

- Disaster recovery progresses through various stages
- Service restoration is multi-faceted. It is an over-simplification to consider service restoration as being only one element of the recovery process: there are different categories of service that need to be considered.
- Utilities are provided to service community needs, which vary considerably:
 - » Some groups are able to adapt, others are not
 - » Community needs change as recovery progresses, so what was acceptable immediately after the event may not be acceptable several months later.

Disaster Recovery Stages

Service restoration goes through several stages as shown in Figure 1. Community priorities and needs change as recovery progresses.

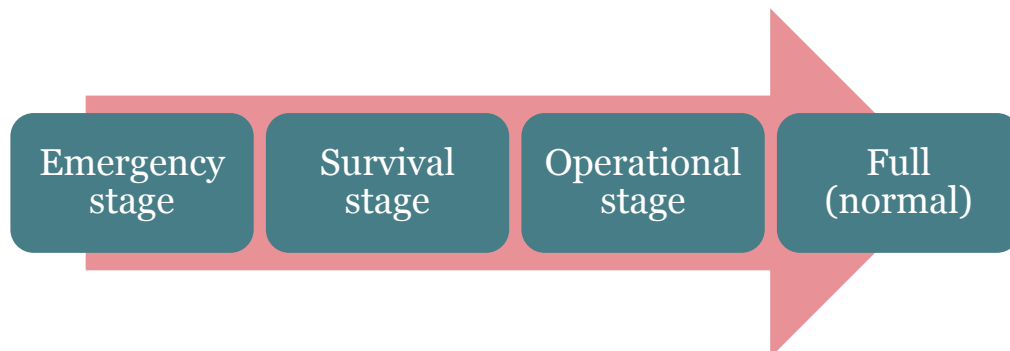


Figure 1: Disaster recovery stages

Recovery Stage Characteristics

Emergency stage – Services may be disrupted and uncontrolled. Individuals and families will be responsible for their own survival. High needs individuals and groups, including those with injuries and in danger of further direct damage will receive priority support.

Survival stage – Controlled services, but these are limited and there is significant disruption to them. Individuals and families may need to travel to obtain essential supplies such as drinking water.

Operational stage – Near normal service delivery will be available, but there will be outages and disruptions. The system may not have as much redundancy as before the event and operating costs may be significantly increased.

Full (normal) stage – The services are restored, with similar or better LOS than those prior to the event.

While it may take only days or weeks to progress through the first stages of the recovery, it may take years or even decades to reach the full stage.

Figure 2 shows the priorities within each recovery stage.

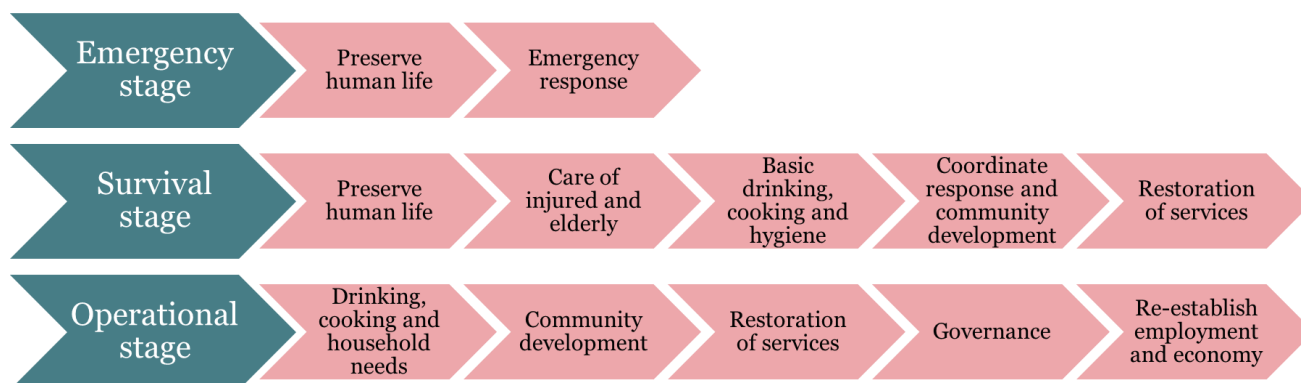


Figure 2: Recovery priorities within each recovery stage

Service Restoration Categories

Service restoration is a multi-faceted task. Studies after the Los Angeles earthquake (Davis, 2011) conclude that considering service restoration as a single element is an over-simplification. Instead, there are many different service elements to consider. For example, water supply can be categorised into several elements: water delivery, quality, quantity, fire protection and functionality. The time it takes to restore all these elements can vary significantly, with some being restored within hours with others taking many weeks or even years.

Table 1: Service Restoration Categories

Water	Wastewater	Stormwater
Quantity	Availability	Collection availability
Quality	System overflows	Containment
Firefighting	Treatment standard	Treatment quality
Functionality	Functionality	Functionality

Community Resilience and the Role of Utilities

Community resilience does not take place in isolation. People and businesses rely on utilities to support them to build activities and respond to hazard events.

A useful way to think about the components of a resilient community is to consider how they (the components) interact to provide critical community functions and outcomes (Witten et al 2011). These components include:

- Organisations and institutions, for example, hospitals, emergency services, , businesses, community centres, schools, government departments/offices
- Built structures, including school buildings, shops, offices, roads, recreation centres
- Natural environments, including water bodies, air quality, greenspace
- Social structures, including individuals, families, peer groups, community groups
- Services, including health providers, hospitality

An example of the interaction between components is demonstrated in the provision of healthcare. For a community to be able to provide health care, it needs buildings with power, watertelecommunications, skilled staff, be supported by funding and have a need from people for the service.

The specific components of a well-functioning community often provide multiple functions in both everyday situations and following disasters. Alongside its everyday basic hospitality function, for instance, a local café may also provide employment and contribute to local prosperity. It may also provide an important social base for local communities (McCreanor et al) to meet and connect socially and share information.

Socio-ecological frameworks are increasingly used to aid thinking about resilience and communities. Barton and colleagues (Barton and Grant, 2006; Barton et al., 2009) have illustrated the interconnected nature of communities by incorporating elements into a “health map” of local environments. Their model (Figure 3) demonstrates how different spheres of local and non-local environments come to influence individuals’ wellbeing.

Models, like that shown in Figure 3, are useful to show where failure to provide water and other services could have the most impact on individuals and communities. For example, buildings with adequate water provision can support a wide range of activities (learning, working, shopping etc.) so they can contribute to wealth creation and social networks needed to support good lifestyles. Failure to provide water to businesses will have consequences not just for wealth creation in the local economy but for everyday activities such as shopping and employment, as well as for the community’s social life.

The model also emphasises that local communities (or neighbourhoods) are connected to what is happening in other areas and wider environments. In terms of water disruption, this means activities and people can be displaced (as occurred in Christchurch) in the immediate response phase as well as longer term recovery (Ivory et al, 2015). Thus, water disruption in one locality can affect neighbouring areas as well as the wider city or region. On the other hand, other areas may ameliorate local consequences by shifting the burden on water provision to neighbouring areas

Another way of thinking about how water can contribute to community resilience involves setting priorities for a faster return to an adequate LOS. Macintyre et al (Macintyre, Ellaway, & Cummins, 2002) developed a list of priorities for maintaining health and wellbeing based on Maslow’s hierarchy of needs (see Table 2). This provides a useful guide for understanding the various community sectors and their specific needs.

Some of the needs Maslow’s hierarchy identifies require water to be directly available (for example, many foods need water for cleaning and cooking for it to be safe and palatable). In other cases, water is required to support the provision of a service. Learning, for example, does not directly require water, but to operate safely, schools need water for drinking, cleaning, educational activities, firefighting and so on.

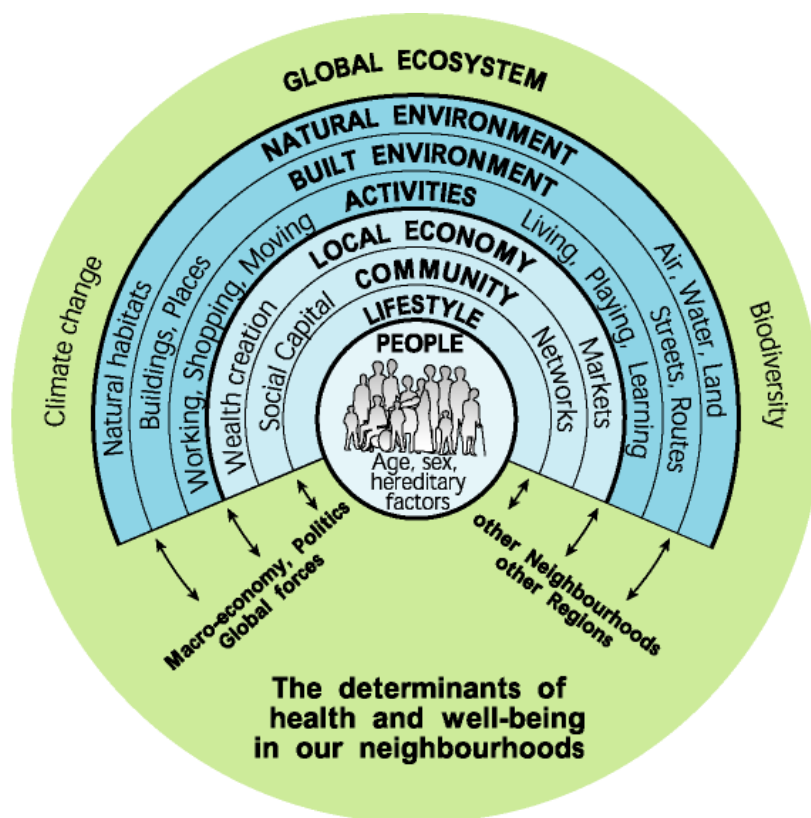


Figure 3: Health Map

Table 2: Maslow's hierarchy of needs

Need	Addressed Through Provision Of	Water Directly Needed	Water Indirectly Necessary To Support Provision At Local Sites
<i>Air</i>	Unpolluted air		
<i>Water</i>	Clean water for drinking and cooking	✓	
<i>Food</i>	Adequate supplies of nutritious and non-poisonous food	✓	
<i>Shelter</i>	Protection from wind, cold, and rain		✓
<i>Security</i>	Protection from threats to people or property		
<i>Hygiene</i>	Protection from infectious disease, contagious disease, toxins and pollutants	✓	
<i>Education</i>	Socialisation in the skills and information needed in a given society		✓
<i>Healing</i>	Care and treatment for the sick and infirm	✓	
<i>Housekeeping</i>	Resources for food storage and preparation, cleaning (of people, clothes and waste), waste disposal	✓	
<i>Work</i>	Gainful labour		✓
<i>Means of exchange</i>	Money, credit or other forms of trading power		
<i>Information</i>	Access to prevailing media for information and communication (books, newspapers, postal and telecommunications services, etc)		
<i>Transport</i>	Private and public transport, roads, railways, etc		✓
<i>Personal relationships</i>	Family life, intimate relationships, acquaintance and friendship networks		✓
<i>Religious</i>	Spiritual or ritual practices		✓
<i>Involvement in group activities</i>	Participation in political, social, or economic activities		✓
<i>Play</i>	Social, cultural, and physical recreation		✓

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