Our place

Sandy Bay, on Northland's east coast (©Bee Scene Photography)

Climate

Northland, with its proximity to the sea, almost subtropical location and low elevation has a mild, humid and rather windy climate. Most of Northland lies between latitudes 34°S and 37°S. Summers tend to be warm and humid while winters are typically mild with many parts of the region having only a few light frosts each year. The prevailing wind for most parts of the region is from the south-west however in summer tropical cyclones give rise to north-easterly winds and heavy rainfall.

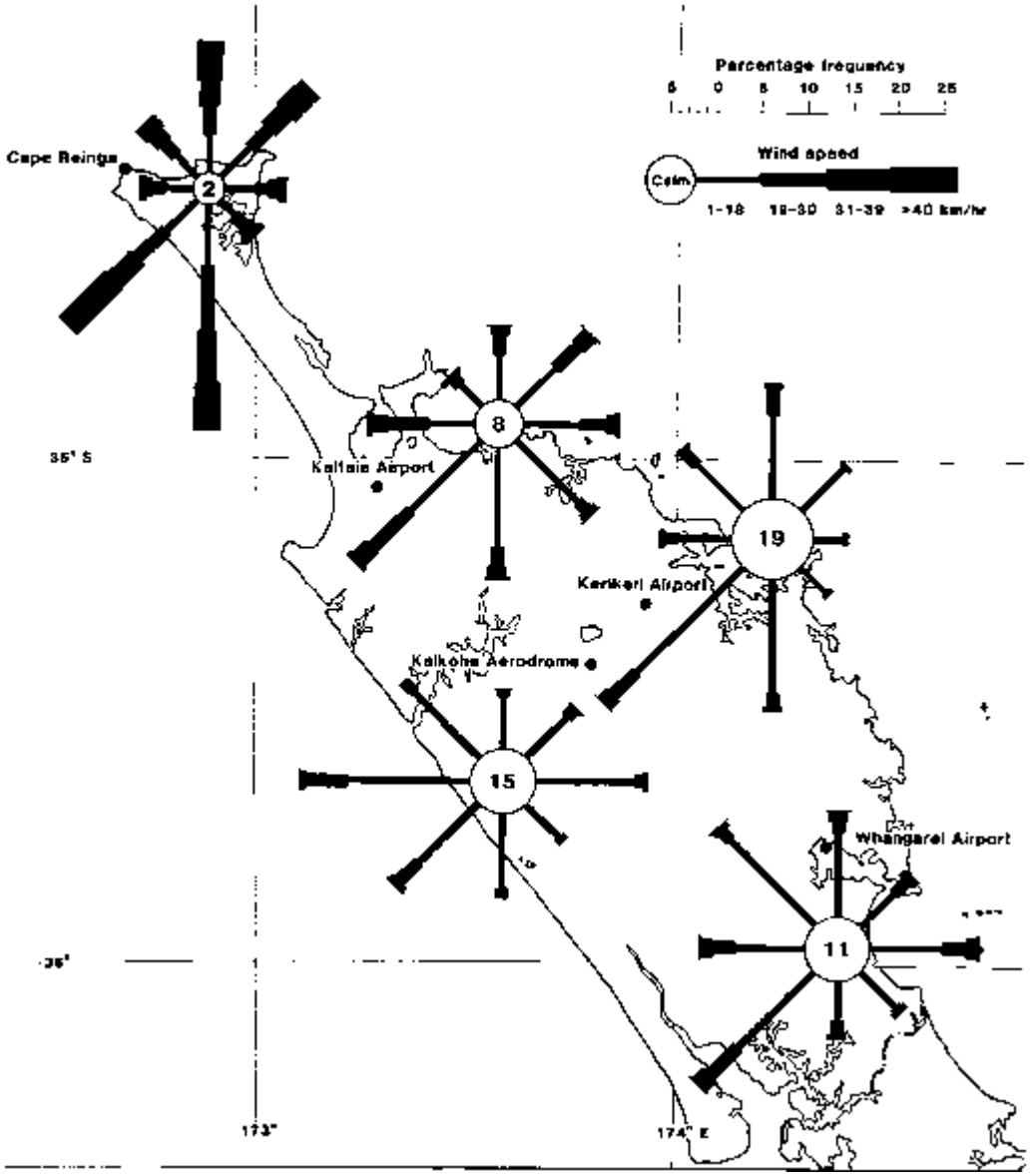
Temperature

Mean annual temperatures range from 15.5°C to 16°C in the Far North and eastern areas, to between 14°C and 15.5°C in the southwest and coastal districts, giving it the highest mean annual temperatures in New Zealand. Daily and annual temperature variations are low.

Wind

The dominant airflow over Northland is from the southwest in all seasons as shown in the wind rose map for Northland (Figure 25). In summer and early autumn, when the subtropical high pressure belt shifts south, Northland tends to experience more northerlies and easterlies.

Figure 25: Wind rose for Northland (Ministry of Transport: 1986)



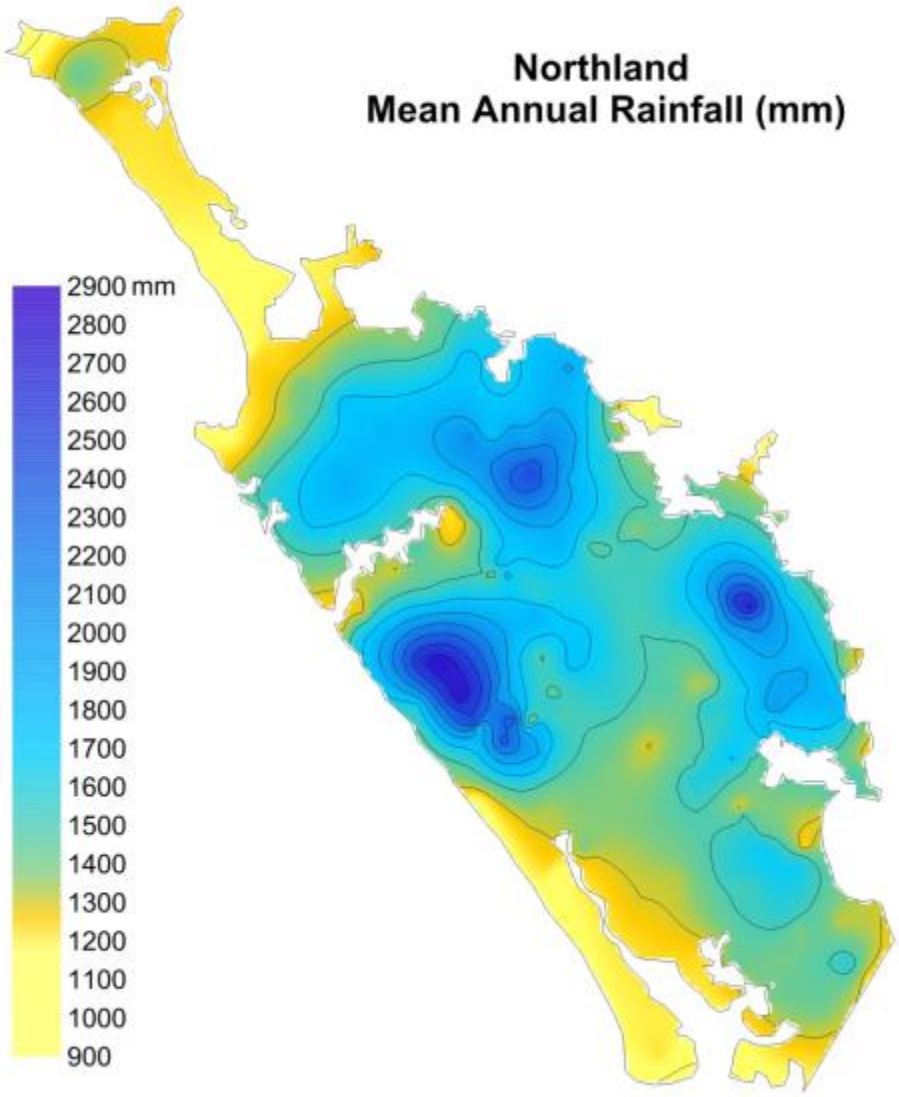
Due to Northland's coastal setting, winds tend to be moderate to strong, particularly in spring, which is generally the windiest season. Exposed coastal areas, particularly those on the west coast and Cape Rēinga, tend to be very gusty and have among the highest wind speeds in New Zealand. Wind direction has important implications for rainfall in Northland.

Rainfall

Northland's annual rainfall is generally plentiful due to its maritime setting, which ensures that the winds arriving have had the opportunity to become moisture laden. The topographical variation across Northland causes rainfall distribution patterns to vary considerably over a small area.

The Tutāmoe and Waimā ranges on the west coast of Northland are the highest points in Northland reaching an altitude of only 770 and 781 metres respectively. Mean annual rainfall ranges from 900mm in low-lying coastal areas to over 2900mm in higher altitudes (Figure 26).

Figure 26: Mean Annual Rainfall Map for Northland



Due to seasonal movements in high pressure belts, seasonal influences on rainfall are well defined. Rainfall is highest in winter (approximately one-third of the yearly rainfall amounts fall in the winter months of June, July and August), and lowest in summer. However, Northland experiences high intensity rainfall associated with the passage of tropical or sub-tropical storms which pass over the region between November and April.

Summer cyclones also occur infrequently during La Niña weather phases. These modified cyclonic depressions affect Northland on average once every five years. These events produce very high rainfall of up to 100mm/hour and can cause widespread flooding, especially when they coincide with very high tides. Isolated thunderstorm cells dump vast amounts of rain over very small areas causing extreme flash flooding.

Late afternoon thunderstorms developing over Bream Bay and Whāngārei Harbour (©Bee Scene Photography)

Droughts are also common in Northland during the summer months. High pressure weather conditions are prevalent during this period, often resulting in several weeks or months of dry and hot or windy weather. Records indicate that parts of the region on average have a drought of economic significance every three years.

Weather systems affecting Northland

Northland lies just south of the subtropical high pressure belt. It is also influenced by the strong westerlies of the westerly wind belt and associated low pressure systems, which generally lie south of Northland.

During the summer months, the subtropical anticyclone highs tend to move south to cover the North Island producing a warmer, more settled climate. In winter, anticyclonic systems have a more northerly track and Northland is exposed to the prevailing south-westerlies and frequent depressions that the rest of New Zealand experiences.

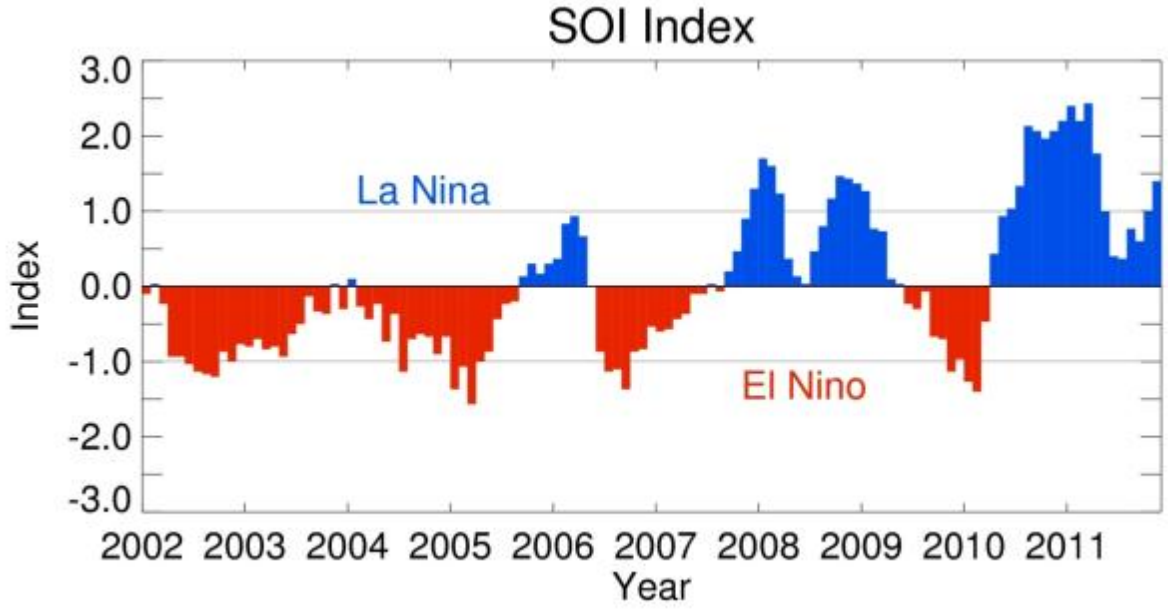
While Northland's location in relation to the subtropical anticyclone and westerly wind belt determines the general nature of the climate, its topography also has an effect on the variation of climate and wind flow within the region.

Northland's weather is largely controlled by the continuous procession of anticyclones, troughs and associated fronts. Extended periods of fine weather occurs when an anticyclone is centred in the South Tasman Sea between southeast Australia and New Zealand, which moves slowly onto New Zealand with a ridge of high pressure extending northwards over Northland.

Anticyclonic blocking occurs when a high pressure system becomes stationary over a region causing low pressure systems to be steered well south, slowing them down or completely blocking the westerly movement of the depression.

Northland is also affected by weather systems of tropical origins. Modified tropical cyclonic depressions from the north may affect Northland on average once every five years, particularly in the months from November to April. These bring gale force north to north easterly winds and heavy rain. Droughts are sometimes broken by heavy downpours associated with these depressions.

Figure 27: Southern Oscillation Index 2002 to 2011 (Brett Mullan, Principal Scientist, NIWA)



La Niña and El Niño influence

El Niño and La Niña refer to weather patterns that occur periodically across the Pacific Ocean. They are both characterised by variable levels of winds and rainfall in different parts of New Zealand.

In El Niño years, New Zealand tends to experience stronger or more frequent winds from the west in summer, leading to drought in east coast areas and more rain in the west. In Northland, this usually leads to slightly cooler than usual temperatures and significantly lower rainfall than normal in eastern areas. In winter, the winds tend to be more from the south, bringing colder conditions to both the land and the surrounding ocean.

La Niña events, which occur at the opposite extreme of the Southern Oscillation Index cycle, have weaker impacts on New Zealand's climate. New Zealand tends to experience more northeasterly winds, which bring moister, rainy conditions to the northeast parts of the North Island, and reduced rainfall to the south and south-west of the South Island.

Although El Niño has an important influence on New Zealand's climate, it accounts for less than 25 percent of the year to year variance in seasonal rainfall and temperature at most New Zealand measurement sites. East coast droughts may be common during El Niño years, but they can also happen in non-El Niño years.

Serious east coast droughts do not occur in every El Niño, and the districts where droughts occur can vary from one El Niño to another (although some are more consistently affected than others). However, the probabilities of the climate variations discussed above happening in association with El Niño are sufficient to warrant management actions and planning to be taken when an El Niño episode is expected or in progress (NIWA Science Centre: web retrieval).

The graph (Figure 27) illustrates the monthly running mean of the Southern Isolation Index (a measure of the changes in atmospheric pressure across the Pacific) from December 2001/February 2002 to November 2011/

January 2012. Above an index of +1.0 is considered to be a strong La Niña influence and below -1.0 is a considered strong El Niño influence.

The graph shows a sustained El Niño influence during the period 2002 to 2007 and a dominant La Niña influence from 2007 to 2011, however during 2009 and 2010 a strong El Niño climate pattern is evident resulting in extreme drought conditions for Northland over a significant duration.

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Feast or famine – El Niña and La Niño bring contrasting weather patterns featuring droughts and flooding.

Environment

Landforms and soils

Northland consists of a narrow peninsula, less than 100 kilometres across at its widest point, bounded by the Tasman Sea and Pacific Ocean. The region is unlike most of New Zealand in that there are few mountain ranges and the highest point, near Te Raupua in the Waima Range, is only 781 metres above sea level. Sand tombolos and their associated shrublands, wetlands and dune systems are a feature of Northland's Far North, with the Aupōuri, Karikari and Poutō peninsulas being the best known examples.

The typical inland topography is one of rolling hill country with landforms ranging from the ancient uplifted east coast greywacke rocks to relatively young volcanic lava and active coastal dunes. Many rivers, streams, tidal inlets and harbours dissect and break the pattern of hills. Modest areas of flat low-lying land are restricted to areas next to the Awanui and Northern Wairoa rivers.

The New Zealand Land Inventory (NZMS 290 map series) identifies over 230 different soil types in Northland. This variety is due to differences in underlying rock, the low relief and the influence that the warm moist climate and original vegetation have had on soil forming conditions.

Kauri in Waipoua Forest – areas forested by trees like kauri tend to have leached and infertile soils.

Northland green gecko (left) (© Richard Parish) and the North Island brown kiwi (right) (©P. Graham) – are just some of the diverse species found in Northland.

The composition of the original indigenous forest is probably the prime influence on soil properties. Areas which were once forested by trees such as kauri, totara and kahikatea tend to have produced soils that are strongly leached and infertile. A succession of kauri over thousands of years has modified many of Northland's soils by creating acidic, infertile podzols.

At the extreme, kauri gumlands are wetlands, with hard impervious pans and short stunted vegetation. On the other hand, areas forested by broadleaf trees such as puriri, kohekohe, taraire and tawa, generally have fertile top soils due to the ability of these trees to retain nutrients. The main exceptions to these soil types are those formed as a result of volcanic activity and recent stream and river deposits.

Much of the land surface has been subjected to deep weathering due to long exposure to a warm and moist climate, leaving a thick mantle of clay-rich soils over unearthed rock.

Native forest and shrublands

Some 32% of Northland's land area remains in native vegetation including over half of the nation's remaining kauri forest. The region's forest and associated shrublands are notable for their high native content, species diversity, structural complexity, and tropical links.

Podocarp/hardwood/kauri forests are the most extensive forest type in Northland. These comprise a wide variety of hardwoods including rewarewa, kohekohe, tawa, pukatea and taraire among others. Podocarp species such as rimu, totara, miro and matai are scattered throughout the region, along with kauri, which often grow in small clumps on steep sites.

Other distinctive forest types are evident on the coast, such as manuka/kanuka shrublands found at Te Paki in the Far North. Volcanic broadleaf and flood plain forests are two types which have been severely diminished by land development.

The coastal forest often comprises pōhutukawa, houpara, and kōwhai together with karaka, puriri and kohekohe. Kauri and podocarps occur in some areas as does a transition to estuarine mangrove forest. The majority of these forested areas have been modified by human influences through logging and forest clearance. These forest and shrubland areas support a rich diversity of wildlife. They are home to large populations of nationally rare or declining species such as the North Island brown kiwi, North Island kōkako, native pigeon or kukupa and Hochstetter's frog, as well as small residual populations of more threatened species such as the red and yellow crowned parakeets, kaka and long and short-tailed bats.

Some forests in the region also support the only naturally breeding populations of species including flax snail, kauri snail and the Northland green gecko. Survival of these and other species is threatened by adverse effects of human activity such as forest clearance, the activities of animal pests (for example, possums, wild cats, and poorly controlled domestic dogs) and plant pests.

Kahikatea swamp forest, Dargaville – one of Northland's distinct forest types.

Rivers and streams

Northland has a dense network of rivers and streams, many of which are relatively short, and with small catchments. Most of the major rivers have their outlets into harbours while few have outlets discharging directly to the open coast. Flows in the rivers vary considerably due to rainfall, with high intensity storm rainfall causing flash floods and prolonged dry spells leading to very little flow in many smaller catchments. (Figure 28 shows the major rivers and their catchments.)

Most of the rivers and streams in Northland, with the exception of the Northern Wairoa, are relatively short with small catchments. While river flows vary considerably, Northland's rivers are generally characterised as being slow flowing and muddy. The rivers with the highest conservation value are those whose catchments are the least modified, and include the Waipapa and Waipoua rivers. (For information on water quality and quantity in rivers see Chapter 4 – Our freshwater.)

© Mike Farrow

Figure 28: Major rivers and streams in Northland

The Waipoua River – one of Northland's major rivers

Lakes and wetlands

Northland has over 400 freshwater lakes, with many of these of national and international significance. Northland has the greatest number of dune lakes nationally and represents a large proportion of warm, lowland New Zealand lakes with relatively good water quality.

These lakes and their surrounding wetland margins support a range of endemic endangered species providing the only known habitat, or national strongholds for a range of biota. Perhaps the most outstanding character of these lakes is the currently limited impact of invasive species on their biota, which is unparalleled in any other region of mainland New Zealand (Champion et al: 2012).

Most of Northland's lakes are situated along the west coast, having been formed between stabilised sand dunes. The dune lakes are in four main groups situated on the Aupōuri Peninsula, Karikari Peninsula, Kai Iwi lakes and Poutō Peninsula. They generally range in size between one and 35 hectares and are usually less than 15 meters deep.

Kai Iwi dune lakes from the north-west

Lake Taharoa of the Kai Iwi group is one of the largest and deepest dune lakes in the country, covering an area of 237ha and being 37m deep. It has the deepest growing vegetation in the North Island, growing at a depth of

24m. Dune lakes usually have little or no continuous surface inflows or outflows, being fed primarily by direct rainfall or surrounding wetlands. As a result, water levels fluctuate considerably with climatic patterns and they have a limited capacity to assimilate any contaminants, because most of these lakes are relatively small and shallow. They are prone to nutrient enrichment from stock and fertiliser, particularly where lakeside vegetation has been grazed or removed and where there is direct stock access to the lake.

Raupō swamp, Cavalli Islands

There are also several shallow inland lakes which originated through the damming of valleys by lava flows, such as lakes Owhareiti and Ōmāpere, near Kaikohe. Lake Ōmāpere appears to have formed some 80,000 years ago (Newnham et al: 2004). The lake reformed 600 to 700 years ago, attributed to siltation following deforestation of the area (Champion et al: 2012).

Further to the north are two large man-made lakes associated with the Kerikeri irrigation scheme, which are a major water resource for that area.

Northland also has many inland wetlands, the most significant being those linked with the mid-catchments of the larger rivers, such as Kaipeha Swamp, Lake Owhareti, Ngāwhā Springs Wetlands, Mōtatau Wetlands, Waitangi Wetland complex, Punakitere Wetlands and Mangonui River Wetlands.

Gumlands are the least fertile and most acidic of the wetlands and are normally found on gently sloping ridges. They are uniquely associated with ancient kauri forests where over thousands of years, kauri have dropped acidic litter causing nutrients and organic material to leach out of the soil. This has left a

hard silica pan, which is a barrier to water draining away. Gumlands are home to an unusual community of plants and animals which have adapted to survive in harsh infertile environments. These include stunted manuka, *Schoenus brevifolius, Baumes* sedges, tangle fern, *Gleichenia dicarpa* and the Northland green gecko.

The original area of wetlands has been greatly reduced, to less than 5.5% of its original extent, due to drainage and conversion for agricultural purposes. Remaining wetlands show evidence of these practices – they are small, scattered and vulnerable to changes in hydrological regimes. The most significant areas of dune lakes and wetlands remaining are Aupōuri Peninsula, Karikari Peninsula, Lake Ohia, Kai Iwi Lakes and on Poutō Peninsula.

Epakauri Gumfield, Ahipara (top) and bog at Lake Ohia, overlaying ancient kauri forest (bottom).

These lake and wetland ecosystems are important habitats for a wide variety of plant and animal species, which are regionally or nationally significant because of their rarity. These species include birds such as the brown teal, banded rail, NZ dabchick, marsh crake, fern bird and Australasian bittern, the aquatic plants *Hydatella inconspicua, Myriophyllum robustum* and native freshwater fish, the black mudfish, Northland mudfish, giant kōkopu, banded kōkopu, short jawed kokōpu and dwarf inanga.

Australasian bittern (©Peter Langlands)

(For more information on lakes see Chapter 4 – Our freshwater, and for wetlands see Chapter 3 – Our land, our air.)

For more information on wetlands go to: www.nrc.govt.nz/wetlands

Groundwater

Groundwater is water that runs through and is stored in, soil and rocks. It is a valuable water resource to Northland, being used for numerous town and rural water supplies, irrigation and stock water. Whāngārei, Kaitāia, Mangōnui, Kaikohe, Ōkaihau, Maungakaramea and Ruawai all take groundwater for community water supplies. Groundwater is also an important water source for many coastal areas, such as Russell, Taipā and Matapōuri.

In general there are three main types of water-

bearing geological formations (aquifers):

- Sands and gravels, which are found along both coasts. Old coastal dune formations, where they are thick and extensive, such as on the Aupōuri Peninsula, can yield large quantities of water. Smaller, shallower areas such as those behind east coast beaches like Taipā and Matapōuri, also provide sufficient quantities of water for small-scale community and individual domestic supplies.

- Volcanic cones and related lava flows are younger features, which occur particularly around Kaikohe and Whāngārei, yielding significant quantities of water capable of supplying smaller towns and intensive horticultural and farming areas.

- Sedimentary rocks, such as greywacke and crystalline limestone. Significant quantities of water can be obtained from weathered and/or fractured greywacke, such as is found at Russell, or from crystalline limestone, like that found at Hikurangi.

Geothermal fields represent an unusual variation in which water is subject to heat and pressure as the result of geothermal activity. Northland has one geothermal field centered on Ngāwhā Springs to the east of Kaikohe. It is different from most other fields in the country in that a relatively thick (500m) impermeable caprock covers the geothermal reservoir preventing the formation of major surface hot springs.

The surface of the Ngāwhā geothermal field is characterised by small gas and hot water seepages and springs.

These surface emissions have considerable cultural and spiritual value to tangata whenua and are used for bathing by local residents and visitors, some for therapeutic purposes. Under the Resource Management Act, geothermal resources are treated in a similar manner to other water resources. The regional council is given primary responsibility for controlling the taking or use of geothermal fluids including geothermal energy. It is also responsible for controlling any discharges of contaminants that may result from the use of geothermal fluids. (For more information on groundwater quality and quantity see Chapter 4 – Our freshwater.)

Lake Waiparaheka, Ngāwhā Springs (geothermal).

Coastal areas

Northland's coast is arguably its most distinctive physical feature. The coastline is some 3200km long and its many harbours, together with a warm temperate influence (or climate) set the Northland coast apart from other areas of New Zealand.

The west coast of the region has a relatively smooth outline broken by the mouths of several extensive shallow harbours. In contrast, Northland's eastern coast forms an irregular line with rocky headlands, sheltered deep water harbours, sandy bays and mangrove forests.

The west coast of Northland is exposed to almost continuous onshore oceanic swells that cause turbulence, turbidity and sediment movement in shallow marine and inter-tidal habitats. Marine species occupying this type of environment are consequently few and hardy.

Beach and dunefield habitats are significant in several respects. Coastal dune systems associated with lakes, wetlands and shrublands are home to several endangered plant species, with beaches important as roosting, nesting and feeding areas for coastal birds, such as the threatened New Zealand dotterel, the rare and endemic variable oystercatcher and the endangered fairy tern.

The west coast harbours (Kaipara, Hokianga, Herekino and Whāngāpē) and the east coast harbours (Pārengarenga, Rangaunu, Houhora and Whāngārei) as well as numerous lakes and swamps, are valuable feeding grounds for migratory waders such as plovers, godwits, turnstones and tattlers.

Harbours and estuaries within drowned river valleys are common along the east coast of Northland. Most are ecologically similar to those on the west coast, but Pārengarenga, Houhora and Rangaunu harbours differ in that they have large inter-tidal sand flats and shell banks.

Extensive areas of mangrove forest and salt-marsh are present in harbours on the east and west coasts of Northland. These habitats are invaluable as a rearing ground for juvenile fish species including many commercially exploited species, and important feeding and roosting areas for birds.

The east coast of Northland is predominantly rocky with intervening sandy beaches. Marine habitats containing locally endemic species and New Zealand endemics that are very rare elsewhere are present at the Three Kings Islands and in the Cape Rēinga areas. These areas and also the Moturoa Islands, Cape Karikari, Cavalli Islands, Cape Brett and the Poor Knights Islands are influenced by the East Auckland current. This warm subtropical current brings with it the larvae of Indo-Pacific species including several species of molluscs, echinoids (sea-eggs) and a variety of fish. The larvae mature within the areas washed by the current, and along with many endemics, make these areas ecologically unique.

Poor Knights Islands

Indigenous terrestrial coastal vegetation in Northland has been largely removed or otherwise modified by human influences. Unmodified coastal forest is now very rare, being present on some islands, and at only a few places on the mainland: Herekino Harbour mouth and Ninety Mile Beach (Te Oneroa a Tohe). Indigenous dune field vegetation is similarly rare and restricted to areas such as North Cape, the north heads of the Kaipara and Hokianga harbours and isolated areas on the east coast.

(For information on coastal water quality, and biodiversity and biosecurity see Chapter 5 – Our coast.)

The Bay of Islands, Northland

Outstanding natural features, landscape and character areas

Northland has a great variety of landscapes and landforms occurring across a range of rural, coastal and marine environments, with a complex matrix of cultural and historic associations. The unique character and values of these areas set Northland apart and play a key role in creating the identity of the region. While many of these environments are subject to human modification, a significant proportion of Northland is in a relatively undeveloped state.

While all environment types have some degree of value, there are areas with particular significance – these areas are the focus of sections 6(a) and 6(b) of the Resource Management Act (the act).

The act identifies preservation of the natural character of the coastal environment and freshwater bodies as a matter of national importance (section 6(a) the act). It applies similar direction for outstanding natural features and landscapes (section 6(b) the act). While a requirement of the RMA, managing landscape and natural character values also contributes to social, cultural and economic well-being.

Outstanding natural landscapes

Outstanding natural landscapes are assessed and identified using a number of criteria established in case law. These include:

- Geology, topography, ecology and associated formative processes;
- Aesthetic, visual, natural or wilderness values;
- Cultural, spiritual or historic associations; and
- Memorability, legibility and expressiveness.

Examples identified to date include Cape Brett and Whāngārei Heads.

Cape Brett lighthouse (©: John Ballinger)

Outstanding natural features

In Northland, the identification of outstanding natural features has been informed by the use of the Geopreservation Inventory (Geological Society: 1995). This inventory provides a list of unique geological landforms and features, such as fossil beds, limestone outcrops, volcanic cones and unusual sediments.

Hurupaki and Parakiore volcanic cones, some of Northland's outstanding natural features (©: Simon Crocker)

©: Simon Crocker

Maungatapere volcanic cone from State Highway 14 – another outstanding natural feature

Natural character

Natural character is essentially a measure of how 'natural' a given area is on a spectrum from completely modified by human activity (for example, an urban area) to pristine (completely natural). Natural character is typically assessed on a case-by-case basis in Northland as it has not been explicitly mapped in plans to date. Natural character assessment can include:

- Biophysical, ecological and geological patterns and processes;

- Natural movement of water and sediment;
- Modification by buildings, earthworks, pests or weeds; and
- Experiential factors (for example, noise, smell etc.).

While these matters have been part of the Resource Management Act since 1991, there has been wide-ranging debate and contention over how such areas should be identified and managed. As a result, there has been an inconsistent approach across the region.

While all district plans have outstanding natural feature/landscape maps, these vary widely in content. The regional plans do not map these areas at all. A review of existing outstanding natural feature/landscape maps in district plans stated that these would not be considered consistent with case law or current best practice and would be vulnerable to challenge (Miskell: 2010). As noted above, natural character has not been mapped at all in Northland to date. Plan provisions are similarly varied.

The result has been cross-boundary inconsistency and outstanding natural landscapes not being identified as such, and subsequently not managed as well as they could be. In some cases, this has led to uncertainty and significant costs for developers, landowners and councils as these issues are debated repeatedly in consent and plan change processes.

Mapping Northland's unique coastal environment (©: Mike Farrow)

This debate over landscape and natural character is set to continue as a result of the New Zealand Coastal Policy Statement 2010. The coastal policy statement requires councils to identify and manage outstanding natural features/landscape and natural character values in the coastal environment.

In response to these issues, the council has embarked on a regional mapping project to provide a consistent approach to identifying:

- The coastal environment
- Outstanding natural features/landscapes
- High and outstanding natural character.

This will also assist all Northland's councils in implementing key policies of the coastal policy statement. The resulting maps will form part of the Proposed Regional Policy Statement for Northland (see www.nrc.govt.nz/newRPS for details).

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What do we want for our outstanding natural features, landscape and character areas?

The operative Regional Policy Statement for Northland 2002 contains several objectives relating to outstanding natural landscapes and features including:

- The identification of outstanding natural features and outstanding landscapes and their protection from inappropriate subdivision, use and development.
- To recognise, in the identification and protection of outstanding natural features and outstanding landscapes, that their values include intrinsic values of ecosystems, ecological, heritage, cultural, spiritual, and amenity aspects.
- Any adverse effects of human activities on natural and physical resources are avoided, remedied or mitigated so that the qualities and values of any outstanding natural features and outstanding landscapes are maintained.

The operative Regional Policy Statement also includes anticipated environmental results, related to measuring the impact of policies that are designed to meet the objectives. Included below are the relevant anticipated environmental results for outstanding natural landscapes and features and a high level assessment of the outcome:

Identification and community-wide acknowledgment of the region's outstanding natural features and outstanding landscapes

- Outstanding natural features and landscapes have partially been identified through mapping across the region by district councils although there are gaps present in some areas with inconsistencies in the methods used. A mapping exercise is being undertaken by the regional council across the region identifying outstanding landscapes and features using consistent region-wide criteria.

There is a direct link between the community's perception of landscape qualities and their protection for the community's enjoyment

- Anecdotally it is clear that some landscapes and features in the region are well known and admired by the community. The 'aesthetic' appeal of a landscape and how it is valued forms part of the criteria for assessing whether it is outstanding.

Protection of the character and qualities of the region's outstanding natural features and outstanding landscapes

- District plans contain provisions related to the protection of outstanding natural landscape and features. However, these provisions vary considerably between districts.

Preservation of the natural character of the region's coastal environment, wetlands, and lakes and rivers and their margins through the protection of outstanding natural features and outstanding landscapes

- Since this anticipated environmental result was developed, what is described as natural character has taken on a broader meaning (as defined by the New Zealand Coastal Policy Statement 2010). This criteria has therefore not been assessed but should be addressed in future state of the environment reporting.

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©: Mike Farrow

Natural hazards

Northland is subject to a number of natural hazards which, because of the pattern of development within the region, may place human life, property and/or economic production at risk.

These natural hazards include inundation (this includes both storm-related coastal events and tsunami as well as high intensity rainfall events) and other weather hazards, earthquakes, landslides, fire and volcanic activity (Beetham et al: 2004).

The operative Regional Policy Statement for Northland details council and community objectives for each natural and physical resource in our region. The objective relating to natural hazard management is:

- To avoid or mitigate the adverse effects of natural hazards by minimising and where practicable, avoiding the risk to life and damage to property, infrastructural services and other aspects of the environment, from natural hazard events.

The following are the anticipated environmental results after the implementation of the policy for hazard management in the operative Regional Policy Statement for Northland:

- Increased public awareness of the risks of natural hazards and their exposure to them.
- A reduction in the damage caused to the environment by significant natural hazards.
- A reduction in the damage caused to the environment by inappropriate protection works.

Tsunami

Tsunami hazard

Tsunami is a natural phenomenon that results when a large volume of water is displaced causing a series of waves to be generated, most commonly due to earthquakes that cause sea floor displacement. Tsunami can devastate coastal communities causing inundation, strong currents, contamination and other effects.

Historic records show that New Zealand has been affected by more than 40 tsunamis in the last 150 years. Four moderate tsunami inundation events have impacted Northland's east coast in the last 150 years. The prehistoric record indicates at least one large event, or a series of large closely-spaced events, has affected Northland's coast in the last 600 years.

Tsunami risk and consequences

Tsunami hazard is considered a high risk for Northland, especially among coastal communities. A generalised tsunami hazard-risk model for Northland indicates that a moderate hazard and risk exists for most of the northwest and east coast, a high hazard and moderate risk for the north, and a low hazard and risk for the west. The hazard is largely a function of tsunami source, intensity and return period.

Tsunami have the potential to cause loss of life, destruction of coastal property and infrastructure, erosion, environmental damage and economic impacts. Tsunami modelling for Northland indicates that the principal threat is from ruptures along the southern part of the Tonga Kermadec Trench. Such events are

understood to be very rare, with reoccurrence intervals measured in thousands of years.

Tsunami risk management

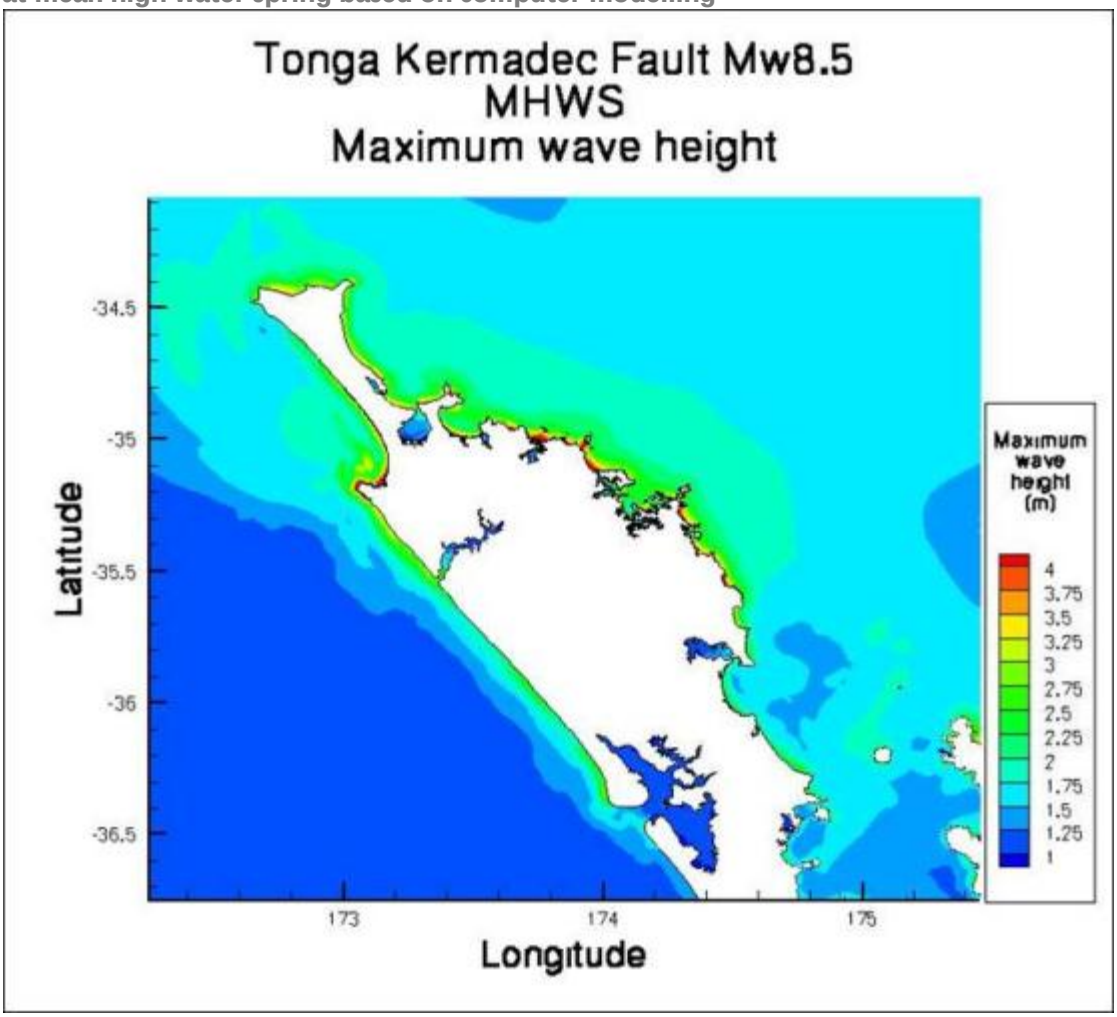
Computer inundation modelling has been undertaken by NIWA for 30 Northland coastal settlements based on earthquakes on the South American coast and the Tonga Kermadec trench (Figure 29).

The inundation mapping shows the predicted extent, depth and velocity of tsunami flows at these settlements.

These results are available on the Northland Regional Council website (www.nrc.govt.nz/civildefence), and can be used to inform planning for future land use and thereby mitigate the potential risk from tsunami.

Community response plans have been developed in high-risk areas and a number of communities in Northland also have tsunami warning sirens. Tsunami evacuation maps have also been produced by GNS Science for the entire Northland coastline, which show evacuation areas in the event of an earthquake or a tsunami warning.

Figure 29: Maximum water surface elevations for a Tonga-Kermadec subduction zone scenario at mean high water spring based on computer modelling



Tectonic activity

Northland has the lowest earthquake risk in New Zealand. No active faults are mapped within the region, and the whole Northland peninsula is generally regarded as tectonically stable. The recorded earthquakes have generally been small in magnitude and are seldom felt.

As well as ground-shaking, earthquakes can result in fault rupture, liquefaction, landslides and tsunami. The main earthquake risk to Northland is likely to be associated with the generation of tsunami referred to above.

For urban Whāngārei, there is an estimated mean return period of 1000 years for an earthquake of six on the Modified Mercalli scale, and 7000 years for an earthquake of seven on this scale, compared with nine and 42 years respectively for Wellington (Beetham et al: 2004). Intensities of six or more are those which may cause damage to some buildings.

A national reporting system helps identify likely impact areas and response to these events is covered by Civil Defence plans and procedures.

Flooding

Flood hazard

Flooding is the most frequent natural hazard that affects Northland, threatening human life, disrupting communications and access, damaging property and reducing primary production.

Northland's northerly geographical setting exposes the region to ex-tropical cyclones that have the potential to cause damage through heavy rain, such as in cyclones Bola and Fergus, and more recently Wilma (January 2011). Northland has, on average, one ex-tropical cyclone pass nearby every year, putting it more at risk from ex-tropical storms than the rest of New Zealand.

Severe convection storms tend to cause localised damage but they can catch communities unaware as the events are often not well forecast. Good recent examples of these events are the Kerikeri 1981, Brynderwyn 1997, Hokianga 1999 and Whangaroa 2003 storms. Due to extremely high rainfall intensities, these events generate high debris flows, and present the greatest risk to life and property.

Historic widespread development of many of Northland's settlements on flood-prone areas, coupled with modification of the natural environment, has exacerbated the current flood hazard. The drainage of wetlands, clearance of native forest for pasture and improved land drainage have resulted in more concentrated runoff of rainfall and increased flood risk.

Development on floodplains, alluvial fans and coastal lowlands has created the most significant flood hazard in Northland. These geographic features developed as a result of fluvial (river) and coastal processes operating over thousands of years, with the processes still active following human occupation. In many instances, the development of these features occurred due to ease of access, many were often accessible via coastal or river transport, and the flat nature of the land tended to lend itself to ready development.

Flood risk and consequences

Northland's weather systems, coupled with a history of widespread development on flood-prone land, means there is a high flood risk for

many settlements, infrastructural assets and primary production activities in Northland. Major Northland settlements at significant risk from flooding include Whāngārei city, Kaitāia, and Kerikeri-Waipapa, with many other smaller settlements also at risk, such as Kaeo, several settlements throughout the Hokianga and a number of east coast communities.

Infrastructural assets, such as roads, railway and utility lines, are impacted during flood events. Route security of Northland's road network is impacted during larger flood events, with local roads and state highways temporarily closed due to inundation or damage to the road that renders it impassable.

Primary productivity is impacted through inundation and loss of stock and damage to pasture. Inundation of flood waters for greater than 72 hours can result in pasture die-off, which has a long-lasting impact on productivity from pastoral farming.

There is also a significant cost, both tangible (easy to quantify) and intangible (difficult to quantify) associated with flooding. Tangible costs include damage to homes and infrastructural assets. Intangible costs relate to lost productivity due to inability to travel to work, stress, health impacts and environmental damage.

Flood risk management

The first steps towards mitigating or reducing the risk from flooding are to understand the flood risk, determining what is at risk, assessing and prioritising options for treating the risk and then implementing the options.

To achieve this, the Northland Regional Council is undertaking a Priority Rivers Flood Risk Reduction project. This project initially identified 27 catchments in Northland as priorities for flood risk reduction planning because of the potential threats the rivers and streams in them pose to lives, buildings, road access, infrastructure and primary production.

Outcomes from the project included the development of flood risk reduction plans, which contained:

- Detailed surveys of the land in catchments and computer flood models.
- Flood hazard maps (these show which areas are likely to flood and what could be threatened as a result, for instance schools, marae etc).
- Assessing the likely consequences for a community if it is flooded and analysing options to reduce any resulting danger/threats.

This information helps inform the community and the Northland Regional Council of the flood risk, and options available to address it. These options include:

- Land use planning to restrict development that may increase flood risk, and ensure that new development is sufficiently flood proofed.
- Flood control and river management works, such as stopbanks, gravel extraction, and detention dams.
- Warning systems based on real-time automated rainfall and river level monitoring and weather forecasts.
- Catchment management, including hill country soil conservation planning and planting subsidies.
- Evacuation / community plans in place for some high-risk areas.

Maintenance works on Tarawhataroa stopbank, Awanui flood scheme, Kaitāia

Erosion

Erosion hazard

There are many forms of erosion hazard; the most common in Northland include land instability, coastal erosion and river erosion.

There are four main types of landslide hazards in Northland; debris avalanche, earth flows, greywacke slips and unstable mudstone. The primary hazard mechanisms relate to the interplay of the underlying geology, steepness of topography and saturation of soils.

Coastal erosion relates to the retreat of coastal landforms, such as dunes or cliffs, caused by coastal processes such as waves and currents, or human intervention that may interfere with natural sediment supply. In many cases coastal erosion is an episodic process, with erosion occurring in defined 'chunks', driven by storm events that generate large waves and sustained periods of elevated sea levels.

Bank erosion is the most common form of river erosion in Northland, and is exacerbated by deposits of sediment and debris that deflect flow onto banks. Other forms of river erosion include bed scour, where the river bed scores, which often occurs following the removal of meanders. Avulsion can also occur, which is where a river channel rapidly changes course to form a new channel. This form of erosion is particularly evident on alluvial and debris fans.

Coastal erosion increased by human intervention

Erosion risk and consequences

The potential for erosion risk varies depending on the nature of the landform and the extent of human development or modification. For example, the landslide risk of shallow instabilities on steep hill country will often be increased as a result of the removal of native forest and conversion to pasture. In certain circumstances this type of conversion of land use has been demonstrated to have a negative economic benefit, due to soil loss affecting the productivity of the land.

Coastal erosion and river bank erosion can result in the need for costly erosion control measures to prevent the loss of property or assets. In certain circumstances the cost of controlling the erosion is beyond the means of the affected landowner, who may need to leave the land.

Erosion management

The management and mitigation of erosion hazard is addressed through a range of tools.

Soil conservation subsidies are provided through the Northland Regional Council Environment Fund to encourage landowners to plant poplar and willow trees to stabilise surface instability on hill country land or to control gully erosion or river bank erosion.

Geological mapping has been undertaken to categorise hazard profiles of land instability in certain urban areas, which is used in land use planning to identify development control and mitigation measures. Likewise, coastal hazard zones have been mapped based on the potential risk of shoreline retreat.

Monitoring assessment and risk reduction works are also undertaken on some areas of

land instability to mitigate the potential threat to life and property. An example of this is the Bells Hill slip, which is located in Kaitāia above the Awanui River. Slope failure during a large flood event may cause significant flooding in Kaitāia. Regular geotechnical monitoring is undertaken of this slip to determine the rate of slip movement, and soil drainage and cut-off drains have been installed to minimise instability associated with soil saturation.

A drill crew installing horizontal drainage to reduce soil saturation and help mitigate instability at the Bells Hill slip, Kaitāia

How are we measuring up against our objectives?

The following are the environmental results anticipated, listed in the operative Regional Policy Statement:

Increased public awareness of the risks of natural hazards and their exposure to them

- The general understanding of natural hazards has been improved through science that has assessed the 'risk-scape' of Northland's natural hazards, based on the frequency of occurrence and consequence to better inform the potential risk.
- Some information about coastal and flooding hazards has been incorporated into district plans, and this information and information on other natural hazards has been published on publically accessible council websites.
- The regional council has initiated the Priority Rivers Flood Risk Reduction project, which is assessing and mapping flood risk for 27 priority catchments.
- Tsunami inundation and evacuation zone mapping has been undertaken for most of Northland's developed coastal areas. In addition, a number of communities in Northland have tsunami warning sirens.

A reduction in the damage caused to the environment by significant natural hazards

- The regional and district plan provisions assist to reduce the extent to which inappropriate development contributes to damage from natural hazards.
- River maintenance works and river schemes have been implemented reducing the risk of flooding and erosion.
- Soil conservation initiatives and subsidies are in place to help reduce sediment discharge to river systems and reduce the risk of hill country land instability.

A reduction in the damage caused to the environment by inappropriate protection works

- The Northland Regional Council has a full-time CoastCare Co-ordinator and an active CoastCare programme aimed at facilitating community-based restoration of dune systems as an alternative to other protection works. This programme provides for the mitigation of natural hazards, as well as restoring natural character and biodiversity of dunes.
- Resource consent is typically required for protection works, and assessment processes are in place to determine the potential damage to the environment from protection works before determining the appropriateness of the activity.

Taipā beach before dune restoration work, May 2008

Taipā beach following dune planting and protection, February 2011

What's being done?

- The regional council now has much better information on tsunami, coastal hazards and flooding hazard. This information is being passed on to district councils and needs to be used to inform and guide sustainable development with regard to understanding the potential risk associated with the hazard and either avoiding or mitigating risk to an acceptable level.

- There is a growing shift in focus from managing hazards through permanent engineering, to more proactive measures including land use regulation, community preparedness for and awareness of natural hazards, including active consideration of how and when managed retreat should be implemented.

- There is also a growing appreciation of the impact flood hazard engineering has on the wider environment. For example, the building of flood protection works along rivers means that less water and therefore sediment spills out onto the adjacent flood plains. This leads to increased sediment being deposited in estuaries. Nevertheless, the maintenance and improvement of existing flood management will need to be continued (until proven unsustainable), and in many situations additional engineering works will need to be undertaken to reduce risk in areas of existing development.

- Better integration of the management of the coastal marine area and adjoining land margins to better manage effects of activities, particularly coastal protection works, and avoid activities that exacerbate coastal erosion.

- Identification, protection and restoration of natural systems that are a natural defence to coastal erosion.

- The natural hazards policies in the proposed new Regional Policy Statement are more restrictive than what is currently in the operative policy statement. There are specific policies for new development within 10 year and 100 year flood hazard areas, and within coastal hazard areas, as well as general 'risk management' policies. Applicants will need to demonstrate to councils that their developments in hazard prone areas will not pose undue risk to themselves or neighbouring properties.

- Territorial authorities will be required to incorporate maps into district plans and Northland Regional Council is also introducing a new method around minimum floor levels in the coastal environment (specifically to avoid risk from coastal inundation).

References

Beetham, R.D., McSaveney, M., Dellow, G., Rosenberg, M., Johnston, D. and Smith, W. 2004. A review of natural hazards information for Northland region. Report prepared by the Institute of Geological and Nuclear Sciences Limited for Northland Regional Council.

Northland Civil Defence Emergency Management Group. Northland Civil Defence Emergency Management Plan. 2010.

Infrastructure

Infrastructure is an integral part of modern life. We use roads or trains to get to work and visit friends; we use electricity to run our factories, light our homes and power our appliances; we use telecommunications to talk to people near and far away, and to inform and entertain us.

Infrastructure is important for the services it provides rather than for its own sake. At its best, it attracts businesses, improves productivity and makes our lives more pleasant. Well-chosen and operated infrastructure can bring benefits that extend for many generations.

Infrastructure is also expensive to build and maintain, and can have significant environmental and social impacts. If we don't choose wisely, it may reduce our quality of life and add to the burdens faced by our children.

Social infrastructure is also included and typically covers schools, universities, hospitals, prisons and community housing. However, social infrastructure does not include the provision of social services, such as the provision of teachers at a school or custodial services at a prison.

Historical growth in Northland, in terms of both population and economy, has resulted in substantially increased demands on Northland's infrastructure in recent years. This demand will continue because the population of the region is expected to continue to grow (albeit at a slower pace than historically experienced).

Historically, the Northland economy has been largely based in primary agricultural and forestry production. However, from an infrastructure perspective the focus is moving towards high-volume energy, communications and transport networks and an expectation of modern, quality municipal utilities (such as water and wastewater).

The Whāngārei urban centre is a key commercial and population hub for the region, as well as a critical 'gateway' node in regional transport, power and telecommunications networks. While maintenance and upgrading of Whāngārei's existing infrastructure will be a critical element in the region's future growth, other urban and commercial centres are emerging throughout the region which will also require strategic investments.

A geographically balanced approach to infrastructure spending is therefore essential to ensure that economic development throughout the region is evenly distributed, equitable and of maximum benefit to the people of Northland.

What are the issues affecting infrastructure in Northland?

The quality of infrastructure has traditionally been a contributing factor to Northland's less favourable position in comparison to other regions in New Zealand, particularly in terms of economic performance and social and community well-being. Nevertheless, there have been a number of improvements in recent years, which are helping to reverse previous poor performance.

Continued investment in infrastructure will help lift the region by encouraging business growth and employment opportunities, enhancing health and safety, improving communication and helping to relieve pressure on the environment.

The Regional Policy Statement for Northland details council and community objectives for each natural and physical resource in the region. These are listed as 'Environmental Results Anticipated' and for infrastructure the policy statement splits them into three subject areas: transport; energy; and waste.

Although not included in the operative Regional Policy Statement, other infrastructure of importance to the region includes telecommunications (particularly mobile and broadband), municipal wastewater and water reticulation.

Telecommunications infrastructure

What do we want for telecommunications (including broadband) infrastructure in Northland?

Most Northland homes have a landline phone. Cellular coverage is patchy in the region with some areas, mainly in the west, requiring additional infrastructure. In 2006, more than 20 percent of households had access to broadband. In 2009, this figure rose to more than 61% (Statistics NZ). However, this rate is relatively low compared to other regions in New Zealand.

In terms of accessing and using this technology, the most important factor to consider is the speed of access. Unfortunately no data is available relating to speed, other than a general distinction between internet access and broadband access. There is no information to compare what speed of service is provided as there can be large variances between the capability of broadband and ultra-fast broadband.

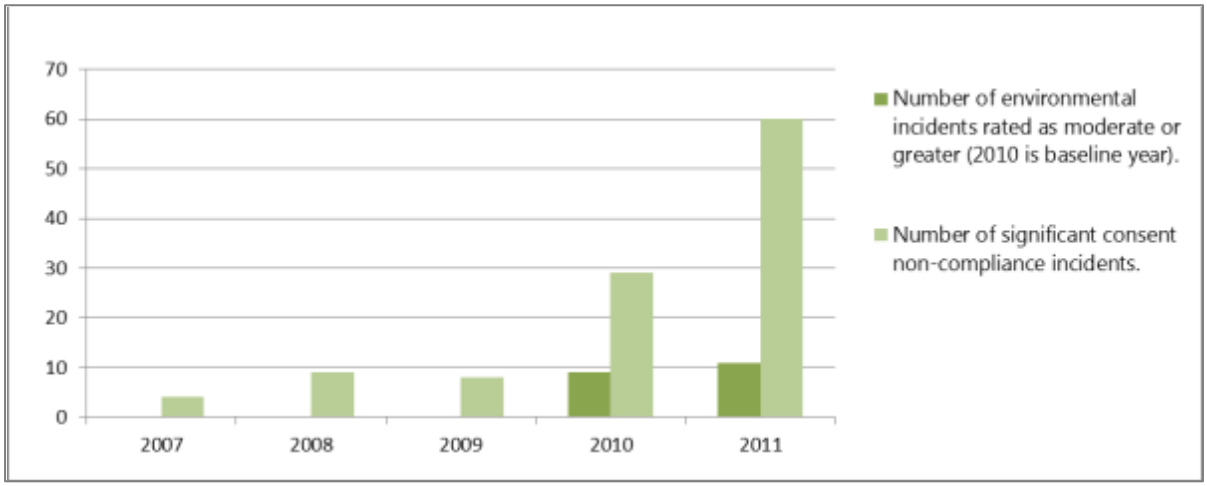
Central government is seeking to improve internet access speeds in New Zealand, through two initiatives. The first is the ultra-fast broadband initiative, which is a $1.5 billion investment in broadband infrastructure for urban areas. Whāngārei was the first city to receive funding and begin laying fibre in 2011.

The second initiative is the rural broadband initiative which seeks to facilitate the necessary investment in technology to improve the broadband capability of the fixed and wireless networks in rural New Zealand. The contract is being undertaken by a joint partnership between Telecom (Chorus) and Vodafone.

Information communications technology is thought to bring about fundamental changes in our economic and social lives. It can also provide environmental benefits such as reducing the need to travel (European Union: 2009).

Water and wastewater infrastructure

Figure 30: Public wastewater environmental incidents rated as moderate or greater (from 2010) and significant consent non-compliance incidents (Note: due to changes in reporting categories in 2009, the baseline year is 2010)



What do we want for water and wastewater infrastructure in Northland?

Wastewater

Historically there has been a lack of suitable sewage reticulation and treatment infrastructure in high growth areas of the region. However, since 2007, wastewater upgrades have come online in both Mangawhai and Whāngārei, and consents have been granted for new wastewater reticulation in Ruakaka and Kerikeri.

There are also known problems with some existing wastewater infrastructure as demonstrated by incidents of (untreated) sewage flowing into watercourses after storm events. Figure 30 shows the number of incidents that were rated moderate or significant – as determined by council staff – arising from public wastewater reticulation since 2010 (unfortunately due to a change in methodology from 2009, it is not possible to compare results earlier than this). The table also records incidents of significant non-compliance from consented wastewater schemes. (Note: the spike since 2009 can be attributed to a reclassification of non-compliance to 'significant' of instances where a management plan has not been provided.)

There have been significant improvements in the technology and standards being used for sewage treatment. An initiative called the Northland Sewage Accord has also been established with the goal of achieving an acceptable level of water quality in Northland's streams, rivers, and beaches by improving sewage management. While the initiative was only confirmed in June 2008, it has already improved staff communication and understanding between local authorities around sewage management issues in Northland.

Water

Northland's climate means that drought conditions are experienced on average, once every three years at east coast and inland locations and once every four years at west coast and high altitude locations (Northland Regional Council: 2002). Northland's aging water supply network infrastructure sometimes can exacerbate these drought and drought-like conditions.

In the Far North district, around 28% of water was lost to leakage in 2007/08 (Far North District Council: 2011) and in Whāngārei district, 27.6% of water was lost in 2009/10. There is a need for more water storage in the region to ensure greater resilience in 'dry' years.

Going forward, effectively funding the maintenance of existing and the development of new water, stormwater, and wastewater infrastructure to service growth, fix known issues, and accommodate climate variability, will be crucial.

Transport infrastructure

What do we want for transport infrastructure in Northland?

The operative Regional Policy Statement for Northland details council and community objectives for each natural and physical resource in our region. The objectives relating to transport are:

- Maintain and enhance the safety and efficiency of the region's transport network, while minimising adverse environmental effects.

The following are the anticipated environmental results after implementing the transport policies in the policy statement:

- Safe and efficient use of the transport network.
- Reduction in noise and other adverse environmental effects associated with the transport network.

The ability to provide a reliable, cost effective, well maintained and fit for purpose transport network is a challenge every region in the country faces. For Northland, the focus is on reducing the cost to do business – particularly focussing on the priority of getting goods and products to markets, both domestic and international, alongside providing a safe and reliable network for tourists and residents. Coupled with this is the desire to see improvements:

- In access to public transport, including developing alternative modes;
- Reducing the effects on public health by ensuring alternatives that promote physical activity are supported (such as walking and cycling);
- Road safety;
- Air quality (including reducing dust from gravel roads);
- Noise levels; and
- Access to health services and other community facilities.

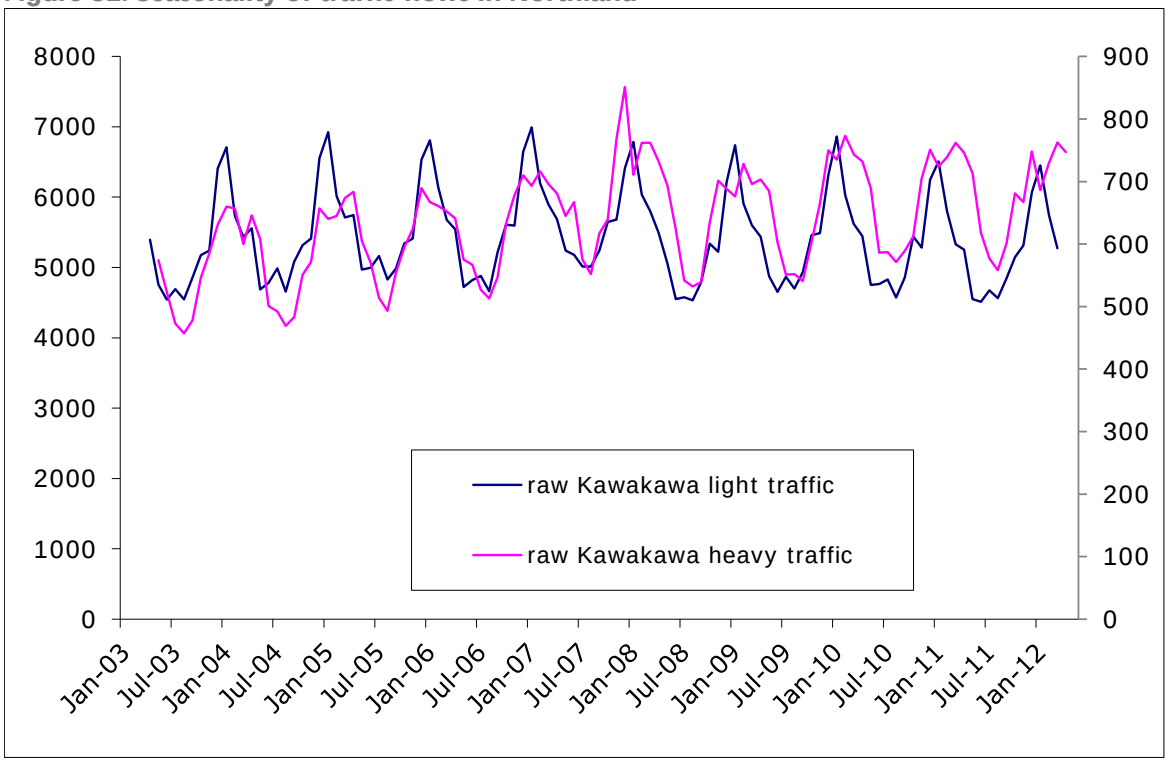
These improvements must all sit alongside environmental sustainability, when any transport network improvements are carried out.

Road network

A key feature of Northland's road network is the ratio of road length kilometres per square kilometre of land area and the ratio of road length per head of population, which is higher than the national average.

This is partly due to the region's challenging topography, which has numerous inlets, harbours, peninsulas and winding hill sections. It also emphasises the relatively high burden of road maintenance on the Northland population and particularly for a sparsely populated district like Kaipara.

Figure 31: Seasonality of traffic flows in Northland



Northland has a large road network for a relatively small population, which means we spent a large proportion of our rates budget on roads. Northland's road network density (metre/head of population) is 42.01m/p compared with the national average of 21.53m/p. Similarly, Northland has 0.47km of road per square kilometre of land area, compared to the national average of 0.34km/km^2.

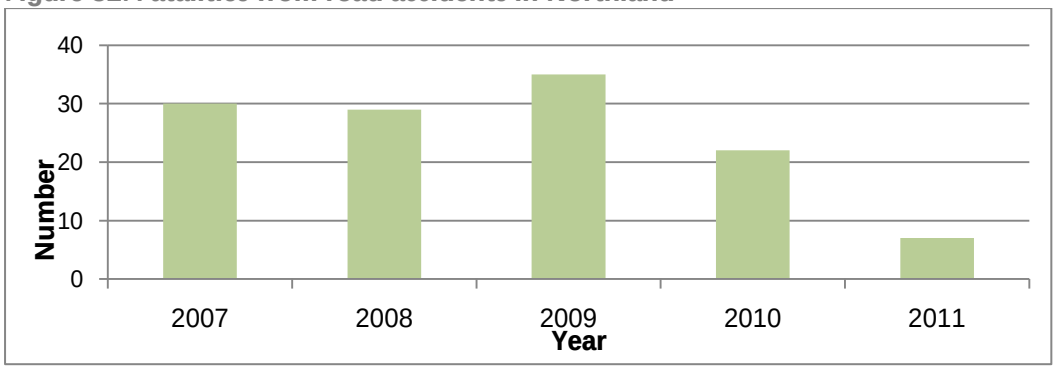
The percentage of unsealed roads in Northland is quite high. Sealed road length is 47.2% of the total (2010/11) compared with 66% for the rest of New Zealand. There has been a very small increase in the sealed network over time but it is not currently a high priority activity. Northland's state highway network is however now entirely sealed following the sealing of the final stretch of State Highway 1 in 2011 (Waitiki Landing – Cape Rēinga).

Unsealed roads can have health, safety and environmental implications, particularly relating to dust and particulate matter that is thrown up by vehicles. This is the most common impact arising from road activities

and can be caused by vehicles (including heavy trucks) using unsealed roads and general road maintenance activities. The environmental effects of incidents concerning dust nuisance have tended to be rated as minor. However, dust from unsealed roads can contain high concentrations of fine (<10µm in diameter) particles that have the potential to cause health effects. This is something that will need to be kept under close watch particularly as there has been a steady rise in the number of logging trucks on the road network in Northland. Northland also experiences a significant influx of seasonal visitors which results in many hired vehicles and drivers unfamiliar with our roads. The seasonal visitor influx coincides with seasonal peak in heavy traffic flows. These factors have significant implications for safety as well as increased demands on local services and infrastructure.

Road safety

Figure 32: Fatalities from road accidents in Northland

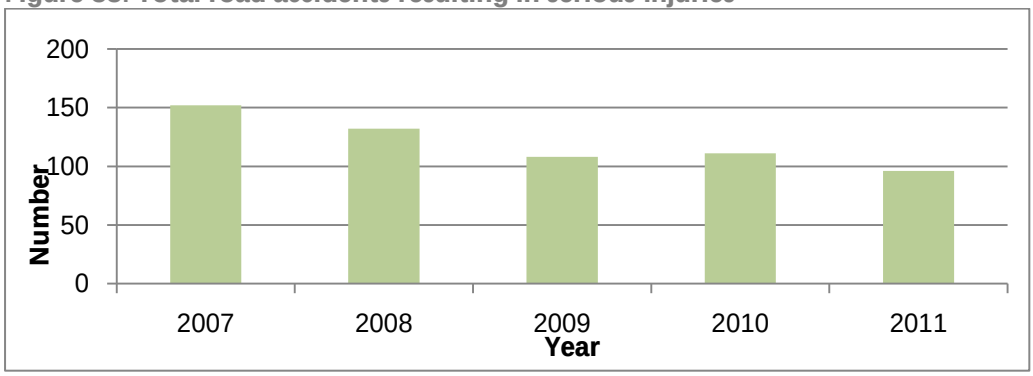


Road safety continues to be a priority for Northland. Northland has seen a lowering of the road death toll from 22 in 2010 to seven in 2011. Whether this represents a long-term consistent trend is unknown at this stage, however, historically the number of fatalities has been trending downwards (Figure 32).

Accidents resulting in serious injury have also dropped significantly in the region (serious injury is defined as an injury resulting in fractures, concussion, severe cuts or other injury that requires hospitalisation). The number of such accidents has fallen from 152 in 2007 to 96 in 2011 (Figure 33).

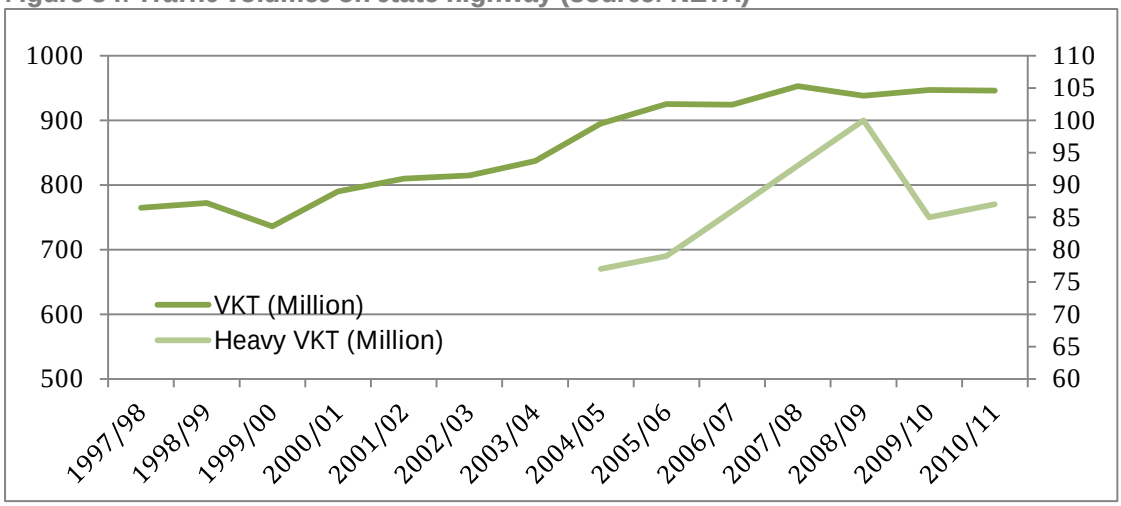
Improvements can be attributed to increased enforcement, improved driver awareness and road engineering improvements.

Figure 33: Total road accidents resulting in serious injuries



The most recent comprehensive report on heavy traffic volumes in Northland was completed in 2007 to identify trends and routes for heavy traffic. Refer to Figure 34 for a summary of the heavy traffic volumes within Northland, shown as total trips per day. The NZ Transport Agency also regularly collects data about traffic and heavy traffic volumes on the state highway network within Northland.

Figure 34: Traffic volumes on state highway (Source: NZTA)



Public transport and total mobility

Public transport patronage in Whāngārei continues to grow. Passenger numbers have more than trebled from 80,000 carried during the service's first year in 2000/2001 to 290,000 passengers in 2010/2011 (financial year – June to July) (Figure 35).

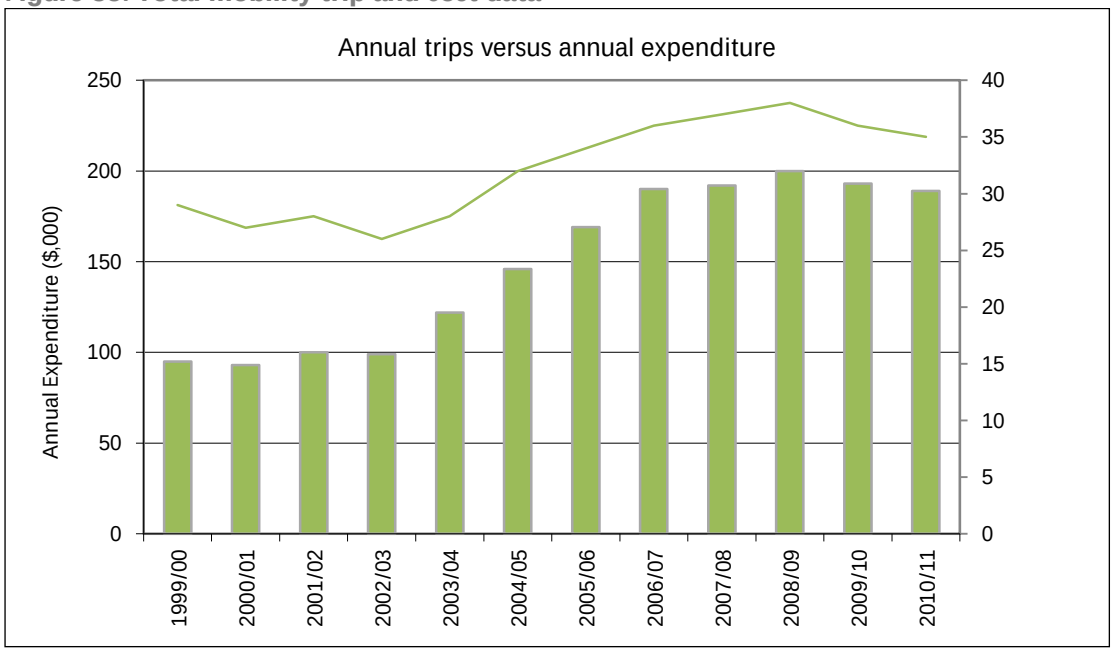
Factors influencing this growth include rising motoring costs, the quality of facilities and buses, positive user feedback and effective marketing. The possibility of other subsidised services in the region is under investigation and may be developed where they are economically viable.

Figure 35: CityLink Whāngārei passengers carried per year data

Whāngārei's CityLink buses

The total mobility scheme is a nationwide scheme designed to increase the mobility of people with disabilities. Assistance is provided in the form of a 50% discount on taxi fares. In Northland, this service is only offered in the Whāngārei urban area to those aged 14 and over who meet the eligibility criteria. The scheme is administered by the regional council and funded by the Whāngārei District Council (60%) and the NZ Transport Agency (40%). The funding allocation for the scheme is provided at a capped amount each year. Although usage has remained stable, costs for the scheme have risen from $3.20 per trip in 1999/00 to $5.39 in 2010/11 (Figure 35), which can be directly attributed to increases in vehicle operating costs and compliance costs.

Figure 35: Total mobility trip and cost data



Rail network

The rail network handles only a small volume of Northland's freight (approximately 350,000 tonnes or 2-3% of the total volume of freight moved). The potential of Northland's rail network is limited by both weight and speed restrictions as well as the size of existing tunnels, some of which are too small for the new larger containers being introduced. This situation is the result of a historical lack of investment in the North Auckland line.

Seaports and coastal shipping

Northland currently has significant port facilities at Marsden Point along with significant industrial and commercial land surrounding the port. In 2011, Marsden Point was responsible for handling 31% of the total volume of merchandise imports into New Zealand sea ports and 8% of exports. While the share of imports has remained relatively static, being predominantly of crude oil for the refinery, the port's share of exports has doubled since 2006. Coastal shipping accounts for approximately 20% of the freight moved in the region.

The facility at Marsden Point has excellent potential to not only increase its volume of bulk cargo but to also become a commercial container port. It is the deepest natural harbour in Australasia and has plenty of land available for holding cargo/containers. However, significant development of further facilities would be required including access to the port area for rail freight and land-based loading facilities (cranes) for containers.

While Marsden Point is recognised as the primary coastal shipping hub in Northland, there are several other coastal shipping operations around the north. The number and size of cruise ships visiting the Bay of Islands has increased dramatically over recent years.

During the 2011/12 season, 52 ships carrying almost 79,000 passengers arrived. This compares with just 19 ships and 12,000 passengers in 2006/07. A challenge for this operation is that cruise ships cannot dock but must anchor in the bay, with the tendering distance from the ship to land being the longest in the southern hemisphere.

The Bay of Islands and Whāngārei are both ports of entry for international yachts. Northland is a very popular destination for recreational boating and the region has a number of marina facilities as well as a significant marine manufacturing, service and repair industry.

Whāngārei and Portland are identified as large-scale wharf and jetty facilities, and Northland has a number of smaller commercial wharves within its harbours. Specialised bulk cement carriers operate out of Portland servicing the Golden Bay Cement operation.

Airports

Northland has three airports where commercial operators offer domestic flight services, located at Whāngārei, Kerikeri (Bay of Islands Airport) and Kaitāia. There are also airports operating at Kaikohe and Dargaville, but these do not currently involve commercial domestic flights. The Kaipara district is currently the only district in Northland not operating commercial domestic flights.

There is no scheduled international airport in Northland, although the Bay of Islands and Kaitāia airports have the facilities to clear passengers through customs for private international flights. All three airports currently have the ability to accommodate 50-seat aircraft such as Air New Zealand's Bombardier Q300.

Whāngārei's airport, located at Onerahi, is used both privately and for domestic commercial flights. It is unlikely that the airport can be extended due to physical constraints and a new location for the airport is not considered feasible. Therefore the approach is to concentrate on increased frequency of flight times and choice of destinations per day.

The Bay of Islands airport has plans for improvements to the airport facilities, including runway strengthening, improvements to taxiways, the apron and airport lighting.

The long-term strategic intention is that Northland has an airport in the Bay of Islands / Far North area that is developed into an international airport with a strong road transport link within the Bay of Islands.

Energy infrastructure

What do we want for energy infrastructure in Northland?

The operative Regional Policy Statement for Northland contains the following objectives relating to energy infrastructure:

- Recognition of the energy production potential of Northland's natural resources.
- Prohibition of the use of nuclear energy sources for energy production purposes.
- Promotion of the efficient and environmentally acceptable use of energy.

The following are the anticipated environmental results after implementing the energy policies in the policy statement:

- Increased use of environmentally acceptable, sustainable energy resources.
- Enhanced extent to which the adverse effects on the environment of Northland of energy generation, distribution and use are avoided, remedied or mitigated.

What does our energy infrastructure look like?

Very little electricity is produced in Northland. The only generation schemes of significance are the Wairua hydro schemes, which produce 11megawatts (MW) output per year, and the Ngāwhā geothermal power station near Kaikohe, which has recently increased its output from 10MW to 25MW. These schemes combined produce approximately three percent of the peak load for Northland.

There is significant potential for the development of further renewable electricity sources, for example, biofuels, wind, wave and solar generation (Energy Efficiency and Conservation Authority and Sinclair Knight Merz: 2006) and there are current proposals for wind generation (Poutō) and a consented scheme for tidal generation (Kaipara Harbour) within the region.

In contrast to the low level of electricity produced, Northland is responsible for 40% of New Zealand's energy production. This is largely attributed to the presence of Marsden Point Oil Refinery, New Zealand's sole oil refinery. This facility and the oil pipeline running south to Auckland are nationally important infrastructure assets. Over the longer term, this pipeline will need to be upgraded to cope with increased demand in Auckland and the upper North Island.

Northland is linked to the reticulated natural gas network from the Taranaki gas fields via Auckland, which supplies key industries in Northland.

Waste management infrastructure

What do we want for waste management infrastructure in Northland?

The operative Regional Policy Statement for Northland contains the following objectives relating to waste management:

- A reduction in the amount of waste produced and associated disposal needs.
- Efficient and environmentally sound collection, treatment and disposal of waste.

The following are the anticipated environmental results after implementing the waste management policies in the policy statement:

- A reduction in the volume of waste requiring disposal.
- A reduction in the frequency and magnitude of unauthorised disposal of waste.
- A reduction in the effects of the authorised waste disposal activities on the environment.

What does our waste infrastructure look like?

A new regional landfill site at Puwera, 10km south of Whāngārei was completed in 2010/11. This has a 35-year capacity of 4 million cubic metres – with the possibility of extending this by a further 10 years. This facility relieves the growing need to transport waste to Auckland for most of Northland (Whāngārei District Council: 2001).

Approximately 5000 tonnes of solid waste is disposed of each month at the Puwera landfill.

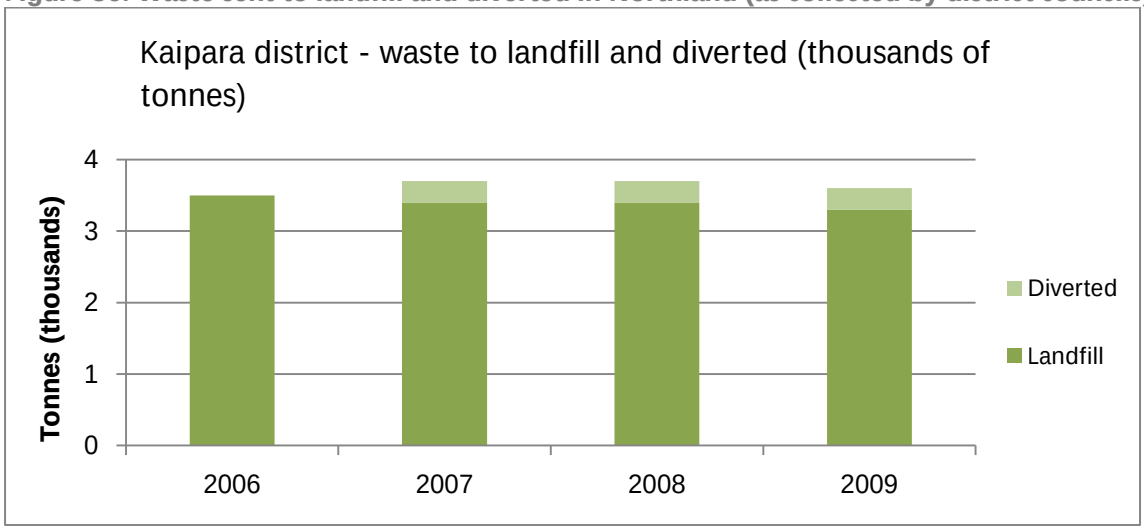
Each year, around 70,000 tonnes of waste is generated in the Whāngārei district. In 2011, approximately half of this waste, some 35,000 tonnes, was disposed of in landfills. This is a decrease of more than 25% from around 48,000 tonnes disposed in 2006.

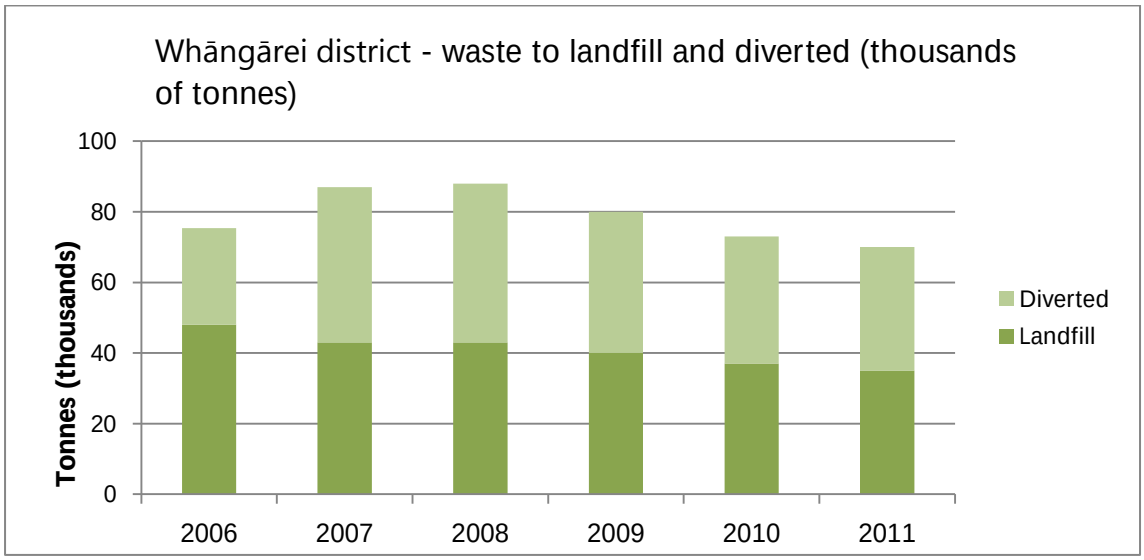
Far North district sent 18,360 tonnes of waste to landfill in 2009/10, down from 18,500 tonnes in 2005/06. The Kaipara district sent approximately 3550 tonnes of waste to landfill in 2006 and 3332 tonnes in 2011.

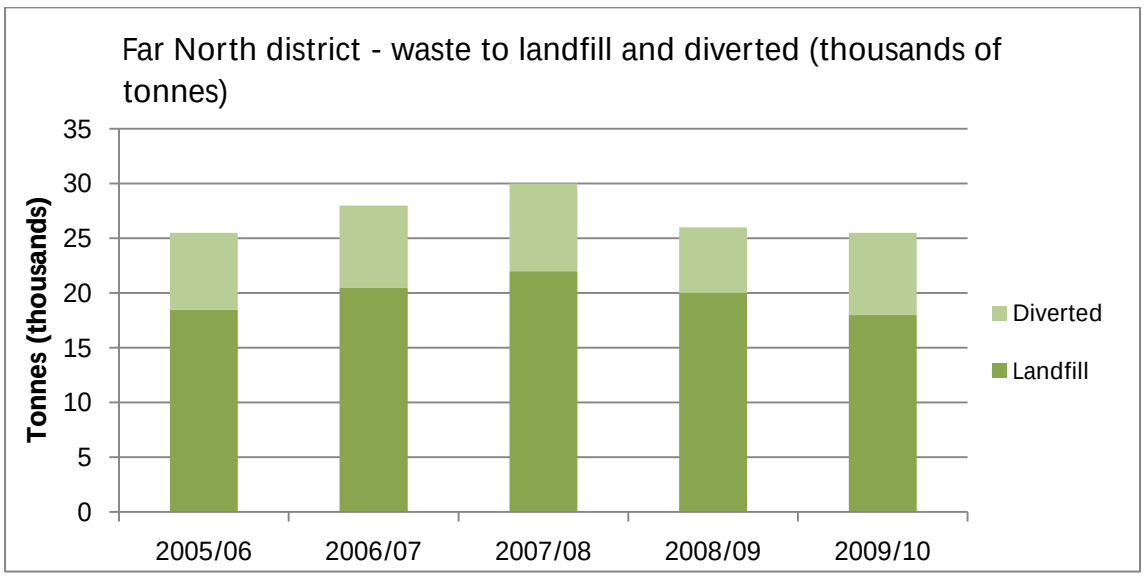
Initiatives, such as charging for waste disposal, have assisted in reducing the volume of waste created. Another significant factor has been the economic down-turn and reduction in resources consumed. A short-term increase in backyard burning of green waste was experienced in the Whāngārei urban area, which was partially attributed to the increased charges for green waste disposal being experienced at the same time. Changes to the Regional Air Quality Plan and monitoring and education by the council have been undertaken to attempt to address this issue. Benefits have been seen from involvement in education programmes such as Enviroschools and the Clean Streams Accord.

The kerbside collection of recyclable materials is working well in the Whāngārei and Far North districts. In Whāngārei, the amount of diverted waste from landfills has increased to the extent that equal amounts of waste are diverted away from landfills as are sent there (35,000 tonnes each in 2011). In Far North, rates of diversion have varied from 23% to 28% over the last five years.

Figure 36: Waste sent to landfill and diverted in Northland (as collected by district councils)







What is being done?

On-going monitoring

Monitoring of infrastructure in the region is conducted by a number of private and public infrastructure providers and statutory bodies. Public infrastructure is monitored through:

- Regional Land Transport Strategy (full report – 2013), Regional Land Transport Programme.
- District council asset management plans and state of environment reports.
- Regional council state of environment reporting (2007 report – transport and waste management only. From 2013 transport, waste management and other infrastructure).

Policy development

Northland Regional Council is developing a new Regional Policy Statement because the current one has been operative since 1999. The new policy statement must have regard to Section 30 (gb) of the Resource Management Act – *to achieve the strategic integration of infrastructure with land use.* This will require a new and more direct approach to managing infrastructure in the region.

In developing the policy statement, the regional council must also implement the National Policy Statement on Electricity Transmission and the National Policy Statement on Renewable Electricity Generation. These statements require specific objectives, policies and methods enabling the development and management of the electricity grid and renewable electricity generation.

Other projects/partnerships/funding initiatives

Aside from the above, the regional council is involved in a number of other initiatives:

- Regional Energy Strategy – the regional council has worked with industry to develop a Regional Energy Strategy to coordinate and promote energy generation projects.
- Transport decision-making bodies – the Regional Transport Committee, managed by the regional council, which is responsible for the preparation of the Regional Land Transport Strategy and Regional Land Transport Programme along with other key transport-related strategies and plans.
- Transport working groups – the regional council is involved in a number of working groups to promote initiatives including the Road Safety Forum, Stock Effluent Disposal Group, and Northland Transport Executive Group (NORTEG).
- The Upper North Island Strategic Alliance was formed in October 2011 to collaborate for responding to and managing a range of inter-regional and inter-metropolitan issues between local authorities in the upper North Island. A work programme was developed for 2012 with the focus including transport (including rail, roads and freight), and ports (including inland ports). The 'Upper North Island Freight Story' is a collaborative piece of work between the alliance, KiwiRail, and the NZ Transport Authority. The focus is on *'Reducing the cost to do business in New Zealand – through an upper North Island lens'*.

How are we measuring up against our objectives?

The following are the environmental results anticipated, listed in the Regional Policy Statement for transport:

Safe and efficient use of the transport network

- The number of fatalities from road accidents reduced substantially in 2011 from previous years (overall there has been a long-term declining trend). The total number of serious injuries has reduced significantly since 2007.
- Continued promotion of road safety initiatives such as 'Share the Road' and 'Coffee Brake'. The Coffee Brake road safety initiative has been a success with the number of outlets involved in the scheme growing to 23 as of 2011/2012.
- There has been a steady increase in the use of the Whāngārei bus service since it was introduced in 2000. Promotion of the development of the bus service is supported through implementation of the Regional Public Transport Plan.
- Land was designated for a future rail corridor between Oakleigh and Marsden Port in 2008.

Reduction in noise and other adverse environmental effects associated with the transport network

- New stock effluent facilities have opened at Pakaraka in the Far North and Dargaville in the Kaipara. This has reduced the risk of contamination entering water bodies.
- On-going trials of dust suppression products to minimise road dust.

The following are the environmental results anticipated, listed in the Regional Policy Statement for energy:

Increased use of environmentally acceptable, sustainable energy resources

- There has been a small increase in renewable electricity generation in Northland. The increase of generation primarily arose from the upgrade of Ngāwhā Geothermal Power Station from 10 to 25MW.
- Since 2007, the only approved (subject to conditions) consent application for renewable electricity generation in the region is for Crest Energy – tidal generation within the Kaipara Harbour. The consent is contingent on an adaptive management approach involving a full monitoring plan, developed in consultation with stakeholders.
- The council is aware of other proposals for renewable electricity development in the pipeline at various stages. Regional and district planning documents will need to give effect to the National Policy Statement on Renewable Electricity Generation and the National Policy Statement on Electricity Transmission.

Enhanced extent to which the adverse effects on the environment of Northland of energy generation, distribution and use are avoided, remedied or mitigated

- New transmission lines have been constructed along with activities associated with routine operation, maintenance and upgrading. The potential adverse effects of these activities have been controlled through consent conditions.
- There are 26 active resource consents for activities concerning electricity transmission. Most of these are for occupying space in the coastal marine area. There have been no breaches recorded for these consented activities.

The following are the environmental results anticipated, listed in the Regional Policy Statement for waste management:

A reduction in the volume of waste requiring disposal

- There has been an overall decrease in the amount of waste sent to landfill in the region and an overall increase in waste diversion from landfills.
- Waste diversion programmes run by district councils have led to increased awareness of alternative waste disposal methods.

A reduction in the frequency and magnitude of unauthorised disposal of waste

- Incidents of illegal dumping of rubbish (including confirmed dead stock and offal dumping instances) have varied considerably from year to year with no overall trend downwards.

A reduction in the effects of the authorised waste disposal activities on the environment

- The number of consent breaches for landfills has trended upwards in recent years. The breaches tend to be administrative and minor operational issues.

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