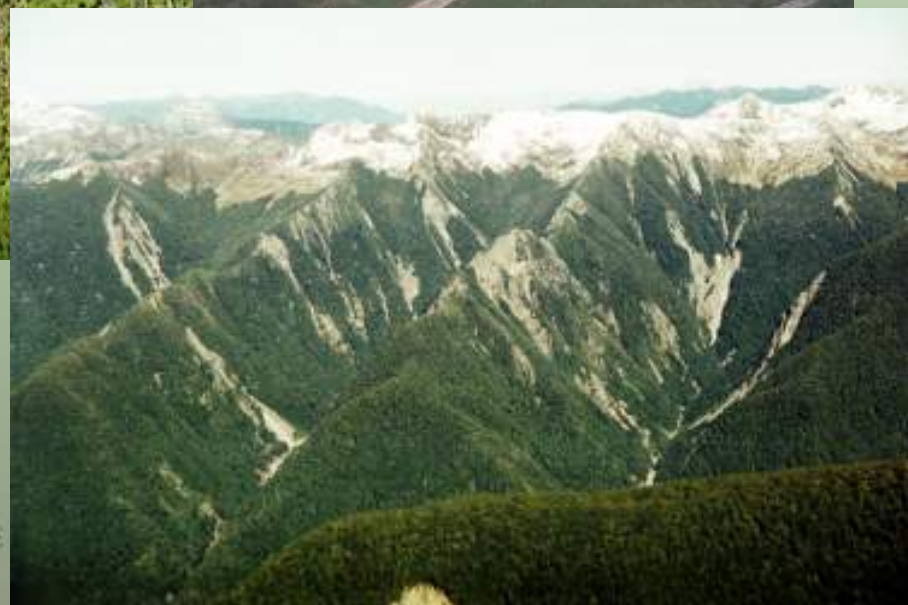
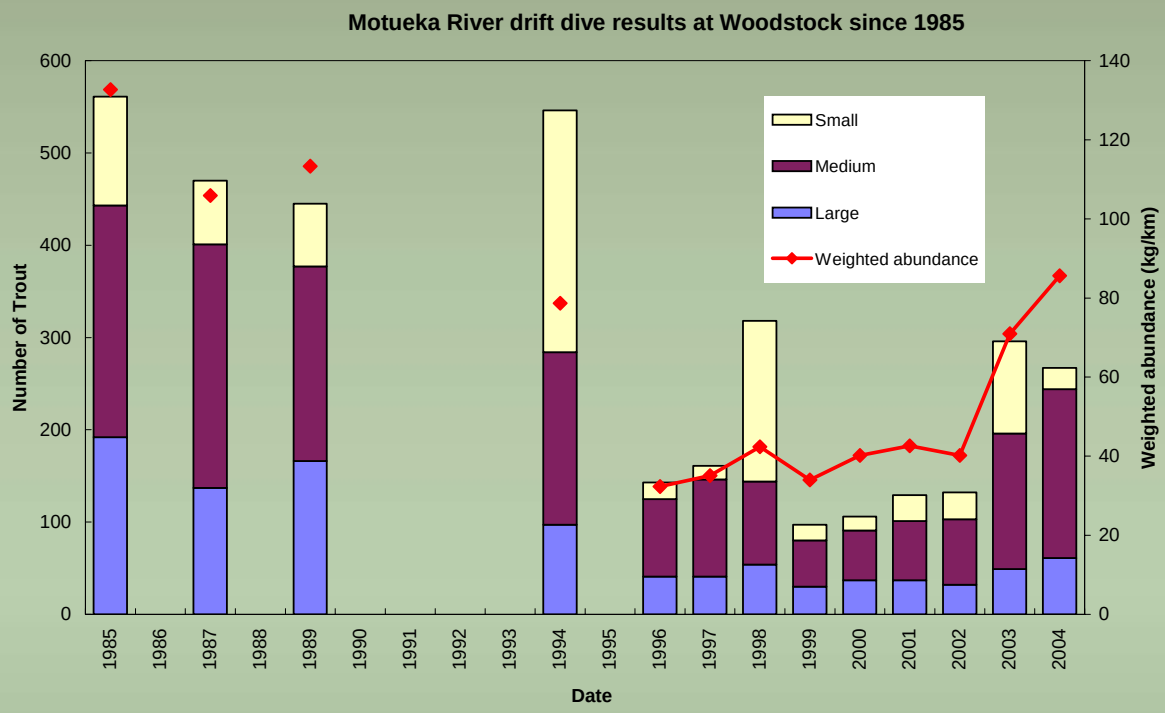
# Sediment research in the ICM programme
## Les Basher, Landcare Research, Nelson



# Drivers for sediment research

- What are the impacts of sediment on freshwater and marine ecosystems?
- Can we mitigate sediment impacts, or are they constraints to freshwater and marine ecosystem management?




Answering these questions requires information on sediment dynamics and the relative influence of key drivers such as rainfall, geology, topography, and land use

# Current work

- Measurement of sediment yield
- Sediment source identification
- Fine sediment characterisation
- Gravel transport analysis
- Linked work at Raglan

# Measurement of suspended sediment yield

- Methods
  - continuous record of turbidity
  - auto samplers and manual sampling to define turbidity - SSC relationship

- 4 sites
  - Woodmans Bend (*suspended sediment delivery to Tasman Bay*)
  - Motupiko at Christies, Wangapeka at Walters Peak, Motueka at Gorge (*contrasts between hilly, low rainfall, Moutere gravel terrain and steep, mountainous, high rainfall, basement rock terrain*)

- Currently trying to set up a small catchment pasture/pine forest/native forest comparison

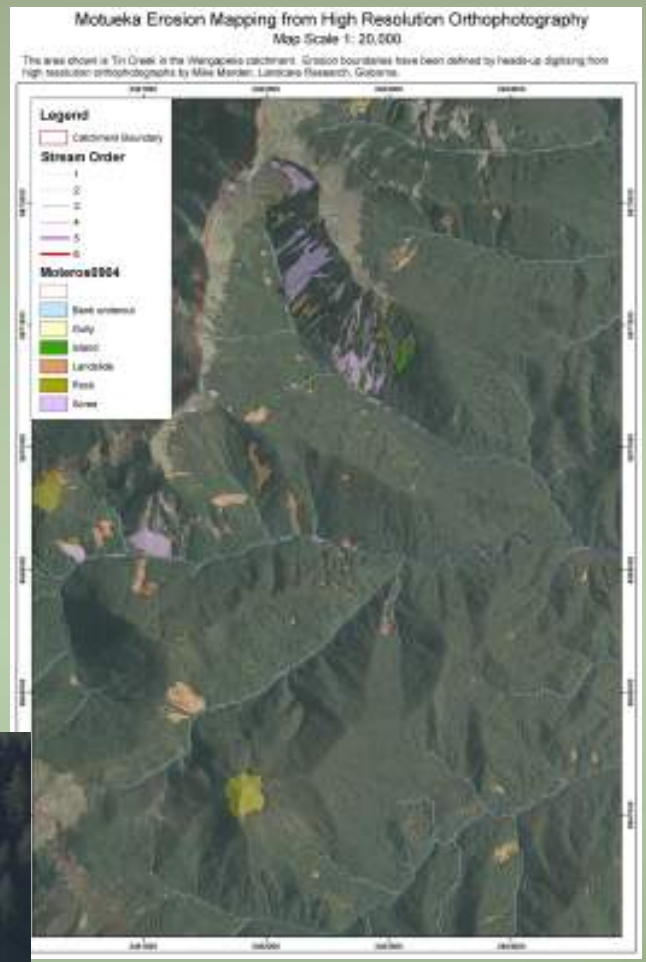
- Access to limited data (both existing and ongoing) from some west bank tributaries under plantation forestry

# Sediment source identification

- Orthophoto analysis

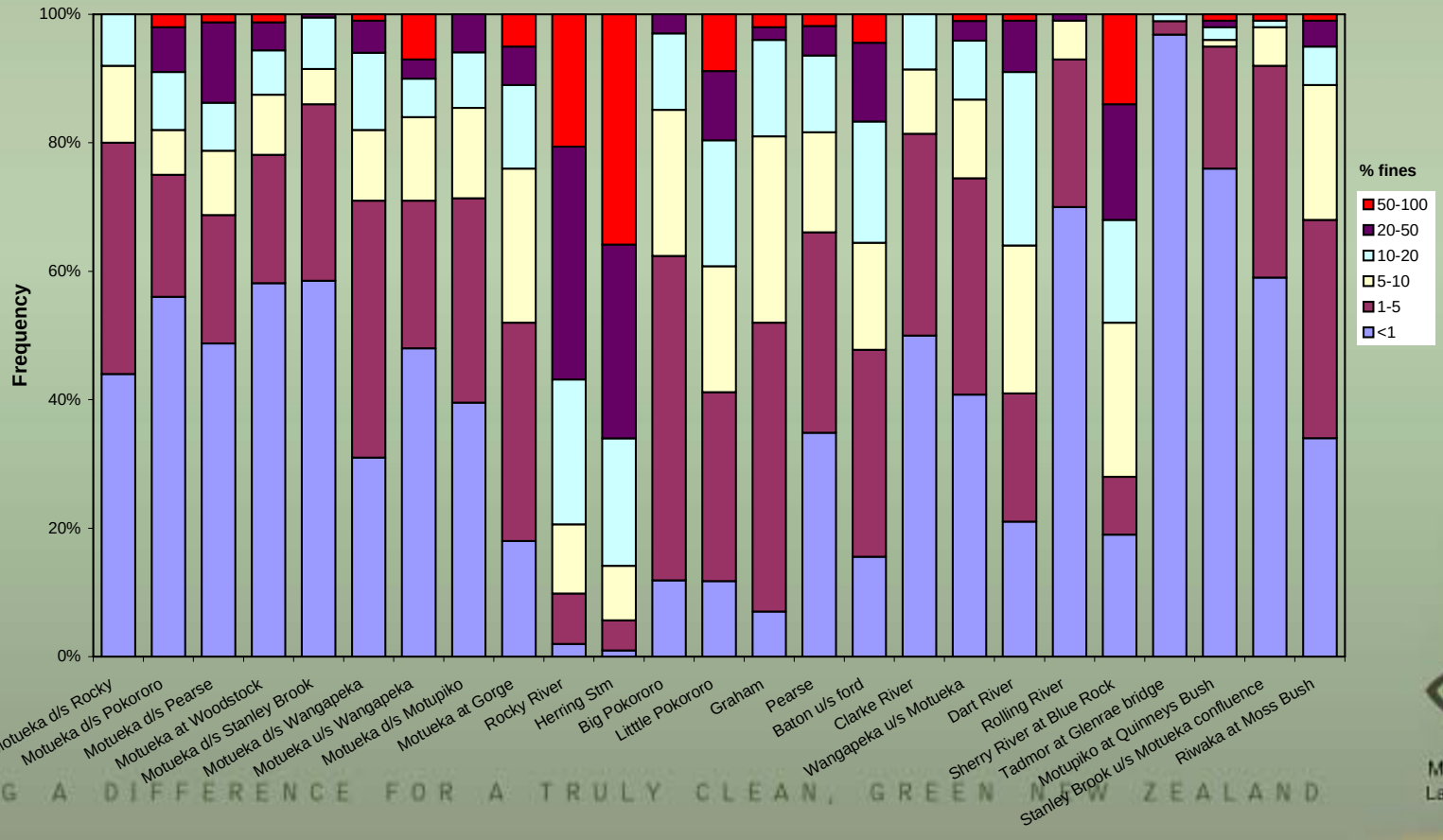
- Field survey of bank erosion

  (location, length/height, activity, bank materials, etc)




# Fine sediment characterisation

- fine sediment implicated as a cause of the decline in trout population
- developed a rapid, visual assessment procedure suitable for demonstrating large changes in proportion of fine sediment



# Linked work at Raglan with NIWA

- mapping of erosion terrains, landslide hazard mapping, sediment sources
- landslide modelling to complement NIWA modelling of surface erosion
- bank erosion assessment and measurement

Manaaki Whenua
Landcare Research

# Gravel transport analysis

## What do cross-section surveys tell us about river gravel movement?

# Background

- periodic cross section surveys are the primary tool used by many councils to allocate gravel
- cross section data for the Motueka date back to 1957
- debate about trends in mean bed level (MBL), changes in gravel storage within the Motueka, and the influence of gravel extraction on those trends

# Aims

- compile all existing river cross-section data for the Motueka River and provide a comprehensive analysis of the data on riverbed levels using a consistent methodology

- calculate changes in mean bed levels and volume of gravel stored in the river channel through time

- compare gravel volume changes with gravel extraction rates, and determine the influence of gravel extraction on observed trends in riverbed levels

# Methods

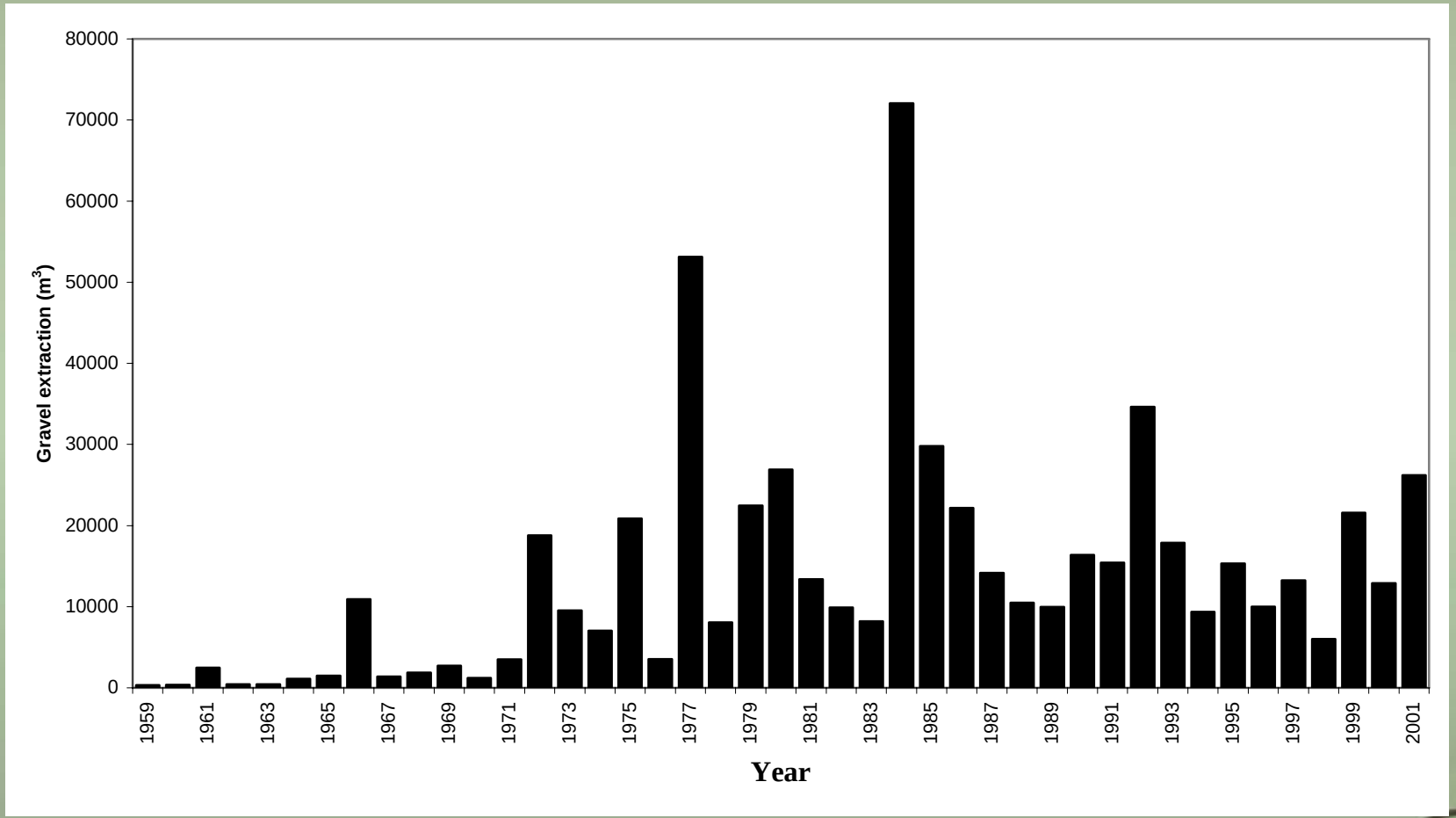
- survey data analysed for a 19 km reach of the upper Motueka (up to 30 cross sections) and a 13 km reach of the lower Motueka (up to 52 cross sections)

- trends in mean bed levels and gravel volumes stored in the riverbed were calculated using the “end area” method

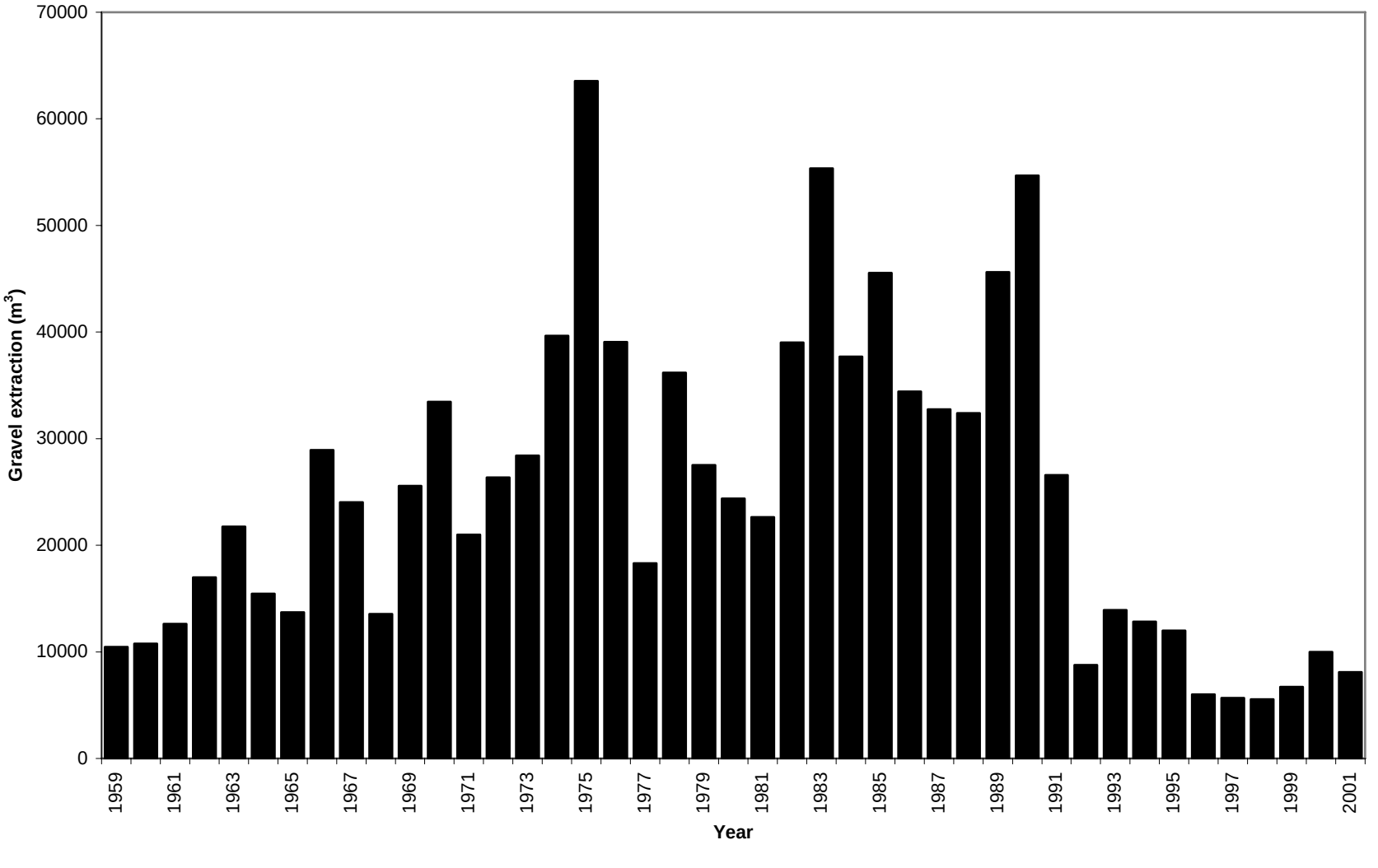
$$_{d}MBL * ACW * dDist$$

- gravel storage changes were compared with the volume of gravel extracted from the riverbed

# Trends in gravel extraction – upper Motueka



# Trends in gravel extraction – lower Motueka



# Results

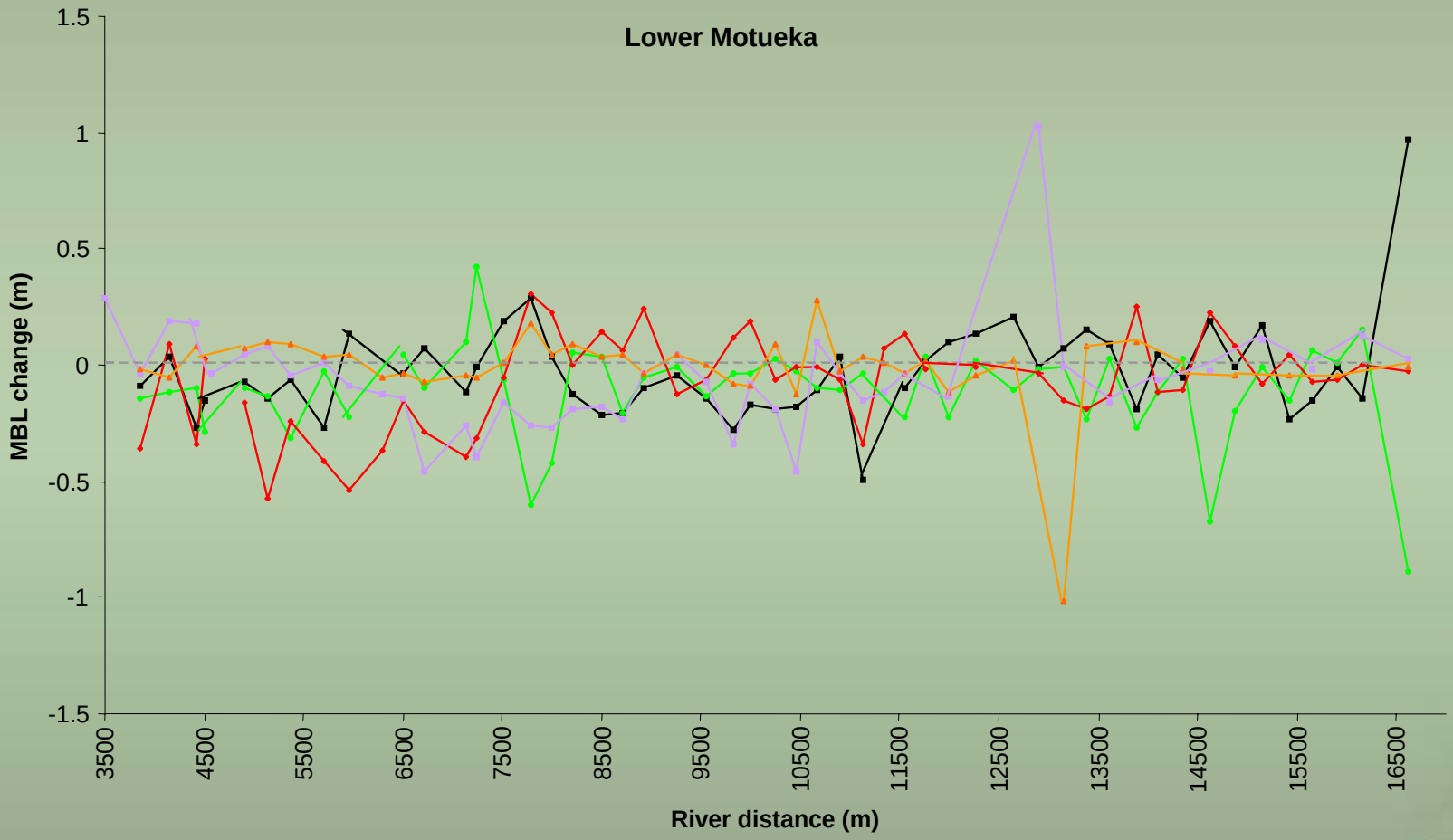
- on average both reaches of the river have degraded over the last 40 years

- Net MBL change
  - Upper Motueka (1960-2004) –0.325 m
    range (– 1.993 to +0.650 m)

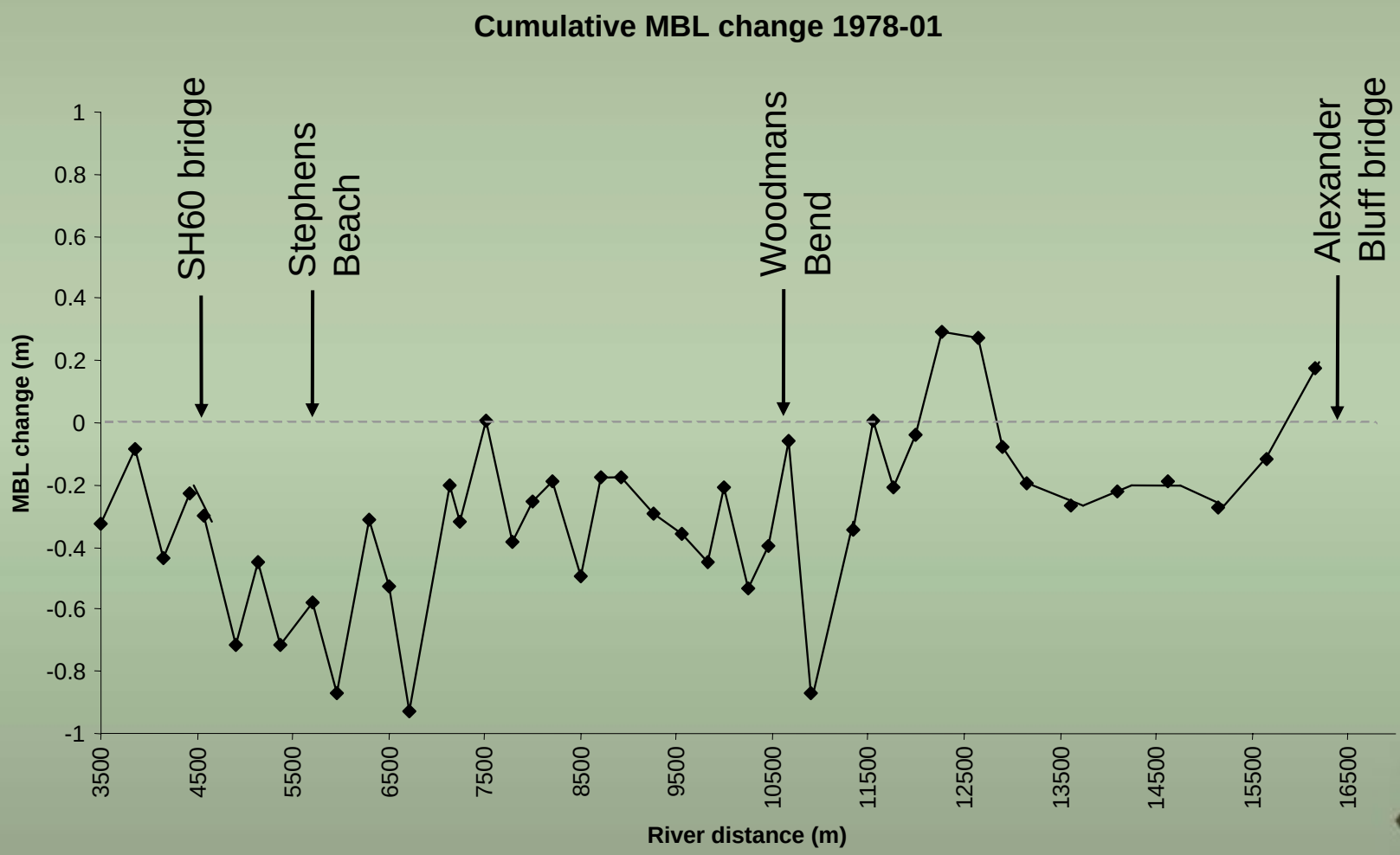
  - Lower Motueka (1978-2001) –0.336 m
    range (– 1.331 to+0.458 m)

- at individual cross sections bed levels were very dynamic, with considerable fluctuation between degradation and aggradation from one survey to the next

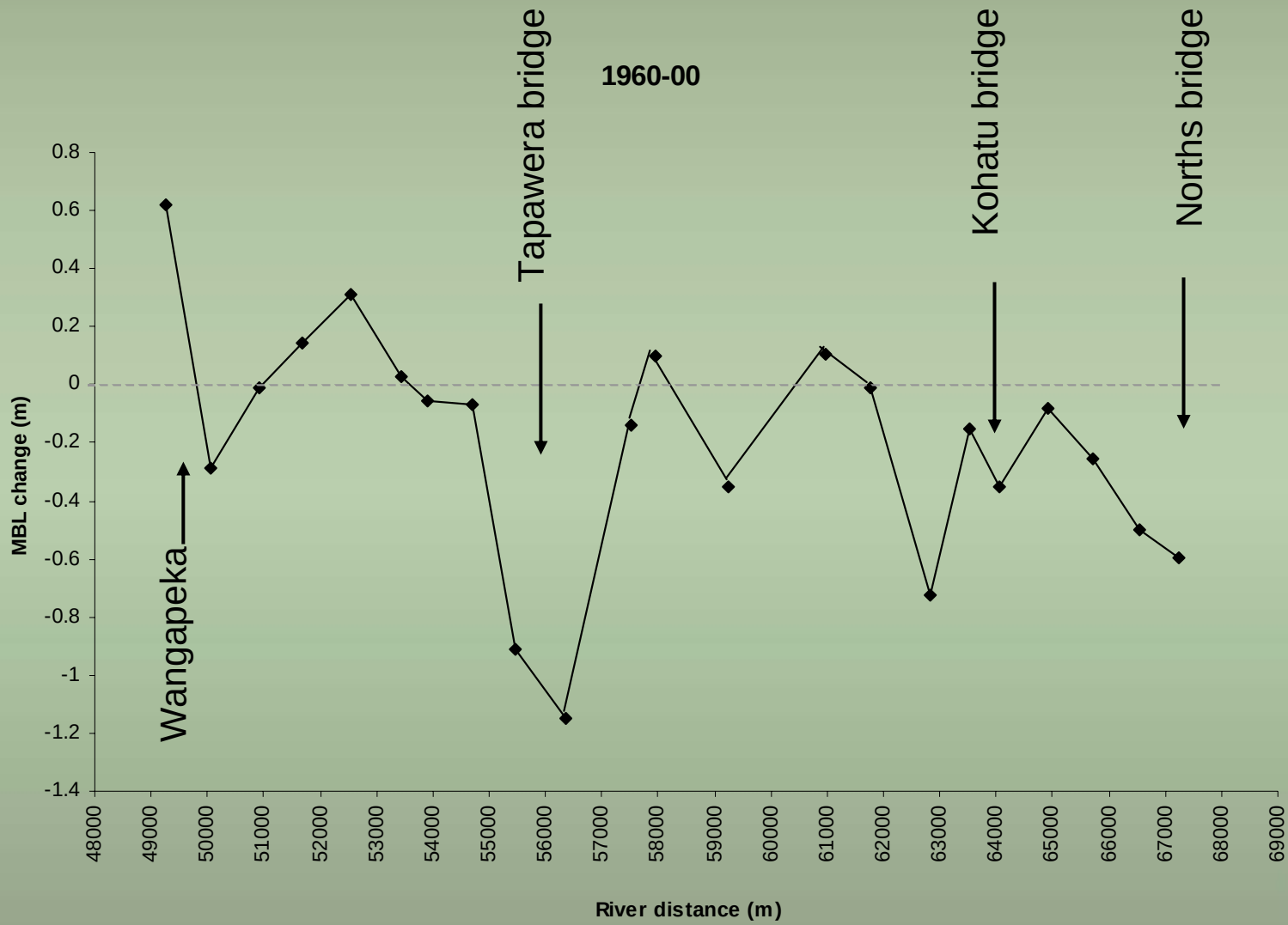
# Bed level trends – lower Motueka



# Net bed level change - lower Motueka



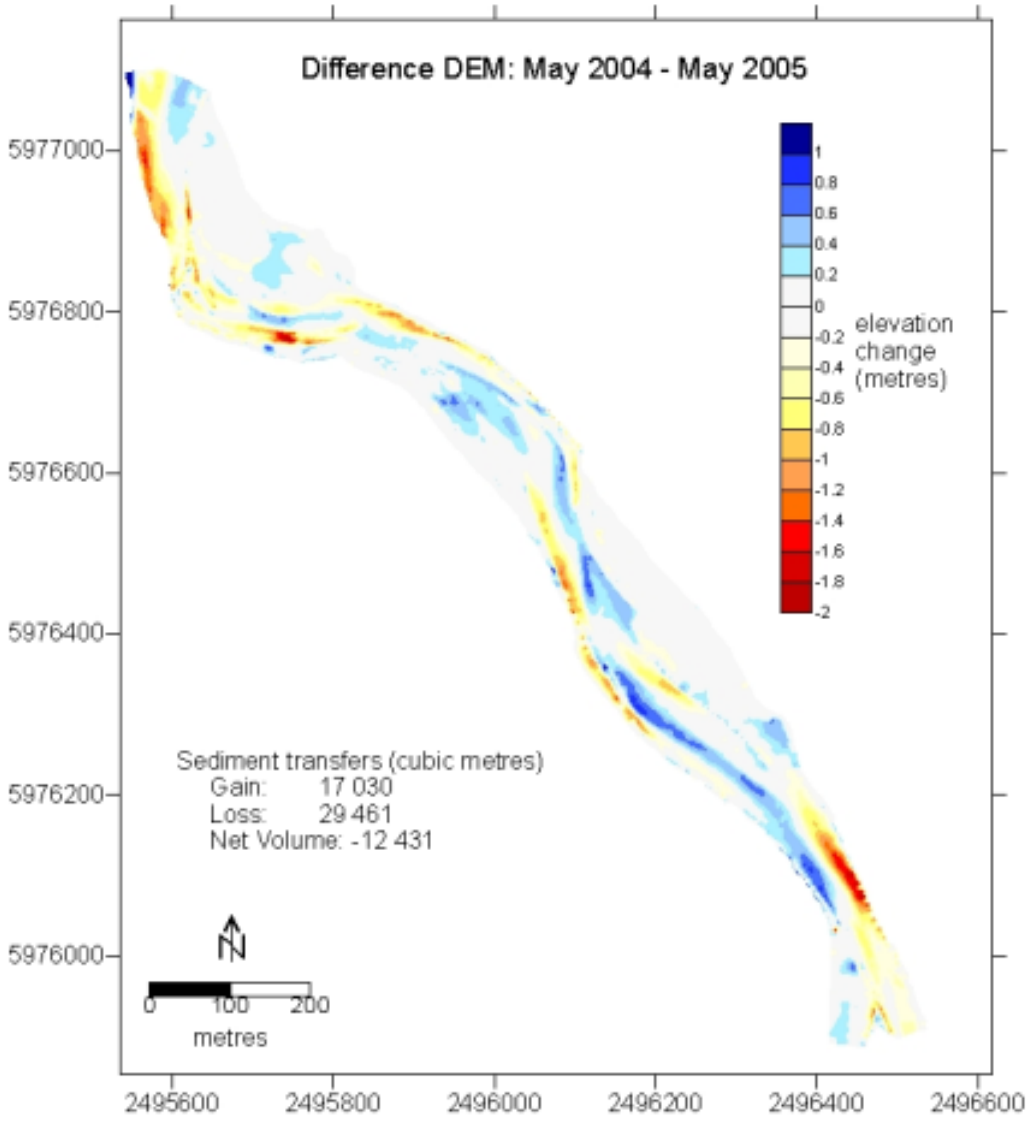
# Net bed level change – upper Motueka



# Results

- the river bed is degrading resulting in a loss of channel storage of gravel
- superficially much, but not all, the change in gravel storage can be accounted for by gravel extraction
- there are large error limits on the gravel storage volume changes derived from cross sections
- the cross sections probably underestimate the total gravel storage volume changes (and gravel transport)
  - don't account for spatial variation between the sections
  - don't account for temporal variation between surveys

# How well do the cross sections represent bed level dynamics?



# Does bed level degradation matter?

- Does it affect groundwater recharge on the lower Motueka plains?

- Does it cause bank instability and increased river control expenditure?

# Conclusions

- By the end of the Motueka ICM programme we will have high quality data on
  - rates of sediment generation,
  - major sediment sources
  - land use influences on sediment generation
  - sediment impacts on freshwater and marine ecosystems

- Gravel transport
  - there are large error limits on the gravel storage volume changes derived from cross sections
  - there may be other drivers for bed level degradation

    channel narrowing

    oversupply of sediment in the past