

## Chapter Six

# THE FIRST SCHEME REVIEW

## The "Upper Valley"

### 1945 to 1970

To the early residents of the Hutt the "Upper Valley" commenced at the Lower Hutt Borough's northern boundary -around Avalon. Although the boundary of Hutt River Board responsibility extended slightly further north to Silverstream its interests lay firmly with its ratepayers south of the Borough Line.

1945 saw the beginning of the end of Hutt River Board parochialism, with the involvement of central government in Board affairs. Principally in the guise of the Housing Department and supported by the Soil Conservation and Rivers Control Council (SC and RCC administered by the Public Works Department) the Government assumed authority for the extension of the flood control scheme under the powers of the Soil Conservation Act 1941.

Government interest in the Hutt was in part driven by a nationwide initiative to extend and improve the management of the country's soil and river resources. Of more importance, however, was the need to reduce Government liability for increased flood levels in central Lower Hutt. Failure of the existing Flood Control Scheme was considered a possibility following Government development of the Taita area and the subsequent closure of the Taita Overflow. The 1971 flood shown in plate 73, p. 121, illustrates the minimal freeboards in the Central Hutt Area, even after the 1956 stopbank raising.

## Housing Development in the Hutt

In 1935 the Coalition Government instigated a nationwide housing survey in order to address New Zealand's critical housing shortage - a problem which had existed since the 1880 depression and had been exacerbated by the depression of the 1930s. The subsequent national housing plan called for the construction of houses in 150 centres throughout the country. Lower Hutt, Wellington and Orakei (Auckland) were the main areas for this expansion. Through the Department of Housing, formed in 1936 by the newly elected Labour Government, construction started in Waterloo in 1938 and had spread through to Taita, with 5400 dwellings constructed, by 1950.

The new suburbs of Lower Hutt were located on land which as late as 1898 had been major floodways. The land south of the (present) Pomare Bridge was previously known as the Taita Ponding Area, and was a maze of old watercourses still liable to flooding. Parts of Naenae were still swamp. The Epuni Block required special stormwater and surface drainage. The Waddington Block contained sections of permanently waterlogged heavy swamp clays and was subject to inundation by unrestricted stormwater run-off from the eastern hills.

To make the land more suitable for housing the Public Works Department undertook major filling and reclamation and constructed a temporary stopbank at Taita, built in anticipation that it would be upgraded as part of the lower valley stopbanking scheme [refer Project Report 8]. Much of the material used for filling, roading and stopbanking was taken from the river near the developments and accounted for the substantial degrading of this reach [refer to Chapter 4, The Exploitation Of The Shingle Resource].



Plate 64: Avalon 1952. Source: Alexander Turnbull Library neg. F61999

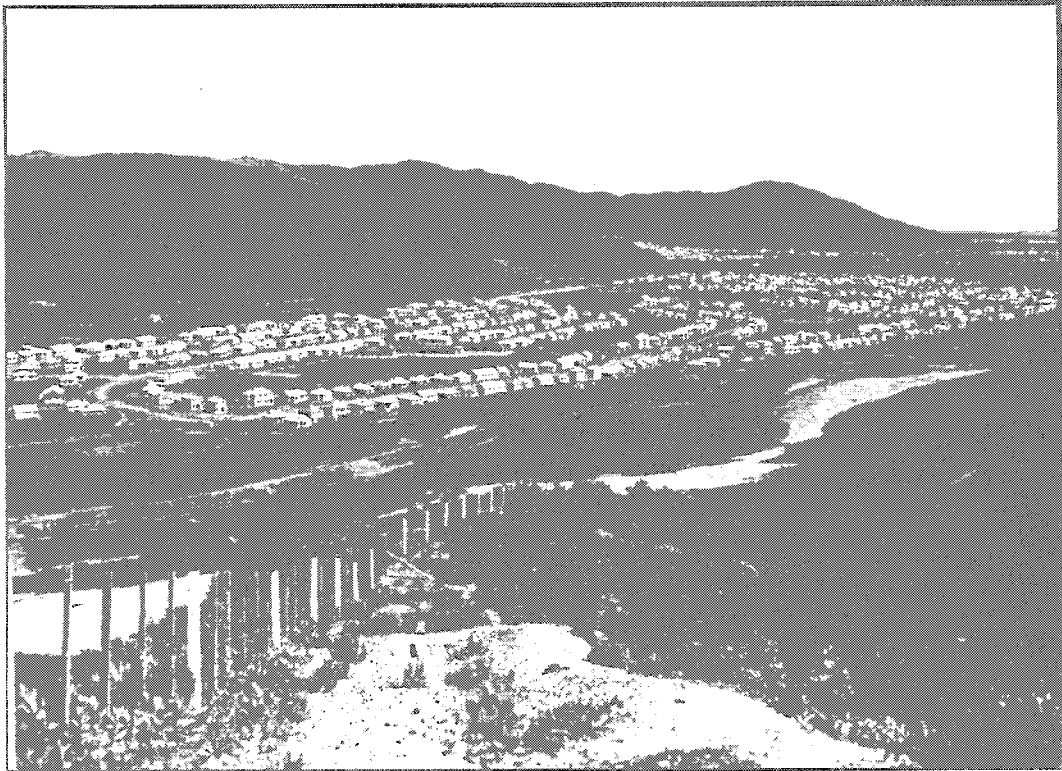


Plate 65: Taita Estate c. 1945. Source: Alexander Turnbull Library neg. G45248

## Extending Flood Protection

In 1931 the Hutt River Board suggested to Government that its housing activities in Taita, and the closure of the Taita ponding area, might jeopardise the security of Lower Hutt. From 1933 this led to Government pressure on the Hutt River Board to extend its district north of Taita Gorge and to upgrade the existing stopbanks to cope with the maximum likely flood (refer to Archive Table 16, 1950 Scheme Review, Design Discharge, [p. 111]).

Government pressure for improvements resulted from:

- (1) The acceptance by Government that it may be held liable for the failure of the lower river stopbanks. The 1931 flood had come near to overtopping the banks in Lower Hutt. Catastrophic flooding was regarded as a real possibility if the Taita ponding area was to be filled and the overflow to the Waiwhetu Stream closed.
- (2) There was a nationwide move by Government to promote major public works to provide employment. Public Works Department regional staff were encouraged to review and report on existing river schemes in their areas.

The review of the Hutt River flood protection works was undertaken by the Trentham Residency of the Public Works Department in 1944. This led to 20 years of Scheme Improvements funded and constructed by the Government and the Hutt River Board. Between 1945 and 1975 major changes took place:

- (1) The extension of the Hutt River Board District to include Petone in 1946.
- (2) The upgrading of the stopbanks in the lower reaches to the "permanent level" - i.e., the level of the maximum likely flood of 100,000 cusecs, plus freeboard, between 1959 and 1961.
- (3) The construction and upgrading of stopbanks from Boulcott to Taita Gorge, and the Haywards stopbank in 1964.
- (4) The extension of the Hutt River Board District to include the Upper Hutt Borough and part of Hutt County in 1959.
- (5) A poll to raise loan monies to construct stopbanks in Upper Hutt was finally successful in 1962. Construction of stopbanks followed between 1964 and 1969.

The joint venture arrangement between the Hutt River Board and the Government was uneasy for several reasons.

- During its early years from 1899 to 1920 the Hutt River Board had accumulated a significant public debt and had on occasion been unable to carry out work because of a lack of funds. By 1944 the debt had been largely cleared and the Board was beginning to establish a reasonable cash reserve. For nearly 30 years it had controlled the river using revenue from rates and shingle royalties and in this it considered it had been successful. Although river rates were low, municipal rates were high and the Board considered that ratepayers in the established and protected areas would not agree to increased rating for works to protect Government property that was not subject to rating levies.
- The Board's first request for assistance with works to upgrade the scheme amounted effectively to a request for a 5:1 subsidy to ensure that the Hutt River Board contribution would be met from revenue. This proposal was not accepted by Treasury and the Board was forced to accept a 1:1 subsidy on Lower Valley scheme works.
- For reasons that are now unclear the Hutt River Board did not wish to be responsible for the actual construction of the scheme works. Although the Public Works Department Trentham Residency undertook the engineering report which formed the basis of both the lower and upper valley schemes the Hutt River Board seems to have been coerced into responsibility for most of the design and construction (probably as a result of its obligations under the Soil Conservation Act 1941).

By 1952 tension between the partners increased as the Public Works Department started to lose confidence in the Board's ability to see through major construction works. There were lengthy delays (by the Board) in producing the necessary engineering surveys, an economic report, contract documents and in holding polls for the extension of the Board's district.

## INTRODUCTION TO THE LOWER VALLEY SCHEME

[Refer to Project Reports 4 to 11, 13, 18 and 20]

On 11 December 1939 the Hutt Valley experienced the largest flood since 1898, with a peak discharge calculated to be 70,000 cusecs (2000 cumecs). This flood came within 150 mm of the top of the stopbanks in some places: between the Hutt Bridge (now the Ewen Bridge) and Pipe Bridge (Estuary Bridge) the freeboard margin did not exceed 0.6 m. It remained within 0.3 m of the peak for 11 hours.

In the 1940s, with increasing residential development in the valley, and in particular with the commencement of the Taita State Housing Scheme - in a known overflow path for flood waters - it became increasingly obvious that the erection of a permanent stopbank at the upper end of the Taita Block was urgently needed to protect both that block and also a large portion of the valley.

In August 1944 discussions were held between the PWD and the HRB and it was agreed that some measure of protection should be provided immediately to the Taita Block as part of the main scheme. Some 260 metres of stopbank were built, using gravel from the river at Taita, at a cost of £7,500. The stopbank was later raised to 6 ft above the May 1948 flood line and extended south to Fraser Park (was raised again in the 1960s as part of the Hutt River Flood Control Scheme).

In the same Period Messrs A P Grant (PWD), H Sladden (Engineer to the HRB) and the Director of Meteorological Services jointly agreed that the design discharge for the proposed Hutt Scheme should be 100,000 cusecs (2800 cumecs). See Archive Table 17, 1950 Scheme Review, Design Discharge, p. 116.

In early discussion it was agreed that because of the size of the project it should be handled through the Minister of Works, and that a comprehensive report should be made by the PWD. The parties considered a report from Mr F W Lindup (PWD) on a limited investigation undertaken in 1943-44 which concluded:

- (i) The existing stopbanking in the lower valley only just coped with the 1939 flood.
- (ii) The recent Taita Stopbanking had shut off "a large escape and ponding area .. so that a repetition of the 1939 would almost certainly invade the area behind the old stopbanks.
- (iii) Evacuation of residents, if required, may be impossible to carry out successfully during a flood.
- (iv) Replacement of the previous landscape incorporating fences and hedges with a Government housing area had removed barriers to intrusion of huge volumes of water entering densely populated areas.

In large floods before this time flood waters were diverted out of the river through the low area at Taita and flowed across the valley to the Waiwhetu Stream, to discharge via this stream channel into the harbour.

It is reported that Sladden did not agree that the flooding risk had increased as a result of the housing construction. Rather, the value of the assets liable to flooding had increased, thus making the flood risk less acceptable. He is also recorded (by the District Commissioner of Works) as saying that the HRB banks should have been improved years ago. His own reports following the 1939 flood do not however support this record as he specifically did not advocate the raising or improvement of the banks as he was confident that further improvements to the channel would increase the system's capacity.

In September 1945 the District Commissioner of Works, Wellington forwarded a tentative estimate for of the cost of improving the river and floodway between the mouth and Taita to enable it to carry a maximum flood of 100,000 cusecs (2800 cumecs). The stopbank section proposed was a 10 ft (3 m) top width, 3 to 1 batters on both sides and a freeboard of 3 ft (0.9 m) above the calculated level of the 100,000 cusec flood. The proposals were discussed with the River Board in October 1945: the Board agreed to the proposals, offered a contribution of £35,000 (1/6) toward the total estimated cost of £212,000 and requested that the work be carried out by the PWD. The proposal was eventually referred to Treasury for approval, but on the basis of a HRB contribution of £53,000.

Advancement of the scheme appears to have been left with the PWD for some years, probably on the basis of this resolution. The reasons for the delay until the start of construction in 1956 are not clear. However, a summary of events to that date is:

- (i) In 1948 the Engineer to the HRB submitted to the District Commissioner of Works plans for stopbank improvements downstream of the Hutt Bridge. The stopbanks were designed to 100,000 cusecs flood level plus 2 ft. with 2 to 1 batters both sides and a top width of 6 ft.
- (ii) The scheme was technically approved subject to top width increasing to 10 ft. Indications from Treasury were that it would require an economic report with cogent reasons in order to approve a subsidy greater than 1:1.
- (iii) In 1952 an estimate and economic report requested by the District Commissioner of Works were submitted by HRB Engineer. Included was a request for 2 to 1 subsidy.
- (iv) In 1955 the HRB was proceeding with the design of the Melling Diversion Cut, the second stage in the Scheme of Improvements.
- (v) Raising of the stopbanks from the Estuary to the Hutt Bridge (stage 1 of the Scheme) started in 1956.

All scheme works were constructed by contract, supervised by the HRB to plans prepared by the HRB.

Some of Sladden's work of this period appears to have been of a cursory nature. This may have been due to the Board's reluctance to be forced into a programme with which it was not entirely happy, or it may have been due to illness before Sladden's death in 1952.

The delays may have been unfairly attributed to the Board, as the various Government departments felt it necessary to comment on stopbank height, width, position, batter slopes, design discharge, funding, etc. The archives show that the lengthy process of what in practical terms amounted to design by committee added to the considerable delays.

The Lower Valley (Harbour to Silverstream) Scheme Improvement contracts are described separately as Project Reports in Part Two of this history. The 1950 Scheme Review included the following projects:

**Project Report 4: 1956 to 1957.** Stopbank raising on both the left and right banks between the Estuary (Pipe) Bridge and Ewen Bridge.

**Project Reports 5, 6 and 9: 1959 to 1964.** Melling Diversion Cut developed in three stages.

**Project Report 7: 1960 to 1961.** Raising of stopbanks between Ewen Bridge and Melling.

**Project Report 8: 1962 to 1964.** Raising of the existing (temporary) stopbank from Taita to Fraser Park and the construction of a new stopbank from Fraser park to Mabey Road.

**Project Report 10: 1964.** Raising of the original (1903) stopbanks from Melling Road to Mills Road.

**Project Report 11: 1964 to 1965.** Extension and raising of the existing Haywards Stopbank (originally constructed by the Public Works Department as part of the subdivision).

**Project Report 14: 1965 to 1966.** Flattening of the city side slope of the stopbank adjacent to the Hutt Valley High School.

**Project Report 20: 1969.** Construction of a new stopbank from the Boulcott Golf Club to a point opposite Tennyson Avenue, to meet the existing stopbank completed in 1964.

**Project Report 24: 1972.** Lowering of the original stopbank from Ariki Street to Hathaway Avenue.

**Project Report 25: 1972.** Stopbank reshaping south of Melling Station.

**Project Report 26: 1972 to 1973.** Construction of the auxiliary stopbank at the Okoutu Stream (Black Creek, Moera) outlet channel.

## 1950 Scheme Review Design Discharge

On the basis of the 10 year period from 1941-1951 Sladden produced a flood frequency relationship which is reproduced as fig. 21, p. 156.

Up until the time of the major scheme extension and upgrade (1945-1975) there had been no call to develop a flood frequency relationship, although evidence given in support of the petition to include Petone into the Hutt District (1948) states that a 100,000 cusec flood was likely to occur at least once in every 200 years. Scheme works were generally designed to pass the greatest known (usually the last) flood plus a substantial freeboard, so that a much larger flood could be contained. There appears to have been no pressure to limit the works to a specific design standard, but rather an intention to provide for the maximum flood.

During the design for the upgraded scheme a suitable design standard was considered and agreed by HRB and PWD engineers to be 100,000 cusecs plus a 2 foot freeboard. The hydrological basis for this figure is not known. However events leading to its derivation were:

- (1) The 1939 flood was computed at 71,000 cusecs. In addition it was computed that the freeboard above the observed flood levels could contain a further 10,000 cusecs - 80,000 cusecs in total. In 1944 it is recorded that the PWD engineers thought that the HRB "designed" its works to pass 80,000 cusecs.
- (2) After the 1939 flood Sladden (HRB) and Grant (PWD) were instructed to agree on a design standard for the new works. They recommended a design discharge of 100,000 cusecs and this was accepted by the government agencies as an extreme event - a standard that was considered warranted in view of the very high value of the developing Taita area. It was recognised that some of the HRB works would have to be upgraded from 80,000 to 100,000 cusec capacity. The freeboard above the design level was originally proposed as 3 feet, but a 2 foot freeboard was eventually agreed upon.

(The Hutt Scheme was the first river scheme designed using computational techniques which permitted the accurate prediction of flood levels corresponding to a specific discharge. The correspondence recognises the experimental nature of the predictions which are more conservative than would be expected today.)

- (3) In 1946, at a joint meeting of local body and government engineers, Sladden is recorded as stating that the 1939 flood may possibly have been exceeded in the 60 years before the construction of the scheme. A definite return period was not placed on the 100,000 cusec event. Various references were made to the 100,000 cusec event as a 200 year flood (Sladden, HRB), 90,000 cusecs as 500 year (Furkett, PWD), and 84,000 cusecs as 500 year (Adams, PWD). The 3 ft. freeboard proposed for the upgraded works would allow for a theoretical discharge of 120,000 - 130,000 cusecs, twice the maximum flood recorded.
- (4) In an interim report from the District Engineer to the chairman of the Soil Conservation and Rivers Control Council (1949) it is noted "...while the 100,000 + 2 ft level is considered ample provision for the highest floods likely to occur ..."

Throughout the remaining period of the scheme reconstruction (1948-1972) the 100,000 discharge was regarded as an extreme event, with the works constructed to a maximum likely flood standard.

### Archive Table 16: 1950 Scheme Review, Design Discharge

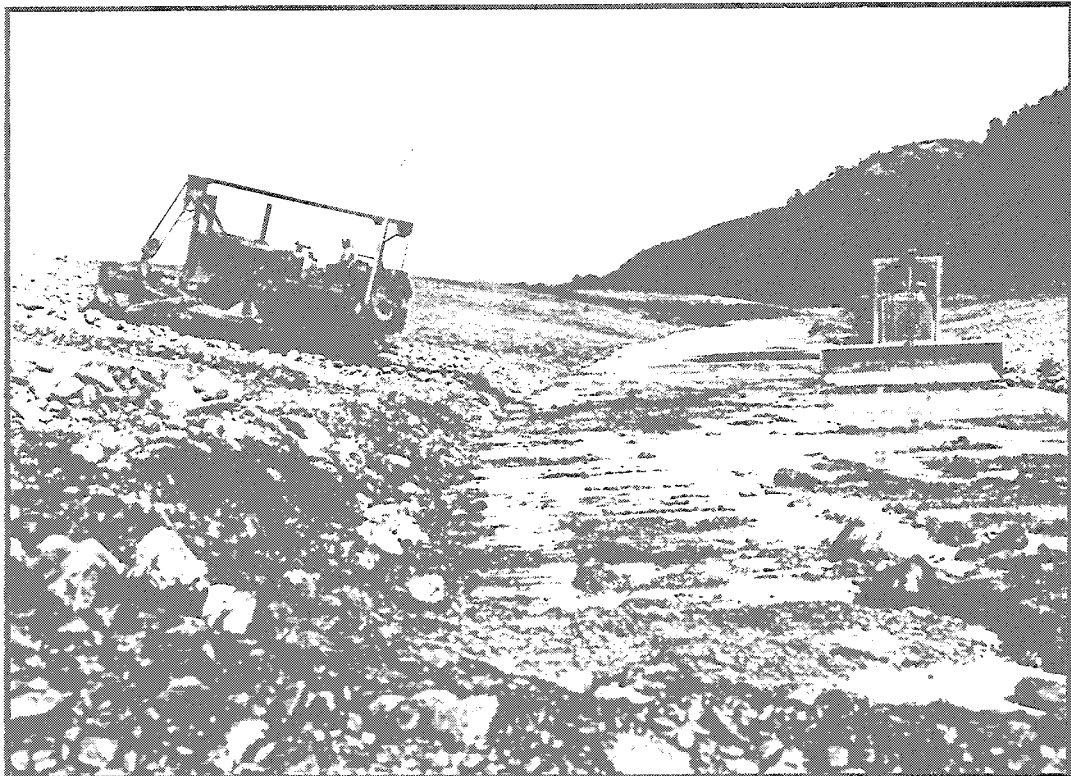
## 1950 Scheme Works - Silverstream to Maoribank

During the 1940s and early 1950s maintenance and control of the Hutt River north of the Silverstream Bridge was largely carried out by the Trentham Residency of the Public Works Department. The work was undertaken on behalf of the Upper Hutt Borough Council and Hutt County Council, with funding contributions from these Councils and from private landowners.

Memories of the 1939 flood (and others) remained with the Upper Hutt Borough Council, Hutt County Council and Residency Engineers, and were of concern as Upper Hutt continued to expand toward the River. River control for the Upper Valley had been considered by Sladden as early as 1937. In 1946 Trentham Residency completed preliminary investigations for flood control. In 1947 the Cabinet acted on this report and approved the purchase of highly floodable properties in the Newton Street subdivision (the area now known as Poets' Park). The land was purchased as the properties could not be protected from flooding as they were so close to the River they would lie within the river zone of any scheme of stopbanking.

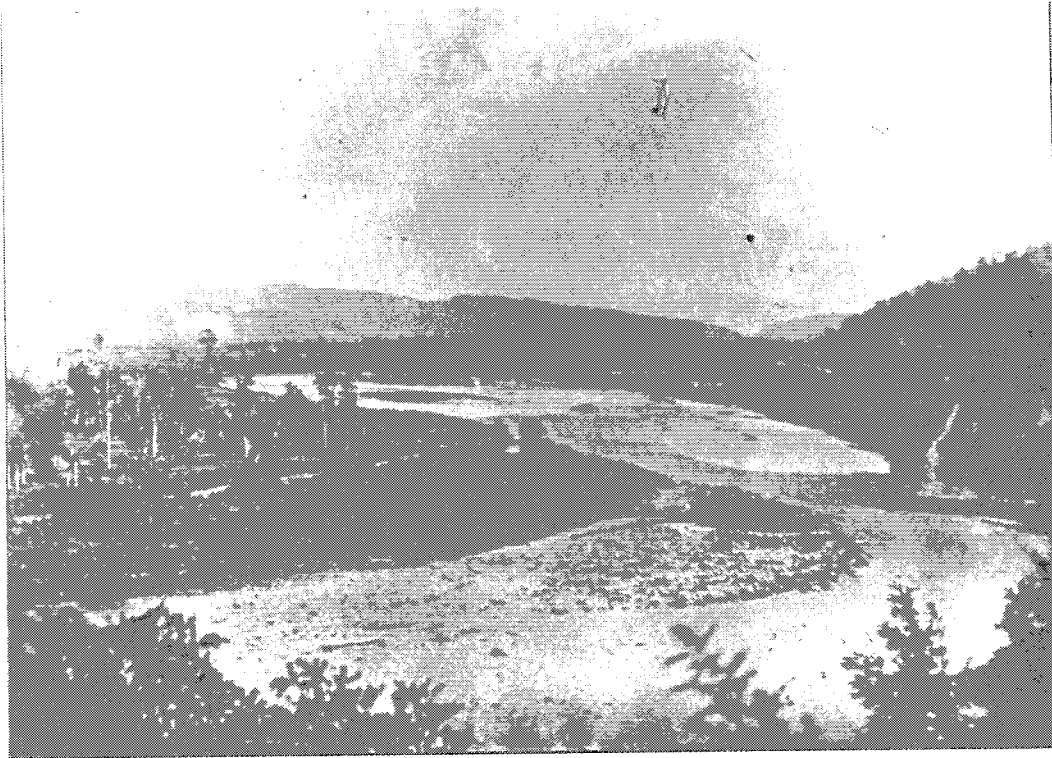
Plates 71 and 72, pp. 117 and 118 are copies of the preliminary scheme plans prepared by Trentham Residency and show how development had already extended well into the River Zone. The "100,000 cusec" line marked on the plans defines the area of flood plain considered to be at risk.

Despite an apparent consensus on the need for a publicly funded scheme of works the Upper Valley Scheme was still 20 years away. In the intervening period isolated works were constructed, mostly for erosion control or to protect existing or proposed housing subdivisions and farm lands.



**Plate 66: Barton's Bush Diversion 1949.** Source: Alexander Turnbull Library, neg. C11330, Evening Post collection.





**Plate 67: The "Bluff" at Trentham, prior to 1900. Looking south towards the Taita Gorge the river alignment remained similar to this until c.1930.**

Source: Alexander Turnbull Library neg. G110598.



**Plate 68: Silverstream c. 1950 looking south through the Taita Gorge.**

Source: Alexander Turnbull Library neg. G1007



**Plate 69: Moonshine 1931.** Source: Alexander Turnbull Library neg G46228



**Plate 70: Moonshine 1939.** Source: Alexander Turnbull Library neg. G46125

Examples of isolated works identifiable in plates 71 and 72, and referred to in Archive Table 14, p. 99, River Management from 1924, are:

**McCurdy Stopbank** protecting farm land northeast and west of the (present) Totara Park Bridge.

**Hudson Avenue Bank Protection** providing protection against erosion up to and beyond the line of the present stopbank.

**Newton Street Subdivision Stopbank** a short stopbank perpendicular to the river, constructed by the subdivision's developers to divert berm flows away from the properties.

In October of 1951 a 32,000 cusec (900 cumec) flood did considerable damage to the isolated works and again raised concern about damage to residential properties. The Trentham Residency this time refused the Upper Hutt Borough Council's request to carry out repair works at the Coltman Estate because of a lack of funds. This refusal triggered the Upper Hutt Borough Council to seriously reconsider its options for ensuring the security of Upper Hutt. The Council resolved to petition the Soil Conservation and Rivers Control Council to design and construct a River Control Scheme for Upper Hutt. This was agreed to in 1952, subject to conditions including:

- (1) An equal sharing of the costs of the investigation by the Soil Conservation and Rivers Control Council, Hutt County Council and Upper Hutt Borough Council.
- (2) The proposed scheme maintenance was to be carried out by the Hutt County Council and Upper Hutt Borough Council.
- (3) Representations were to be made to the Hutt River Board to extend its District to include the Upper Valley.

In 1953, at the request of the Soil Conservation and Rivers Control Council, the Trentham Residency produced a preliminary report and plan considering two main flood control options. The report concluded that the Residency had insufficient resources to design and build a stopbanking scheme at that time, and that it would be more appropriate for the work to be carried out by the local authorities.

The Hutt River Board was not opposed to the extension of the River District and had previously declared interest in managing the Upper River. True to form, however, it was responsible only to its classified ratepayers and refused to proceed with investigations in the Upper Valley until the beneficiaries became Hutt River Board ratepayers and, as ratepayers, formally instructed the Board to proceed.

Following representation from the Upper Hutt Borough Council and the Hutt County Council the Hutt River Board requested the Local Government Commission to order the extension of the District to include the Upper Valley. An Order in Council to that effect was subsequently issued in March 1956. Obtaining the support of the Upper Valley ratepayers was not so straightforward and ratepayer opposition, mainly from areas unaffected or marginally affected by flooding, delayed the start of the Scheme Works until 1961.

## Promotion of the Upper Valley Scheme

(Abbreviations refer Archive Table 2, p. 7)

F1: 23 Nov 1933: NA96/298000: 1400-1780

Letter from H Sladden to Chairman, HRB

Refers to a petition covering the area between the Silverstream Rail Bridge to the Moonshine Bridge, includes estimates for alignment of the river, and maintenance. Work envisaged is generally willow and cable, netted stone groynes, and some boom groynes.

F2: 23 Jul 1936: NA96/298000: 1400-2300

PWD commissions "...a complete survey of the Hutt River from the Silverstream Railway Bridge up to Maoribank."

F3: 30 May 1938: Report, Seaton Sladden and Pavitt to Engineer in Chief, PWD

"Hutt River Survey And Control Scheme from Maoribank Downstream To Silverstream". Plans (numbers not recorded), comments and brief cost estimates for training works (but no stopbanking) to control the river between the Silverstream Bridge and Maoribank.

F4: 3 Mar 1952: NA96/298000

Resident Engineer (Trentham) to DCW (Wellington). The (Upper Hutt Flood Control) Scheme on plan T1751 prepared at a few day's notice. "...first time this office has done any accurate fixing of the stopbank position from cross sections and calculations. Former schemes submitted have been based on estimation and judgement."

F5: 1953: HRB32

Report: "Hutt River Investigations". Flood gradient established from 22 levels taken during the 27/11/52 flood of 17,400 cusecs. See plan T2276. Backwater curve calculated from the Silverstream Bridge using cross sections at 1400 ft intervals, and the assumed stopbank alignment.

F6: 22 Nov 1954: from Minutes of Meeting of Hutt County Council and HRB representatives.

- (1) Upper Hutt the most urgent problem in the area at this time,
- (2) A comprehensive survey and plan has already been prepared by the PWD,
- (3) Resolved that the HRB make application to the Local Government Commission to extend the boundary of the HRB District to the Wellington City and Suburban Water Board boundary and further investigate its extension to the Wainuiomata River.

F7: 21 Jun 1955: DCW (Trentham) to Comm. of Works.

It appears that the scheme cannot go ahead until the new boundaries of the Hutt River District are gazetted, and a new controlling authority has classified the area.

F8: 4 Aug 1955: DCW (Trentham) to Comm. of Works re River Control - Silverstream to Maoribank Section.

The HRB not up to tackling the job at present, but must face up to it. Job not likely to be effectively started by the HRB for 3 years. If the MOW assists, they will be taken advantage of by the Local Authorities. The MOW does not have enough staff to take on this extra work.

F9: 1964: HRB111: 1400-2260

Commencement of stopbank construction from Maoribank to Masfield Street.

F10: 1966: HRB112: 1620-1900

Commencement of stopbank construction from Masfield Street to Wellington Golf Club.

F11: 1966: HRB127: 1400-1700

Commencement of channel realignment from Trentham Memorial Park to Silverstream Bridge - "The Silverstream Cut".

F12: 1968: WRC8/7/13: 2050-2250

First stopbanks constructed to protect Totara Park. These extended from the Maoribank Suspension Bridge (now partly demolished) at the Maoribank Bend to the western end of the development. Embankment unfinished west of Totara Park Road until 1977, when it was raised on insistence of the Wellington Regional Water Board along with construction of a main stormwater outlet channel.

F13: 1981: WRC8/7/13: 2250-2350

Construction of the first part of the Totara Park stopbank extension from Maoribank Bridge upstream.

F14: 1983: WRC8/7/13: 2330-2390

Construction of remainder of Totara Park stopbank extension from Maoribank Bridge upstream.

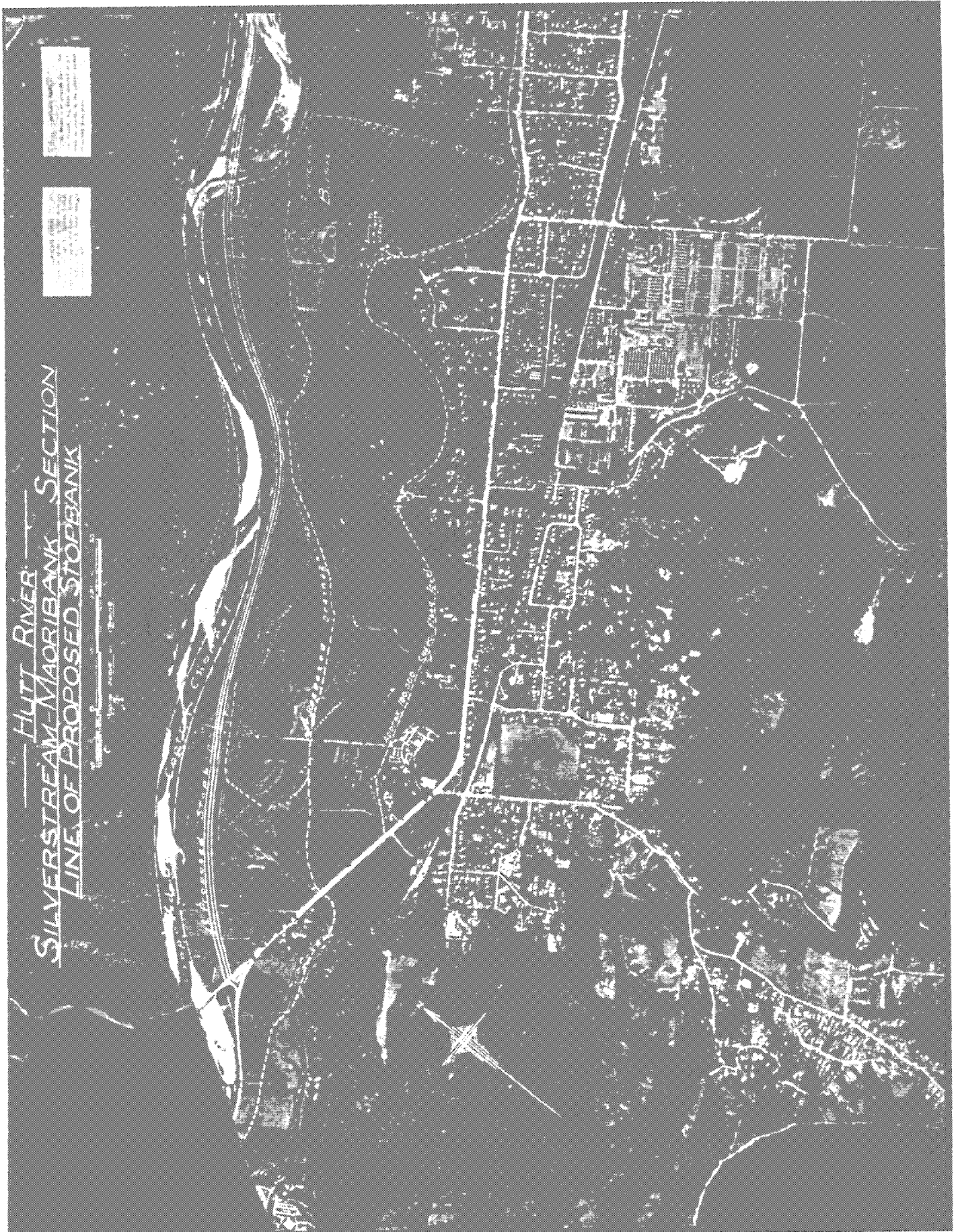


Plate 71: 1953 Upper Valley Scheme proposed by Trentham Residency, PWD (plan T1725).



Plate 72: 1953 Upper Valley Scheme proposed by Trentham Residency, PWD (plan T1725).

In the Upper Valley the river channel is largely confined to the west. Eastwards the flood plain rises towards a terraced margin so that not more than 50 percent of the plain lies below the 100,000 cusec (maximum likely flood) contour. Older residential areas were generally free from flooding and the threat of flooding or erosion to new properties occurred principally because of unwise subdivisional activity.

There was no doubt that stopbanks were a worthwhile investment, in terms of reclaiming land for housing and assisting in the long-term development of Upper Hutt. It is not surprising that the poll, seeking a mandate to raise a loan for stopbank construction, was defeated the first time it was taken in 1958. Ratepayers who were already heavily rated by the Borough feared a repeat of the land speculation which followed the construction of the Lower Hutt scheme and some were concerned that they may be forced from their land by rising land values and rates. Leading this group were St Patrick's College Board and the Board of the Wellington Golf Club who also argued that rising land values would prevent them from continuing their rural activities. During the Hutt River Board 1959 election this group gained strong representation, such that the new Board supported the option of excluding the land south of Barton's Bush from the scheme proposals, a major variation to a scheme where the subsidy support was based on the importance of the continuity of Scheme Works and lines of communication. That the less satisfactory option was accepted by central and local government is an indication of the political power this lobby group enjoyed.

In 1959 a number of small floods affected the area and the poll was repeated. The truncated option received ratepayer support and a start was made immediately on final design and specifications. The first works started at Masefield Street in 1964 and were completed by 1972.

Commissioning works and stopbank extension continued for another 11 years.

The works which comprise the original Upper Valley Scheme (added to in the 1980s with the development of Totara Park and Parkdale - refer Chapter 8) are described separately in the Project Reports, Part 2 of this History, and include:

**Project Report 12: 1964 to 1965.** Construction of a new stopbank from Whakatiki Street (now known as Masefield Street) to Maoribank.

**Project Report 13: 1966 to 1969.** Construction of a new stopbank from Whakatiki Street to the Wellington Golf Club.

**Project Report 15: 1966 to 1967.** Construction of an auxiliary stopbank to improve outlet conditions for the internal drainage channel discharging at Gibbons Street.

**Project Report 16: 1966 to 1971.** "The Silverstream Cut". Channel realignment between Trentham Memorial Park and the Silverstream Bridge.

**Project Report 17: 1967.** Central channel alignment adjacent to Hudson Avenue.

**Project Report 22: 1972.** Construction of an open perimeter drain around Maoribank Park.

**Project Report 23: 1972. Regrading of the drainage channel between Clouston Park Road and Ebdentown Road.**

Extracts from the archives referring to the promotion of the scheme are included in Archive Table 17, p.116 and the historical river alignments, plotted in Appendix B, illustrate the rapid changes in river alignment that took place between 1945 and 1988.

In terms of its current stage of development, the Upper Valley Scheme should be compared to the Lower Valley Scheme of the 1930s. During the initial Lower Valley Scheme construction the diversion and associated control works were the first works constructed. This was followed by 30 yeras of follow-up works to stabilise the new channel. In view of the history of the Lower Valley Scheme it should not have been a surprise that the frequent flooding of the late 1970s caused extensive damage to the newly constructed Upper Valley Scheme. Reconstruction has (so far) been repeated twice and scheme refinements and commisioning can be expected to continue well into next century. Bed levels have dropped dramatically following river straightening and gravel extraction,. New features have appeared, such as the exposed bedrock at Maoribank and Whakatiki, to determine the new river regime of the 1990s.





Plate 73: Lower Car Park, Hutt City, 1971. Source: Photo held by WRC

