

# SOUTHERN ARCHÆOLOGY LTD

ARCHÆOLOGICAL ASSESSMENT, SURVEY AND EXCAVATION

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## **Archaeological Assessment Waikaka Gold Project EP56372 Southland**

Waikaka Gold Mines Ltd (WGML) proposed to develop an alluvial gold mining operation within Exploration Permit 56372 at Chatton Northm Southland. The area of the proposed mine had previously been investigated by L&M Mining, and in 1998 an Archaeological Assesment of the site was commissioned from Jill Hamel (Hamel 1998). However, the area in question was not mined at the time. The area covered by this assessment is the same as the present proposal.

The present mine proposal and Hamel's 1998 assessment were both reviewed by Peter Petchey (Southern Archaeology), and in particular Hamel's 1998 plans and photographs were compared with current aerial photographs. The 1998 assessment is still relevant, as the historic research is sound and the land has changed little since 1998, and is still used for agriculture. The only new recommendation that is made here is that the site of the Mains house (Hamel 1998: 4 and Figure 4) may contain sub-surface archaeological material, and should be subject to archaeological monitoring when surface overburden is removed.

My recommendations are:

1. Hamel's 1998 Archaeological Assessment remains relevant and contains all of the necessary background history and site description information.
2. Most archaeological evidence in the proposed mine area is related to post-1900 dredging.
3. A small amount of sub-surface pre-1900 occupation evidence may be present (notably the Mains house site).
4. Waikaka Gold should apply for an Archaeological Authority from Heritage New Zealand Pouhere Taonga to cover any pre-1900 archaeological evidence that might be encountered.
5. An Accidental Discovery Protocol (ADP) should be in operation during all mining, especially the initial overburden stripping.
6. There is no evidence of any manuwhenua sites on the area in question, which has mostly been disturbed by historic-era dredging. However the ADP should specifically include reference to manawhenua sites, and if any such site(s) is found then Te Ao Marama Inc should be immediately informed and no further work that may affect that site should occur until a suitable response has been received.

Dr. Peter Petchey  
Southern Archaeology Ltd.

# **Dredging at Freshford, Waikaia and at Pullar, Waikaka**

**Jill Hamel, 1998**

This volume contains two report, bound together, on the archaeology of two areas which L&M Mining are proposing to open-cast mine for gold. The work was commissioned by L&M Mining as part of their environmental assessment for land use resource consents.

Each report contains an assessment of archival material, some of which is bound in with the Waikaia report. The archival material for the Waikaka survey was compiled by Barry MacDonnell and is available in three other volumes (see References). Field work of two days was carried out in April 1998 on each area, assisted by the local farmers who provided useful local history. The Company provided aerial photographs of Waikaka, the 1946 one being particularly useful, but there was insufficient time to research early aerial photographs of Waikaia.

Though the dredge tailings had been badly damaged at both sites by bulldozing, cultivation and flooding, it was surprising how much could be deduced by correlating archival material and features on the ground. Dredge tailings do not have great spectator appeal, and the only protected ones are the massive stony tailings on Earnsclough Flat. These Southland tailings are wholly different, in that they are in finer sediments and the ground level was lowered by the flushing away of fines into the river. They are significant because they represent an important aspect of the economic history of Southland, in that the dredges at Waikaia and Waikaka were the only turn-of-the-century dredges which worked profitably and for more than four or five years. It is important that a representative sample be protected, and one group of ponds at Waikaka may be a suitable candidate.



# McGeorge and Paterson Dredges at Pullar, Waikaka

Jill Hamel, 1998

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Jill Hamel  
April 1998

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## Introduction

This object of this project was to undertake an archaeological survey of an area at Waikaka where L&M Mining propose to carry out open-cast working of alluvial deposits. The area runs down the Waikaka River, south from the Chatton-Waikaka Road, east of the Willowbank-Waikaka Road, and covers a roughly rectangular area 2800 x 1000 metres (Fig.1). The survey shows what archaeological features remain from historic dredging or other activities in the area and discusses the historic significance of those features. The project was funded by L&M Mining as part of their environmental assessment. The historical data was compiled by Barry MacDonnell and is assumed to be accurate. The match between his maps of the dredge locations and other historic maps which he obtained is discussed under each dredge. The section boundaries on the modern cadastral map are very different from the old map. Grid references refer to NZMS 260 F45.

## Maori occupation in Waikaia Waikaka area

Otago and Southland were occupied by Polynesian people about 800 years ago, and inland areas seem to have been visited soon after their arrival. Moa provided an ample food source and the special stone sources, such as porcellanite and silcrete, needed for tool making were more common inland than on the coast. Cabbage tree, as a source of "starchy" food called kauru after it was processed, seems to have been used from the earliest moa hunting times to more recent, and would have drawn people inland.

Initial settlements were large coastal villages near seal colonies and were dependant on rich supplies of moa and seal meat, as well as barracouta shoals offshore. With the extinction of the moa and decimation of the seal colonies, the village pattern broke up to one of smaller camp sites. There was a gradual development of a socially well-integrated gathering of scattered resources. These were foods such as weka, forest birds, titi, eels, lampreys, kauru, and fern root, which were dried and stored in large quantities or exchanged, along with pounamu, with northern tribes for kumara.

The plains and hills around and north of Gore have never been surveyed for Maori sites. Known moa hunter sites are sparse on the Southland Plains, with one recorded by J T Thompson, the early surveyor, at Tomogalak near the McKellar homestead north of Gore. Ovens were once common on the farms immediately down the Waikaka Valley at Maitland, and artefacts have been picked up from many of these farms (McArthur 1992:2). The ovens are likely to have been for processing cabbage tree stems and roots into kauru.

Porcellanite has been noted on a geological map (Wood 1956) at three places on the Chatton Waikaka Road immediately south of Trig H at NZMS1 S170 (GR840571, GR847577, GR850581) and on the Merino Downs Road GR914435. (Metric values respectively GR962633, GR968639, GR971643, GR032510.) The sites south of Trig H are only three or four kilometres west of the project area and are very likely to have been used by Maori throughout the whole period of occupation. No evidence of Maori occupation of the survey area, even prior to dredging, was recorded during the survey. Local iwi should

be consulted for traditional knowledge.

### **The early farmers**

The earliest run in the area was Greenvale, which was split about 1863 into two runs — Greenvale (175A) and Waikaka (175B). Beattie (1979:265ff) and Evans (1962: 86ff) describe the history the two runs, and the Connell and Moodie map of 1875-76 (Hocken Library) shows the farmstead for Greenvale as lying north of Waikaka township. Waikaka Run was probably farmed from Otama. The 1875 map shows the land around Waikaka as already subdivided into small holdings for the miners, and Evans (1962:99) describes James Paterson as running 800 sheep on freehold and 'hundreds' land as early as 1864. (It is not obvious what the distinction between freehold and hundreds was, since land taken for subdivision under the Hundreds system was commonly freeholded.) After 1867 the Patersons (James and Robert) held land elsewhere but at the splitting up of the Greenvale estate in 1894, James is listed as taking up many sections. The name Patersons Freehold may date from their earliest holdings in the district. It was the name given to the second dredge to start up in the project area, Patersons Freehold Dredge 1899-1900, which was one of the most successful.

Around 1900 the Patersons owned about 1100 acres near Waikaka, and one of their early houses, The Mains, was on the western edge of the flats within some old macrocarpas, about 1200 metres south of the Chatton-Waikaka Road junction (GR998656). The building was demolished by the local farmer, and only the shelter trees mark the site. (The Patersons had a second house and farmstead on the hill to the west, of which some interesting old farmstead buildings survive (GR013666) on the road between the local rubbish dump and Turnbulls Road.) One of the Paterson brothers with 'a feel for gold' became a jeweller on Princes Street, Dunedin (A J Gardyne : pers.comm.). The only other house site known on the project area was close to the stock yards on the road to the rubbish dump at GR001668. It belonged to Arthur Ballantyne who worked on the dredges and also had a small holding. It too has been removed, and no significant sign of it remains. There may have been another house near a short row of pine trees at the south end of the project area (GR008649).

The first site for a purpose-built Waikaka school was also in the project area, along with a school house for the teacher. It was placed half way between Chatton and Waikaka to serve both settlements in 1883, and the site is still marked by a shelter belt of pine trees (Fig.9). It was close to the river, on the true left near the Waikaka Road bridge (GR997668). The building itself was removed to Waikaka township in 1910 for other uses when a new school was opened on the south side of the township. The house for the school teacher was acquired by the McGeorge Brothers and later by the County for their grader driver. Subsequently the land and building were acquired by the local farmer, and the old house removed (K Gardyne : pers.comm.).

The settlement pattern in the project area is probably typical of much of the land around Waikaka township. There is no trace of the buildings of the earliest runholders, nor of the first alluvial miners. There are memories and some trees marking the sites of houses existing at the turn of the century. Some

of these belonged to the smaller runholders of the late nineteenth century, e.g. the Patersons' houses, and some to the men who worked on the dredges and had small holdings, e.g. the Ballantyne's house. The old school section has lost both the school building and school house, though a small holding has been cut from part of it for a modern house, the only extant house on the project area. The 10 acre plot of land around the school has not been dredged and stands up on a slight scarp from the dredged ground. Southland farmers have a strong cultural trait of keeping tidy farms, and hence tend to remove nearly all traces of buildings which are superfluous to their needs, leaving only trees with some value for shelter.

### **The Waikaka Branch Railway line**

The 1890s to 1930s was the peak period for branch railway lines, which provided mechanised transport throughout the country before the general availability of cars and tarsealed roads. The government was tardy about constructing a branch line to Waikaka, which was badly needed for carting heavy loads of grain out of the district and backloading lime. In 1877 there had been agitation for a line connecting Gore to Kelso. In 1904, a local group formed a joint stock company, called the Gore Waikaka Finance Company Ltd, to build a line from McNab to Waikaka, and the line was authorized by the Waikaka Branch Railway Act. Evans (1962: 185) provides details of the means by which the line was financed, which involved local shares and a loan from the Bank of New Zealand. Building of the railway began in 1907 and a camp for the labourers was built at Willowbank, where the line is commemorated by a windmill that pumped water for the engines. Scoops pulled by two or three horses and tip drays formed the raised sections of the railway formation, such as that crossing the project area. The line was opened in 1909, and the government provided free cartage of lime to the farms. Passenger services were provided until 1931 when they were replaced by buses, and the line closed entirely in 1962 (McArthur : 1992).

The trace of the railway formation across the project area is quite clear. The farm track south from the Waikaka Road to the rubbish dump, turns left past the cattle yards and runs along the old railway formation for about 300 metres (Fig.4). The track then drops off the formation which sweeps round through the paddocks towards the river. The formation has been hollowed out during the removal of ballast and bulldozed flat over the last section towards the river (K Gardyne: pers.comm.). The remaining part of the formation is 1.0 — 1.5 m high and 10—13 m wide. The line crossed the Waikaka River (GR004660) on a relatively long bridge of heavy wooden piles, made of both rounds and sets about 14 inches across (Fig.4a). On the west side of the river, the formation has been used for a farm track. The height has been reduced, so as to give the river free flow down the flats when in flood. Bulldozing and cultivation have removed any trace of borrow pits along the line.

### **Gold mining at Waikaka.**

Gold mining had begun in the Waikaka Valley with the gold rushes in the 1860s. Large races were built to sluice the river terraces, including the Great Waikaka water race which is shown by Evans (1962) as running down the flats on the eastern side of the Waikaka River through the project area<sup>1</sup>. This is

<sup>1</sup> The map from Evans (1962) is included in MacDonell's (1995b) compilation of relevant literature, but it has been placed at the front of Appendix E instead of at the end of Appendix D where it belongs.

inaccurate, as the water would not have provided any working head to the sluiced hollows along the ridges east of the flats. The race was just above the sluice hollows and ran to the area marked Old claim down Turnbulls Road ( GR.020645). The end of it is visible on the hillside above this claim (K Gardyne: pers.comm.).

The account of the race building in Evans (1962) provides evidence about the sluicing carried out prior to dredging on the river flats. The Great Waikaka race was started in 1868 and brought water from the southern slopes of Mt Wendon, through Wendon Valley to the east side of Waikaka township and paralleled the later railway line to the east of the project area. There were some major wooden flumings for aqueducts along its route, but even so it did not have sufficient height for hydraulic sluicing and most work was ground sluicings (Evans 1962:11). The race was completed by 1870 and was used up until 1876 when the huge flume at Waikaka was blown over (Hall-Jones 1982). It is likely, therefore, that the major workings along the edge of the river terrace to the east of the project area were carried out between 1870 and 1876.

By 1890 mining was declining. It revived enormously in 1899 when dredging technology gave the miners access to the stream deposits and low-lying gravels. The total dredgeable area around Waikaka was estimated at 5,000 acres, and by 1899 was mostly pegged out (Caygill 1984:196). At the end of 1904 there were 23 dredges spread over 12 miles, with a large area of ground untouched. Though the returns were not large, the ground was easily worked, and there were lignite pits nearby on the ridges to the west. Several of the companies were private and must have been profitable, since by 1904 they had been working for several years (NZMR 1904 (1):2). In 1905, an analysis of dredging in Southland showed that there were average losses of eight shillings per ounce on the Waimumu and Charlton fields and of £12 per ounce on the outlying dredges. Only the Waikaia and Waikaka dredging fields were making a profit (Caygill 1984:205).

Dredging was carried out in the project area during the first twenty five years of this century. MacDonnell considers that the dredges which worked the area were

Gleniti (1899-1904),

Paterson's dredges (about 1900 to 1917)

McGeorge Brothers Dredges Nos.1, 2 and 3 (1902 - 1926) ( MacDonnell 1995a: plan on end paper, MacDonnell 1995b: Plan 1).

A summary of MacDonnell's material on these three firms shows that the latter two firms were among the longest lived on the whole field, most of the other dredges working for a short period between 1900 and 1908. The Gleniti dredge was the first to work in the project area at the southern end, but was poorly managed, producing 347 ounces of gold to 1902 but paying no dividend. Other than the general locality of Gleniti, the area worked by this dredge is not recorded in the archives.

The McGeorge No.1. Dredge, working beside the Waikaka Willowbank Road, was very successful,

judging by its long working period from 1902 to at least 1916, when it was recorded as getting 608 ounces of gold for the year. It worked a claim that was listed as 198 acres (see below), in fine quartz gravels down to a depth of 12 feet, though the dredge could work to 20 feet. It had pontoons 80 feet long and 30 buckets, each of 6 cu.ft capacity and discharging 10 per minute. In 1906 it was working abreast the Waikaka school, which would have been at the old site beside the river, and the dredge would have been at the upper end of the project area. Hall-Jones (1982:70) has a clear photograph of the dredge, showing how the extended tailings boxes spread the fines over the coarser material. The McGeorges are credited with creating the soil distributor system<sup>2</sup>. The dredge was described as working across "the road between North Chatton Church and the river" (Evans 1962:37), i.e. the Chatton-Waikaka Road (Figs 1 and 2). A 1946 aerial photograph clearly shows three strips of dredging, side by side, crossing this road. When the claim was worked out about 1916, the dredge was dismantled and taken to Freshford and then brought back to Waikaka.

In 1903 the McGeorge Brothers bought the Gleniti farm (400 acres) which extended beyond the southern boundary of the project area, since it was probably Sections 29 and/or 17 on the old cadastral map (Fig. 5). They brought in a dredge from Alexandra (McGeorge No.2), using traction engines to get the large load over the hill at Raes Junction and through to Waikaka. The dredge was rebuilt by its dredgemaster and was successful, working until 1923, getting up to 1350 ounces of gold in a year. Its ladder was 48 feet long and the pontoons extra strong. The average depth of the ground here was 14 feet. Coal was supplied to this dredge from the Ramsay's pit at Chatton, and had to be double handled on to a pontoon to reach the dredge (Evans 1962:36-39). MacDonnell (1995b: Plan 1) shows this dredge working the most south east corner of the project area.

The performance of these two dredges (as well as the results of boring) would have been a factor in the McGeorge's decision in 1909 to build their No.3 Dredge with the most powerful steam winches of any used for gold dredging in the country. Its construction on the river was halted when a deeper lead was found by boring near the Pullar siding. The pontoons were taken to pieces and shifted to the top of the claim and the dredge finished there (Evans 1962:39). It was sometimes called The Deep Lead Dredge. Details of its machinery, some of which was built in Dunedin by Messrs Sparrow and Son, are provided by Evans (1962:40). This dredge operated from about 1909 to 1926, and was near the Pullar railway siding in 1914, suggesting that it had worked down the river and back again in five years. It got up to 1800 ounces of gold in a year, and the average depth of the ground worked was much deeper - down to 40 - 62 feet. Hall-Jones (1982) considered that the three dredges between them produced 58,063 ounces of gold.

MacDonnell shows a Paterson dredge worked the cadastral sections which lie in between the McGeorge's No 1 and 3 claims. Evans (1962: map on end paper) shows Paterson No 1 dredge in this position (Fig.3).

<sup>2</sup> It should be possible to find more photographs of the dredges, particularly with the help of the Gore Historical Society, who have a display of photographs in the corridors of the Gore Hospital.

In the Mining Privileges' List of 1903, William Hugh Paterson is given as the registered owner of a dredge on Section 9 at Waikaka, 16.25 acres, License No. 9, 22 April 1901 (AJHR 1903 C-3:61). It must have been a large dredge, since it employed 16 men (NZMR 1902, No.10:420). Section 9 on the old cadastral maps lies in the north east corner of the project area. In 1903, the Paterson's Freehold No 2 is described as starting work in August above the Gleniti Dredge and below the Paterson's Freehold No 1 dredge. (This would be on Section 30 of the old cadastral map.) The No.2 was a new machine (NZ Mines Records 1903, No.1: 3). The McGeorge Dredge of 1903, the No.1 Dredge, was described as north of the Paterson's Freehold No 1 Dredge, which suggests that the latter was then in the southern part of its claim (Fig. 5).

The Paterson dredges are described as working at least from 1900 to 1917, with an output of up to 1200 ounces in a year and working to a depth of 23 feet. The Paterson No 3 dredge may have worked to the south of Gleniti, out of the project area. The Mines Department provides figures for the total annual output of all three dredges which was as high as 1900 ounces in 1908. The total output for two of Patersons Freehold is given by Healy (MacDonnell 1991a) as 21,288 ounces, but his figure for the McGeorge dredges is much less than Hall-Jones's, and so he may have missed some records for Patersons as well. As early as 1912, Paterson sold 40 acres of land to the McGeorges because they could not work a deep lead (MacDonnell 1995a, 1995b).

The transportation of dredges between gold fields over the gravel roads of the time was an engineering feat in itself, well described by Evans (1967:74). The McGeorge No 1 dredge came from Bannockburn, the No 2 from Alexandra, and two of the Paterson dredges from the Clutha River at Beaumont. They were hauled by up to three traction engines at a time, with extra wire ropes and steam winches, on specially built platforms. The platforms ran on full-sized traction engine wheels of which about six collapsed en route and lay with buckled spokes by the roadsides for many years. The traction engines did a great deal of damage to the roads, as did the haulage of coal from the various coal pits to the dredges. Teams of five or six horses could haul five tons of coal in summer, but to prevent damage to the roads a regulation was made that only one and a quarter tons per axle could be hauled during winter. This made the haulage uneconomical during winter, and each dredge stockpiled a winter's supply, which could be 1,300 tons for three months of 6-day weeks. The McGeorge No 2 dredge put in a tramline from the main road to the dredge along which a horse could pull up to three tons. The line was up to three quarters of a mile (1200 m) long.

At least four coal pits fed the Waikaka dredges in the early part of the century - Johnson's at North Chatton, Pacey's, Ramsay's and Sam Perkins. The latter was the only open-cast mine and the rest were tunnelled. One of the mines had a cableway from the mine to a ridge top in view of the project area, from where the coal was drayed down hill to the valley (K Gardyne: pers.comm.). All the mines will be marked by adits, dray roads and tip heads, but are out of the project area. Others were worked around Springfield and Willowbank.

### Field evidence of dredging.

The tailings and many of the ponds left by the dredges have been progressively bulldozed and obliterated. The tailings were never particularly stony and in many places were covered with fines by the dredges themselves. Seen from the road, the ground looks flat with a good cover of grass, winter feed crops and grain, with neat fences and some patches of willows. When examined in detail the ponds and fence lines began to fall into patterns, associated with gentle ridges and swales. By comparing aerial photographs taken in 1946 and 1997 (L&M archives), this pattern could be related to the dredge workings. The ponds were often linked by drains, which form part of the farm drainage systems. Some of the creeks left by the dredges have been filled in and some new drains created to maintain an efficient drainage system. About 30 years ago the local county worked a drag line up the Waikaka River from McNab to Waikaka, defining a single channel and cutting off many bends. The present day meanders of the river, therefore, bear little relation to the 1905 dredging.

Existing ponds and drains are shown in Figure 4. The shapes of most of the ponds do not seem to be significant, except where they have straight edges against a claim boundary. Many of the ponds on the 1946 photograph have been filled in or reduced in size. Those that have been retained have been planted with willows, flax and raupo to form attractive duck habitat. The shapes of the ponds were not drawn accurately, since the aerial photographs provided better information, and it was often difficult to tell what the original shapes had been. The positions of the ponds, relative to drains, fence lines, ridges and swales seemed to be more relevant.

Since the tailings are not stony, it was difficult to distinguish dredged from undredged ground by just looking at the surfaces. Local farmers are very aware of the difference when they cultivate, and Ken Gardyne confirmed that the low scarp of less than 1.5 m with a ditch at its base, running down the eastern edge of the Willowbank-Waikaia Road, was the western edge of the dredged area. In the centre stretch of the project area, the drain marking the edge swings away from the road, leaving an irregular strip of undredged ground between 100 and 200 m wide. At the south end of the project area, the scarp and drain are in long grass within the road reserve. The scarp and the lack of piled-up tailings shows that a considerable volume of fine material was washed out into the river.

On the eastern side of the valley, north of where the railway crossed the valley, there is only a short low scarp. The edge of the dredged ground is not clear around the cattle yards, or along the road. The scarp does reappear around the 10 acre plot of land on which the old school stood. South of the railway line, the dredges seem to have worked right to the hill edge. The presence of sluice pits in the hillside all along this stretch of valley suggest that there was probably gold bearing wash running under the hill edge. The edge of the dredging is marked by a line of substantial ponds and a sharp edge to the hill slope. Near the southern end of the project area, the largest pond of all was formed by a McGeorge dredge working into the hill slope. The 1946 aerial photograph and local informants indicate that this pond was so large that it interrupted the flow of the river. The drag line formed a deep channel for the river through it, and most of the pond and the hollow between it and the hill is now rough swamp filling with willows.



The archival evidence for the location of each of the five or six dredges which worked in the project area is summarised above and in the appendices. Field evidence helps to define the area worked by each dredge, which is shown only approximately in MacDonell's (1995b) Plan 1. The 1946 aerial photograph (Figure 7) shows most of the flats north of the railway line as neither cultivated nor subdivided into paddocks (compare Figure 8). It seems likely that the ponds and drains visible there in the 1946 photograph are much as they were when the dredges ceased work in the 1920s.

The easiest dredge to locate from the archival evidence is the McGeorge No.1 dredge in the northern part of the project area (Fig. 6). The three broad strips of tailings running south from the Chatton-Waikaka Road in the 1946 aerial photograph are still marked on the ground today by ponds, ditches and fences on the long edges, as well as across the bottom boundary (Fig.9). This bottom boundary runs across the flat from the position of The Mains farmstead (Fig.4), and is now marked by a farm track (the Mains track). Fences and ditches follow the margins of each strip. The acres of ground worked by each dredge during its lifetime may be of lesser interest compared to the amount of gold obtained, but they can be reasonably well calculated for the McGeorge No 1. From approximate measurements on the 1946 aerial photograph of the three strips, about 180 acres (75 hectares) below the road and 50 acres (21 hectares) above the road were covered between 1902 and 1916. The area of the claim was given in the mines records as 198 acres, though this may have been added to. It is not possible to determine from the records whether or not the dredge worked continuously between these dates, but it does seem to have worked most of the claim.

The edge of the outside strip that lies on the boundary of the McGeorge No 1 claim beside the Willowbank-Waikaka Road is marked by a scarp with a ditch along the bottom, the Western Ditch (Fig.9). The possible reasons why these topographic features were formed will be discussed below, but the assumption is made for the other dredging claims that ponds, drains and fence lines tend to be aligned with the dredge strips.

South of The Mains track the alignment of the Western Ditch changes, and it runs obliquely across the flats to the river. This ditch is large — 3 m deep and about 6 m across — and visible in the 1946 aerial photograph. Some fences are aligned with it, and it is assumed that a dredge worked strips parallel to the ditch and obliquely across the flats. East of the river the alignment of two crescent shaped ponds suggest that the dredge strips crossed the river. These workings lie within Section 30 of the Paterson Freehold tenure as shown on early cadastral maps (Figs 5 and 6), and would have been created by the Paterson Freehold No 2 dredge. The southern boundary of Section 30 is still marked by an old fence line. The crescent-shaped ponds lie within Section 10, which could have also been part of the Paterson dredge claims.

Section 9, north of Section 10 on the east of the river, was the other part of the Paterson Freehold. The alignment of the two ponds at the northern end and the drains visible in the 1942 aerial photograph do not indicate any obvious dredging pattern (Figs 4 and 9). The drain from the ponds has been diverted into the main river and no longer runs down the middle of the flat. Not only does the drainage pattern relate more



to the natural water courses from the eastern gullies, flooding has also been so heavy on this part of the flat that thick layers of fine gravel have been laid over the dredged surface (P. Woperis: pers.comm.). These deposits are clearly visible in the drains near the old railway bridge, and have blanketed any pattern of ridges that might have been left by the Paterson Freehold No. 1 dredge (Fig.10).

Continuing south from where the Western Drain crosses the flat to the river, the western edge of the dredged ground runs south through two small ponds and along the edge of a larger pond system. It is not marked by a scarp over this section (K. Gardyne : pers.comm.). Judging by the alignment of the old fences, the very large system of ponds running alongside the track from the old Pullar siding (the Pullar Track) and the system of ridges and swales in the paddocks, the pattern of dredging here ran very obliquely across the valley. The size of the ponds (Figs.4 and 11) suggest that a larger dredge was involved than further up the valley, especially when the size of the lake left in the river bed is considered. The lake has been indicated in Figure 4, even though it was drained by the operations of the drag line. Its irregular shape shows that arms of it were aligned with the fences and ponds to the north in the paddocks. The dredge is most likely to have been the McGeorge No.3 (MacDonnell 1995b: Plan 1), since it is reported as working near the Pullar siding in 1914. This line of large ponds along the southern edge of the Pullar Track are the least modified of all the dredge ponds in the area, judging by comparison of the 1946 and 1997 aerial photographs. Their shapes are very complex and could repay more careful survey.

The old fence line north of and parallel to the Pullar Track lies on a property boundary between Sections 30 and 29 (Fig.6) which predates the dredging, and it looks as if the lie of the dredge strip across the paddocks was determined by the section boundary, rather than by the road and river. Considering that Patersons sold some ground containing a deep lead to the McGeorges, the McGeorge No 3 dredge could have worked the strip from the old fence north to the Western Drain, an area lying within Paterson's section 30. Immediately south of the line of large ponds, the ground is very confused and there is only a general indication from the drainage system that the dredge on this ground worked obliquely on the same angle as the McGeorge No 3. Since it left relatively large hollows, the latter dredge is the most likely candidate. Given that the dredge started "at the top of the claim" (Evans 1962:39) in 1909, was near the Pullar siding again in 1914 and finished in 1926, it had ample time to work three or four strips of ground.

About 300 metres north of the Deer Fence track, a firm line of fences, drains and the edges of ponds mark the northern boundary of a different dredging pattern. To the south there are lines on the 1946 aerial photograph and an alignment of drains and ridges on the ground that suggest a dredge worked three or four strips parallel to the road, running south well beyond the Deer Fence Road and the southern edge of the project area (Fig.4). These strips run down through the old Sections 29 and 17, both held by the McGeorges, and were most likely the work of the McGeorge No 2 dredge. It worked right to the road edge, judging by the 1.5 m high scarp and ditch now partially within the road reserve.

A very small area close to the river has been worked in a totally different direction from the neighbouring dredges, leaving low ridges at right angles to the river. Possibly this was where the inefficient early

Gleniti Dredge worked (Fig.4).

### How could dredges have formed the features seen on the ground?

Paddock dredges on river flats started work in ponds, which were not always alongside the river, judging by the account of building the McGeorge No.3. Pontoons were constructed and the machinery either assembled new or from other dredges. A large corrugated iron building enclosed the boiler, winches and gold saving machinery, which could be either a sluice box or revolving perforated screen. A tailings elevator tilted up at about 35 degrees with a chain of buckets to lift the tailings on to a mound at the back of the dredge was common on stony ground. The Waikaka, Waikaia, Charlton and most of the Tuapeka dredges seem to have had just sluice boxes out the back, using water and gravity to shift the tailings (Hall-Jones 1982:52, 70; Hearn and Hargreaves 1985:18). The conditions which allowed paddock dredges to dispense with tailings elevators need to be determined, but must have involved the proportion of fines which could be washed down river and how much the gravels bulked up when excavated and redeposited.

A strong wire hawser was anchored forward of the dredge for the bucket chain to work against and smaller hawsers run out to the sides. The dredge then worked systematically from side to side in a broad strip up the river flat, forming its pond ahead of itself and closing it up with tailings. A dredge was constantly being winched sideways across the strip. At the edge of the strip where the dredge *changed direction*, it could be winched to an angle so that it either threw tailings on to adjacent ground, filled the ground level or left an irregular ditch or chain of ponds along the edge of the strip. When the dredge reached the top of its claim, it should logically have created a large pond, been *turned* end for end, filled most of the pond and worked its way back on an adjacent strip. Changing direction and turning were two quite different operations. At the end of its life when removed, sunk or demolished, the dredge should leave a final pond. This logical pattern is interrupted, of course, by irregularities in the gravels, water flow, mechanical problems, human whims and Acts of God.

The level of the water in the dredge pond was probably the natural ground water level. The fines in the upper levels may have contaminated the pond water, so that it was too "thick" for effective gold saving. This could have been the incentive to flush the fines away as vigorously as possible into the drains to the river. Though farmers have maintained and added drains since dredging ceased, the loss of fines from the area indicates that the dredges also maintained a flow of water from their ponds to the river. They could have formed the drains by leaving space right down one edge of each strip for a drain or chain of ponds, and shifted the drain across the flat. When they worked the last strip, the drain should have been left intact if the dredge was working upstream. It could be filled in if they were working downstream, and filling to an edge seems to have created long low ridges. The larger the dredge the greater the amount of fines that had to be shifted, which would be a good reason for creating and maintaining the large ponds along the Pullar Track for the McGeorge No 3 dredge. The flow of water out of these ponds into the river is still vigorous.

The creation of ridges by a dredge seems to have been more irregular than the creation of ditches which had to be even in grade to carry away water. Ridges are consumption areas for tailings and will presumably only be formed if the substrate is very even in stratification and texture. All the ridges have been smoothed by cultivation but they are still quite visible and farmers have preferred to run fences along them rather than in swales or obliquely to the line of the ridge.

The transport of coal to the dredges would have required tracks across the flats from stock piles, and the McGeorge 2 had a light tram. If the dredges had started from the river and worked across towards the road they would have destroyed these tracks. No trace of them or of the stock pile sites was found. Ken Gardyne confirmed this, providing a history of recent formation for all the existing tracks.

### Summary and discussion

There are no above-ground traces of nineteenth century farming in the project area, though there were at least two houses present, as well as the old Waikaka School. Given the general use of bulldozers in the area, it is unlikely that the surroundings and foundations of these buildings are sufficiently intact to be of archaeological interest. Nor would they provide a snapshot view of a decade, as did the United States Hotel at Nokomai (Hamel 1990).

The formation of the Waikaka Branch line where it ran through the project area and the foundation piles of the railway bridge are still visible. The position of the line is defined on maps. The formation is no longer intact anywhere on the project area, and though it is appropriate to preserve sections of 'hand-built' formations of early branch lines, the remnants in the project area are not sufficiently intact to be of value. The remnants of the wooden trestle bridge built about 1908 are more interesting. The Central Otago Rail Trail protects a good series of wooden trestle bridges of this period, but the preservation of some of these early bridges in Southland is important for regional historic values and identity. These wooden piles should not be removed unless it is absolutely necessary to do so, and if they are to be destroyed there should be a detailed description made by an expert on old railway bridges. Other bridges along the line should be considered at the same time, and listing in the district plan considered. Since they are post-1900 they are not protected under the Historic Places Act, 1993.

The goldfields' wardens rarely described the locations of claims relative to the ordinary Land Registry system, and it is unusual to have such firm evidence of section numbers for claims. Since the claims were issued under the Wardens Court, however, we cannot assume that a claim described as *on* Section 9 covered the *whole* of Section 9 or even lay entirely within it. The river has been used as a boundary for sections but it is unlikely that it was used always as a claim boundary, since the dredges probably worked the river bed just as freely as the paddocks.

Dredge workings have been defined in this study by correlating information from the early cadastral maps (with caution), occasional comments by the wardens, and the alignment of ponds, ditches, ridges (often with fences along them) and 'crop marks', both as seen on the ground and in aerial photographs. The dredge tailings and drainage systems of five, possibly six, named dredges can be distinguished within the

project area. All but one of the dredge claims, that of the McGeorge No 2 dredge, seem to have been wholly within the project area. About three quarters of the workings of the latter dredge run south from the Deer Fence track. The manner in which each dredge worked could be partly deduced from the surface features seen.

The historic significance of the features left by the dredging is difficult to assess. The alignment of the features are useful for indicating on the ground the area that each dredge worked. The amount of damage they have suffered from cultivation, bulldozing, the straightening of the river, modification of drains and the deposition of gravels by flooding makes it difficult to deduce further details of working patterns. The most interesting matter is how the dredges managed without elevators to lift the gravels to the rear of the ponds. In effect they worked like river dredges, washing the tailings down lengthened sluices to the rear of the dredge. It must have been a well-understood method, since it was only the placement of fines on top of heavier gravels that the wardens commented on. The scarps, ponds and briskly-running drains all indicate that the dredges managed the water levels and the tailings very skilfully without having to resort to the use of elevators which would have had to be driven by steam power.

It could be archaeologically interesting to have a detailed survey map made of the present topography. This should show the levels of the remaining features compared to the levels of undredged ground at the old school site, at the scarp just south of the cattle yards, and along the western road edge. It may even provide a rough indication of how much soil and fines were washed down the river. Flood deposits since 1930 will complicate this calculation. The possibility that the gravels were so fine that they did not bulk up much when excavated may have also assisted in maintaining levels, so that ditches did not have to be inordinately deep. The school site would be particularly valuable for providing core samples of the old stratigraphy close to the river, which could be compared with cores from the The Mains farmstead and near the cattle yards. From these we may be able to account for the vanished material and lowered surface of the dredged areas.

It has not been possible to deduce much of interest from the present-day shapes of the dredge ponds. The ponds which seem to be closest to their original shape are those formed by the McGeorge No 3 dredge on the south side of the Pullar Track. There are still traces of the shape of the large pond in the river but it was too obscured by willows and bogs to be sure of this. These large ponds and about 150 m wide margins around them, especially of undredged ground near the road, could be worth further investigation with a view to preserving them as an example of this type of paddock dredging in fine materials. In the Waikaia report it was suggested that a group of linked sites would be of more value than separate sites. Further study of the McGeorge No 3 Dredge to determine which coal pit it bought coal from, the state of that pit, the transport route and if any of the workmen's houses still survive could be an useful exercise to determine the historic value of the ponds.

### Acknowledgements.

I am grateful to Mark Pizey and Paul Woperis of L&M Mining and to Peter Bristow for discussions on the operations of historic dredges. Mr and Mrs K Gardyne and Mr A J Gardyne provided useful practical comments about recent modifications to the area, as well as welcome cups of tea.

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system of sluice boxes and shoots in 1903 (Caygill 1984:205). Large dredge with 16 hp engine. NZMR 1904 (1):3. Claim 198 acres, worked to 12 feet in fine quartz gravel. Buckets six cubic feet, employed 8 men (MacDonnell 1995a).

McGeorge No.2 Dredge 1903 - 1923. Pullar, near Waikaka. Claim 480 acres, worked 12-14 feet of fine quartz gravels. Buckets six cubic feet, employed 8 men (MacDonnell 1995a).

McGeorge No 3 Dredge 1909 — 1926. Pullar, near Waikaka. Buckets seven cubic feet, worked down to 55 feet.

McGill and Party 1898. 480 ounces for 36 weeks work, paying moderate dividend. (OW22/9/98:19). In the following year tried stripping off the clay above the wash but went back to working a face 12-15 feet high, doing an acre per week (ODT 1899:86).

Mckenzie and Party (Ibbotsons?) dredge being built 1898. Same as Perrys Dredge. OW 1/12/98:12

Patersons Freehold Dredge. No 1. 1899 — 1917 Waikaka. N Z Mining Records 1902:118.

Patersons Freehold Dredge No 2. Waikaka. 1904 - c1917 Large dredge with 16 hp engine. NZMR 1904 (1):3.

Perrys Dredge 1896 — 1905. Getting 15 oz/week and profit of £30/week (OW15/9/98:18).

Perry and McGill's Dredge 1897 — ?1903 At Waikaka. N Z Mining Handbook 1906:247. N Z Mining Records 1902:118.

Premier Waikaka Dredge 1899- 1900. At Little Waikaka. No dividends Hearn and Hargreaves 1985:81.

Pride of Waikaka Dredge 1900 1901. No dividends Hearn and Hargreaves 1985:82.

Record Dredge Waikaka. N Z Mining Records 1902:118

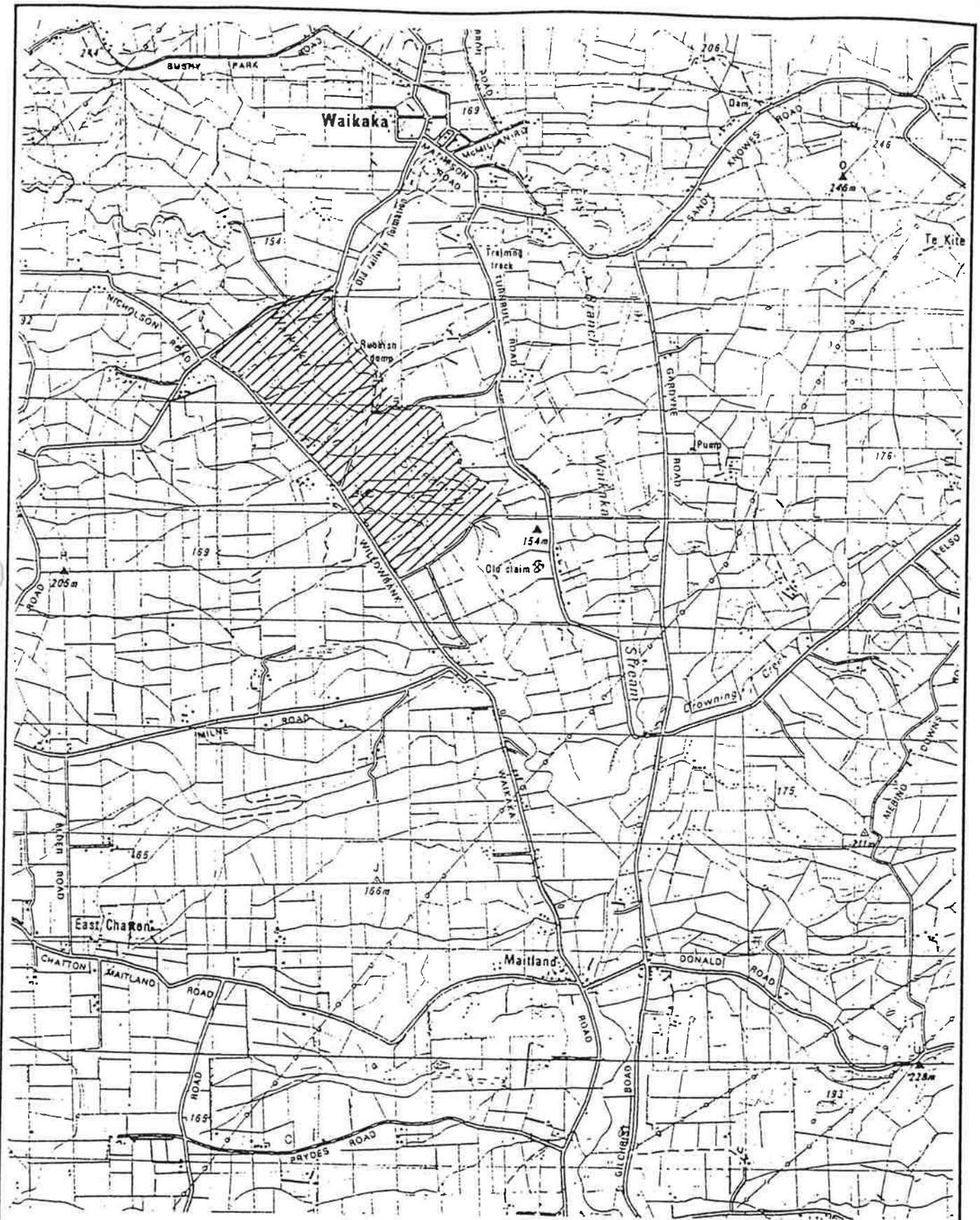
Record Reign Dredge 1899-1905 1.5 miles south of Waikaka. Being built at end of 1899. OW 1/12/98:12 No dividend. Hearn and Hargreaves 1985:79.

Rosedale Dredge 1906—1918 Waikaka Valley 100 acres N Z Mining Handbook 1906: 315.

Sheddans Freehold Dredge 1901-1905 Waikaka Valley N Z Mining Records 1902:118. Large dredge with 16 hp engine. NZMR 1904 (1):3.

Waikaka Dredge 1900-1905. At Waikaka. Total dividends £4,029. Hearn and Hargreaves 1985:82.





<b>Legend</b>  <div style="display: flex; align-items: center;"> <div style="width: 20px; height: 10px; background: repeating-linear-gradient(45deg, transparent, transparent 2px, black 2px, black 4px); margin-right: 5px;"></div> Project Area </div>	Project <b>WAIKAKA PROJECT</b>		
<b>L &amp; M MINING LIMITED</b>  P O Box 13-442 Christchurch New Zealand	<b>PROJECT LOCATION MAP</b>		
	Date Feb 1998	Scale 1:50 000	Figure No

Figure 1. Topographic map of Waikaka Valley showing location of the project area.





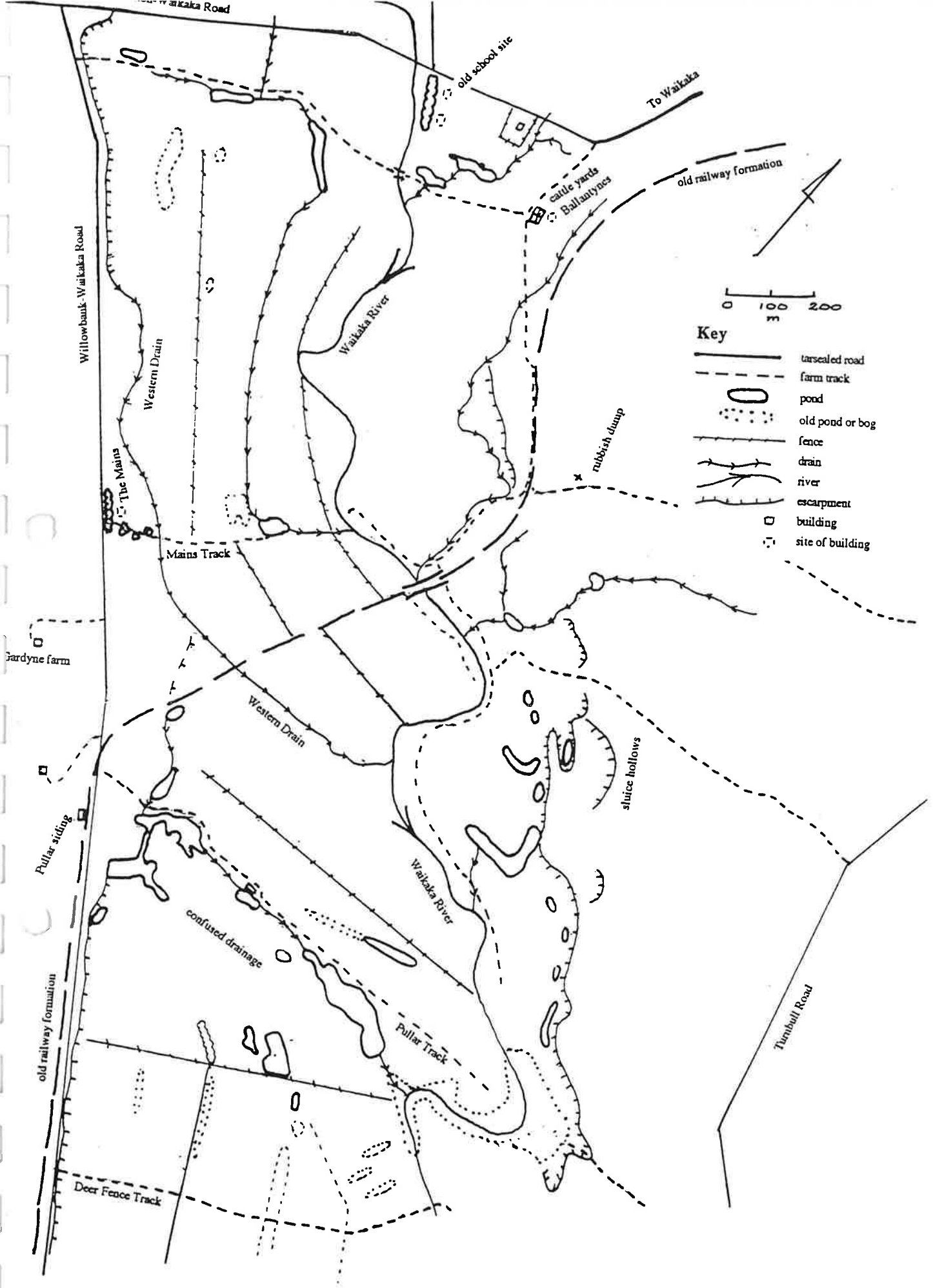


Figure 4. Sketch map of field evidence of dredge patterns shown by ponds and fence lines, based on a 1997 aerial photograph of Waikaka Valley





Figure 4a The remains of the Waikaka Branch Railway.  
 Left: the piles of the bridge crossing the Waikaka River.  
 Right: The partially bulldozed formation sweeping towards the eastern side of the valley and Waikaka township. It is crossing the Paterson Freehold Dredge No 1 workings with 1870s sluice hollows in the background. The Great Waikaka Water Race ran along the edge of the ridge above the sluice hollows.



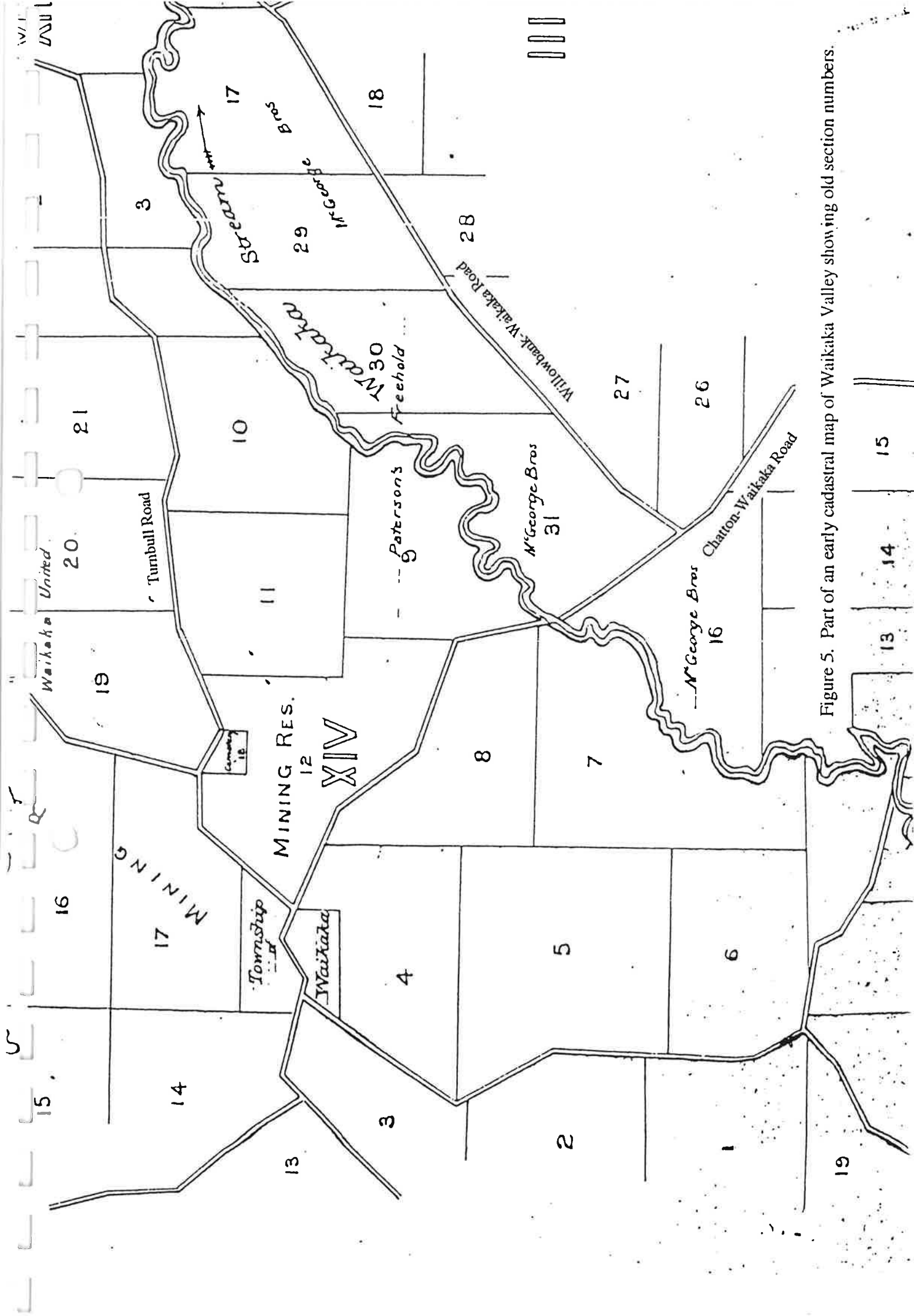


Figure 5. Part of an early cadastral map of Waikaka Valley showing old section numbers.

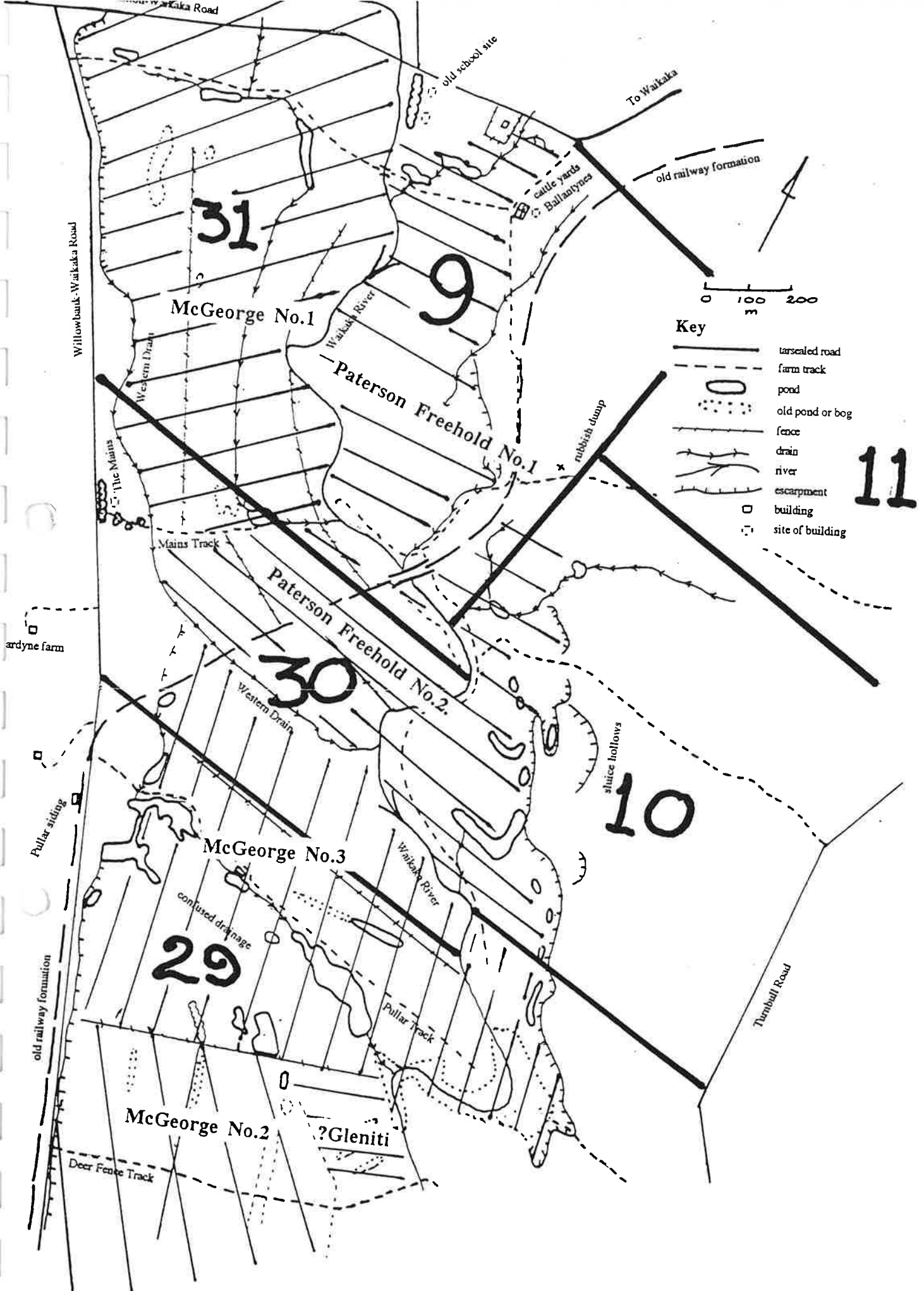


Figure 6. Old section boundaries and numbers superimposed on the sketch map of the field evidence (see Figure 4), with a best approximation of the working area of each dredge shown by oblique hatching. The boundaries between the dredges on the eastern side of the river could not be determined.



Figure 7 Part of a 1946 aerial photograph of the project area, showing ponds, drains and swales prior to bulldozing and intensive cultivation, except for the area just south of the railway line. Definition was clearer on the original copy.





Figure 8. Part of a 1997 aerial photograph of the project area, showing modern cultivation and crop marks of old ponds.



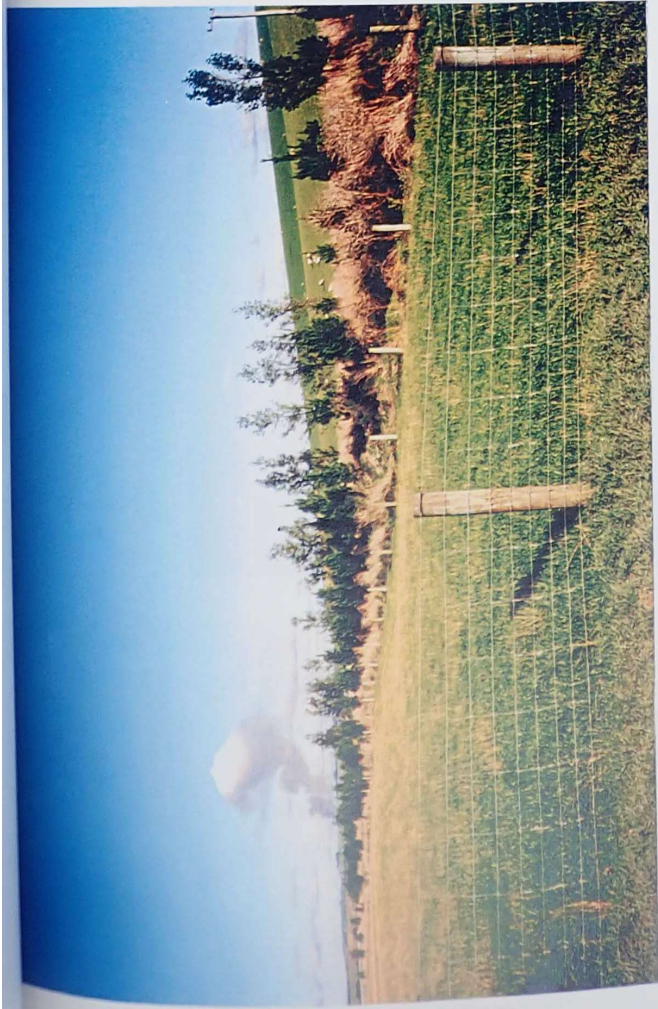


Figure 9. Upper left: the northern end of the Western Drain. Upper right: a pond on the southern boundary of the McGeorge No 1 Dredge workings. Lower left: trees at the old school site. Lower right: a pond left by Paterson Freehold Dredge No 1 just south of the old school site.





Figure 10. The eastern side of the Waikaka River.

Upper: looking north across the Paterson Freehold Dredge No 1 workings, showing the natural flood deposit blanketing the flat and visible in the drain.

Lower: looking south across the probable boundary of the two Paterson dredges near the distant willows.



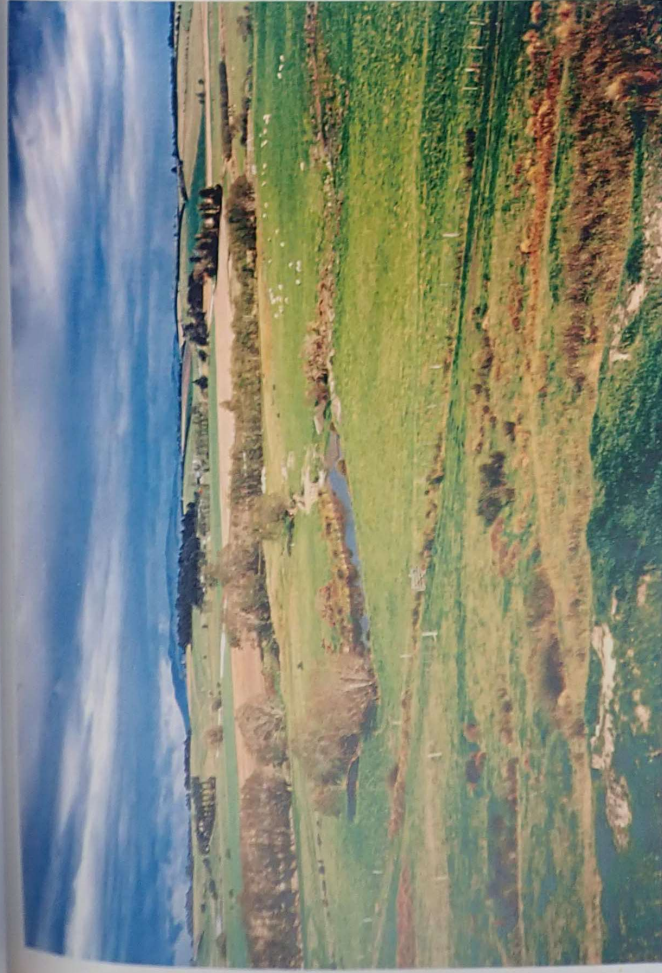


Figure 11. Upper: East of the Waikaka River and looking across and down Patersons Freehold.  
 Lower left: part of the large pond on McGeorge No.3 Dredge claim with an ambitious maimai.  
 Lower right: looking south along the scarp on the road edge south of Pullar siding, McGeorge No 3 claim.