

OLD TIP SITES IN HOBART: BENEFITS AND IMPACTS

by
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requirements of the degree of Master of
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DECLARATION

Except as stated herein, this thesis contains no material which has been accepted for the award of any degree or diploma in any university and, to the best of my knowledge contains no copy or paraphrase of material previously published or written by another person, except where due reference is made in the text.

M. Tamvakis

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ABSTRACT

Old tip sites are important features of the urban landscape. Through their study we can learn many things about the environmental impact of solid waste disposal, and the community's attitude towards waste and their environment. The history of solid waste disposal in Hobart is a fascinating one of filth, death, disease and local government politics. Solid waste disposal was once performed indiscriminately and without regard for human health or the environment. Changing attitudes saw the cessation of waste being thrown into the streets, the gradual development of supervised tips instead of dump sites and the increasing awareness of the re-use and recycling of waste as a viable option to landfill. Old tip sites today are an important part of the urban environment. They provide valuable open space and playgrounds for the people of Hobart. However, their environmental impact has not been examined to determine the extent of damage or whether there any damage has been done at all.

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CHAPTER ONE

INTRODUCTION

The old tip sites of Hobart provide valuable information on issues as diverse as public health reform, politics, economics, death, disease, environmental values, public perceptions of their own waste products and technological change. Old tips sites are storytellers of particular periods of time.

The importance of rubbish dumps has long been recognized by archaeologists. Valuable insights into the people and lifestyles of ancient civilizations have been gained from digs in rubbish dumps and graveyards. The significance of modern landfills has been recognized by an American group of archaeologists headed by Bill Rathje (Rathje 1991, Rathje et al. 1992). This group has excavated a number of modern tips and has made important discoveries concerning the lifestyle and consumption habits of US citizens during particular periods of time.

A study of old tip sites can also give scientific data on the decomposition rate of the waste, the production of leachate, stability of the waste and the production of gases. These are indicators of the performance of waste within a landfill according to the waste management practices used at each specific site, i.e. whether the waste was burned, compacted or covered over. Documented evidence and oral evidence from people who remember old tip sites first hand can be used to reinforce evidence collected from the sites themselves.

It is necessary to document Hobart's old tips. There is a lack of detailed documentation of the tips themselves and the issues surrounding their establishment, use, closure and redevelopment. This information must be collected urgently because once these tips have passed out of living memory and the little physical evidence that remains today disappears, this information will need to be pieced together from hazy jigsaws of the past. This thesis will focus on the disposal of solid wastes which are the main type of waste disposed of at tips.

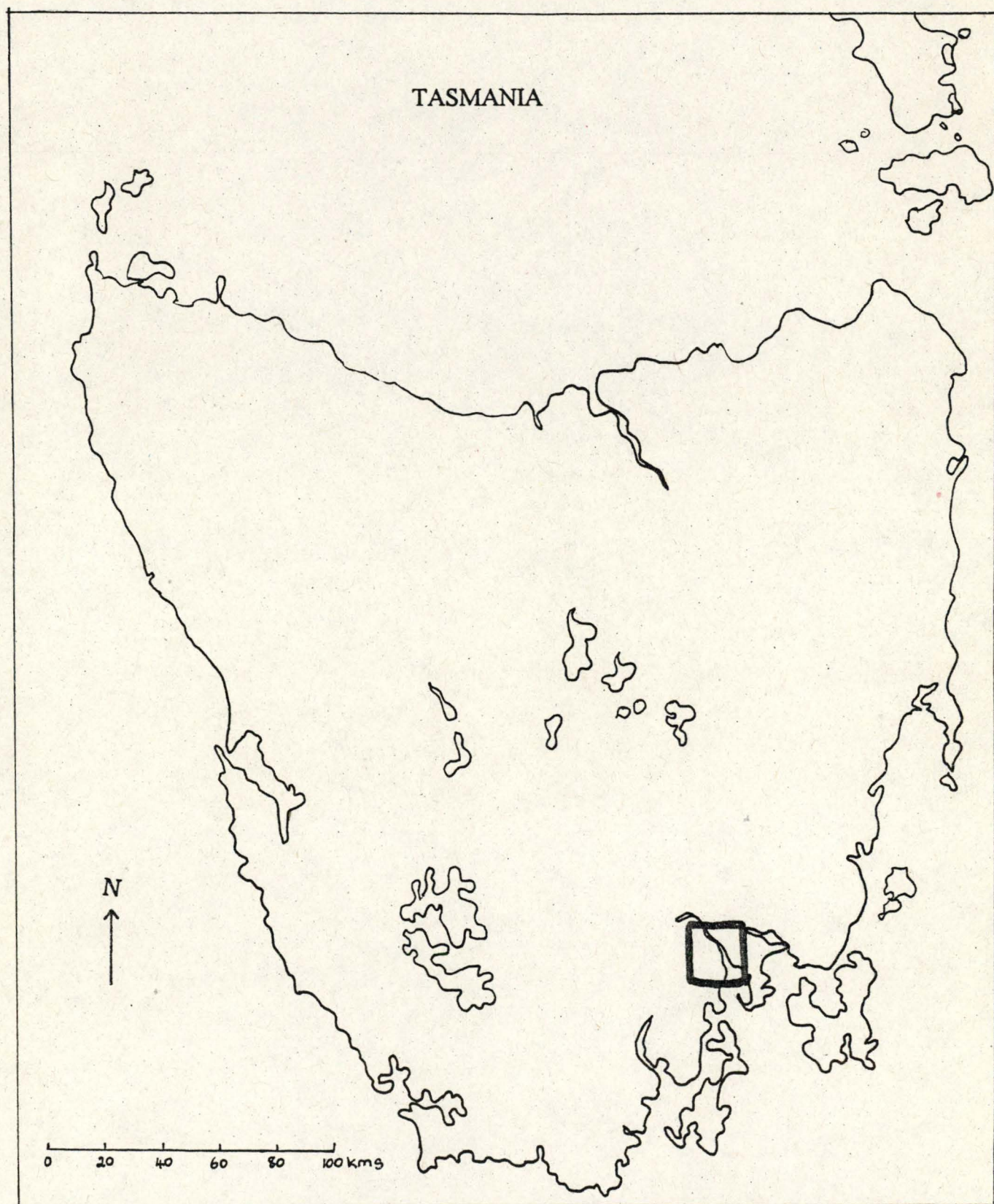
On the surface, there may be no interest in the tip sites except to the historian. However, these tip sites have much relevance for our understanding of the current perspectives of solid waste management, city planning and pollution control. These sites are able to show how Europeans settling in Hobart have created and perceived solid waste and the urban environment for the past 180 years. They provide clues as to the affluence as well as the resourcefulness of city dwellers and the progression of technological change throughout the period. Old tip sites reflect community attitudes towards their environment, their solid waste products and the rest of the community.

This study will look at the area which now lies under the jurisdiction of the Hobart, Glenorchy and Clarence City Councils (see Figures 1.1 and 1.2). The tips which have been examined are no longer used for waste disposal activities. Dumping ceased at the youngest tip dealt with in this study in 1988. Sixteen sites have been identified as either Council tips, reclamation areas or local rubbish dump sites. Most of the sites are now parks, playgrounds or open space. A few have been built upon and two are yet to be fully redeveloped. Each Council now has one tip which services their respective populations. These tips comprise of large areas within each municipality and are planned for long-term use (on average, for the next twenty years).

It was impossible, within the limitations of this study, to gather information about every single tip which appeared on vacant lots and the like, due to the expense, and the difficult and time-consuming nature of checking all land titles in the study area. This is complicated by the fact that not all tips which were in existence until about 1940 have been recorded. The main sources of information for before 1940 are Council minutes and newspaper reports. Unfortunately only complaints about certain tips would have been noted. There were few regulations guiding the management of solid wastes and tips. However, few tips would have escaped without complaints due to the haphazard nature of solid waste disposal in Hobart. Archival records then should represent a general if somewhat, sketchy picture of last century's major tip sites.

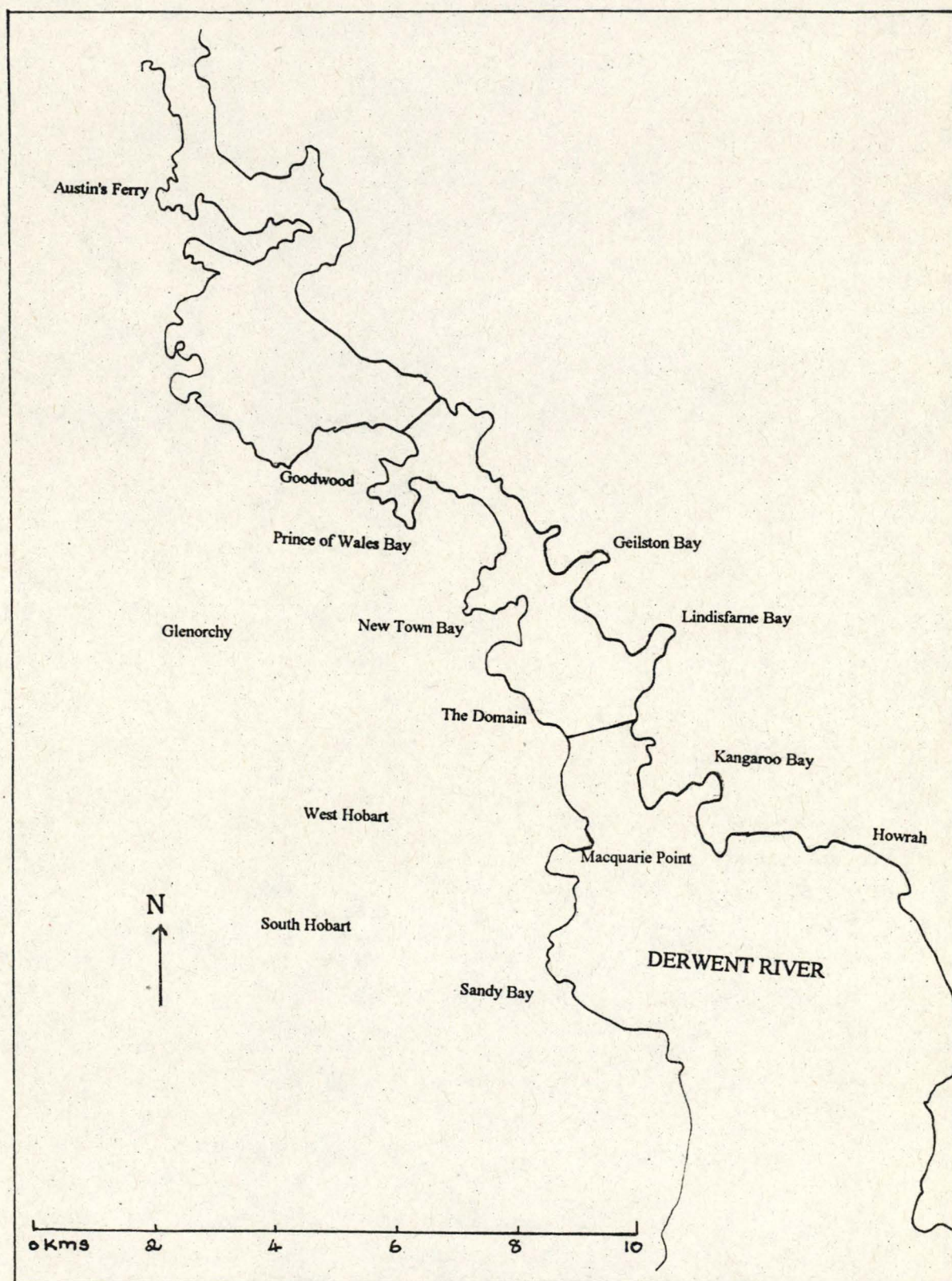
Research for this thesis was carried out in a number of ways. Anecdotal evidence and personal communication was relied upon to provide a background for the little recorded information which existed. Interviews with tip operators

Figure 1.1 - Location of Study Area



(Source: Department of Environment and Land Management)

Figure 1.2 - Location of Study Area



(Source: TASMAP 1:100 000 Topographic Survey)

provided essential information. It was even possible to speak to an elderly man who had been working on tips for all of his working life. Interviews with municipal officers such as engineers and town planners provided information as to the local authorities' attitudes towards old and current tips. Officers from the State Government provided information about the regulatory aspects of tips and an overview of general tip management in Tasmania. Members of the public assisted by answering questionnaires and newspaper advertisements about the tip sites which they could remember.

Due to lack of time and financial constraints, information on the environmental impacts of the sites were obtained through simple field observations. Impacts on groundwater were ascertained or estimated from inspections of local watercourses. The presence of landfill gases was evident in the younger tips by smelling the air which came out of vents and pipes. The surface of the site provided clues about how the waste had decomposed and settled. A study with greater resources would include borehole drilling to determine the thickness of the surface and waste fill, the ground conditions below the fill and groundwater samples. Seismic refraction traversing, laboratory testing and engineering analysis could also be performed (Kurzeme and Walker 1986:9). Monitoring of the site's settlement requires many years.

This study is relevant to the present system of solid waste disposal in Hobart. Looking at old tip sites shows the strengths and weaknesses of the present system of landfilling, including potential pollution and loss or gain of amenity and service to the community. Determining the environmental impact of these tips is very important. These sites may create hazards. Lessons can be learned from this type of waste disposal. Environmental and social impacts upon the city can also be determined.

On a practical level, the location and documentation of these sites will provide essential information for future land use purposes. When land use information becomes necessary, an easily accessible database documenting features of the site will avoid potential expenses and hazards. There have been many cases in Australia where unsuspecting redevelopments have taken place on contaminated land. Kingston, a suburb of Brisbane was built on top of an old tip site which was used for the illegal disposal of hazardous wastes. Part of a suburb in Melbourne was built on the site of an old tannery. A number of

houses have been built on old sheep and cattle dip sites around the country. The problems which result from inadequate monitoring, control and prevention of potentially contaminated sites cost local authorities and the people who have purchased the site dearly. The health of the people who live on, or around, contaminated sites can be adversely affected and the environment can be damaged, sometimes irreparably.

Documentation for purely historical value should not be overlooked. Discussion of the past use and current value of old tips can illustrate the importance of solid waste management today and the future of landfill as part of it. The following questions about old tip sites will provide a starting point for this examination: How successfully have old tip sites been transformed to their present use? What are the benefits which these sites have provided in the past? What benefits do they accrue to the present? Which sites have been rehabilitated most successfully?

This study looks at how historical information on tip sites can be used in today's situation. The major themes of this study revolve around the service provided to the community in the past and present as well as reflecting the major attitudes of municipal waste managers and the community throughout the twentieth century and the last half of the nineteenth century.

CHAPTER TWO

STORYTELLERS OF TIME

2.1 Colonial Hobart Town

It was not until the late 1830s that the problem of excess waste within Hobart became pronounced. There had been no documented evidence in Council minutes relating to any problems or complaints which may have been caused by the accumulation of solid wastes before 1830. Up until that time, either there were no adverse effects felt by citizens, or if there were any problems, they were tolerated and not reported. There may not have been any effective means for people to register complaints concerning health and environmental issues. It must be remembered that attitudes toward waste were very different from today and the structures we now take for granted did not exist.

All waste, human, animal and vegetable, was discharged into the streets, rivulets and blocks of vacant land. People scavenging for scraps helped to keep the waste in check and pigs were a common sight in the middle of the city until 1886 (Petrow 1984:34). However, with the sudden increase in population, and the subsequent increase in waste products, scavengers alone were not able to sufficiently control the flood of wastes which now appeared.

In the young colony, there was no regular collection and disposal of solid wastes by Council or private contractors. Human wastes (or nightsoil) was collected after 1887 when cesspits were outlawed and taken to a boat which would dispose of this waste in the Derwent (Petrow 1984:282). Rivulets and creeks were used as rubbish dumps and sewers for all manner of wastes. In 1843, the Hobart Rivulet was sanctioned by legislation to be used as a public sewer (Petrow 1984:292).

The problem of what to do with waste products was left with those who generated it: they could dispose of it how they pleased. Scavengers still provided the only form of waste collection. An 1886 report by the Engineering Inspector of the Central Board of Health, documented the "sanitary condition"

of Hobart. It stated that a small section in the centre of the city, presumably the business district, had some waste collected by the "scavenging department of the Council in return for special rates and regulations". Other houses and businesses in Hobart were not provided with any service at all. Ashes and dust were placed in backyards, streets and gutters. Animal and vegetable wastes were given to neighbours with pigs or cows or buried in backyards. If there were no such facilities, wastes were thrown out indiscriminately (Petrow 1984:269).

Hobart's population remained steady from settlement until the 1830s. The population of the town in 1830 stood at about 6000. By 1841, the population had grown to 14 602 and in 1891, it had reached 34 807 (Petrow 1984:12). In 1839-40, with the first dramatic increase in population, two epidemics hit the town: firstly, typhus and then scarlet fever in 1843 (Petrow 1984:12). Such outbreaks were caused by the neglect of public health and hygiene by the town's officials and its residents. The link between disease and filth was in its infancy, therefore, people were more tolerant of the proliferation of waste both within their own dwellings and in the streets. It is also apparent that there were no forums available to the community in which complaints could be registered, or addressed.

The amounts of waste around the city was reported in the *Mercury* of 10 October 1887. It was observed that "refuse was allowed to accumulate for years in backyards" (*Mercury* 10 October 1887). The major perception of wastes at this time is what Melosi (1980) has described as an "out of sight out of mind" mentality. The problem was thought to be solved as long as wastes were removed from "the immediate range of the senses" (Melosi 1980:14). However, the waste in Hobart could not even be put out of sight.

Such haphazard disposal of waste was largely ignored until it became a nuisance. Melosi tells of the predominant attitude of city dwellers towards waste in the American cities late last century, which can also be applied to the citizens of Hobart at this time. "Little attention was given to the hazards created by flushing raw sewage into the river, open burning of rubbish, or indiscriminate dumping of uncovered garbage on vacant lots" (Melosi 1980:14-15).

Historical accounts of the period show that Hobart's streets and waterways were in a dirty state. The rubbish which "was left to accumulate in backyards and vacant lots and the Rivulets were little more than open sewers" (Petrow 1984:292). The rivulets provided a quick and easy method of disposal as the wastes would eventually be flushed out to sea. Unfortunately, such flushing did not occur rapidly enough to cope with the volume of waste going in. The problem escalated in summer during times of infrequent rainfall.

In 1843, one observer noted that "dunghills, pigsties, neglected privies, stagnant water and other accumulations of offensive matters are everywhere to be seen and exert a most unfavourable influence on the public health" (Petrow 1984:12). Little or no attention was paid to the health concerns of citizens as illustrated with the amount of rubbish piling up in the street and vacant lots as well as the unsanitary practices at the tip sites themselves. Melosi points out that it was not until the middle of the nineteenth century that a direct link was made between infectious diseases and unattended waste. It was made only in the late nineteenth and early twentieth centuries and revolutionized public health (Melosi 1980:110-111). The state of Hobart at the time would have shocked an observer from the present. Health reform since that time has dramatically changed the way in which wastes are collected and disposed.

2.2 A History of Dirty Politics and Dirty Streets

By the 1890s, Hobart's urban environment had deteriorated so much that the rivulets were no longer flowing with clean water. As a result, pure water became scarce and expensive for the poor people of the town, most notably those living in Wapping, an area which would now lie between Macquarie, Campbell and Liverpool Streets (see Figure 2.1) and who would have relied very heavily on the Hobart Rivulet's water supply. Petrow has documented that "those who could not afford to buy fresh water were forced to use the foul water of the Town Creek for washing and drinking" (Petrow 1984:12).

Once the stench and filth became too much for citizens to bear, the situation could no longer be ignored. After much deliberation by the aldermen of the Council, The *Hobart Town Improvement Act 1857* was introduced in an

Figure 2.1 - Map of Wapping

Wapping and environs c. 1840.



(Wapping Historical Group 1988:28)

attempt to address the city's mounting waste problems. This Act empowered the Council to "pave, cleanse and drain their city" (Petrow 1984:13). The terms of reference are vague and no major changes resulted from this Act. Problems were nowhere near being solved or even adequately controlled. Petrow argues that this is because the aldermen "accepted the principal of refuse removal but were chary of any scheme that would increase rates" (Petrow 1984:271).

The waste removal service which occurred in central Hobart was initiated by the Council. However the properties in the centre of the city were owned by the largest ratepayers who could afford the cost of waste removal (Petrow 1984:271-2). It appears that Council politics and personal gain dominated all of the decisions made by the Council in relation to waste management. In particular, the Council was loath to provide a service which would reduce the amount of rates which they were receiving or force an increase in rates. The flushing of water closets directly into the Hobart Rivulet allowed to continue despite outbreaks of typhus among people who were using water from the Rivulet for bathing and drinking because a few Alderman had their own water closets flushing into the Rivulet. Water closets were preferred, by those who could afford them, to the nightsoil cart collection system (Petrow 1984:295-96).

Indeed, as Melosi argues, "few sanitary authorities operated without overt political interference" because "a large proportion of the boards of health were dominated by city officials rather than by physicians or sanitarians" (Melosi 1984:110). As a result these sanitary authorities were unable to provide daily or periodic improvements of the town's health conditions; "they could merely react to cataclysmic events such as epidemics - and not very well in those cases" (Petrow 1984:112).

A good example of political and economic interests overriding public health interests is that of a tip which was on a block of land owned by one of the aldermen of the Hobart Council. It was located in a block running parallel with Elizabeth Street, between Warwick and Patrick Streets near Bishops court on the Wellington rivulet (see Figure 2.2). The area consisted of a large, stagnant pool with a tip above it. It was alleged that the Council knew about the formation of the tip but took no action to control or close it down. It was

Figure 2.2 - Location of illegal dump site owned by Alderman Dillon



SCALE 1:5000
1 millimetre represents 5 metres



(Source: TASMAT 1:5000 Orthophoto Map Series)

described by the *Tasmanian News* as a place which contained "all kinds of rubbish and abominations in large, irregular heaps, whilst between the heaps stood filthy pools" (*Tasmanian News* 21 May 1895).

People who lived in shanties close to this tip constantly complained to the Council but to no avail. In September 1894, the City Inspector recommended that the area be drained, but his advice was disregarded by the Council (*Tasmanian News* 21 May 1895). The owner, Alderman Dillon, wanted to reclaim the swamp by filling it with rubbish, then persuade the Council to drain the land so that he could redevelop the site to erect some buildings. The land was eventually drained by Council at the ratepayer's expense (Petrow 1984:274-5). Alderman Dillon's notion to fill in and reclaim swamps and/or derelict land with solid wastes is the first example of its type in Hobart. His idea reflects those of many city engineers and town planners who used solid waste to fill in bays and quarries around Hobart in later years. However, this area was an unsupervised dump. It was not managed to prevent any nuisance or health problems from occurring. The loss of amenity and threat to health posed by this dump to neighbouring residents was ignored. Petrow argues that the Dillon case is one of many examples where Aldermen used their position for personal gain (Petrow 1984:275).

The nuisance caused by the accumulation of waste was tolerated to a large extent by many people. The stench and loss of amenity did not seem to bother citizens. Rubbish and raw sewage in the Hobart Rivulet, for example, was tolerated until people's health was being affected directly. Incineration was suggested as the best way to deal with the large volumes of solid waste. In 1893, one of the first papers released by the Sanitary Association advocated the use of a "refuse destructor". Dr. Hardy, the author, wrote that "the principle of destruction of rubbish by fire had been recognized by sanitary engineers and others as being the only solution to the refuse problem" (Petrow 1984:280). The print media also favoured incineration and advocated the purchase of a destructor by Council (Petrow 1984:282). The general feeling amongst city engineers, aldermen and the general public was to get solid wastes "out of sight and out of mind". They believed that incineration provided a quick and easy answer to reduce the piles of waste accumulating in the city. However, there was no mention made of the potential air pollution that this might cause.

Stop-gap measures were made in an attempt to address the problem of filth at the turn of the century. These were mainly to set rat traps near sewers, rivulets, public buildings, the slaughter yard and the tips. Poison, in the form of sulphur, was also laid near these places (Petrow 1984:277). Such actions served only to attack the visible problem associated with inadequate disposal and treatment of wastes. The problem persisted. The Secretary of the Health and Sanitary Committee in 1901, wrote to the Commissioner of Police "drawing attention to heaps of rubbish tipped in various parts of the city contrary to the (Hobart Town Improvement) Act" (Hobart City Council Health and Sanitary Committee Minutes (HCCHSC) June 1901 to June 1905:16).

More attempts were made to clean up the city in 1903. The practice of water closets draining directly into the rivulets was halted. However, the rivulets remained "a convenient receptacle for other kinds of pollutants" (Petrow 1984:301). Presumably these pollutants consisted of household refuse, waste water and industry waste (for example, effluent from the tannery in South Hobart). The management of solid waste was now a burning issue as the accumulation of waste on the streets and in the Rivulets was no longer being tolerated.

2.3 Tip Sites: 1830-1930

The main tip sites which have been documented through searches of Council records and interviews for the period between 1830 and 1930 are located:

- *at the end of Hunter Street (Macquarie Point), behind the slaughter yard which was located in the Wharf area,
- *at Quarry Street in West Hobart and an adjoining piece of land known as Baker's Pond (now known as John Doggett Park),
- *at the northern end of Campbell Street (now the Campbell Street Primary School's oval),
- *adjacent to the golf links at Queenborough (now the Queenborough Ovals),

- * at private property in Fitzroy Crescent and
- * at private property on the corner of Grace and York Streets, Sandy Bay.
- * at Kangaroo Bay

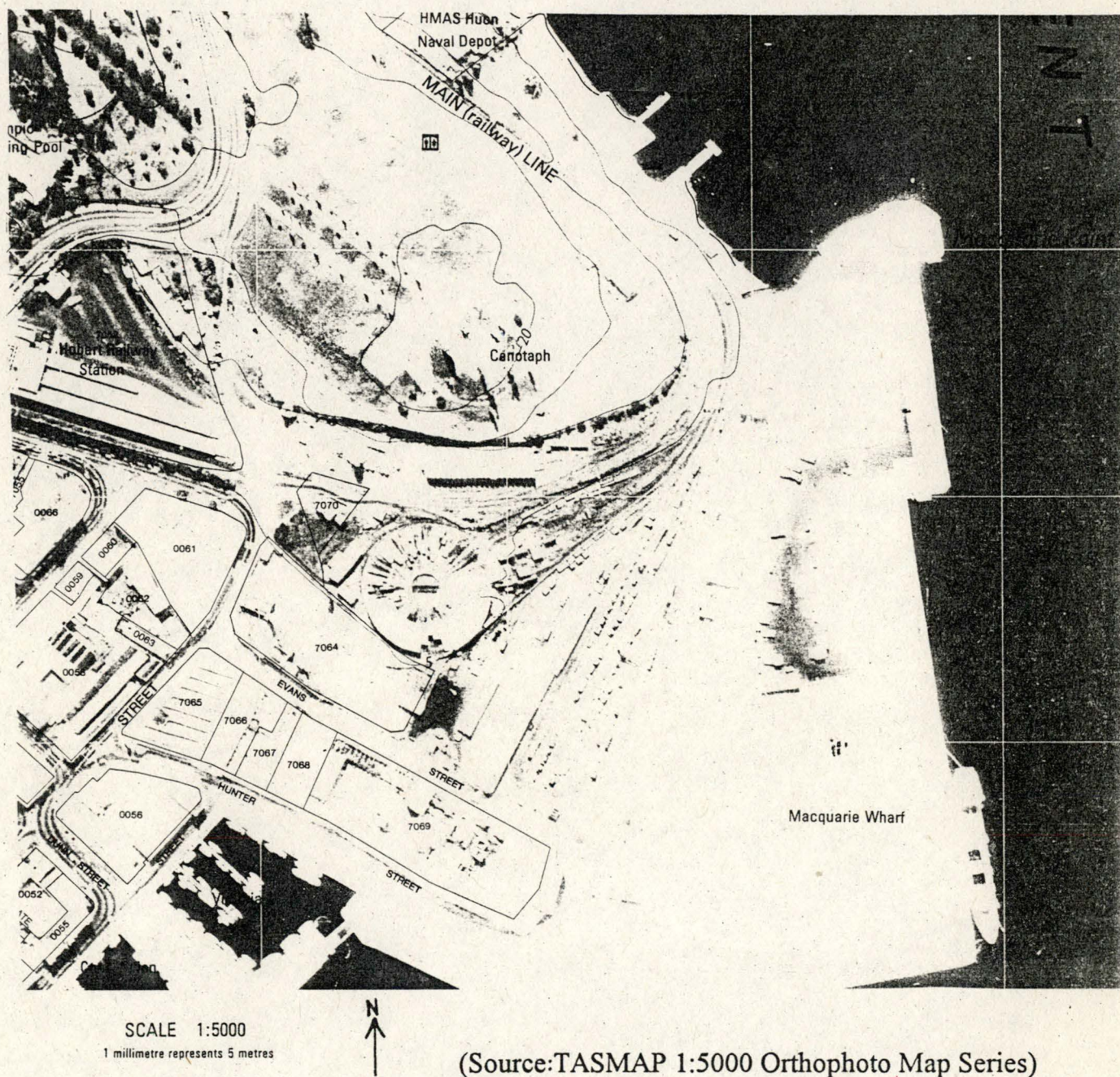
These were the main areas in which large amounts of waste were dumped. It can be assumed that other areas in which smaller amounts were deposited existed at this time and even up until the 1950s and 1960s.

2.3.1 Macquarie Point Tip Site

The tip at the end of Hunter Street occupied land owned by the Marine Board (see Figure 2.3). It was a convenient location for the surrounding industries to dispose of their waste. These industries included the gas works, railway yards, the Jones and Company jam factory, the slaughter yard and other industries associated with the wharf area such as ship maintenance. The stench of the tip was reported to the Health and Sanitary Committee in 1910, who later inspected the area and found a "trench opened by the Railway Department which was causing an offensive smell" (HCCHSC Minutes June 1905-December 1910). The tip caused many problems for the Wapping community. The area was seen as "a convenient backyard and dumping ground for the Hobart City Corporation which had, with the establishment of municipal government, inherited the problems of rivulet misuse, sanitary and garbage disposal and noxious trades left unsolved by the colonial administration" (Wapping Historical Group 1988:65).

The waste being deposited at the end of Hunter Street, was part of the Marine Board's plan for reclaiming the area to provide more wharf space. Putrescible wastes such as vegetable processing waste and animal carcasses were left to rot in the open air instead of being buried or covered over with ashes, sawdust, or other rubbish or burying them. This created problems such as vermin and extremely strong odours which affected people in other parts of the city. A good example of this is that of a comment made by the Medical Officer of Health in 1934; "I believe that Government House have to keep their southerly windows closed when the wind is from that direction" in order to avoid the

Figure 2.3 - Map of Macquarie Point tip site



stench which emanated from the Hunter Street site (HCCHSC Minutes 21 May 1934).

The Marine Board owned the land on which the tip was located. The Hobart Council was in charge of the tip and paid some of the wages of the men who worked there (HCCHSC Minutes 21 May 1934). In 1917, the Council requested more space at the tip. The problems of odour and vermin, however, were still apparent. Tipping practices were changed in an effort to minimize these problems. The Council's answer to the problem was to incinerate waste at the tip. This was seen as the only effective solution to the city's growing waste problem. All efforts were made to purchase a refuse destructor which was thought by engineers and city officials to be a revolution for modern waste management practices. "To many engineers and sanitarians, the introduction of the incinerator harkened a new day for refuse disposal. Regulated disposal by fire seemed to be the technological panacea to a monumental problem" (Melosi 1980:114). The focus of waste disposal reform was placed on reducing the amount of rubbish after disposal rather than concentrating on other methods which are widely used today such as sanitary landfilling, reduction of waste at source, re-using and recycling.

The Macquarie Point site operated until about 1938. The problems associated with the tip in the early 1920s persisted until that time. It seems that the Council was unable or did not attempt to abate the nuisances caused by the tipping of waste as well as the air pollution emitted by the destructor. In 1932, a complaint from Trades Hall Council drew attention to "carcasses of animals etc. at high water which float over the barricade (the reclamation wall) and lodge along the river foreshore; the stench with an up wind being beyond description" (HCCHSC Minutes 6 April 1932:77). There were not enough men working there to deal with this problem. There would often be a load of rotten meat or fish dumped after hours and left uncovered until someone was able to attend to it (HCCHSC Minutes 13 March 1933:12). The above description probably provides a good example of the condition of most tips around Hobart at the time.

It seems that the Hobart Council and the Marine Board were at odds with each other concerning the proper management of the Macquarie Point site. In 1933, in an attempt to minimize the health risks caused by the tip, the Health

Department appealed to the Marine Board to assist the Council to improve their tipping procedures and fix some problems. The Marine Board blamed the Council for the nuisance caused by the tip and did not appear to take any further action to help improve conditions. After this conference, the Council attempted to cover putrescible rubbish with cover material such as ashes from the Gasworks or Zinc Company or overburden from the Domain quarry (5 April 1933 Memo from Town Clerk to Chair and Members of the Health Committee). There were still problems resulting from decaying rubbish however. The Health and Sanitary Committee noted the problem of offensive smelling, stagnant water at low tide around the tip and "dark, evil smelling decaying sludge round the edges and among the rocks" (HCCHSC Minutes 21 May 1934:51).

By the end of 1935, tipping operations were slowing down at Macquarie Point and the Council was looking for a new location for the next municipal tip. During the time the Macquarie Point tip was operating, the Council was involved with other tip sites. Two of these sites were on public land and were the sources of complaint from surrounding residents for many years. Figures 2.4 and 2.5 show how the Macquarie Point tip site looks today.

2.3.2 Quarry Street and Baker's Pond

The Quarry Street site and an adjoining piece of land known as Baker's Pond (now known as John Doggett Park in West Hobart) was a large publicly owned piece of land used as a tip (see Figure 2.6). It was not part of the Council's formal waste disposal plan but the Council deposited street sweepings there regularly. The site was originally a quarry but by 1902 the site was a well established tip. The Health Officer reported on the bad state of the tip and ordered 15 bushels of lime to be slacked and spread over the rubbish (HCCHSC Minutes 27 February 1902:31). Due to its proximity to small business and residential area of West Hobart, the site was a convenient place for local businesses and residents to dispose of their rubbish. After being notified of the condition of the site by the Health Officer, the Council put up a sign forbidding the disposal of rubbish there by the public.

Figures 2.4 and 2.5 - Photographs of the Macquarie Point tip site , 1994.

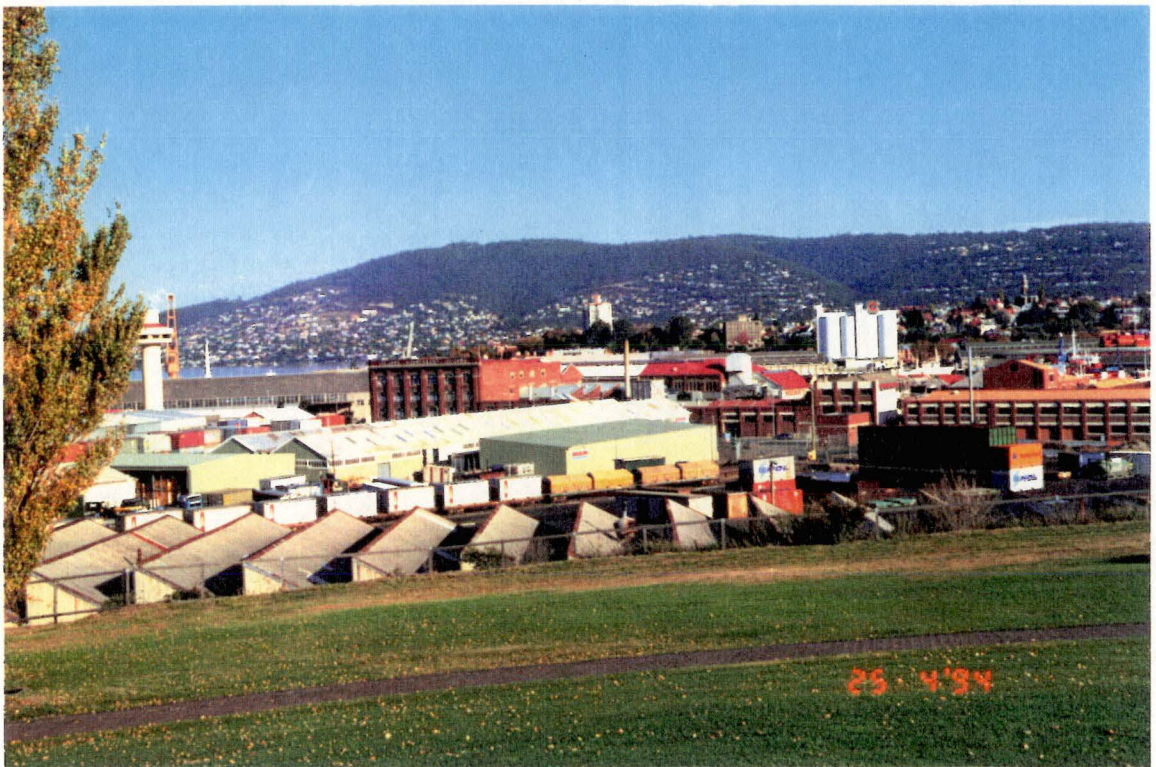


Figure 2.6 - Location of Baker's Pond and Quarry Street tip sites



(Source: TASMAP 1:5000 Orthophoto Map Series)

A petition from residents adjoining Baker's Pond was received by the Health and Sanitary Committee in June 1930. The petition requested the closure of the tip due to the nuisance caused and the health concerns of residents. There was no regular supervision of this tip by Council as there was at the Macquarie Street site. It was reported that private contractors disposed of all of their waste on the site without any controls. Children were able to get over the fence or through the gates, which were often kept open, and light fires (HCCHSC Minutes 11 June 1930:58-9). It seems that no action was taken by the Council to address these problems because in November 1930, the Lansdowne Crescent State School Parents Association requested the Council to fix the fence surrounding the tip. This and another complaint prompted an inspection by the City Engineer. He reported that he found "a couple of dead cats and fowls and some fish offal on the site. He also reported that it was difficult to stop people from throwing refuse over the fence (HCCHSC Minutes 19 November 1930).

The tip, still operating in 1934, was praised by the City Engineer despite more complaints from local residents. He acknowledged that the tip was "ugly to look at but could not be seen unless one walked to the edge". He reported that the "chief deposits were street sweepings, spoil from new buildings, garden rubbish and old tins". He admitted that "as happens at all unattended tips, household refuse and dead animals were occasionally dumped there but were covered with earth by the attendant on his next visit" (HCCHSC Minutes 25 June 1934:67). The attendant apparently visited twice a week which would not have been sufficient to minimize the smell emitting from rotting materials.

In the same report, the City Engineer described the value of the tip and others like it.

The tip served a useful purpose as it was a convenient place for residents of West Hobart to dispose of waste materials: an unsightly hole was being filled up and a valuable piece of land would be available to citizens on completion (HCCHSC Minutes 25 June 1934:67).

Despite the problems associated with tips of this sort, it was the only place residents could dispose of their wastes quickly and cheaply as there were no

private contractors collecting rubbish in the area at that time. The alternative was to take all rubbish to the Macquarie Point tip which would have been a long and expensive trip for many of the people living in West Hobart. Eventually, the site did provide valuable open space for surrounding residents. Today, the site is a well-used park and playground with excellent facilities. It could be argued that most of the other tip sites around Hobart have evolved in this way. What was once an unsightly rubbish dump is now an attractive park, playground or open space (see Figures 2.7 and 2.8).

2.3.3 The Campbell Street site and the Refuse Destructor

The Campbell Street site, which was used as a tip in the first two decades of the twentieth century, is now the Campbell Street Primary School's oval (see Figure 2.8). It was a disused cemetery before the tip was established (Pearce 1992:93). In 1910, the Council ordered all wastes here to be covered. In the 1918, a "refuse destructor" was purchased by the Council. It was a *Fryer's Destructor*, which was first built by Alfred Fryer in Manchester in 1876. It was the first municipal waste incinerator ever built and began the large-scale use of incinerators throughout England. Its success quickly spread to the United States (Melosi 1980:114). By 1922, the destructor was operating on the North Hobart site.

Unfortunately, incineration did not provide a quick and easy solution to Hobart's waste disposal problems. While the volume of waste was being successfully reduced to ashes and clinker which could be re-used, the resulting air pollution caused immense problems to surrounding areas. After only a few months of operation, the City Engineer recommended that fruit pulp from the jam factory not be put through the destructor, as many complaints had been received about the "smell, smoke, fumes, dust and soot ejected" from the destructor (HCCHSC Minutes 7 March 1922). The pollution from the destructor reached as far as Park Street near the Domain and Mt. Stuart. The Council received complaints from a number of residents in that area as well as from the warden of Christ College, which was located on the Domain.

Figures 2.7 and 2.8 - Photographs of John Doggett Park



Figure 2.9 - Location of the Campbell Street Primary School Oval



SCALE 1:5000
1 millimetre represents 5 metres

(Source: TASMAP 1:5000 Orthophoto Map Series)

There were two explosions at the destructor in April and May 1924, raising concerns about its safety. However, its use continued and the Council's enthusiasm for waste incineration did not wane. The Medical Officer of Health in 1926, was still praising incineration as an alternative to tips. He report that the Macquarie Point tip was "insanitary and obsolete, a breeding ground for rats, disease and foul odours". He argued that "it had long been recognized amongst Health Authorities that the proper and economically sound method of dealing with garbage was by burning, the by-products at the same time being productive" (HCCHSC Minutes 16 August 1926:42).

The destructor was phased out in the late 1920's. In 1935, the Medical Officer of Health proposed to reinstate the destructor. His argument against the tipping of solid wastes was as follows:

Tipping is cheaper and reclaims land but is the cause of frequent complaints from bad odours, and undoubtedly breeds rats and disease, and the land reclaimed is not savoury for many years. I myself have seen trenches dug in reclaimed areas in Victoria, and the vapours were so bad that the workmen had to wear gas masks - even after fifteen to twenty years, cross sections showed, that the refuse had not disappeared even fifteen feet from the surface (Memo to the Town Clerk 21 November 1935).

His statement illustrated the dominant mode of thought amongst civil engineers and health authorities at the time towards incineration of municipal refuse. It is also an early description of the way a landfill decomposes, a topic which will be pursued in other chapters. The site is now the Campbell Street Primary School's oval (see Figure 2.10).

2.3.4 Queenborough Ovals

In 1908, complaints were received about land at Queenborough being used for the disposal of sludge from septic tanks (HCCHSC 14 May 1908:215). Household wastes from surrounding residents were probably disposed of on

Figure 2.10 - Campbell Street Primary School Oval



the site from 1908 until 1914. There have been only a few complaints recorded about this site. It could be argued that it was managed satisfactorily by the people who used the site (wastes may have been covered). Alternatively, the surrounding residents may not have complained about any resulting nuisance because they were using the site themselves. The site now has two levels of playing fields. The upper oval is used for Australian Rules football and the lower level is a hockey ground (see Figures 2.11).

2.3.5 Kangaroo Bay

A tip located on the eastern shore of Hobart at Kangaroo Bay was first documented in the Clarence Council minutes of 1922 (see Figure 2.12). Before that time, complaints of rubbish on the sides of roads were documented in Council minutes in 1909, 1910 and 1911 (Clarence Municipal Council Minutes 1 Feb. 1909, 28 Feb. 1909, 6 Feb. 1911). The area was firstly used as an illegal dump site for solid wastes and then officially opened by the Council in 1915 (Clarence Municipal Council Minutes 12 April 1915). It was cleaned up by the Council in 1927 and signs were erected to prohibit further dumping on the site. The problem of rubbish dumping on the foreshores was documented in Council minutes in 1926 and 1928. This may have resulted from a number of small tips emerging on the Kangaroo Bay foreshore and Bellerive and Howrah beaches. Council minutes show in 1929 that the "sanitary area extended to Wentworth Street instead of River Street (Clarence Municipal Council Minutes 1 October 1929).

In 1948-9, rubbish was again being tipped at Kangaroo Bay. This was undertaken as a reclamation works. A rock wall was built in 1970 to contain the waste. Tipping continued until 1975 "in response to a need for car parking space with the collapse of the Tasman Bridge and increased use of the ferry service" (Wood 1985: 20). Wood has pointed out that leachate from this landfill may be contributing to the pollution of the Bay. He has identified a "black odorous sludge" which covered divers as they emerged from the water. This substances, "it is suspected, comprises decaying matter resulting from septic effluent, putrescible leachate and siltation" (Wood 1985:21).

Figure 2.11 - Hockey Grounds, Queenborough

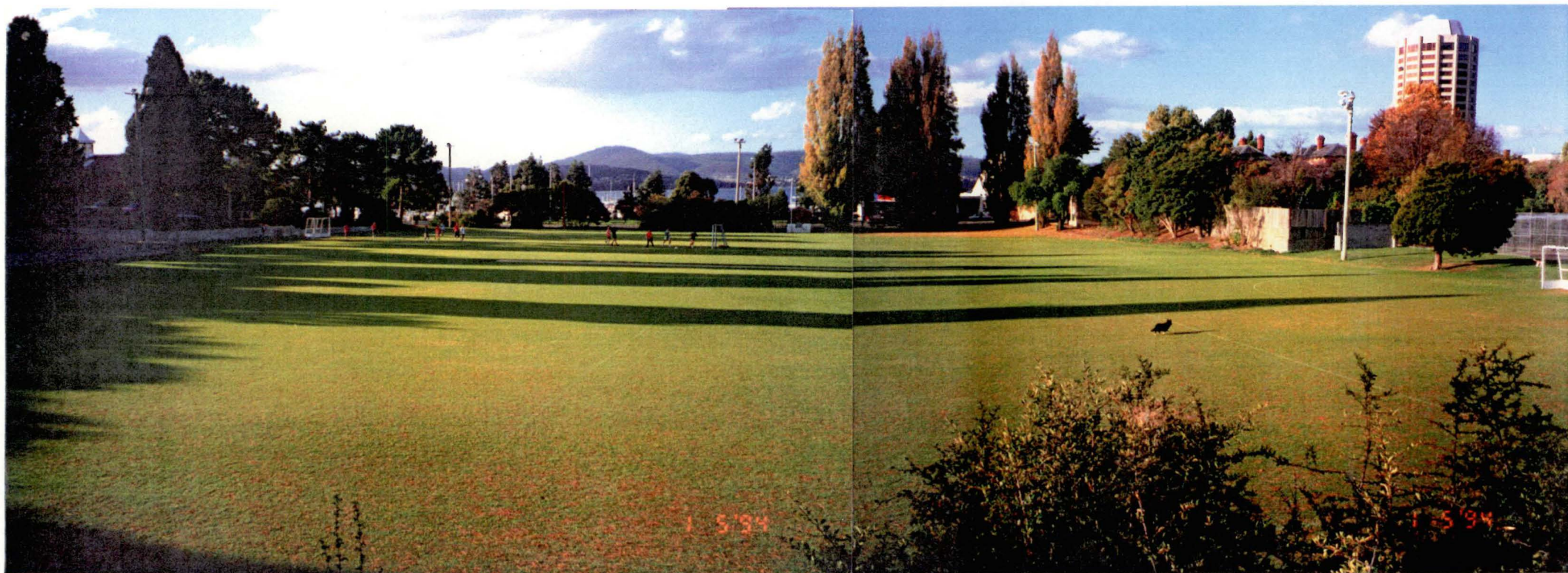
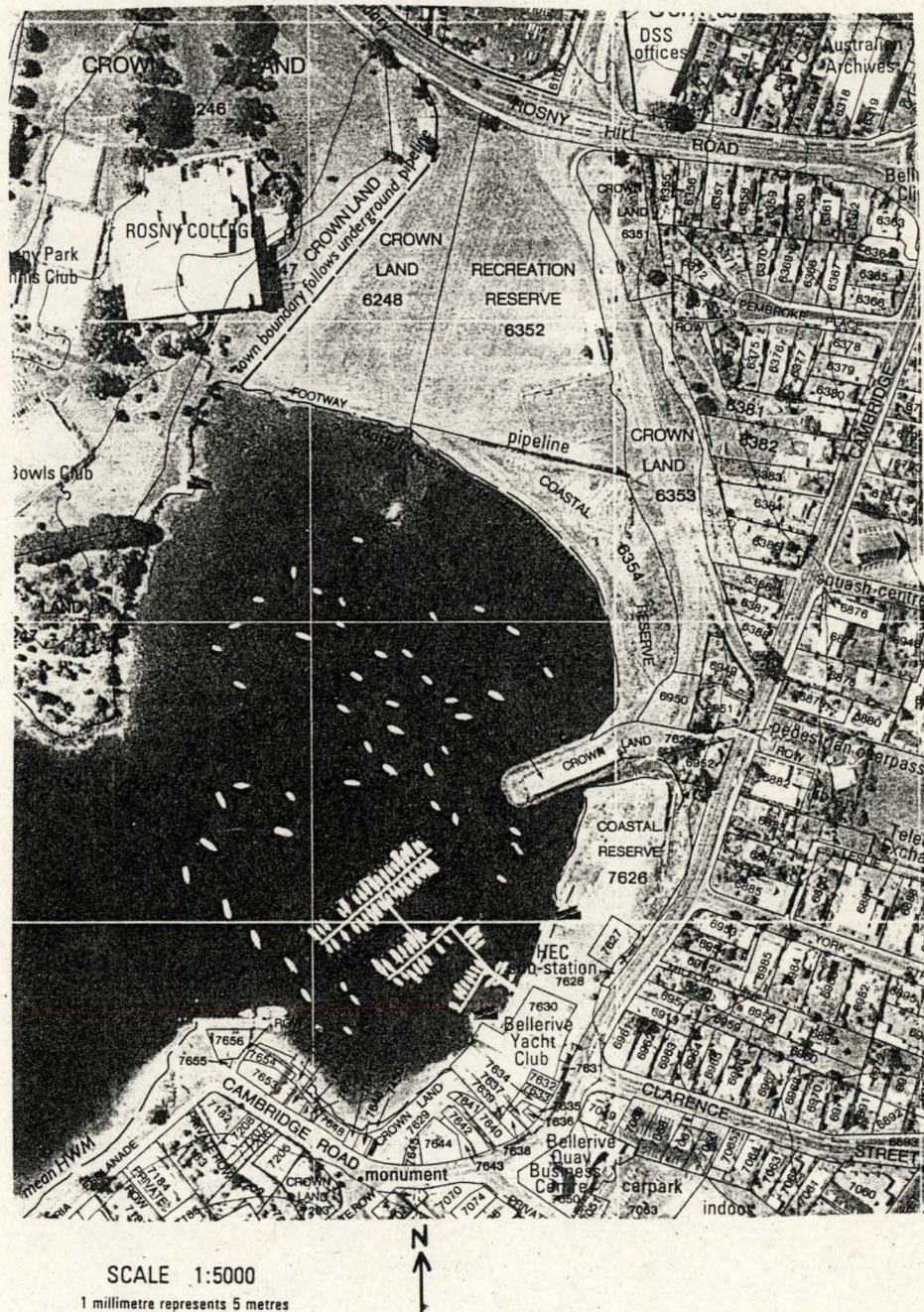


Figure 2.12 - Location of Kangaroo Bay



(Source:TASMAP 1:5000 Orthophoto Map Series)

The area was redeveloped into a park by the Council with the help of local community groups. More landfilling was undertaken for this redevelopment (Wood 1985:22). Figure 2.13 shows how the site looks today.

2.3.6 Tips on Private Property

There was a property at Fitzroy Crescent, owned by an S. Linton, which was used as a tip (see Figure 2.14). The first complaints received by the Health Committee about this site was about an unsewered stable. It was reported that 20 loads of manure were dumped there. The owner was subsequently prosecuted in 1916 for having too much manure on the property. No more complaints were recorded for this site. It can be assumed that the tip continued for a short time and the site was redeveloped into housing and part of Fitzroy Park.

The second private tip was located on the corner of Grace and York Streets in Sandy Bay (see Figure 2.15). The site was owned by George Cheverton and adjoined the Sandy Bay Golf Links. The Golf Links Progress Association in 1923, complained of the rats breeding there and the regular burning of rubbish and the smoke nuisance which resulted. Letters were sent by the Council to the owner to fence the site and cease the tipping of wastes. The Council's requests were not heeded and the complaints continued. The tip was closed after 1935 and the land was used for housing development. The site is now completely redeveloped (see Figure 2.16).

Figure 2.13 - Kangaroo Bay Reserve

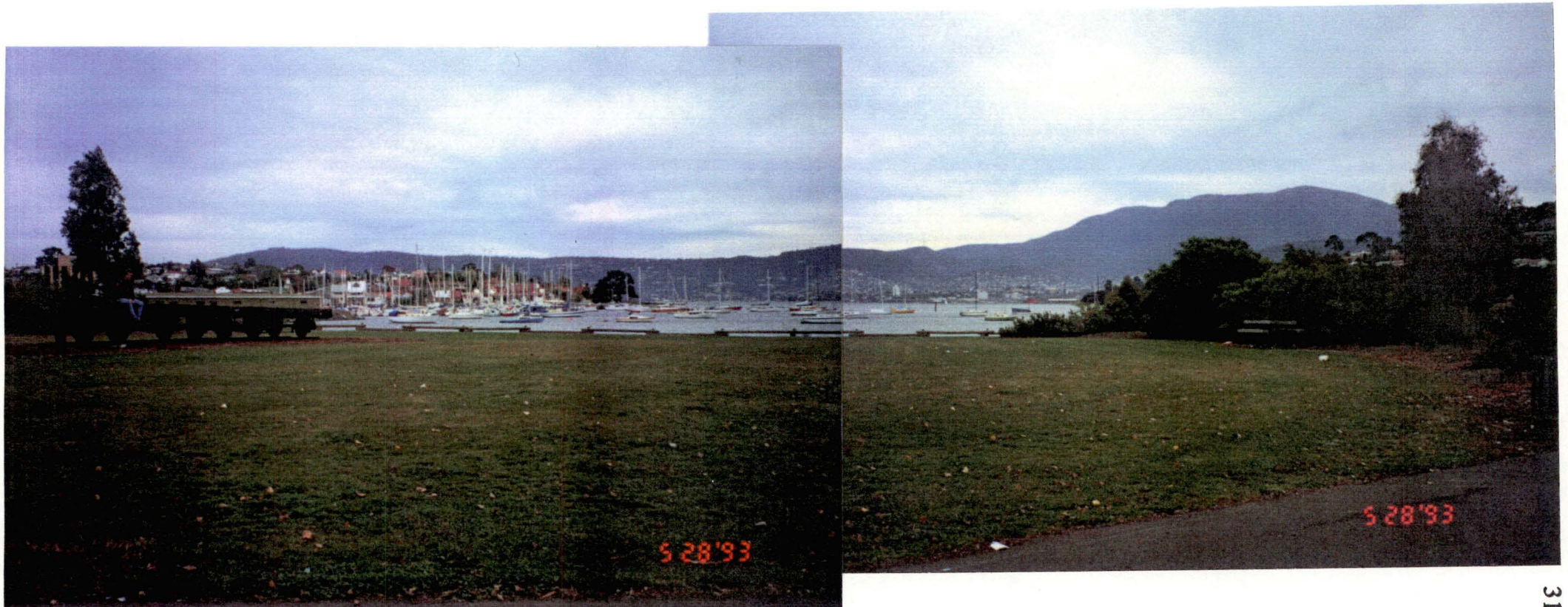


Figure 2.14 - Location of site near Fitzroy Place



SCALE 1:5000
1 millimetre represents 5 metres

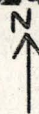


(Source: TASMAP 1:5000 Orthophoto Map Series)

Figure 2.15 - Location of Grace and York Streets, Sandy Bay.



SCALE 1:5000
1 millimetre represents 5 metres



(Source TASMAT 1:5000 Orthophoto Map Series)

Figure 2.16 - Corner of Grace and York Streets, Sandy Bay.



2.4 Lessons learnt from Colonial Hobart Town

These tips illustrate many facts about the early management (or lack thereof) of waste in Hobart from settlement until the late 1930s.

1. Soon after the settlement of Hobart Town, solid waste was indiscriminately disposed of in backyards, streets, rivulets and vacant land.
2. The main tip which was run by the Hobart Town Corporation at Macquarie Point was a large project designed to reclaim land around the wharf area. Tips were used in this way until the 1960s.
3. Other sites which became tips were seen as waste land, such as swamps and quarries which were filled with refuse to enable future redevelopment.
4. Incineration (in the form of the *Refuse Destructor* or the burning of smaller tips) was believed to be an easy way to reduce the volume of rubbish, kill any vermin and get rid of odours.
5. Solid waste products were not appropriately disposed of at tip sites to minimize odours from rotting materials, leaching or escape of wastes and decomposing material to surrounding areas and the risk of disease.

CHAPTER THREE

TIP SITES IN HOBART 1930s-1960s

3.1 Waste Management Practices 1930-1970.

Waste management practices after the 1930s in Hobart changed slowly from earlier years. This particular period in the history of solid waste management in Hobart marked the beginnings of a more co-ordinated effort to control the disposal of the city's garbage. The most important effect upon the nature of waste management was the establishment of a regular collection service for solid wastes in the city. Up until that time, the community had to deal with its solid waste in any manner they were able. The large Council-run tips if used at all, were a small part of what is now recognized as effective and efficient waste management. There were no dramatic changes in waste management practices between 1900 and 1960. Changes were made very slowly.

A regular rubbish collection service began in the central business district of Hobart in the 1920s. The Hobart Corporation was only willing to provide a service to those who were able to pay. In the suburbs and poorer areas of the city such as Wapping, residents were left to their own devices, within the guidelines of the Hobart Corporation Act. In 1941, a Council report showed that residents in Strickland Avenue were burying wastes in their backyard or throwing them in the rivulet (HCCHSC Minutes 21 April 1941).

The period from approximately of 1930 to 1970 shows the changing composition, location and nature of tip sites in particular. The colonial period of the late Nineteenth Century marked the "out of mind out of sight" type of waste management. Tips of this period can be identified as vacant lots, creeks, bushland, virtually anywhere available. Only the Macquarie Point tip was run officially by the Council as a reclamation works. Tips became more of a focal point for the city's waste management because of the large increase in the volumes of waste being produced. There was also a change in attitude which saw indiscriminate disposal of waste as socially unacceptable. After 1940, this change can be seen in the establishment of regular collections of waste, more

strictly controlled tips and the gradual clean up of vacant lots which were used as illegal dumping grounds and the general discouragement of illegal dumping.

Community attitudes towards waste were a small part of the changing nature of tips. The Council's management of waste played an instrumental role in the way tips were established and utilized. In comparing the three Hobart Councils, it can be seen that the development of landfills reflects the extent of services which Councils had provided in terms of collection and disposal facilities.

By May 1940, 14 000 "tenements" in Hobart were provided with a regular collection of household refuse (HCCHSC Minutes, 6 May 1940:81). However, the illegal disposal of refuse on vacant land was still a problem. A report made by the Medical Officer in 1938 is a good example of the persistence of this problem,

About twelve months ago, three condemned houses on land at 191 Harrington Street were demolished, and old fence removed. The land had been unoccupied in the interim and owing to there being no fence on the street boundary, was being used as a dumping ground for rubbish (HCCHSC Minutes 5 December 1938:78).

During the same period, Clarence Municipal Council was removing wastes but only as emergency procedures when their accumulation became a nuisance. It was not until 1947 that rubbish bins were put in shopping areas in Clarence. A regular collection service was proposed in Glenorchy as early as 1916, however, it was not until 1933 that a service began in earnest. Despite this, Glenorchy Council still came across problems with the accumulation of rubbish on vacant lots and illegal disposal of solid waste.

Tip management in the 1940s had not changed dramatically since Colonial times. Burning of rubbish was continuous on the larger tips. It was still viewed as an adequate means of reducing the volume of rubbish. The Medical Officer of Health in 1940 advocated the use of a refuse destructor despite the problems which were caused by the one which was in use during the 1920s. He argued that:

The only satisfactory way to dispose of the dogs, fish and poultry offal is by incineration, as has been recommended on several occasions before, and the installation of a proper incinerator at Self's Point to dispose of the city garbage in a hygienic manner. No doubt this method must be adopted in the future, and the present cost of 350 pounds per year for the removing of this waste material would pay interest on a large proportion of the cost for the construction of an incinerator. Since Aldermen closed the incinerator about ten or twelve years ago the Health department and the Council has been subject to much adverse criticism regarding the disposal of garbage and refuse and these complaints will continue until a proper incinerator is provided as in other cities. Undoubtedly the erection of a modern incinerator would overcome many of the complaints now received regarding the disposal of city refuse (HCCHSC Minutes 18 Nov. 1940:43).

Much of the debate which led to the advocacy of incineration was due to the messy condition of the tips at this time in the form of smoke nuisance, vermin and odour. These factors affected the amenity of a great many residents and workers in the vicinity of the tip. A modern incinerator was seen as the remedy to the problems incurred at a tip site. However, despite these problems, a second incinerator was not bought and tips in Hobart would continue to be uncontrolled dumping grounds until the late 1950s when the notion of sanitary landfilling was finally put into practice.

3.2 Location of Tip Sites 1930-1970.

The main tip sites which have been documented through searches of Council records and interviews during the period 1930 - 1970 were located at:

- * New Town Bay,
- * Prince of Wales Bay,

- * South Hobart (end of Wellesley and Wentworth Streets, now known as the South Hobart Oval),
- * Pottery Creek Road, Glenorchy,
- * The Domain,
- * Goodwood,
- * Austin's Ferry,
- * Geilston Bay,
- * Lindisfarne Bay,
- * Wentworth Park, Howrah,
- * Old Proctor's Road; behind Mt Nelson,
- * Chapel Street, Glenorchy.

3.2.1 New Town Bay

The largest and longest running tip in Hobart, before the present tips, was located at New Town Bay. Figure 3.1 is an aerial photo of the site in 1946. Figure 3.2 shows the area as it is today. The whole area of the Bay from the hockey fields which are now on the western side of the Brooker Highway was filled in with refuse. With the filling of the Macquarie Point tip due in the late 1920s, the Hobart Council was scouting around for a new tip site. New Town Bay as a possible tip site first appeared in Council records in 1921 when the Medical Officer of Health reported on the "unsanitary condition" caused by siltation of the Bay and the dumping of rubbish in New Town Creek and the Bay. The Medical Officer's solution to the nuisance which resulted was to fill in the Bay itself (HCCHSC Minutes 15 February 1921). It was seen as an appropriate site because the bay itself was becoming silted up and exuding foul odours.

This is a good example of what was to happen to many of the bays in the Derwent estuary around this time. Like Kangaroo Bay, Lindisfarne Bay and Geilston Bay, the gradual siltation and offensive nature of the mud flats resulted in their use as a dumping ground. The pollution of New Town Creek, due to increased development of the catchment area, as well as the disposal of wastes directly into the creek itself, became an eyesore to residents. Another course of action would have been to tackle the pollution problem at the source

Figure 3.1 - Aerial photo of New Town Bay - 1946

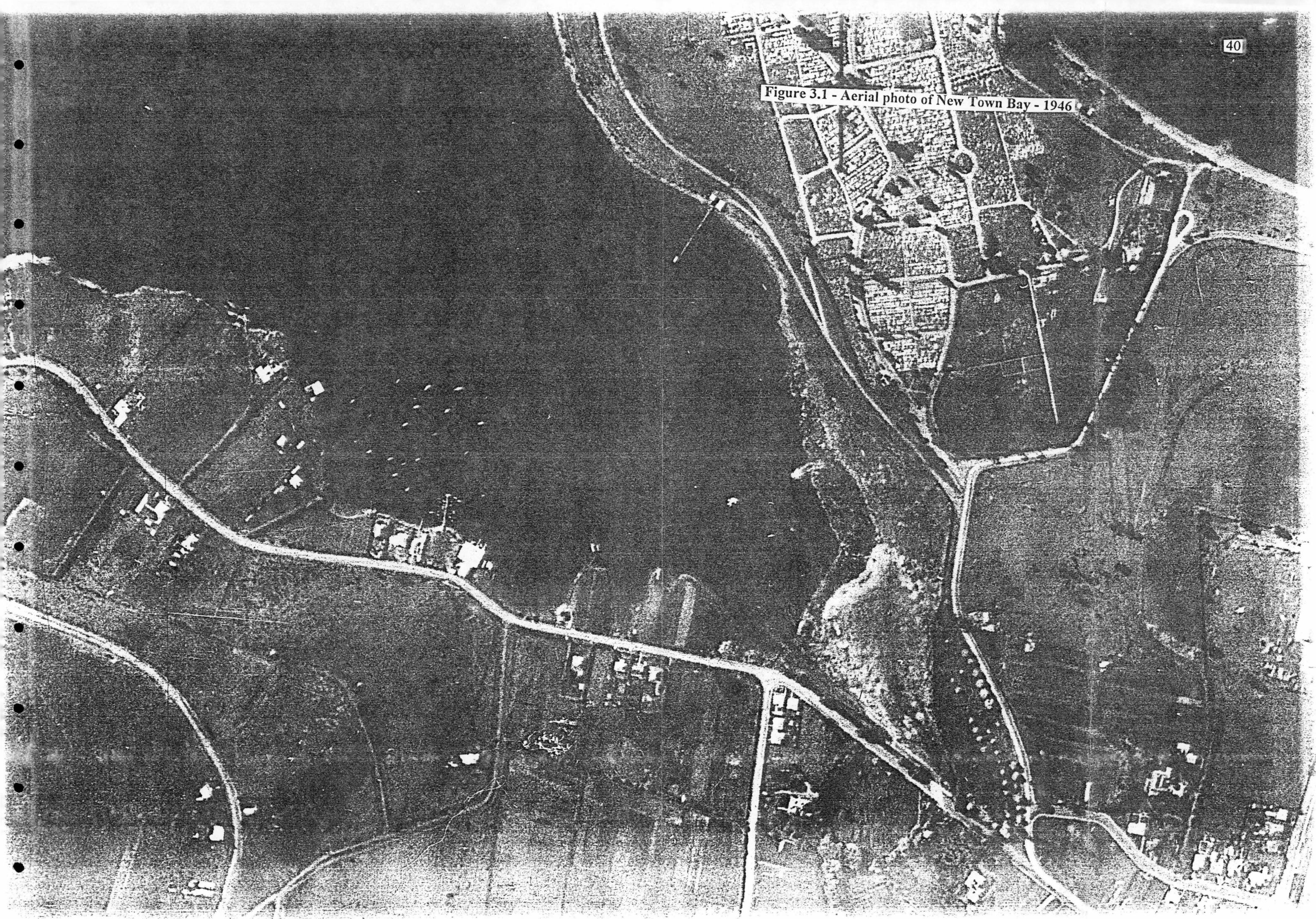
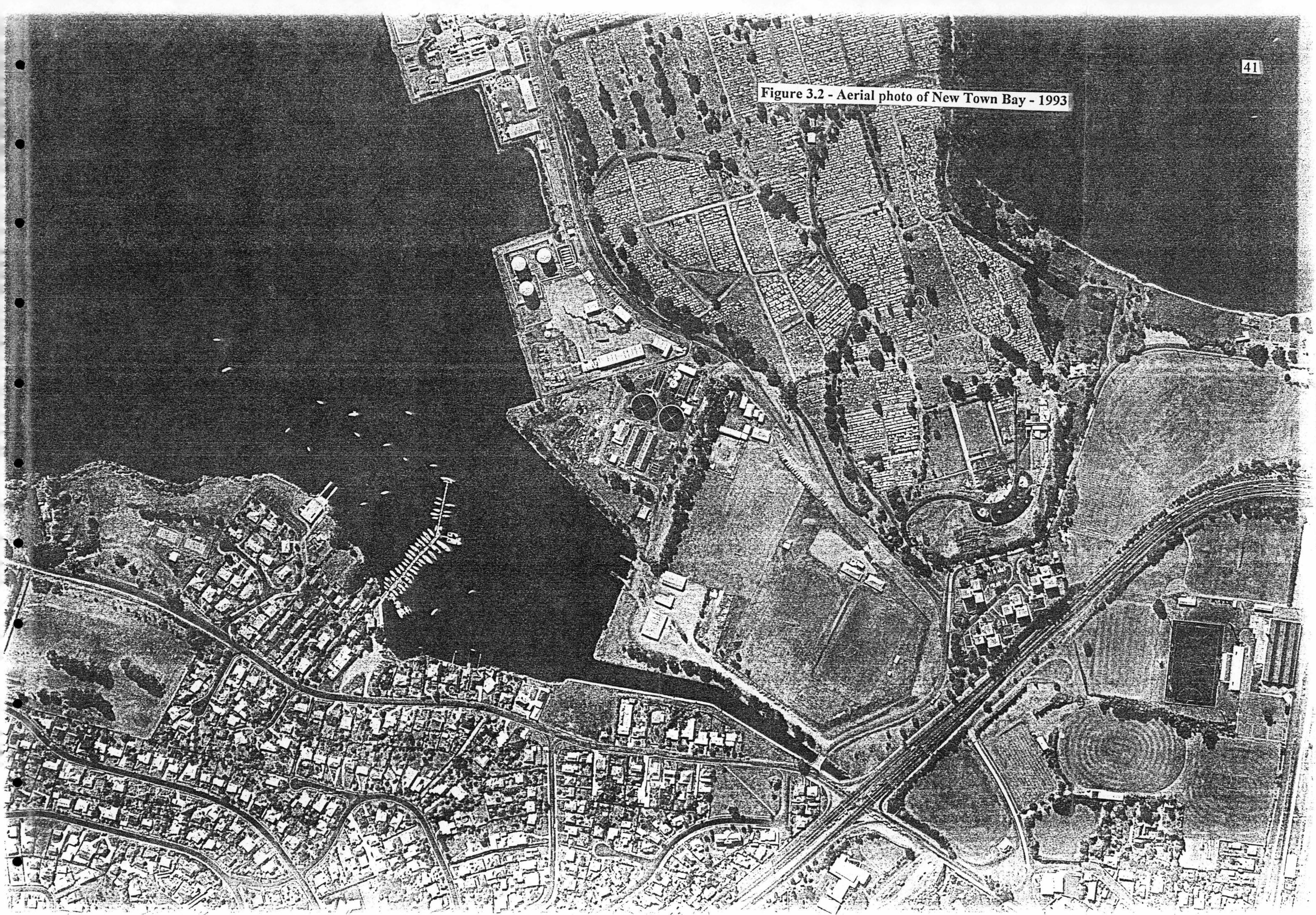


Figure 3.2 - Aerial photo of New Town Bay - 1993



but this did not occur to decision makers at the time. It could be argued that this was not part of the way people thought at the time in relation to pollution problems. The nuisance which resulted was to be dealt with instead of the actual cause of the problem.

This new location was seen as an ideal site for a tip to replace Macquarie Point. It was a short drive away from Hobart's businesses yet far enough away not to be a nuisance to surrounding residents and businesses. However, as the population of Hobart increased and more people began to work and live in the New Town area, the complaints about the tip began.

In 1922, the Glenorchy Municipal Council refused Hobart Council's request to use the bay as a tip. Despite this, in 1925, the Glenorchy Council was aware that New Town Bay was being used as an unofficial disposal site for solid waste despite the provision of tip facilities at Prince of Wales Bay. By 1930, The Hobart Council was officially operating the New Town Bay tip as a replacement for the Macquarie Point tip. The Medical Officer suggested that more offensive matter be taken to New Town Bay and that the other tips, which by now had become part of Hobart's urban sprawl, Baker's Pond and the old Golf links at Sandy Bay, be used for inoffensive matter (HCCHSC Minutes 30 October 1930). Once the tip's future was secured, the Glenorchy Council began to use it and by 1936, a garbage contractor who collected rubbish in the Council area was depositing wastes at New Town Bay.

In 1931, an outbreak of diphtheria in the Glenorchy area prompted a clean-up of the area by Council. Approximately 550 to 600 houses were targeted for the removal of accumulated rubbish from their premises. Many vacant lots in the area were also identified as dumping grounds (Glenorchy Municipal Board of Health Minutes 17 May 1931). The Council responded to this problem slowly as it was another four or five years before a regular garbage contractor was appointed to dispose of household waste at New Town Bay. At the same time, many houses on the eastern shore were targeted by the Clarence Council for clean up.

An inspection of the New Town Bay tip made in May 1933 is recorded as follows:

Almost from the cemetery gates to the bridge on the Risdon Road, there were heaps of rubbish floating about on the water edge of the tip. The stormwater channel discharging into the Bay at the Risdon Road end is obstructed with tin and metal containers. A fresh screen was needed to prevent the refuse floating into the Bay. The original scheme to alter the course of the stormwater channel would get rid of the nuisance and allow the reclamation of a valuable area of land (HCCHSC Minutes 15 May 1933:51).

Tip inspections became part of a management plan. Unlike, Macquarie Point, New Town Bay was the sole responsibility of the Council, so that there was no longer any conflict with the Marine Board. By 1936, the Hobart Council employed a man to visit the tip to "straighten it up". Loose papers were burned and ashes from EZ were kept available for covering rotting and offensive materials. However, this weekly visit was not sufficient to deal with the ever increasing amount of putrescible matter which was being disposed of. In 1937, the tipping area was extended to "a line leading from the sanitary jetty to the Buckingham Rowing sheds" (HCCHSC Minutes 3 May 1937:109).

The beginning of 1938 saw the first of the complaints to be recorded by Council about the Tip. In May, a petition was received by the Council and a letter from the Tramway Employees Association stating that "the stench from the tip is very strong and swarms of flies invade the buses and these carry germs and disease" (HCCHSC Minutes 30 May 1938:133-4). The tip was not the only source of "offensive" activities at this location. A sanitary jetty was located close to the tip. It was used as a pick up point for the sanitary pans containing nightsoil to be taken by the sanitary ferry into the middle of the Derwent and dumped. In addition to human wastes, offal from fish and poultry processing activities and dead animals from around the city were picked from here and also dumped in the middle of the Derwent.

The complaints about the tip continued while the Council debated over whether a rubbish collection services should be extended to the outer suburbs of Hobart. It was not prepared to spend extra money on the service despite the fact that the problem of the accumulation of solid wastes around Hobart was ever increasing.

The problems with solid waste management for the Hobart Council at this time were associated with the extension of rubbish collection services and deliberation over the re-introduction of an incinerator. Information concerning the overseas progress of municipal waste management gradually reached Hobart. In 1941, the Medical Officer submitted to the Health Committee an extract he had found in a journal of the New Zealand Branch of the Royal Sanitary Institute. It was called "Controlled Tipping in America" and introduced the "Bradford System", meaning controlled tipping or sanitary landfilling as it is known today. The extract outlined the principles of sanitary landfilling, which at the time was only just beginning to be part of tip practices. The practice incorporates controlled waste disposal on a tip into trenches or designated areas. These are systematically levelled and covered by a bulldozer. (HCCHSC Minutes 14 July 1941:4-5).

The principles of sanitary landfilling were attempted by the Council at New Town Bay. The principle to cover all offensive matters was always present, however, systematic disposal of such materials in designated areas was not to occur until the mid 1950s at New Town Bay. In the meantime, the Council had problems involving the lack of covering materials, lack of human resources to deal with it and lack of machinery. This has been well documented in Council minutes during the 1950s when fortnightly or three-weekly inspections were regularly made. These inspections began in 1952 and were presented to Health Committee in standard forms such as that in Figure 3.3.

In the meantime, vacant lots were still being used as rubbish dumps in Hobart. The Medical Officer alerted the Council to the problem in September and October of 1941. This problem was also being felt by the Glenorchy and Clarence Councils. New Town Bay was to be Hobart's major tip until 1963 when the area designated for reclamation was completed. Household garbage which was disposed of at the tip during the mid-1950s comprised only one-sixth of the total waste which were disposed there, the rest being trade waste, building rubble etc. The use of putrescible wastes was to be slowly phased out to incorporate a quicker and more effective reclamation (HCCHSC Minutes Special Report: amendment 14 November 1955). However, as inspections revealed, household matter was still being disposed of there. A letter by one of

Figure 3.3 - Hobart City Council's Health Inspector's Report on New Town Bay Tip.

11. NEW TOWN TIP:

The three weekly report of the Health Inspector dated 14th. July 1955 is attached.

14th July, 1955.

The Municipal Health Officer.

Sir,

Re: NEW TOWN TIP.
THREE WEEKLY INSPECTION.

Report No. 24.

Inspection made. 14.7.55 11.45 a.m.

Weather conditions. Wet and cool with light breeze from a general northerly direction.

Tide. Full - mud flats covered and inoffensive.

Smell. Very mild.

Insects. No flies observed.

Rats. None observed, but usual signs of infestation present.

Scavengers. One man and one boy.

Smoke Nuisance. Offensive smoke from fires on both tipping faces was drifting in the direction of the Risdon works. This smoke coming from the burning of sawdust and garbage.

Fencing. Requires attention on Risdon Road and Queen's Walk boundaries.

General appearance. Has deteriorated since last visit. Too much garbage, fruit wastes etc. remain uncovered and a good deal of spoil is tipped at random over the surface of the high level face.

Conclusions:- The following matters require attention -

1. Control of fires.
2. Repairs to fencing.
3. Prompt covering of all putrescible matter.
4. Clearing of the breakwater roadway so as to allow this extension to continue.
5. Provision of sanitary and ablutionary facilities for tip employees.
6. Clearing of spoil tipped on the surface of the high level face.

(R.F. GALL)
HEALTH INSPECTOR.

Revised
7 5

the Councillors explained this problem and described the appalling state of the tip in August of 1956. Controlled tipping was not introduced until 1958.

The completion of the tip was outlined in a letter by the Town Clerk 11 February 1963. By this time, other locations around Hobart were designated as tipping areas. None were to be of the same order and magnitude of New Town Bay. Figure 3.4 shows how the site looks today. It is called Rugby Park, Hobart's major Rugby football fields.

3.2.2 Prince of Wales Bay

The head of Prince of Wales Bay was used as an dumping ground in the 1920's (see Figure 3.5). The Glenorchy Municipal Council's Health Committee resolved in 1926 that "a notice be erected at the rabbit tip at Prince of Wales Bay prohibiting the depositing of offensive matter at the tip" (Glenorchy Municipality Health Committee Minutes 20 Jan. 1926:98). The site was infested with vermin and the nuisance caused by the decomposing waste was a problem for the Health Committee. In 1926, 1927 and 1928, the Committee resolved that the site be cleaned up and rats exterminated (Glenorchy Municipality Health Committee Minutes 15 September 1926:125, 4 March 1927:148, 2 May 1928). However, it seems that these measures were not successful in keeping the area free of waste. It is also possible that the Glenorchy Council required a tip site and Prince of Wales Bay site was the easiest and cheapest option. In 1929, supervision of the tip began (Glenorchy Municipality Health Committee Minutes 21 October 1929).

The tip was used until 1964 by the Glenorchy Municipal Council when it was redeveloped into playing fields (see Figure 3.6).

3.2.3 South Hobart

The area used for a tip at South Hobart was "5 acres, 1 rood, two and one-tenths purchase" between Huon Road and Cascade Road (see Figure 3.7). It

Figure 3.4 - Rugby Park, New Town



Figure 3.5 - Location of Prince of Wales Bay Tip Site



Figure 3.6 - Prince of Wales Bay Softball Fields



Figure 3.7 - South Hobart Tip Site



SCALE 1:5000
1 millimetre represents 5 metres



(Source: TASMAP 1:5000 Orthophoto Map Series)

was purchased by the Council from Ken Gibson in 1961 (Letter Town Clerk to Deputy Commissioner of Tax 1963). The site was an old quarry used for sand mining and was known locally as the sand pits. The purpose of placing a tip at this location was to reclaim the land and develop it into a park (*The Mercury* 24 January 1968:12). This tip was much better planned than previous tips as problems were anticipated and therefore largely avoided. The technology and literature which was developing in relation to overseas experience at the time was influencing the development of Hobart's new landfills.

It was proposed in a 1961 letter from the Town Clerk of Hobart to the Minister of Public Health that the site be used as a tip. The Town Clerk recommended that the site be used for garbage disposal so that the land be rehabilitated: "The area is at present an old sand pit which for many years has been eroded by stormwater from higher levels and, as it stands, is of no value" (HCCHSC Minutes 10 July 1961).

The Director of Public Health was not keen on establishing a tip there, supposedly because of its proximity to residents and the steep slope of the land: "it is in my opinion a most unsuitable site and one that would present great difficulties if an attempt were made to institute controlled tipping there" (Director of Public Health to Town Clerk 7 July 1961).

The South Hobart Progress Association (SHPA) illustrates the fact that "rubbish was being tipped at the continuation of Wentworth Street" (Letter SHPA to Town Clerk 15 July 1961). The site was already being used as an illegal dump site. The dumping of waste occurred because the land was viewed upon as waste land. It provided a convenient and easy way to get rid of solid wastes. In this case, the SHPA did not want a clean up of the site but wanted the Council "to commence a controlled project, to fill in this area and bring about the purpose, for what this ground was originally purchased, for required sporting facilities" (Letter SHPA to Town Clerk 15 July 1961).

The future of the site as a tip was not yet decided. The Town Clerk recommended to clean up the site and put up notices to prohibit tipping on the site on 20 July 1963. By 1962, the Minister for Health recommend to the Town Clerk that

considerable planning and work will be required to prevent the possibility of drainage and putrescible garbage reaching the stormwater system, flowing either through or alongside the proposed pipes and creating a nuisance where stormwater discharges. The proposed continuous height of 70 feet for the bank on the lower level is rather excessive and it is felt that the provision of an intermediate bench or step would be desirable (Memorandum from Minister for Health to Town Clerk 6 September. 1962).

The proclamation of the tip was gazetted on 13 March 1963. However, it was not ready for use until September 1963 and the Town Clerk put a notice in the *Mercury* as follows: "until the Wentworth Street disposal area is opened for use, all garbage is to be taken to the present disposal area on the Queen's Domain" (*Mercury* 7 and 9 September 1963). It was approved for a period not exceeding two years. The residents were not opposed in any way to the establishment of a tip in their neighbourhood. In fact the SHPA welcomed the site's use as a tip. Their enthusiasm for the site's use as a tip matched the Council's.

The SHPA believes that this waste land which has been an eyesore and nuisance for many years could, in three years, and without any adverse effect on residents, be transformed into much needed sports fields (*Mercury* 29 and 30 January 1963).

The actual period of disposal extended until 1967.

The plans for the South Hobart tip were accompanied by drawings of drains which would be built in order to divert run-off away from the surface of the tip. Sub-surface drainage was also provided to divert this into the closest watercourse. This represented a change in thinking as efforts to curb the potential nuisance of the site were being taken.

A depot was built in Hillborough Road to deposit rubbish which would then be taken by Council employees to be put on the tip face. A man was constantly cleaning the streets around the depot and Cascade Road, picking up paper

which may have strayed from the tip. It was there for about two years between 1963 and 1965. There was no control as to the types of waste which were disposed of and scavengers were common. When Hobart was hit by devastating bushfires in 1967, the tip also caught alight (Mrs. Perkins pers. comm. 21 July 1993). Leachate was never tested.

The site at present consists of two levels with an intermediate level which provides access to both levels. The lower level consists of a playground and the upper level is the home of the South Hobart Soccer Club (see Figures 3.8 and 3.9). The upper level was once used as a cricket ground. However, the uneven settlement caused by the waste as it decomposed under the topsoil made the site unsuitable for playing cricket. When the ground was being used for cricket, some people delighted in lighting the cracks in the ground which would then ignite (Caretaker, South Hobart Soccer Ground pers. comm. 19 July 1993). This is a perfect example of how methane, produced by the decomposition of waste, escapes into the atmosphere from underground.

3.2.4 Pottery Creek Road

A tip on Pottery Creek Road was proposed in June of 1961 (see Figure 3.10). The residents began their objections against the siting of the tip immediately after its announcement. They complained that they were not consulted at all during the planning stages for the tip. The Council tried to resolve the issue by assuring residents that "eventually and attractive playing area would be developed" (*Mercury* 5 June 1961). Approximately 32 acres were earmarked for the tip. About "400 feet of Brushy Creek" was diverted (Memorandum City Engineer to Town Clerk 2 May 1961). The announcement of the tip came as a surprise to many residents who feared that the nuisances encountered at the New Town Bay tip would be duplicated at Pottery Road. The Council tried to assure residents that the Pottery Road tip would be an example of controlled tipping:

Figures 3.8 and 3.9 - Playground on the lower level of the South Hobart Tip Site



Figure 3.10 - Pottery Creek Road Tip Site



(Source: Department of Environment and Land Management 1993)

Refuse tipped in the area being reclaimed would be covered at least once daily, but twice daily if found necessary. As each successive terrace was completed, it would be developed into playing areas, which would become an asset to the district" (Alderman Chesterman Meeting with Lenah Valley Progress Association (LVPA) 3 June 1961).

Fortunately, the residents' fears did not eventuate. While the usual nuisances associated with a tip would have been present, the burning and large scale vermin infestation common at all other tips in the State was not present. The site was turned into a park and playground. This site is different from other tips as the original site was not deemed to be waste land and did not require major reclamation works. The difference in resident's reaction to the tips is interesting to note. Lenah Valley residents were appalled at the idea of a tip being located in their suburb and often compared the conditions at New Town Bay to the ones which were expected at the new tip.

Another factor which swayed the residents away from the new tip was that the land upon which it was to be located was not viewed as a waste land because it was located in the middle of farmland and the encroachment of the urban sprawl. There is much documentation as to the resident's protests about the tip. On the other hand, residents in South Hobart actually welcomed the tip as a means to the redevelop an eyesore to valuable playgrounds and parks (*Mercury* 30 January 1963). The sand pits had been seen as a wasteland which the disposal of rubbish would facilitate an eventual improvement. This in fact was to happen. However, the tip itself was not without its problems. Today, the site provides open space and parkland for local residents (see Figure 3.11 and 3.12).

The tips in the 1960s were managed much differently to the earlier ones. Putrescible wastes were covered, burning was prohibited but did occur from time to time through carelessness or arson and scavengers were not allowed. The result was that a tip became more of a Council project rather than an unwanted dump. The New Town Bay tip was the first of the new wave of tips. It began in an era of haphazard disposal and evolved into a Council project designed to provide space for the Brooker highway, Selfs Point and playing fields.

Figures 3.11 and 3.12 - Pottery Creek Road Park



3.2.5 The Domain

Tipping first started at the Domain cross-roads in 1962 (see Figure 3.13). The purpose of this was to fill the land once used as a quarry for redevelopment into playing fields and ovals. It had a short life of about 2 years. Filling operations were completed in 1964. The decade of the 1960s can be identified as a time when there were a few small tips which were relatively well managed and were used for the reclamation of derelict land. Another feature was that they only lasted for a couple of years. The site at the Domain is now called Crossroads sports grounds was one of these (see Figure 3.14).

3.2.6 Goodwood and Austin's Ferry

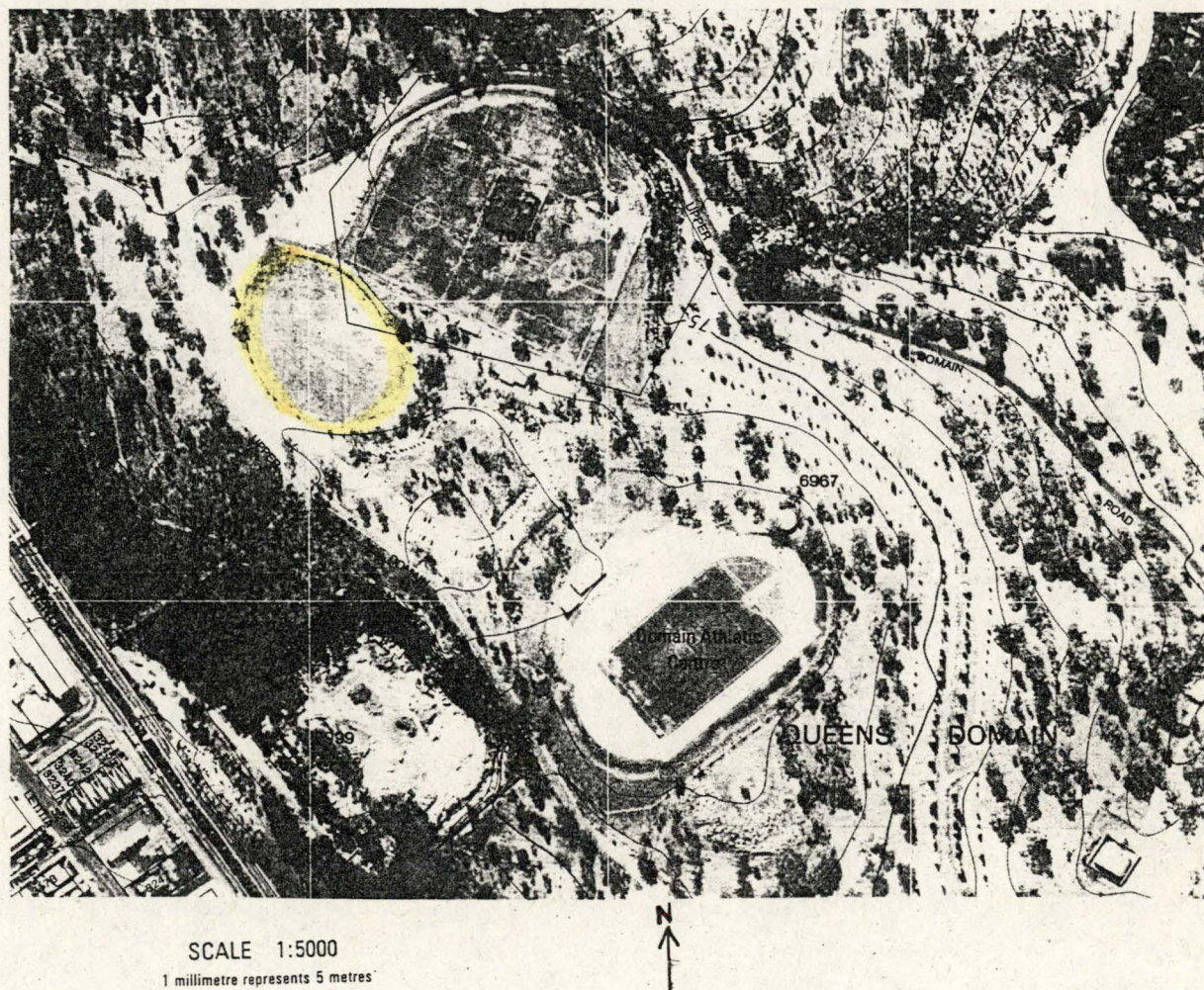
The sites at Goodwood and Austin's Ferry were both small tips used for the reclamation of land from the Derwent River for redevelopment (Doug Seaborn pers. comm. 10 June 1993) (see Figures 3.15 and 3.16). The period of filling for both sites lasted from about 1967 to 1969. The site at Austin's Ferry is called Shoobridge Park and is now a playing field (see Figure 3.17). The site at Goodwood is now a park and playground (see Figure 3.18).

3.2.7 Geilston Bay

Illegal dumping of refuse occurred at Geilston Bay in about the late 1960s (see Figure 3.19). The Clarence Council officially set up a tip on this site in September 1969 when a rock bung wall was built to contain the rubbish. Tipping was stopped by the Council in November 1970 (Wood 1985:16).

As with Kangaroo Bay, Geilston Bay was at first used as an illegal and uncontrolled dumping site for all manner of wastes. The Council's solution to the problem was to fill up the Bay as quickly as possible to reduce the offence, reclaim and redevelop the land. The area could then be used as a park or playground. This idea was the dominant mode of thought amongst town planners, Councils and residents at the time. The swampy and muddy

Figure 3.13 - Domain Crossroads



(Source: TASMAP 1:5000 Orthophoto Map Series)

Figure 3.14 - Photo of Domain Crossroads Sports Grounds



Figure 3.15 - Goodwood Tip Site

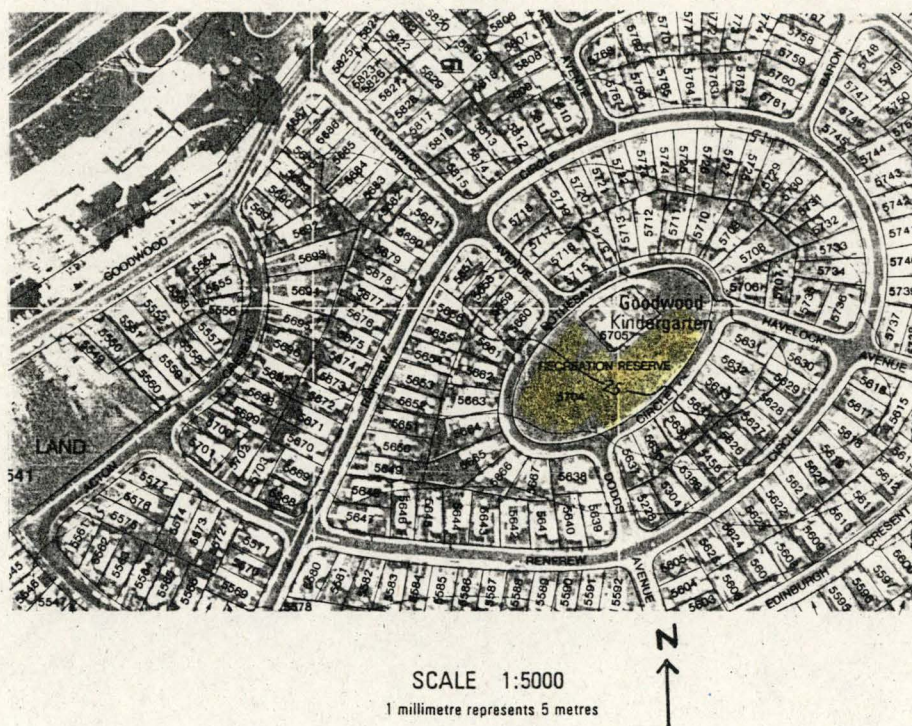
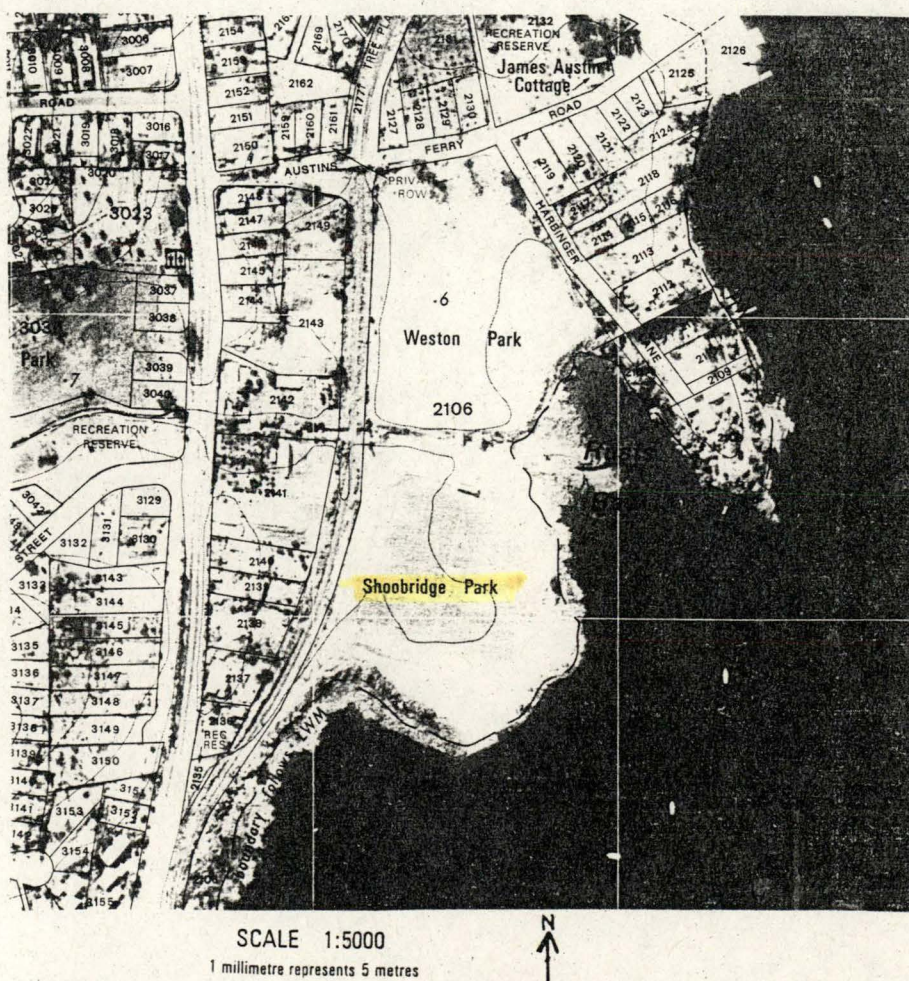


Figure 3.16 - Shoobridge Park, Austin's Ferry



(Source: TASMAT 1:5000 Orthophoto Map Series)

Figure 3.17 - Goodwood Park



Figure 3.18 - Shoobridge Park



Figure 3.19 - Geilston Bay



foreshores were thought to be highly offensive. The only solution to this problem was thought to be the redevelopment of the area into parkland and constructing a rock wall as a barrier to the River.

"The siltation of the bay and subsequent offensive nature of the foreshore is thought to have led to the use of the area as a dump site" (Wood 1988:41). The urbanization of Hobart resulted in the gradual pollution of the bays. The clearing of vegetation to make way for housing produces sediments which "damages lower land, blocks stormwater drains and is eventually deposited in the streams and harbours into which these discharge" (Wood 1985:23). Increased stormwater run off resulting from the clearance of land and urban redevelopment also contributed to the accumulation of rubbish around the bays. The resulting problems are: the turbidity of the bay's waters, the reduction of their recreational value and damage caused to aquatic life" (Wood 1985:23).

As the bays became more and more polluted in this way, people viewed the foreshore areas as wastelands and contributed to the problem by illegal dumping of wastes. The introduction of controlled tipping by Councils allowed the reclamation of the bays so that the offensive nature of the dumps was minimized and parkland was quickly established. However, these disposal areas have an effect on the marine environment. Wood has documented that leachate from the tip at Geilston Bay filtered into the bay and "was considered to have a deleterious effect on water quality" (Wood 1985:16). He has also documented the existence of a "black odorous sludge" found in the waters of Kangaroo Bay (Wood 1985:21).

Redevelopment of the Geilston Bay foreshore began soon after the tip was closed. Park land was established after the site was compacted and topsoil applied (Wood 1985:16). It is now known as the "Geilston Bay Recreation Area" and consists of a football field, an extensive playground and other playing fields (see Figure 3.20).

Figure 3.20 - Geilston Bay Recreation Area



3.2.8 Lindisfarne Bay

Last century, Lindisfarne Bay was once a popular holiday spot for many of Hobart's citizens (see Figure 3.21). As the ever increasing urbanization reached Lindisfarne, the impacts on the Bay began to show. A sanitary jetty was located at Lindisfarne Bay to be used for the transfer of sewage from sanitary pans collected from around the Lindisfarne area for disposal into the river (Wood 1985:9). The development of rubbish dumps on the foreshores of the bay can be attributed to "the unsightly nature and gross pollution of the bay" which probably "led to the association of the area with a dump site" (Wood 1985:13).

It has been documented that the dumping of waste materials in the bay began in 1950 and continued until 1953. A rock wall was built across the head of the Bay in 1964. Presumably, dumping continued illegally from 1953 to 1964. After the wall was built, dumping continued uncontrolled until March 1968 when public tipping was stopped because the type of rubbish being disposed of was unsuitable for finishing off the area. Earth and rock were the preferred materials for disposal (Memo Council Clerk to Municipal Engineer February 1968). Only the disposal of clean building materials vegetable matter and garden refuse was permitted on the site. In June 1968, a "drag line" was used to clean up siltation at the Ford Parade outfall to move the siltation build up behind the rock wall. The stormwater pipe at Hume Street was extended 120 feet at this time. In 1970, dumping of all refuse ceased, the area was filled, covered with topsoil and grass and trees planted (Wood 1988:41). In 1972, the Clerk was mindful of the difficulties which may be inherent in the planting of trees etc., "tree planting will require a great deal of thought, especially as trapped sea water and stone fill. are only just under the surface" (1 February 1972: Clerk to Superintendent of Reserves).

In 1974, a plan was released by the Clarence Council for the ultimate redevelopment of the park. Amongst these plans was the provision of a car park, the removal of boulders and improvement of raised areas, fencing, watering system, top dressing, replacing dead trees and planting others, gravelling and sealing car park, child's play area, picnic area, tables, seats etc., pathway, hot mix, drains etc. (1974 report, Clarence Council records). The area is now called Matthew Simmonds Park and is a valuable part of the suburb

Figure 3.21 - Lindisfarne Bay



SCALE 1:5000
1 millimetre represents 5 metres

N
(Source: TASMAP 1:5000 Orthophoto Map Series)

which provides open space and playground and barbecue facilities to local residents (see Figure 3.22).

3.2.9 Wentworth Park

The area which now comprises of Wentworth Park and its surrounds was once used for sand mining (see Figure 3.23). The Council commenced tipping activities there in 1962 as an aid in the reclamation works for the redevelopment of the area into parkland, playgrounds and sporting fields. Tipping continued for seven years until September 1969. The area was redeveloped into football grounds at first while the foreshore was turned into parkland.

The foreshore was landscaped recently to provide a better foreshore walkway, playground equipment, barbecue areas, public toilets and landscaped gardens. This occurred in the mid-1980s. The ground at that time was settling unevenly and playground equipment had to be moved to prevent them from subsiding into the ground (Ian Bowman pers. comm. 20 July 1993). A few of the houses in Silwood Avenue, a street which borders the western side of the site, were built on top of part of the tip. A builder recalls the excavation of tyres, assorted plastic items, bottles, old toys and household appliances. A "black gooey substance" was also unearthed. This is decomposed putrescible matter which was disposed of 20 years earlier. The footings of one building in particular extended downwards to four metres as a safety measure should the ground subside in the future (Ian Bowman pers. comm. 20 July 1993).

The park is a very popular one with people from all around Hobart using its sporting and recreational facilities. It provides access for local residents and visitors to the foreshore of Howrah Beach and valuable open space amongst a sea of urban development (see Figure 3.24).

Figure 3.22 - Matthew Simmonds Park

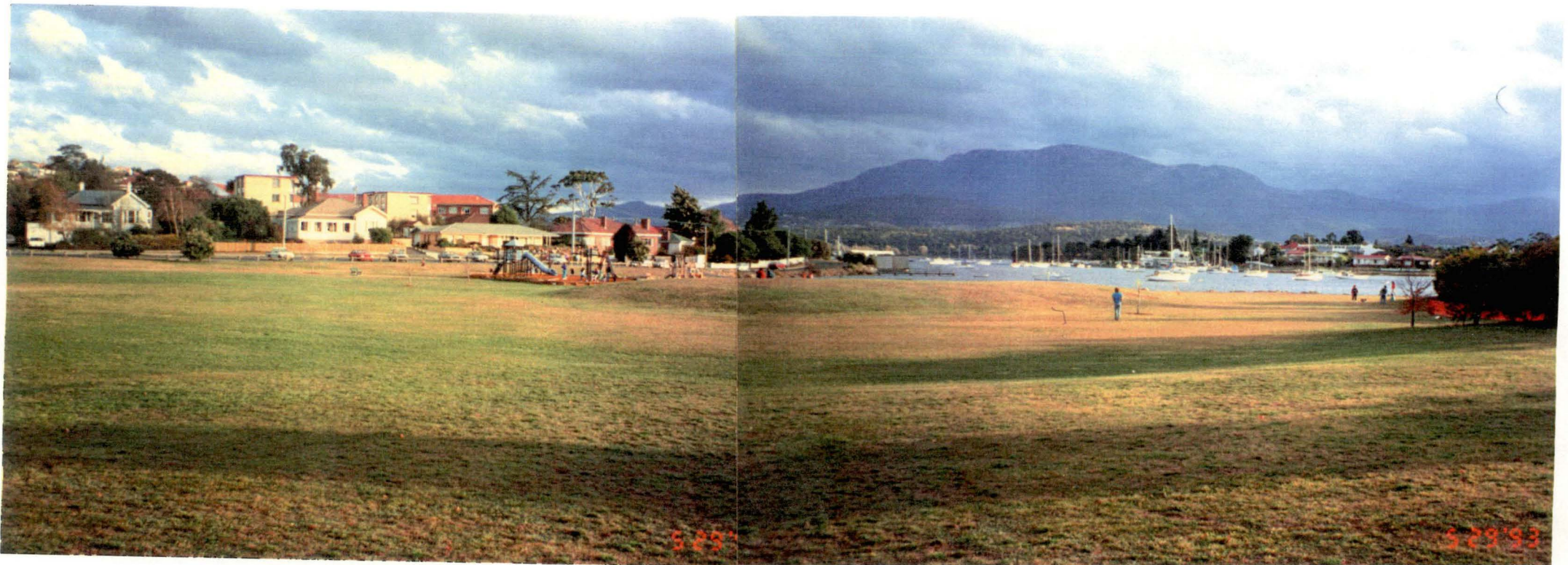
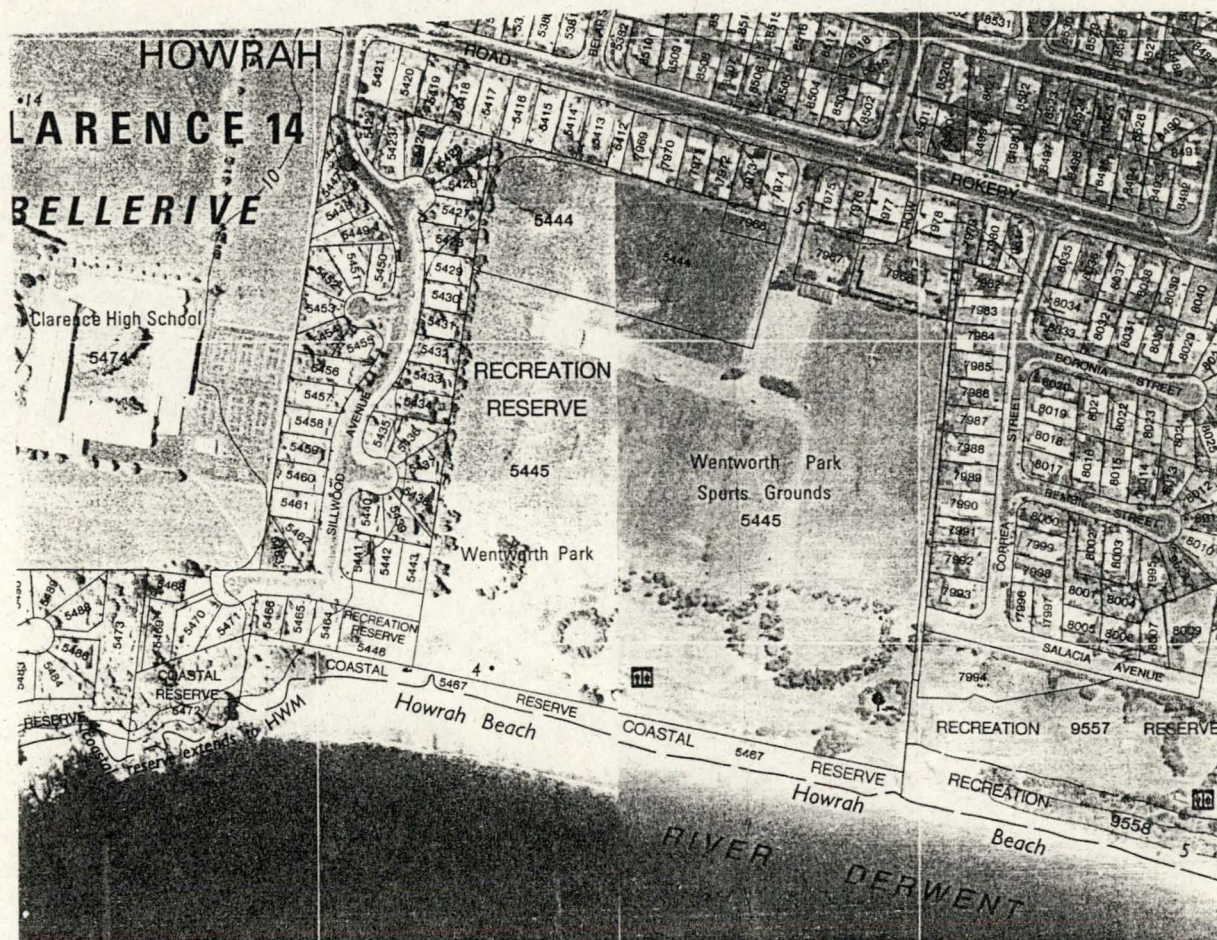


Figure 3.23 - Map showing location of Wentworth Park



SCALE 1:5000
1 millimetre represents 5 metres



(Source: TASMAP 1:5000 Orthophoto Map Series)

Figure 3.24 - Photo of Wentworth Park



3.2.10 - Old Proctor's Road

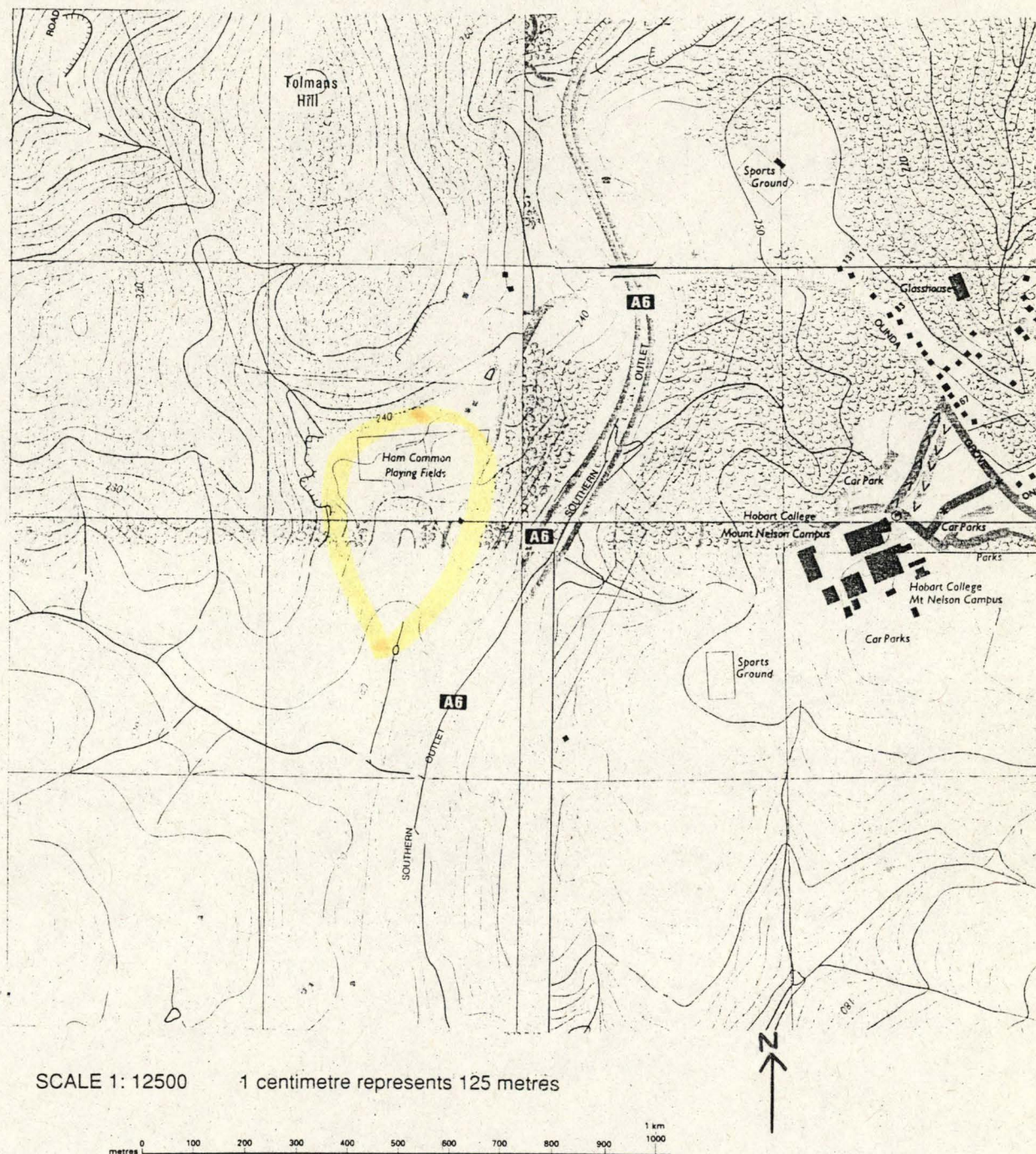
The site for the Hobart City Council's refuse disposal site from about 1967 to 1974 was located on Old Proctor's Road close to the summit of the Southern Outlet (see Figure 3.25). It is located on the southern side of a low hill crest in a gully which is bordered by Mt. Nelson to the east and Tolmans Hill to the west. The site is now called Ham Common and was once known as Whitton's quarry. The tip was remote enough not to cause a nuisance to a large number of people and a short drive away from most residents in the Hobart City Council area. Rubbish was used to fill the quarry for its eventual redevelopment.

The site's area is approximately 1.7 hectares and it has two levels. Below these levels is a leachate pond, a run-off collection pond and Whitton's creek. Leachate is collected in the pond and directed to sewer. This was one of the first tip in Hobart to have a leachate pond for the purpose of redirecting any run-off coming from the tip to avoid possible pollution of the creek or groundwater. However, the leachate was not tested at this time to determine any contaminants which may be present (Department of Environment, Tasmanian Waste Collection and Disposal Survey 1973).

The introduction of the *Environment Protection Act 1973* enforced greater management of tips by Councils, such as the collection and monitoring of leachate. Councils were legally obliged to manage their tips according to the requirements of the Act. This involved taking a greater responsibility to minimize any environmental risk which may result from the tip's operation. Environmental issues were now on the agenda for the first time.

The tip was supervised to ensure wastes were disposed of into piles or trenches and covered over at least once a day. About 90 000 cubic metres of waste (including cover materials) were deposited on the site per annum. A perimeter fence ensured that illegal dumping or scavenging did not occur after hours. The problems associated with the older tip sites were minimized or absent from this tip. There was sufficient cover material to ensure each rubbish layer was contained. Vermin numbers were subsequently minimized because wastes were being covered. The tip was also sprayed with poison to eradicate any rats

Figure 3.25 - Map showing location of tip site on Old Proctor's Road



(Source: Department of Environment and Land Management 1993)

which persisted in the waste (Tasmanian Waste Collection and Disposal Survey 1973).

Complaints about the nuisance from this tip were considerably less than those received about other tips. This can be attributed to its distance from populated areas and the greater attention paid to the management of the tip by the Council. The requirements of the new legislation assisted this change. Perhaps the Council had also learned some lessons from the management of earlier tips.

An inspection of the site reveals a number of clues as to its past use. An odorous gas is expelled from vents in the ground, indicating that the landfill is still producing gas 20 years after its closure (see Figure 3.26). Small pieces of crockery and scrap metal can be found on the edge of the playing fields. Their presence indicates the site's use as a household tip.

Leachate has been tested regularly since 1977 in conjunction with the monitoring of the Hobart City Council's current tip at McRobies Gully. The same parameters are tested and samples are taken from the leachate pond, the run-off pond and the creek below. Figure 3.27 shows the leachate pond. Figure 3.28 shows the parameters for which the leachate is tested. Results of these tests will be discussed further in chapter 5.

The site has been leased by a Hobart school which has developed hockey grounds, netball courts and erected a clubhouse on the upper level of the site (see Figures 3.29). Future plans include the development of an athletics oval on the lower level of the site.

Figure 3.26 - Air vent on Old Proctor's Road Tip Site



Figure 3.27 - Leachate Pond, Old Proctor's Road Tip Site



Figure 3.28 - List of parameters for which leachate from Hobart's current refuse disposal sites (including the Old Proctor's Road site) are tested.

Total Coliforms	Zinc
Fecal Coliforms	Copper
Fecal Streptococci	Lead
Total solids	Chromium
Non Filterable Residue (NFR)	Cadmium
pH	Barium
BOD	Boron
COD	Cyanide
Oil and grease	Arsenic
	Mercury
	Selenium

Figure 3.29 - Hockey Fields on Old Proctor's Road Tip Site



3.2.11 - Chapel Street, Glenorchy

The largest tip run by the Glenorchy City Council previous to the present one at Jackson Street is located adjacent to present site and is known as the Chapel Street tip (see Figure 3.30). Operations began on the site in 1971 and parts of it are still being used today. The site is about 9 hectares in area (see Figure 3.31). About 80 000 cubic metres of refuse was disposed on the site each year (Glenorchy City Council records). The fill was used to build up the side of a hill and is in very steep position. As a result of the steepness of the fill, concerns for the stability of the site have been made by consulting engineers and the Glenorchy City Council. There is an added concern as recent housing developments have been located very close to the site. One property's boundary is only about five metres away from the old leachate pond. Future redevelopment of the site will depend upon it being stabilized perhaps by further tipping of waste.

A leachate pond was established at the bottom of the site, just off the end of Chapel Street, about 50 metres away from Humphrey's Rivulet. The leachate pond was filled in a few years ago to make way for a system of surface drains and underground pipes which divert any run-off and leachate to sewer (see Figure 3.32). The leachate is tested quarterly. Groundwater levels from 8 boreholes situated around the site are frequently measured. The results of both test were not made available to the author for this study.

A large pipe which was originally designed to collect leachate runs directly from one end of the site to the other (see Figure 3.33). The pipe has been crushed under the weight of the fill and is now useless for leachate collection. Landfill gas has infiltrated into the pipe and is now escaping from it. The gas which escapes from the pipe was warm and had a musty odour. Gas was also escaping from the boreholes. Gas coming from four of these boreholes was tested with a *Drager* meter. The results revealed combustible gas of over 9 points, meaning that it is 100% flammable. The Glenorchy City Council has considered harnessing this gas. A feasibility study for the utilization of landfill gas from the site was completed by Stephenson EMF and Maunsell consultants for the Council. However, the use of landfill gas for electricity generation has not resulted for a number of reasons beyond the Council's control.

Figure 3.30 - Chapel Street tip site, Glenorchy



(Source: Department of Environment and Land Management 1993)

Figure 3.31 - Photo of Chapel Street Tip Site

(arrows indicate location of fill)



Figure 3.32 - Photo of run-off drains, Chapel Street Tip Site



Figure 3.33 - Top of pipe running underneath the Chapel Street Tip Site



The Glenorchy City Council has considered many options for the site's redevelopment. However, concerns over the stability of the site have contributed to a delay in operations. Possible redevelopment options include a mini-golf course, a community park and bush reserve.

3.2 - Trends for the future

The gradual change in the way tips were established and managed is illustrated very well throughout the twentieth century in Hobart. The first tips were mostly small lots of vacant land, bush land or Rivulet into which all solid waste and human and animal wastes were disposed. The gradual recognition of the hazards to human health associated with haphazard disposal of wastes led to a change in thinking amongst decision-makers and the community. This change is identified in many ways. One is the introduction of legislation which prohibited firstly, the disposal of human wastes into the Rivulets and then of solid wastes. Another is changing community attitudes. The community demanded from the Council more facilities with which to deal with solid wastes as they recognized that they were becoming more difficult to dispose of because of increasing quantities and greater awareness of the wider urban environmental issues. A greater awareness of human health issues relating to the inappropriate disposal of waste was also instrumental to a change in attitude. Tips sites reflect this change.

CHAPTER FOUR

TIP MANAGEMENT IN HOBART: THEORY AND PRACTICE

4.1 The evolution of solid waste disposal on land.

Land disposal of solid waste has been used extensively since ancient times. "Traditionally, waste materials have been deposited in voids (either natural or man-made), or on adjacent land of little or no value" (Crawford & Smith 1985:1). As documented in chapter two, tips in Hobart very much resembled the above description. All of the old tip sites named in chapters two and three were located in such areas. Lands considered to be of little or no value in previous years were: tidal areas (mud or sandflats), quarries and mined areas. Quarries and mine areas are still considered to be marginal lands, however, the ecological importance of tidal areas has since become recognized.

Solid wastes were first used as reclamation material to develop marginal land within or close to populated areas in Europe and the United States. It is an efficient way of using solid wastes and reducing the need for more tip sites. Low lying land such as swamps and marshes is the most common type of land filled in this manner. However, the redevelopment of wetlands "sometimes disrupts patterns of water run-off, resulting in increased water pollution and risks of flooding" (Turk et al. 1972:41). This problem has been identified and the reclamation of marginal lands is now a complex and comprehensive undertaking with all of these factors being taken into consideration.

In the U.S., as an alternative to the location of dumps in isolated locations, which were unpopular due to their inconvenience and resistance by local residents, dumps were established in urban areas as a reclamation measure. This began the practice of using refuse as fill, to be utilized in restoring derelict land, filling bays and building up quarries (American Public Works Association (APWA) 1966:89). In Hobart, almost all of the old tip sites were located in bays or quarries.

4.2 Open dumping in Hobart

At first, wastes were disposed of in an uncontrolled manner on tip sites. "Open dumping is refuse dumped and allowed to remain exposed to the atmosphere" (Berry and Horton 1974:259). In Hobart last century, open dumping was the predominant form of solid waste management and the practice continues today in some parts of Tasmania. There are a number of problems associated with open dumping including vermin infestation. If dumps are swampy or filled with water then the probability of ground water contamination is especially high (Berry and Horton 1974:259). In populated areas, open dumping has become an unacceptable practice in Australia. This attitude reflects the community's perception of waste and the changing attitude towards environmental issues and the community's right to amenity.

4.3 Sanitary Landfilling in Hobart

Changing attitudes towards open dumping resulted in changing waste disposal practices. "Sanitary landfilling is a natural extension of open dumping" (NCRRI 1974:2). The gradual incorporation of some landfilling techniques was employed. The smell and escape of rubbish dumped on tips and left uncovered prompted constant requests by the Health Committee and Marine Board to the Town Clerk to rectify this situation (HCCHSC Minutes 13 March 1933:12, 23 April 1934:43, 21 May 1934:51, 9 June 1910:338). The problem of securing adequate covering material was then identified as a problem by the Health Committee. It was suggested that ashes from the gas works, overburden from the Zinc company or Domain quarry would be good cover materials (Memo from Town Clerk to Health Committee 5 April 1933: memo). However, the cover materials either did not reach the tip or was not used often enough or the wastes were not covered properly as many complaints were made about the offensive nature of the Macquarie Point and New Town Bay tips.

This problem was to continue throughout the life of the Macquarie Point tip and most of the working life of the New Town Bay tip. It seems that the covering of wastes was not a concern for the smaller tips at the time. The

Council was not responsible for them so that they were left alone and not even targeted for clean up or covering operations.

A number of factors were instrumental in changing focus to a more environmentally and socially responsible means of land disposal and solid waste management. The first instance of the Hobart Council complying with overseas trends was the purchase of a refuse destructor in the 1920s. Incineration of all solid wastes (even putrescibles) was thought to be the best way to dispose of wastes mainly by reducing their volume. The Medical Health Officer consistently advocated the use of the destructor as a remedy to the problems incurred by the dumping of wastes around Hobart. The Medical Officer was keen to avoid the "rats, disease and foul odours" through incineration and the ashes were seen as productive result of the process. Indeed, incineration was a useful means by which the volume of wastes could be dramatically reduced, however, the resulting immense smoke nuisance caused the destructor's demise.

As argued in chapter two, the politically and economically motivated Hobart City Council, was not overly concerned about the state of solid waste disposal and tip sites. It seems that changes to tip management were forced upon the Council after the problems which resulted from mismanagement (or lack of management) could no longer be ignored. This was the case even though the Medical Health Officer often visited the mainland to attend conferences and inspect tips run by other municipal councils around Australia (Memorandum Medical Officer to Town Clerk 21 November 1935) and the Health Committee was kept relatively up to date with new technology and practices being used elsewhere.

The long time it took for simple landfill technologies to emerge in Hobart may have been due to a number of factors: lack of knowledge of tip operators to perform the tasks, shortage of materials being taken to the site (even though there may have been materials being used around the town), lack of human resources to perform the tasks and lack of political will to enforce the procedures. The problem of getting refuse covered persisted until the 1960s in Hobart when the unsanitary practice of open dumping was no longer tolerated within the city limits.

The theory of landfill practices was introduced formally to the Hobart City Council in 1941. The Town Clerk submitted an extract from the journal of the New Zealand branch of the Royal Sanitary Institute which describes the "Bradford System of Controlled Tipping". It did not describe the methods in detail but it alerted the Council to the changing technology of waste management and tip practices.

It was the Council's reluctance to spend any money or time on tips which resulted in its offensive nature. In reference to the New Town Bay tip, what was being done was only stop gap measures. A pertinent example of the Council's practice at the tip was described following a memo from the Hobart Public Cemetery Trust. Following complaints it had received concerning the odour coming from the tip, it made a request for all offensive matter to be buried immediately. The Chief Engineer reported that after inspecting the tip, he was satisfied that garbage was being covered as soon as possible after being deposited. He went on to say that "it is not practicable to keep the waterside of the tip covered, but filling is kept right up to the top edge leaving only the sloping face uncovered, and this is frequently watered to minimize nuisance of flying paper and flies, and also to assist in consolidation" (HCCHSC Minutes 14 July 1941:5).

The fact that the waste was being watered down, shows the misunderstanding of the way in which tips should be managed. Watering the exposed waste would have contributed to its decomposition and its odour, increased run-off to neighbouring areas and spread the waste over a larger area. The practice would not inhibit infestation by rats or birds. This practice shows how much the Council at the time understood the intricacies of tip management. The appropriate handling of wastes so as to minimize all problems was not known about. Leachate control was unheard of. As the problems continued, public unrest followed. The New Town Bay tip was offensive from its birth. The progress of the tip can be mapped against the increased knowledge of the Council to deal with the problems which occurred as a result of open dumping.

Better landfilling practices were used towards the end of New Town Bay's tip life. While the problems such as the burning of wastes, vermin infestation etc. were still present, the tip was a little more controlled with caretakers being employed, greater access to machinery and more modern equipment and more

cover materials available. These were only small improvements and it must be said that the environmental impacts of tips were not yet questioned, it was a change from late last century when waste disposal was uncontrolled.

4.4 Sanitary Landfilling Methods in Theory

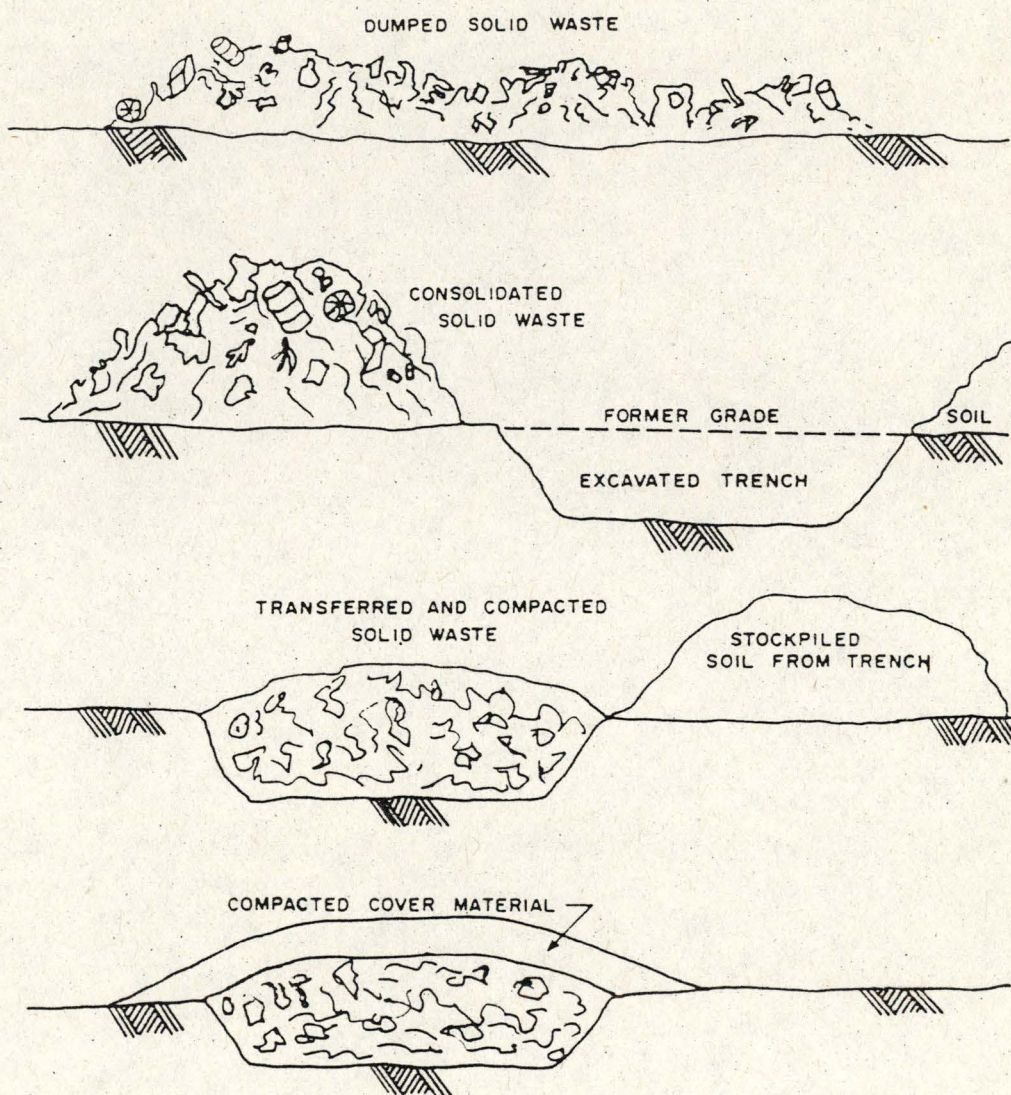
The practice of "covering and mixing the organic refuse with a sufficient quantity of inert materials such as earth or ash was used to minimize odours" was first used early this century in the U.S. and Europe (APWA 1966:89). The practice was not widely used in Tasmania until the 1950s. It was often recorded in Hobart City Council Health Committee minutes that the covering of refuse was required to minimize odour, flies and other vermin. However, this was not performed as regularly as many tip reports testify.

The compaction of refuse to save tip space was first performed in the 1930s. Compaction allows a longer tip life as a greater volume of waste can be disposed (AWPA 1966:89). The trench method of landfilling also emerged during this time. Trench disposal involves the digging of a trench so that refuse can be deposited in the hole and covered with the earth displaced by the digging of the trench. The sanitary landfill has evolved into different forms and different practices over the years but the basic features include the trench and area methods of landfilling.

The trench method is generally used on flat or gently sloping land. It involves the "excavation and filling of successive parallel trenches separated by a 3-4 foot dirt wall" (NCRRIUS 1974:15). Figure 4.1 is an example of the trench method and Figure 4.2 shows how this is employed presently in a tip in Triabunna, on Tasmania's east coast.

The area method of a landfill "is usually employed on sloping land, in ravines canyons, marshes, quarries and other natural or man-made depressions" (NCRRIUS 1974:13). This is the method practised in Hobart's present working landfills. The Hobart City Council's tip is in a gully, Glenorchy City Council's is in an old quarry and the Clarence Council's RDS is located on low lying marshland. The wastes are dumped in or adjacent to the fill site and spread

Figure 4.1 - Diagram of the trench method of landfill



(Source General Electric Company 1975)

Figure 4.2 - Photo of the trench method being employed at Triabunna



and compacted by a bulldozer. Cover material is spread over the exposed refuse to form what is known as a cell. This compacts the refuse and "generally, the deeper the cell, the greater the degree of refuse compaction which can be achieved (NCRRIUS 1974:15). Some examples of the area methods are shown in Figure 4.3 and 4.4.

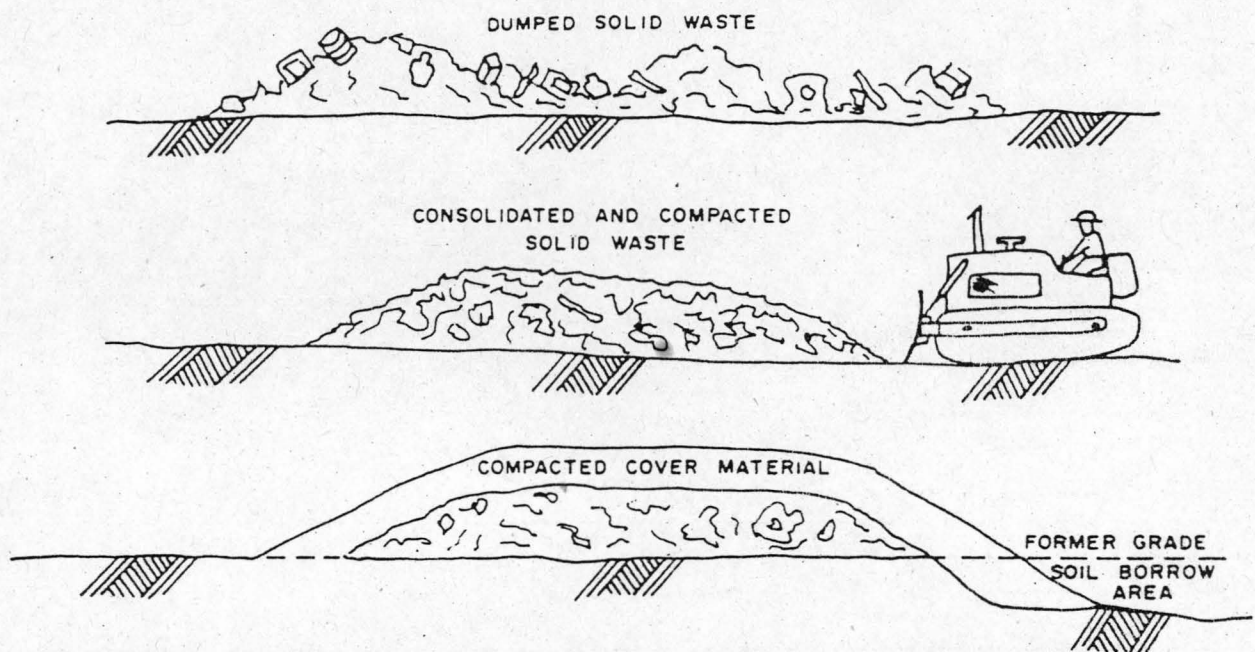
The nuisances associated with the land disposal of refuse such as infestation by pests, odours resulting from decomposition of wastes and uncontrolled burning to name a few were recognized in Europe and the United States in the 1920s. The term sanitary landfill was coined in California to describe a more controlled form of land disposal of wastes. It has become the dominant form of land disposal in developed countries. Many of the more recent modifications of a sanitary landfill are: impermeable liners, sophisticated leachate collection systems, gas collection and decomposition assistance and the mining of old tips for re-usable, non-renewable materials such as metals. The emphasis has changed to accommodate primarily ecological and social concerns.

The latest landfill technology trend in Germany is known as *Integrated Solid Waste Management* where wastes are put through a number of stages in order to remove recyclables and hazardous materials and to recover the energy generated in the remaining waste is taken to a secure landfill where wastes are treated to impose a minimal impact (see Figure 4.5) (Cossu 1989:6). This latest technology has not as yet reached the tips of Hobart, however, there is an increasing emphasis being placed on reducing, re-using and recycling of solid wastes. Many of the tips in Tasmania have recycling centres to encourage the recycling ethic with an aim to slow down the use of valuable landfill space.

4.5 Benefits, drawbacks and impacts of landfills.

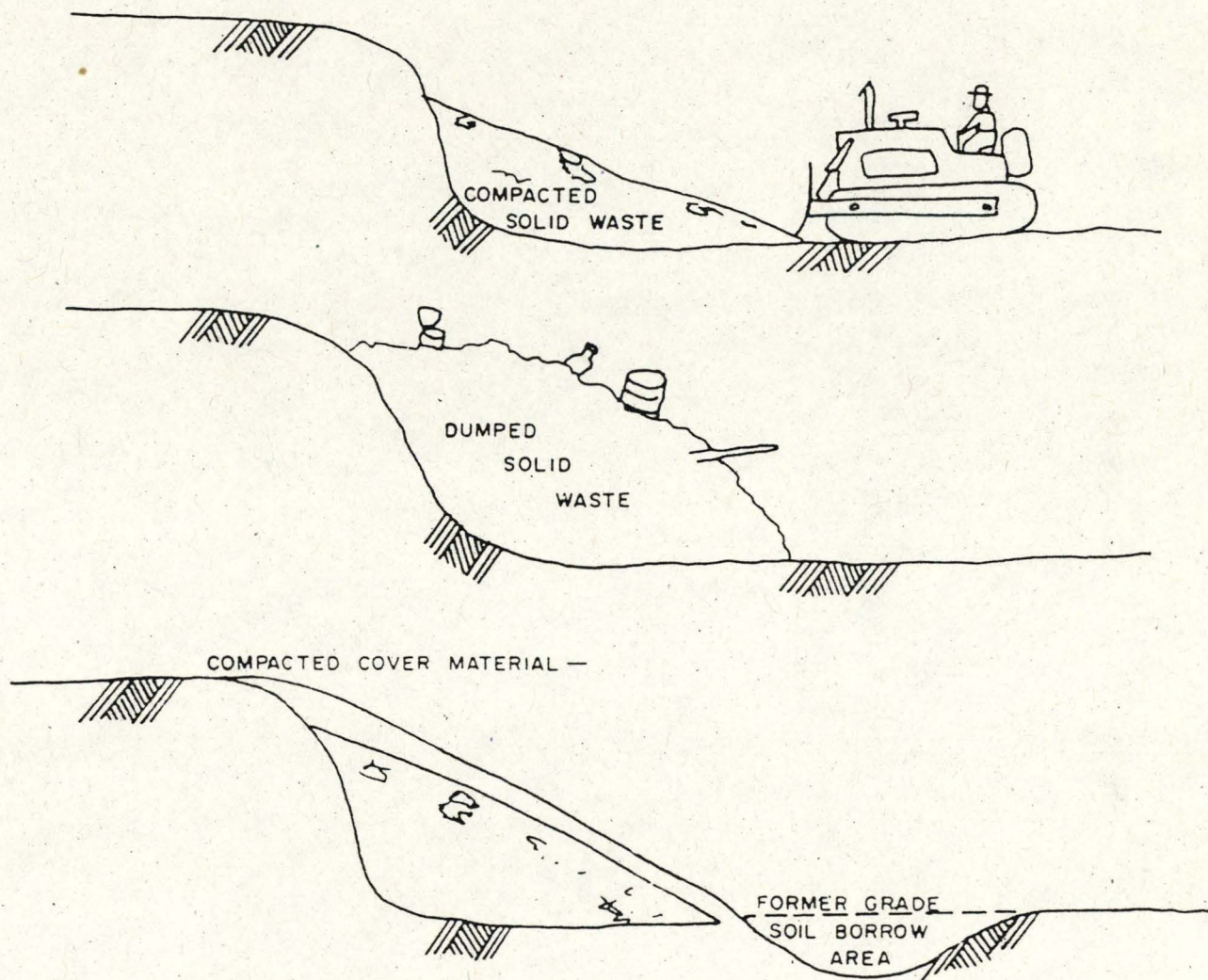
The sanitary landfilling method is an improvement on the open dumping of wastes in that many of the nuisances caused by open dumping are avoided. However, only when landfills are operated correctly. Turk and Turk have identified this problem. "In practice, the distinction between a sanitary landfill and an open dump is not always sharp, for example, a thin layer of earth may

Figure 4.3 - Area Method of Landfilling - Waste is deposited on top of the ground

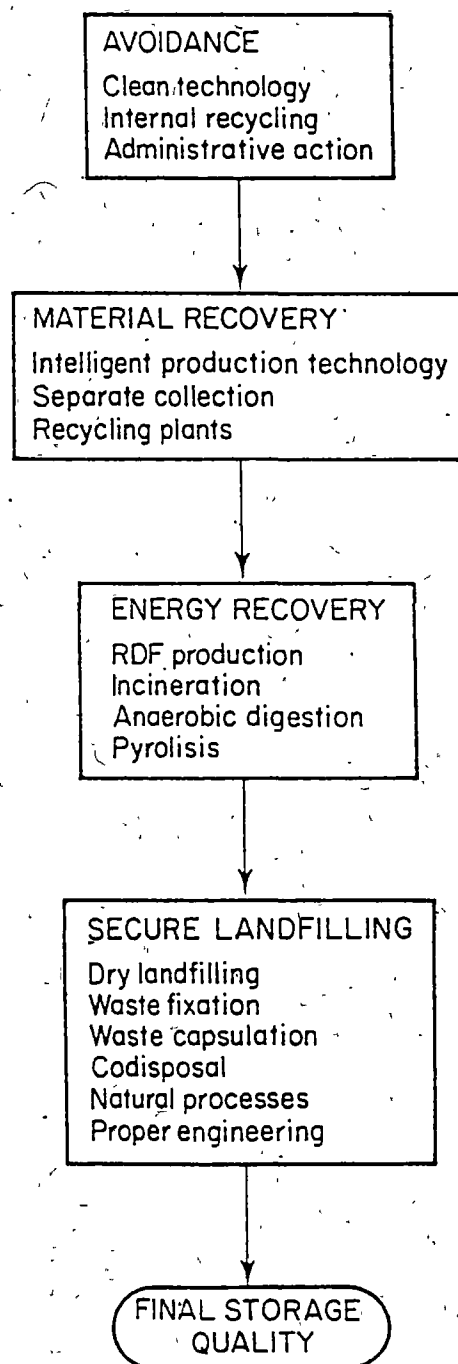


(Source General Electric Company 1975)

Figure 4.4 - Area Method of Landfilling - Waste is deposited on the side of a hill



(Source General Electric Company 1975)

Figure 4.5 - Schematic Diagram of Integrated Solid Waste Management

(Source: Cossu 1989)

be an ineffective barrier against burrowing rats, flies or gases evolving from decomposition" (Turk & Turk 1988:652). Some may argue that this was and still is the case with landfills around Tasmania. The advantages and disadvantages of landfills are summarized in the Figures 4.6 and 4.7.

4.6 The New Age of Landfills in Hobart: Tighter Government Control.

The most recently closed (youngest completed landfills) at Old Proctor's Road and Jackson Street, Glenorchy, were undoubtedly the most advanced in terms of tip management technology for Hobart's disused tips. The reasons for this are many. The Hobart and Glenorchy City Councils' increased awareness of better tip management and the principles of landfilling as opposed to open dumping may have been one. Certainly, by this time they had enough experience to avoid any potential problems. Better tip management technology available from overseas may have filtered through to the Councils. The Councils may have been pressured to lift their game through the public's greater awareness of environmental issues. The introduction of the *Environment Protection Act* in 1973 played a major part in the improvement of tip management.

The State Government Department of Environment and Land Management now plays a watchdog role in keeping local Councils in line with Government policy. Some of the rules introduced were not popular with Councils as they were forced to spend resources on tip management and comply with strict controls. The Hobart City Council was not keen on this change as a newspaper headline shows: "Mayor slams refuse rules" (*Mercury* 7 May 1975:7).

The current tips in the Hobart, Glenorchy and Clarence areas, are run according to State regulations. However, problems are still experienced relating to environmental impacts of these tips. Indeed these problems may always be present by the very nature of solid wastes when they are landfilled through their decomposition by-products and synergistic effects. The life of tips are now expected to be much longer. The present tips have a life expectancy of twenty years or more. The small open dumps of the past have made way for larger tips with transfer stations in remote areas and tight

FIGURE 4.6

ADVANTAGES OF LANDFILLS

- *Initial capital investment is low compared with other disposal methods such as incineration.
- *Increased or peak quantities of solid wastes can be disposed of with little additional personnel and equipment.
- *All types of solid wastes can be received eliminating the necessity of separate collections.
- *Operations can easily be terminated without a great loss in equipment or land (equipment such as bulldozers can be utilized elsewhere).
- *Less land than that used in open dumping is required because wastes are compacted.
- *Landfills can be established immediately - no plant has to be built before operations can begin.
- *Landfill is the most economical method of solid waste disposal.
- *Landfilling is a complete and final disposal method (compared with incineration and composting where residue, quenching water, unusable materials remain and require further disposal).
- *Unusual materials and bulky articles do not usually cause difficulties of operations.
- *Submarginal land can be reclaimed.

(Adapted from Baum and Parker 1974:283)

FIGURE 4.7

DISADVANTAGES OF LANDFILLS

- *Large amounts of land required
- *Prevention of groundwater pollution may be costly
- *If distance to a landfill is very great, the cost of transfer operations may be high.
- *Wildlife habitats can be destroyed.
- *Depletion of resources. Food wastes and sewage sludge could be used as fertilizers, paper and wood could be recycled and metals are non-renewable.
- *Marine and freshwater pollution through leachate drainage and surface run-off.
- *Land and groundwater contamination.
- *Land degradation.
- *Air pollution through methane, odour from decomposition of waste and smoke, odours and fly ash from burning.
- *Litter, unsightliness and blowing paper.
- *Injury to wildlife.
- *Spread of human diseases.
- *Haven for pests, vermin and pathogens.
- *Increased traffic around the site.
- *Filling of swamps or flood plains can cause groundwater pollution and can have an adverse effect upon flood conditions.

(Adapted from Baum and Parker 1974:283, Turk and Turk 1988:652, Berry and Horton 1974:258)

government controls. The problems associated with landfilling are still present, however, more time and money is spent to minimize these nuisances and attack solid waste management in different ways such as emphasizing waste minimization at the source of production. Recycling and re-use forms a major part of solid waste management.

CHAPTER FIVE

ENVIRONMENTAL IMPACT OF OLD TIP SITES: PROBLEMS AND AFTER-USE OPTIONS

5.1 - Composition of solid wastes going to landfill

The changing nature of tips from dumps to landfill reflects the changes in the Hobart community and their affluence. The years since settlement have seen the generation of more solid waste due to an increase in population and an increase of disposal goods. The greater management of tip sites by local authorities can be attributed to the increase in awareness of public health issues and the development of environmental issues within the society which eventually pressured the local authorities to change the way in which solid waste are managed. These changes can be identified in the way management of tip sites has evolved as explained in the last three chapters.

One of the major changes which contributed to the changing nature of tip sites is the composition of wastes which were disposed of. As discussed in Chapter 2, people in colonial Hobart indiscriminately disposed of all manner of wastes to tips, vacant lots and the streets. The composition of these solid wastes would have been mainly vegetable matter but also rags, ceramics, glass and scrap metals. Because of the harsh economic situation of the times, many of these wastes would have been salvaged, such as in the case of pigs roaming the city streets feeding on food scraps.

Many factors influence the types of waste which finally end up at dumps and landfills: "Climate, economics, diet, religious practices, social welfare and general standards of public health protection all influence the nature and quantity of materials which arise as municipal wastes" (Crawford and Smith 1985:5-6). As the nature of Hobart society changed from a colony to a commercial centre and State capital city, so too did the solid wastes being disposed of by its citizens. The hoarding of potentially useful wastes such as pieces of metal and wood, was actively discouraged by the local authorities.

It was not until the post war boom period that the production of a wider range of goods resulted in an increase in the amount of solid waste. Household

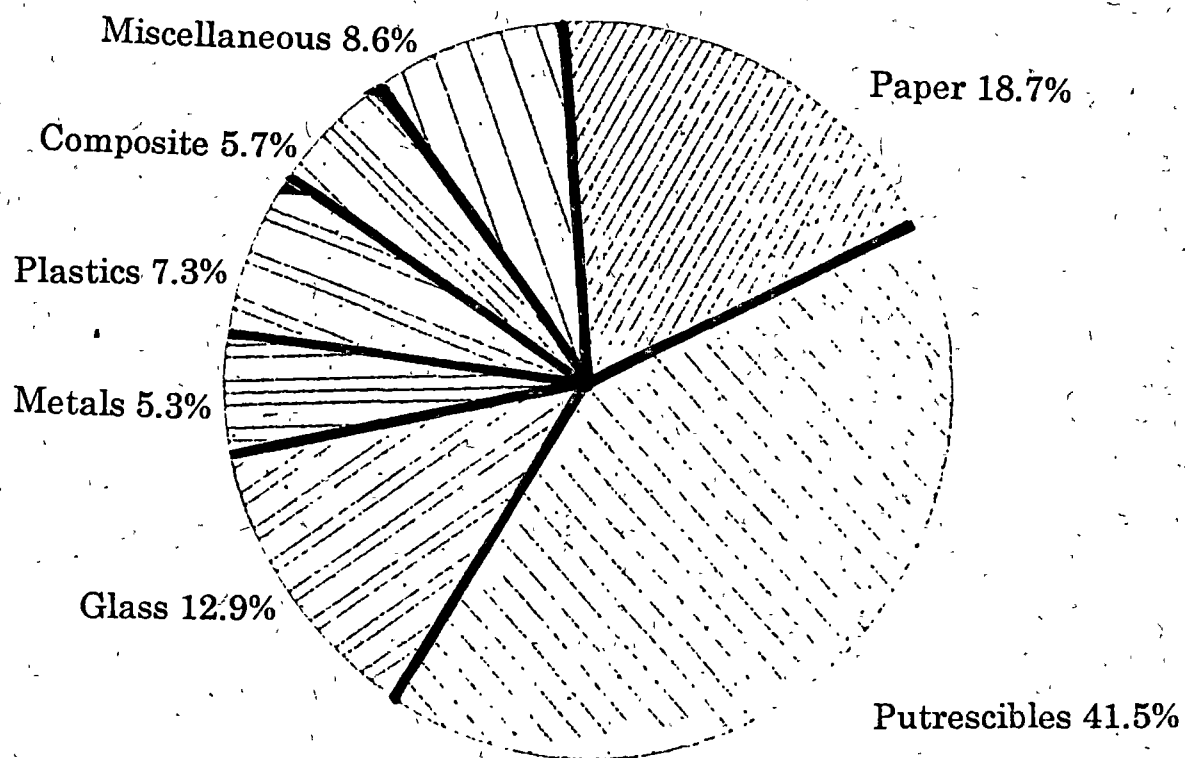
commodities in the form of electrical appliances such as refrigerators, toasters, washing machines, heaters and air conditioners were now available on the mass market. Their manufacture involves the use of many chemicals and synthetic materials never before produced on a large scale in the State. The introduction of these new plastics and synthetic materials resulted in their addition to the solid waste stream. Many of these new products were actually designed to become obsolete in order to boost annual sales (Packard 1970:10), so that eventually many would find their way to landfill. In addition the introduction of the packaging of goods resulted in a much larger volume of solid waste which at the time, were not re-used or recycled. The greater affluence of the Hobart community during the post war boom period resulted in the disposal of many solid wastes which may have been salvaged. "As a country becomes more prosperous the proportion of salvageable materials in the refuse increases" (Oweis and Khera 1990:2).

These changes which first occurred in Britain and the U.S. have been documented by Crawford and Smith:

The general rise in the standard of living which has resulted in the pre-packaging of materials and a gradual replacement of the traditional open coal fire by central heating systems, burning gas, electricity solid or liquid fuel. The open fire contributed substantially to the ash content of the municipal waste, but also provided the householder with an immediate method for disposing of combustible waste, including paper (Crawford and Smith 1985:4).

While central heating systems are not used as widely in Tasmania as they are overseas, open fires and wood heaters are used by many householders, yet, there is still a large amount of combustible wastes being taken to landfills. A typical composition of solid waste produced by householders presently found in Hobart is shown in Figure 5.1.

Industrial waste which may currently be found in Hobart includes a wider range of chemicals such as pesticides, herbicides and chemicals from the manufacture of goods. The category of miscellaneous may include rubber, leather, wood, textile and rubble. Figure 5.2 shows the hazardous wastes which can be produced by a number of industries. In Hobart, there are only a small number of these industries, however, some of these hazardous substances may have been disposed of on the larger landfills located close to these industries. Household wastes could also be the source of a number of

Figure 5.1 - Categories of domestic waste by weight

(Source: Dowson 1991).

Figure 5.2 - Representative hazardous substances found within the industrial waste stream

Industry	As	Cd	CH ^a	Cr	Cu	CN	Pb	Hg	MO ^b	Se	Zn
Battery		x		x	x						x
Chemical manufacturing			x	x	x			x	x		
Electrical and electronic			x		x	x	x	x		x	
Electroplating and metal finishing		x		x	x	x					x
Explosives	x				x		x	x	x		
Leather				x					x		
Mining and metallurgy	x	x		x	x	x	x	x		x	x
Paint and dye		x		x	x	x	x	x	x	x	
Pesticide	x		x			x	x	x	x		x
Petroleum and coal	x		x				x				
Pharmaceutical	x							x	x		
Printing and duplicating	x			x	x		x		x	x	
Pulp and paper								x	x		
Textile				x	x				x		

^a Chlorinated hydrocarbons and polychlorinated biphenyls.

^b Miscellaneous organics such as acrolein, chloropierin, dimethyl sulphate, dinitrobenzene, nitroaniline and pentachlorophenol.

(Source: Oweis and Khera 1990:7).

hazardous substances which find their way to landfill. These wastes include cleaners, automotive products, paints and garden products (Oweis and Khera 1990:2).

5.2 - Landfill changes after closure

"Once trash is buried in a landfill, we tend to ignore it and presume that micro-organisms gradually convert the refuse to innocuous materials. Relatively little is known about how well this disposal technology actually functions (Suflita et al 1992:1486-1487). Indeed, the out-of-sight out-of-mind attitude was evident until the middle of the 1970s. It seemed that once the solid wastes of the community are safely put away in a landfill, they can be forgotten. Just as attitudes towards landfill management have changed, so too has the attitude towards the environmental impact of tip sites after they have closed.

The problems which are now being encountered as a result of the bad practices of the past have brought this problem to light. There are a number of examples within Australia alone which involve the inappropriate development of old tip sites. The most prominent example of this would be the redevelopment of an outer Brisbane suburb, Kingston, on top of an old tip site, mine shafts and contaminated tailings dams. Fortunately, in Hobart, there have been no problems relating to this type of development. All of Hobart's old tip sites have now become valuable blocks of land providing open space and recreation grounds for its citizens.

The subject of much of the literature relating to landfills at the moment involve the discussion of the decomposition of waste after closure of the site, the processes the waste undergoes and the problems which may result. Many argue that the composition of the waste put in landfill is important to know as it influences how a landfill will decompose when complete. Any treatment of wastes before and after they enter a landfill will also have an effect on a landfill's after-use behaviour. Such treatment includes whether the wastes were compacted, shredded or baled and the extent to which these practices were carried out (Cancelli 1989:488).

When solid wastes are tipped into a landfill, several biological and chemical reactions occur. These are many and varied and sometimes mostly unpredictable due to all factors influencing decomposition and settlement of

the wastes. The major problems which can occur include the leaching of toxic substances from the site into local watercourses and contamination of groundwater, the generation and escape of flammable methane gas and the settlement of wastes resulting in subsidence, the instability of the fill and exposure of large objects such as car bodies. These pose problems when the site is being used intensively for recreation and other human activities.

Environmental degradation can occur through the leaching of organics and inorganics from the solid waste by infiltrating rainwater. Explosive methane and carbon dioxide gas generated during anaerobic solid waste decomposition can migrate away from the fill (Dewalle and Chian 1979:742).

Dewalle and Chian have described some of the problems which can occur when decomposition of a landfill happens. These problems can have a significant environmental impact if no measures are taken to minimize or control them. If protective measures are taken, then these problems are effectively minimized and in some cases, abated.

5.3 - Decomposition of solid wastes

A landfill is a "partly continuous chemical and microbial fixed bed reactor" (Belevi and Baccini 1992:432). Different types of wastes all react differently when put together in such a mixture. "Paints, plastics, pharmaceuticals dissolve and degrade in the acidic anaerobic environment, thereby, releasing degradation products which may be even more toxic than the products from which they originated" (Brown and Donnelly 1988:2).

When wastes are deposited in a landfill, certain chemical, physical and biological reactions occur. These reactions occur simultaneously and have been identified as:

1. biological decay of organic compounds with the generation of gases and liquids. This is when putrescible wastes begin to decompose and produce carbon dioxide and water,
2. chemical oxidation of materials occurs,

3. escape of gases from landfill and diffusion of gases through landfill,
4. dissolving of organic and inorganic materials by water and leachate,
5. movement of liquids through or past the landfill,
6. settlement caused by consolidation of material into voids created by the decomposition, leaching and gas evolution (Senior and Kasali 1990:10).

The most significant changes to a landfill occurs when water comes into contact with the waste. The processes which follow result in the movement of leachate, the production of gases and the eventual settlement of the fill. Some of the problems which may follow from these occurrences have been identified by Petts. These are summarized in Figure 5.3.

5.4 - Leachate - what is it?

Leachate is water which has travelled through the waste in a landfill. It carries with it suspended and soluble materials (Senior and Shibani 1990:82). Senior and Shibani describe the generation of leachate as a "consequence of a complex of first- and second-tier interacting variables". First-tier variables include geology, hydrogeology, hydrometeorology, refuse composition (particularly electron donors and electron acceptors, microbial inoculum and moisture content), refuse emplacement strategy, cover permeability and topography, vegetation cover, and site after-use, season and time. These in turn, direct second-tier variables such as redox potential, pH and temperature (which mediate microbial selection) together with physicochemical reactions, particulate acidification, volatilization, precipitation, solution, sorption and ion exchange (Senior and Shibani 1990:82). The complexity of the way in which leachate is generated makes it difficult to predict its toxic potential to the surrounding environment.

A number of generalizations can be made as to the likely nature of leachate and the period around which it will be at its most dangerous. Keenan et al. have identified that "as a rule - pH is acidic, heavy metal concentrations are high, the ration of Chemical Oxygen Demand (COD) to Biological Oxygen Demand (BOD) is high and total organics and ammonia are very high (Keenan

Figure 5.3 Potential Risks of Landfill

<u>SOURCE</u>	<u>PATHWAY</u>	<u>RECEPTORS</u>	<u>RISKS</u>
Liner failure	Hydrogeological	* Groundwater	* Pollution of groundwater
Leachate leakage		* Potable water supply * The public * The rivers and associated fauna	* Loss of a potable supply * Public health risk * Damage or loss of flora and fauna
Leachate discharge		* Sewage treatment works	* Effects upon biological processes
Contaminated surface water	Run-off	* Soils, flora and fauna, watercourses, the public (via ingestion of water)	* Water Pollution Public health risk Damage or loss of flora
Gas migration	Geological: soils, landfill cap to air	* Buildings and people, flora	* Explosion and fire, death serious injury, asphyxiation Damage and loss of flora *
Dust	Air	* People and flora	* Health risk
Odour	Air	* People	* Loss of amenity and nuisance
Exposed wastes	Direct contact	* People	* Health risk

(Source Petts 1993:31).

et al 1983:1371). Figure 5.4 shows a list of all of the chemicals which have been detected in landfill leachate from domestic, commercial, industrial and co-disposal sites.

Figure 5.4 - Chemicals Detected in Landfill Leachate from Domestic, Commercial, Industrial, and Co-Disposal Sites

ELEMENTS		
Aluminium	Cobalt	Nickel
Arsenic	Copper	Potassium
Barium	Iron	Selenium
Beryllium	Lead	Silicon
Boron	Magnesium	Silver
Cadmium	Manganese	Sodium
Calcium	Mercury	Strontium
Chromium	Molybdenum	Zinc
INORGANIC RADICALS		
Ammonium	Fluoride	Phosphate
Bicarbonate	Nitrate	Sulphate
Chloride	Nitrite	Sulphide
ALIPHATICS		
Acetic acid	Heptanol	Methyl hexyl ketone
Acetic acid, ester	Hexane	2-methyl pentanoic acid
Butanol	Hexanoic acid	4-methyl pentanoic acid
2-Butyl alcohol	Hexanoic acid, butyl ester	2-methyl propanoic acid
iso-Butylamine	Hexanoic acid, butyl ester	Myristic acid
sec-Butylamine	Hexanoic acid, heptyl ester	γ -Nonalactone
t-Butylamine	Hexanoic acid, hexyl ester	Octane
Butyric acid	Hexanoic acid, methyl ester	Octanoic acid
iso-Butyric acid	Hexanoic acid, octyl ester	1-Octanol
Butyric acid, ester	Hexanoic acid, pentyl ester	Oleic acid
Butyric acid, propyl ester	Hexanoic acid, propyl ester	Palmitic acid
Carbon tetrachloride	1-Hexanol	Pentanoic acid
Caproic acid	Hexanone	iso-Pentanoic acid
iso-Caproic acid	Hexene	Pentanoic acid, ethyl ester
Chloroform	Ketones	Propionic acid
Dialkoxymethoxy propane	Lauric acid	iso-Propyl Alcohol
Dichloroethane	Methanol	Squalene
Dichloromethane	Methyl acetate	Stearic acid
Diethyl ether	Methyl amine	Tetrachloroethylene
Disulphides	Methylene chloride	Trialkyl phosphate
Ethanol	2-Methyl butanoic acid	Trichloroethylene
Ethyl acetate	3-Methyl butanoic acid	Trimethylamine
Ethyl butyl ether	2-Methyl butyric acid	3,5,5-Trimethyl hexanoic acid
Ethyl ester	Dimethyl ketone	Valeric acid
Ethyl hexanol	Methyl ethyl ketone	iso-Valeric acid
Heptane	Methyl iso-butyl ketone	Vinyl chloride
Heptanoic acid		
AROMATICS		
2-(4-Acetyl phenyl) propan-2-ol	2,6-Di-t-butyl-4-methyl phenol	Lignin
Alkyl benzenes	Diethyl phthalate	3-Methyl indole
C6 allyl phenol	Dimethyl benzoic acid	Methyl naphthalene
Benzaldehyde	Dimethyl t-butyl phenol	Naphthalene
Benzene	Diethyl phthalate	Phenol
Benzoic acid	Dipropyl phthalate	Phenyl acetic acid
Benzyl alcohol	Disulphides	2-Phenyl ethanol
Butyl benzene sulphonamide	Ethyl benzene	Phenyl propanol
t-Butyl cresol	Ethyl methyl benzene	Phenyl propionic acid

t-Butyl methoxy phenol
t-Butyl phenol
 Chlorotriisopropyl
 Cresols
 ■-Cresol
p-cresol
 Di-*t*-butyl cresol

Ethyl methyl thioindone
 ■-Ethyl phenol
p-Ethyl phenol
 Fulvic acid
 Humic acid

Phthalates
 Styrene
 Tannin
 Toluene
o-Xylene
p-Xylene

ACRYCLICS

t-Butyl cyclohexane
 Cyclohexane
 Cyclohexane hexanoic acid
 Cyclohexanol
 Cyclohexanone

TERPENES

α -Bicyclic sesquiterpene
 Camphene
 Camphor
 Fenchone
 Terpeneol
 α -Terpineol
 Thujone

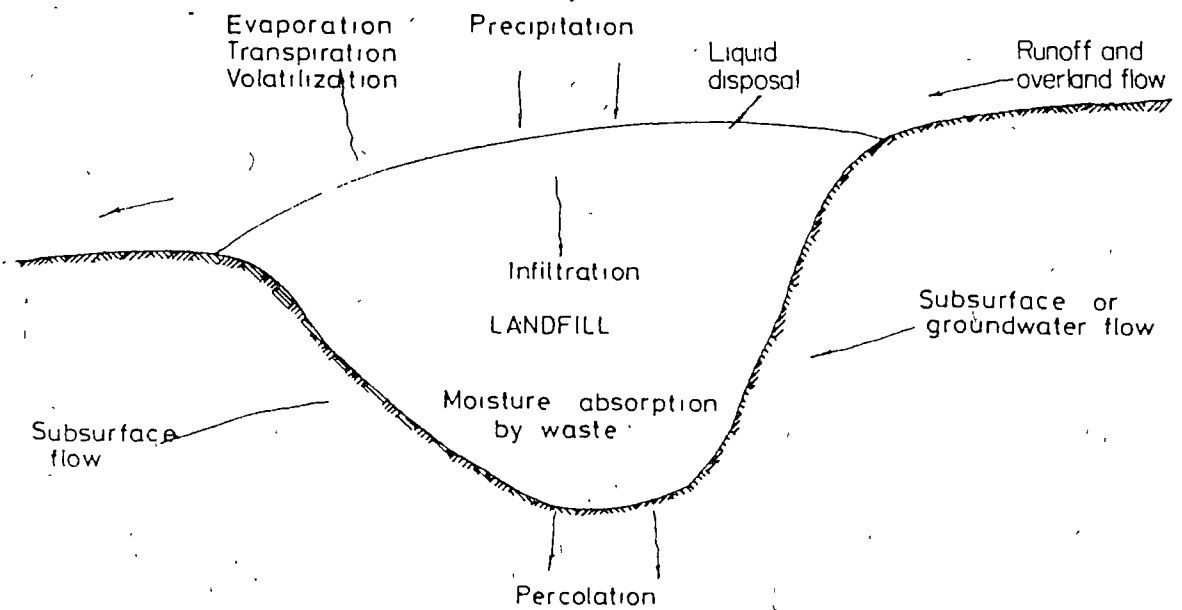
(Source: Senior and Shibani 1990:85-86).

The length of the list shows a huge number of potential contaminants which may be found in leachate. Some chemicals may have no significant effect at all and others may pose a problem at low levels, or a mixture may synergise to produce toxic effects. The significance of their presence is their effects when coming into contact with groundwater and any surface water which runs off the waste. It is important to note that the desired quality of the receiving waters significantly influences whether certain contaminants are of concern or not. Figure 5.5 shows how a landfill affects this cycle. The potential for contamination of groundwater and local watercourses can be clearly seen.

5.4 How leachate is generated

The generation of leachate can be seen to occur in three stages. Leachate is generated in the initial period during which a landfill is approaching field capacity. The second stage is when extended period of leaching occurs. This period is the time when the landfill undergoes major decomposition and eliminates all of its contaminants. The length of this period has been surmised as anything from 50 years to centuries (Senior and Shibani 1990:83). The third stage is when leachate no longer produces a pollution threat (Senior and Shibani 1990:83).

The measure of time needed for these stages to be complete is highly dependent on other factors such as the moisture content of the waste, the depth of the landfill and the first and second tier variables described previously. The moisture content of the wastes within a landfill and the precipitation received

Figure 5.5- Water Balance of a Landfill

(Source: Crawford and Smith 1985:21)

on it have been identified as measures of how much and how long toxic leachate will be produced. It has recently been argued that a landfill with a high moisture content will decompose more rapidly and the watering of landfills to speed up the decomposition process has been recommended. This is being advocated despite the fact that many modern landfills are designed to keep water out (Uehling 1993:12). "In general, deeper fills will absorb more water before leaching occurs but take a longer time to decompose, and so produce leachates over a longer period of time than shallower fills of similar surface area and under similar conditions of precipitation and percolation" (Senior and Shibani 1990:82).

From the literature studies of other tips, it can be assumed that the tips which would no longer be producing leachates would be those filled before 1930. These tips would be those described in chapter 2. The leachate levels of the older tips in Hobart (1830s to 1930s) may be of little or no consequence at this stage in time. These tips would no longer be producing leachates as the wastes within would have decomposed many years ago. As mentioned earlier, the types of wastes which were disposed of would have influenced leachate production. It is unlikely that large amounts of toxic substances such as industrial and agricultural chemicals would have been disposed of in the smaller suburban tips, therefore the leachate produced would not have significant long-term effects. However, due to the lack of information available as to what exactly was disposed of in these tips and the lack of monitoring data, it cannot be conclusively proven that there were or still are any adverse impacts to the environment caused by these tips.

It is unlikely that the leachate from most of these sites would be highly toxic. One of the reasons for this may be that the majority of wastes were non-hazardous putrescible wastes and glass, metal and building rubble. Another reason could be that the amounts of wastes which were disposed of at these sites (except for the New Town Bay tip) were very small, therefore, only a small amount of leachate would be produced. However, there may also have been small amounts of hazardous household and industrial wastes disposed of at these sites. This would result in a leachate containing substances toxic to the receiving environment.

Tips which were used after the 1930s are more likely to have larger amounts of toxic substances within them because of the more widespread use of chemicals within the home and industry. Again, however, as no monitoring of leachate has been carried out and no information as to the exact nature of the

wastes disposed of at these tips, the effects of any leachate cannot be proven. Tips of this period may still be leaching substances as the wastes within could still be decomposing. However, due to the lack of information, it cannot be proven whether they have been a problem now or in the past, or if they have posed a threat at all.

The problem of leachate contaminating groundwater has not posed a threat to human health as Hobart's water supply is not reliant upon groundwater resources, thus eliminating the necessity of an essential non-contaminated groundwater supply. However, leachate finding its way into creeks which are used for irrigation or recreation may be affecting human health.

The leachate of the two youngest tips, Old Proctor's Road and Chapel Street, which are most likely to contain toxic substances, are diverted to sewer for treatment. Samples of leachate and surrounding waters are taken regularly and tested as required by State legislation. These samples are tested for a number of contaminants. The parameters for which the leachate from the Chapel Street tip is tested are listed in Figure 5.6.

Figure 5.6 - List of parameters for which the Chapel Street tip site's leachate is tested.

Flow rate (l/m)	Sodium
Turbidity	Carbonate
Odour	Hydrogen Carbonate
pH	Sulphate
Conductivity	Chlorine
Total Dissolved Solids	Fluorine
Total Suspended Solids	Cadmium
Total Organic Carbon	Copper
Biological Oxygen Demand	Chromium
Nitrite	Lead
Nitrate	Zinc
Ammonia	Arsenic
Calcium	Selenium
Magnesium	Phosphorous
Iron	Cyanide
Aluminium	Organochlorines
Potassium	Organophosphate

(Source: Glenorchy City Council)

The results of monitoring for Old Proctor's Road and Chapel Street tips was made available to the author for perusal by the Hobart and Glenorchy City

Councils. Most parameters were below levels set in the State Government's *Guidelines on Minimum Desirable Ambient Water Quality for Receiving Waters in Tasmania* for primary, secondary and tertiary contact waters. Slightly higher levels for total coliforms were present in leachate from the Old Proctor's Road tip.

The parameters which the leachate is tested for are sufficient for legislative requirements to be a range to determine its toxicity. However, Kristensen has identified some problems associated with this type of testing. He advocates a combination of tests to correctly determine the toxicity of leachate. "The failure to identify a component does not mean that the chemical is not toxic or otherwise harmful to the environment. A reduced chemical programme has led to a characterization of samples of leachate as "non-polluting" even though they may still contain hazardous substances (Kristensen 1992:89, 103). To overcome this, he advocates a combination of chemical analytical methods - biotests to pick up substances with toxic properties and a chemical analytical approach to pick up substances of environmental concern, persistent or bioaccumulative (Kristensen 1992:103). These methods are supposed to ensure that a good majority of the potentially toxic substances which can exist in leachate will be identified.

Kristensen has identified a valid point. Testing of leachate for a handful of relatively random parameters will not provide a completely accurate picture of its potential toxicity to the surrounding environment and its flora and fauna. However, these tests are expensive and time consuming for Hobart's local authorities, so it is unlikely that tests of this kind will be carried out unless legislative requirements change.

There are, however, a number of parameters for which the leachate from Hobart's tips should be tested immediately because of the likelihood of these substances being present; and the dangers posed by their persistence in the environment. These substances include chlorinated pesticides such as DDT, aldrin, dieldrin, 2-4-5T and 2-4D which were widely used from about the 1930s until the 1960s. Leachate from the Chapel Street tip is the only one tested for organochlorines. 1080 poison was sprayed directly onto tips to control rats, therefore, it is likely that some residue will remain on site (HCCHSC Minutes 1934). Other hazardous substances which may be present in an old tip include PCB's which were used widely in electrical appliances such as transformers, heaters and fluorescent globes. These substances are carcinogenic and are highly persistent in the environment. It is essential to

determine whether these substances are present within the tip so that threats to human health and the environment can be minimized.

It is not possible to eliminate the production of leachate from any landfill. The best methods currently available to deal with it are to control and manage its escape from the site into local watercourses and the groundwater.

5.5 - Landfill Gases

The decomposition of wastes within a landfill produces gases. As with leachate, the composition of these gases is influenced by many factors including the types of waste, the quality and quantity of nutrients in the waste and their input rates, moisture content, landfill pH, temperature and waste density together with operational practices, site hydrogeology, waste age, climate, cover material, site geometry and geology (United Kingdom Department of Environment (UKDE) 1992:5, Richards 1989:320, van den Broek 1986:4). The usual major constituents of landfill gas are methane and carbon dioxide. They are both colourless and odourless. The gas can be odorous depending upon the presence of trace components. Landfill gas can form a flammable mixture in air when methane and hydrogen are present: "it may also act as an asphyxiant either alone or when mixed with air when the oxygen content is depleted" (UKDE 1992:15). An important feature of the gas is its high energy content. It has an energy potential of up to 24 MJ/m^3 , which is regarded as a valuable source of energy (Senior & Kasali 1990:114).

Four stages of the decomposition process have been recognized. The first stage occurs immediately after wastes are buried. Oxygen is used by micro-organisms breaking down the waste forming carbon dioxide and hydrogen sulphide. In the second stage, oxygen is depleted and a peak in carbon dioxide and hydrogen sulphide production occurs. Methane is produced in the third stage and its concentrations rise up to 55% of the total volume of gas produced. Traces of volatile organics which were present in the waste are now in the gas. Long term gas production occurs in the fourth stage and can last for decades. Landfills which were started thirty years ago and closed more than ten years ago are still active gas producers (Nuttall 1993:34).

Landfill gas will usually be corrosive, saturated with water vapour and will normally be above ambient temperature (UKDE 1992:15). A warm, musty

smelling gas was emanating from the top of the pipe which is located under the Jackson Street tip site at Glenorchy on a visit to the site in 1993. The sickly sweet smell can be due to the presence of the trace components of esters and thiols (UKDE 1992:15). Anaerobic digestion of the waste resulting in the production of methane occurs more readily within a deep landfill. The compaction of wastes, the daily application of a waste cover and the further application of a thick final cover results in a deeper landfill where the total depth can be 20-30 metres or more. "In such fills the organic fraction of the waste decomposes via predominantly anaerobic mechanisms rather than aerobic conditions which may prevail in open dumps or poorly compacted shallow fills" (van den Broek 1986:4).

Higher temperatures within a deep landfill provide the most favourable conditions for the survival of anaerobic bacteria. The optimum temperature for methanogenic bacteria is between 35 and 45 degrees Celsius. Temperature change inside a landfill is determined by many factors. These include "microbial metabolism (aerobic and anaerobic) which, in turn, are directed by the dry density of the emplaced refuse, the specific surface area, the refuse composition and availability of electron acceptors, the landfill water content and temperature, and the addition of solar energy, all of which are balanced by the heat loss both to atmosphere and surrounding soil" (Senior and Kasali 1990:130).

The deeper tips within the Hobart area would be the most recent ones such as, Jackson Street, Old Proctor's Road, South Hobart, Wentworth Park and New Town Bay. These tips are more likely to have once generated or are still generating combustible landfill gas. After cricket matches played on the South Hobart oval, team members would light cracks in the field and watch the flames come up through them. This occurred during the mid-1980s, almost twenty years after the site was redeveloped. The cricket ground was turned into a soccer ground after the Council found it too difficult and expensive to maintain a level cricket pitch due to uneven settlement of the fill (Caretaker South Hobart soccer ground pers. comm. 19 July 1993). Tip operators at the current Glenorchy tip in Chapel Street light the vents at Christmas time.

Gas production is roughly proportional to moisture content up to saturation point (Richards 1989:321). As explained previously, it has been shown that the greater the moisture within a landfill before saturation point, the decomposition of wastes is more successful. The presence of a high water content should enhance the general availability of nutrients and also stimulate

bacterial growth directly (Senior and Kasali 1990:123). A cooler climate will influence gas production negatively as "lower temperatures generally produce slower reactions and in extremes cases stop methane production" (Richards 1989:321). It is unlikely that any landfill in the Hobart area would be greatly influenced by such cold temperatures.

Waste composition is another factor which influences gas production. Readily degradable organic matter will initially produce gas (UKDE 1992:19). A higher proportion of this putrescible waste will assist rapid decomposition and gas production. If there is a higher carbohydrate/polymeric content, the digestion process will be slower (Richards 1989:321). Waste in the earliest of Hobart's tips would have consisted of a higher putrescible content and would have decomposed quite rapidly. The introduction of more packaging wastes into the waste stream during the 1960s will result in the slower digestion of Hobart's later tips.

Methane producing bacteria (also known as methanogens) require a pH range of 6.5 to 8.5 (UKDE 1992:19). Senior and Kasali have observed that these conditions are more likely to develop in those landfills which contain a mix of both biodegradable and "inert" material "as high initial fermentative activity can lead to the accumulation of high concentrations of reduced organic acids which lower the pH to the detriment of the methanogens" (Senior and Kasali 1990:134). This scenario is most likely to affect the newer landfills in Hobart as they contain large volumes of both inert and biodegradable materials.

Density of wastes within a landfill affects the yield of gas. A higher density of waste will exclude oxygen and encourage the growth of anaerobic bacteria. "However, water movement within the waste is necessary to permit the free movement of nutrients for bacteria to flourish" (UKDE 1992:19).

5.6 Problems caused by landfill gas

Landfill gas is combustible and can be a hazard to users of old tip sites or those who live close to them. Methane is explosive in concentrations of 5% to 15% in air, and above concentrations of 15% it will support a flame (Nuttall 1993:34). Because of the gas's flammability, fire could break out within a landfill where a large amount of combustible materials has been deposited. It is very difficult to control these fires once they take hold and especially when

the fire is burning underground. A fire at the Hobart refuse disposal site at McRobies Gully illustrates this point. "Once a fire gets inside a tip, it can burn for months" (*The Mercury* September 12 1994:9).

Volatile organic compounds may be contained within landfill gas. They are formed by "vapourization of organic liquids dumped in the landfill, volatilization from contaminated water, microbial action or chemical reaction" (Little et al. 1992:2060). These compounds can move through the landfill and escape by diffusion or by "advective transport in the gas and aqueous phases" (Hodgson et al 1992:277). It has been documented that these compounds can accumulate in basements of nearby buildings, posing a health hazard to occupants. Halogenated compounds have been found in buildings where a large percentage of ventilation air for a house may derive from the advective entry of soil gas (Hodgson et al 1992:277). This is unlikely to happen in Hobart as few houses have basements designed for this type of ventilation.

Landfill gas can have a detrimental effect upon vegetation growing on the landfill cover and surrounds. Landfill gas can destroy the soil structure, cause poor drainage and oxygen depletion and is also directly toxic to most plant species (Crawford and Smith 1985:151). Methane is partly oxidized by bacteria in the soil when it diffuses through the top layer of fill. This causes the depletion of the oxygen content of the topsoil. Another problem is caused by the malodorous nature of the trace components within landfill gas, causing a nuisance to residents surrounding the landfill (van den Broek 1986:4).

Landfill gas production can continue for up to 15 years depending upon on-site conditions (van den Broek 1986:4). Precautions must therefore be taken to prevent any hazards caused by the escape of gases from the landfill site as well as the on-site management of gases. It has been estimated that McRobies Gully tip site is likely to produce about 1260 tonnes of landfill gas per year. This figure is expected to grow as the tip continues filling up (Carter 1994:2).

5.7 - Settlement of wastes and landfill stability

As some wastes within a landfill decompose more readily than others, the cover layer settles unevenly over the fill. This settlement is the result of a number of factors, mainly: "time dependent physical and chemical processes such as compression and structural re-arrangement of fill components under

their self-weight, and the aerobic and anaerobic decay of a proportion of waste materials" (Kurzeme and Walker 1986:4). The settlement patterns can be seen when a visual survey of an old tip site is undertaken. It is argued the "field observations are the only means of obtaining reliable data on which to base estimates of future settlement" (Kurzeme and Walker 1986:4). Small depressions and mounds are the main features of the surface of the playing fields and parks which were once old tips sites.

Compaction of wastes during the landfill stage of a site greatly influences its future settlement. Generally, more settlement will occur at a site where there was little or no compaction of wastes (Kurzeme and Walker 1986:8). Compaction of wastes was not practised at the older tip sites in Hobart, therefore, settlement is likely to be greater and more uneven than the most recent tips. However, through many field observations, it is clear that much uneven settlement has occurred in even the youngest tips. Doug Seaborn, who worked on the Chapel Street tip has estimated that it has dropped up to twenty metres from its original fill level. Most settlement will occur within ten years of the waste being deposited but the fill may not even finish its settlement for up to thirty years (Crawford and Smith 1985:144).

Other problems involving earth movement, slope stability and drainage can occur on old tip sites. In the cases of waste being used to build up the side of a hill, incorrect engineering of the tip slopes can result in the instability of the waste. "Surface water can escape into the soil mass or underground water can emerge beneath a slope and lubricate a dangerous slip plane" (Kurzeme and Walker 1985:142). Drainage is thus important to keep water away from the landfill. Drains which have been dug around the Chapel Street, Old Proctor's Road and South Hobart tips are still present to prevent surface run off infiltrating the fill.

5.8 - Re vegetation of old tip sites

The re vegetation of old tip sites is one of the most important factors for their successful rehabilitation. Re vegetation is required to restore the amenity of the site and can also be a major factor in the control of leachate (Kurzeme and Walker 1985:149). Bradshaw and Chadwick, in their study of old tip sites in England have documented that colonization takes a little time to occur but very soon after, a well defined flora develops (Bradshaw and Chadwick 1980:228).

In Hobart, weeds are the main colonizers on the younger tip sites. Grasses and small shrubs are the main types of vegetation which can be observed on the Old Proctor's Road site as seen in figure 5.7. On older tip sites, the vegetation is confined to small trees and shrubs. There are also patches of bare ground in some areas of the site. This could be evidence of landfill gas penetrating the surface cover.

The quality of the topsoil in the cover layer of a tip also affects plant growth. The soil may be nutrient deficient, mainly lacking nitrogen and phosphorous (Crawford and Smith 1985:151-2). The diversion of water away from the top of the fill also has a detrimental effect on plant life as Gordon describes:

Drought conditions can be caused by increased run-off due to surface compaction and by higher soil temperatures resulting from the biological decomposition of trash. The discontinuity of texture between the refuse and cover can also inhibit water being pulled to the surface (Gordon 1991:80).

5.9 - Tip Site Redevelopment

Tip site redevelopment is a task requiring much thought and planning. All of the factors described above must be taken into account and their effects should be reduced before any redesign and development on an old tip site takes place. In Hobart, where land is not scarce, the redevelopment of old tip sites has been confined to covering the fill with a layer of topsoil and using the land as open space or flat playing fields which require minimal effort and resources for their redevelopment.

There are a few isolated cases where houses have been built on the edges of a landfill site. A few of the houses in Silwood Avenue were built on the edge of the Wentworth Park site at Howrah. During excavation for the footings for one of the houses in 1989, a builder found many objects which were once disposed of at the tip. He recalls finding toys, bottles, plastics, tins, tyres and a black gooey substance (Ian Bowman pers. comm. 20 July 1993). This substance would have been the decomposed putrescible materials tipped at the site more than 20 years previously. The footings for the house were established four to five metres underground to ensure the stability of the building in case of ground subsidence and uneven settlement of the

Figure 5.7 - Vegetation on Old Proctor's Road Tip Site



decomposing wastes beneath. This is an expensive activity, which explains why the redevelopment of old tip sites is mainly restricted to recreational use and open space.

5.10 - After-use options for landfills

The scarcity of land close to cities overseas has resulted in old tips sites being redeveloped into many and varied land uses. Some of these uses include: residential development, light industry, agriculture, sports, recreation, woodland and wildlife reserves. Figure 5.8 shows the viability of redevelopment options for old landfills.

In Hobart, where most of the old tip sites have been redeveloped into parks, playing fields and open space, sheds and sporting facilities such as clubhouses and public conveniences are the main buildings which have been constructed on these sites. The Macquarie Point tip has been completely redeveloped into wharf facilities as was intended by town planners last century.

Some of the smaller tip sites such as those illegal dump sites located in residential areas were used for housing developments. This may have been possible due to the smaller amounts of waste disposed of at these sites resulting in easier and cheaper methods for redevelopment into housing. In addition, because they were privately owned, it was unlikely that the owner would have given up the land for public open space or that the Council would have purchased it to provide open space. Privately owned sites were more likely to be redeveloped soon after the land ceased to be used as a dump. These sites were easily redeveloped as the fill could be bulldozed in preparation for redevelopment. A good example of this is the tip which was located on the corner of Grace and York Streets, Sandy Bay.

The wastes disposed of at these sites would have been mainly putrescible household wastes, including horse manure, glass, tins and building rubble, from surrounding neighbours, it is not likely that these sites would be contaminated with hazardous wastes. Council owned tips were left as public property, presumably because land prices could not justify the cost of redevelopment for residential or industrial purposes.

Figure 5.8 - Restoration Problems - comparative table

Problem	After-use								
	Residential	Light Indust	Arable	Grazing	Sports	Recreation	Woodland	Public open space	Wildlife
Settlement	1	1	1	3	1	2	4	4	4
Leachate	1	2	1	2	2	3	3	2	4
Gas	1	2	1	2	1	3	2	3	4
Contamination	1	3	1	2	3	3	3	3	3
Litter/hazard	1	2	1	2	1	2	4	2	4
Plant growth	1	4	1	2	2	4	3	3	4
Soil strength	1	4	2	3	1	3	4	2	4
Soil profile	1	4	1	4	2	4	4	4	4
Total scores	8	22	9	20	13	24	27	23	31

1 = major consideration; even small amounts would have serious consequences

2 = important consideration; some, although small, amounts could be tolerated

3 = minor consideration, not likely to have serious consequences

4 = needs to be checked but only extreme conditions would be important, if at all

Total scores: low total = expensive; high total = relatively low cost.

(Source: Crawford and Smith 1985:139).

5.11 - Conclusion

The change from open dumps to controlled landfill has occurred over a period of about a hundred years. During that time, many important lessons have been learnt about the waste which we generate as a community, how these wastes are perceived and managed, the role of tip sites within the urban environment and their impacts upon the environment and human health. This chapter has merely summarized these issues, mentioned many of the in depth studies which have been and still are taking place around the world and applied them to the Hobart situation. Waste management practices in Hobart even lag behind those in the rest of the country. The main reasons for this could be isolation which delays the communication of latest trends and technologies but the main reason seems to be lack of political will to, in earlier years, effectively manage public health and, in later years, address environmental concerns.

CHAPTER SIX

SUMMARY AND CONCLUSION

As storytellers of particular periods of time, old tip sites in Hobart have provided a valuable study providing useful information on many issues. These issues include public health reform, politics, economics, death, disease and environmental values. The aim of the study was to document old tip sites within the Hobart area for the first time. Existing records of these sites are incomplete. The small amount of information which does exist is vague and unclear. In Council minutes and reports for example, a tip or rubbish dump is mentioned and it is assumed that the reader knows its location. Many details of old tip sites are still within living memory. Their documentation was necessary before any more detailed information was irretrievably lost.

Details of tips which existed before the 1940s were not previously documented. For example, there are no details concerning the type of wastes disposed of on particular sites and no detail given of the exact dates during which the site was used and who used it. The author relied on scant clues to paint a picture of the situation at the time. This was a fascinating job as many other issues which are connected with tip sites and the management of wastes were discovered. Some of the main issues include: the Hobart community's perception of its own wastes, public health and their local environment, the local Council's decision-making on public health issues and the importance of these issues on the political agenda.

The Hobart community's perception of wastes and their environment can be discerned from the siting of tips, the number of tips, the way in which they were managed and the way problems arising from the tips were dealt with. Parallel to the community's attitude towards solid wastes was the local Council's attitude. Local government politics played (and still plays) an important role in the siting of tips and the provision of waste management services. Councils are presently in charge of waste collection and landfill management. The State Government has a responsibility to oversee Council's activities and ensure that waste disposal is carried out according to the regulations set under the *Environment Protection Act 1973*. Thus, local

government has an extra obligation to ensure that solid wastes are disposed of correctly and that disposal sites are properly managed.

Immediately after settlement, it was not an uncommon sight in Hobart for solid wastes as well as human wastes to be discharged into the streets and rivulets. There were no laws prohibiting their disposal. In fact, there was a Council by-law in existence which allowed the discharge of household sewerage systems into the Hobart Rivulet (Petrov 1984:10). Today, there are a number of laws which are designed to protect the health and amenity of Hobart's citizens. The disposal of wastes into the Hobart Rivulet still occurs, but not to the extent of last century.

Environmental problems caused initially by the tip sites discussed in this study such as odour, vermin, litter problems and loss of amenity would have disappeared long ago. These are the problems which were well documented in Council records. Other problems which were not observed and recorded (and were probably not commonly known about at the time) were leachate and landfill gas production. There may have been a large amount of leachate from the New Town Bay tip going into the Derwent, but there was no monitoring of leachate or the receiving waters apart from a visual observation recorded on the fortnightly report of the health inspector. This was also the extent of leachate monitoring at the other tips. No mention of landfill gases were made in any Council records. The environmental impact of tips, apart from the obvious nuisances such as odour, were not properly addressed until the introduction of the *Environment Protection Act 1973*. The true impact of these old tips will never be known as there was no awareness of the problems which may result on the land, in the air and in the water which surrounds, and is connected to a tip.

The documentation of old tip sites for their historical value has opened a window of knowledge on life in early Hobart Town. The community's perception of their environment is implicit in the way in which wastes were managed. By today's standards, the indiscriminate disposal of solid wastes in city streets is unacceptable. The connection between filth and disease was not made until the late Nineteenth Century. However, the lack of political will to halt the indiscriminate disposal of solid wastes allowed this situation to continue despite protestations by many of Hobart's citizens. The problem of

inappropriate disposal of waste affected many of Hobart's citizens, especially those who lived in Wapping, through the spread of epidemics (in the late Nineteenth Century) and loss of amenity both in the past and present.

The value of land surrounding the city is also an issue which has an interesting perspective when studying old tip sites. Hobart's first tip was used for the reclamation of land from the Derwent for the purpose of the shipping industry. Wharves and docks were among the first necessary items of infrastructure for the port of Hobart. Other tips were located on land deemed as marginal by planning authorities and the people, the New Town Bay area being a case in point. The mouth of New Town Rivulet was gradually becoming an eyesore due to urban development surrounding it, resulting in silting of its mouth, more rubbish being taken out to the river and the foulness of the water from its use as a dump and sewer. The only solution at the time for the problem of a degraded water system was to fill the silting area, reclaim the land and control the Rivulet's flow. Marshlands were deemed to be waste lands consisting of stagnant waters and foul odours. For this reason, there was no hesitation by the Council to fill in the offensive area with full support of the community. This situation occurred in most of the Bays in the study area: Kangaroo Bay, Lindisfarne Bay, Geilston Bay, Austin's Ferry and Prince of Wales Bay. Some of the areas adjacent to other Bays, such as Elwick, have also been filled in but not with municipal refuse.

Quarries have been defined as marginal land as they have already been exploited for their resources and left in a state unlike the original. The use of refuse to reclaim quarries, can be a valuable way in which these sites can be redeveloped. The most successful reclamation of a quarry would be the South Hobart soccer ground site. It was considered an eyesore after the sand had been extracted and residents demanded that the Council redevelop the site. The subsequent tipping of refuse was welcomed by the Progress Association and now the site is a valuable amenity for South Hobart residents, although, its present maintenance has been criticized by some of its neighbours and the landscaping does need some attention. Wentworth Park at Howrah was also a quarry discussed in this thesis which has been successfully redeveloped into a valuable recreation site. Old Proctor's Road is now being redeveloped and is currently being used by one of Hobart's schools. The future for the whole site has been secured and its redevelopment as a school sports and athletic centre is

imminent. The Chapel Street tip at Glenorchy is yet to be redeveloped and a number of plans for its future redevelopment is still in the hands of the Council.

The rest of the tips sites have been located on vacant land. These were not deemed to be marginal lands but convenient places for wastes to be deposited. This can be ascertained by their subsequent redevelopment into parks or housing. The small privately owned tips, the ones in Sandy Bay and Fitzroy Place, have been completely redeveloped and are now valuable pieces of real estate. The Queenborough Ovals provide an important space for football and hockey activities to the people of the Southern parts of Hobart.

The advantages provided by these old tips sites are clear, both in terms of service provided in early years to the amenity afforded today. Their study provides an important starting point for the examination of their environmental impact. While they provided a valuable public service in the past, the impact upon the environment then and now is irreversible. While many sites were regarded as marginal land in the past, the value of marshlands to the estuary ecosystem has since been recognized and their destruction is illegal in most cases.

It has been argued that old tip sites provide valuable open space in suburban areas which may have otherwise been subdivided. A loss of amenity has occurred as the original landscape has been irreversibly changed. If the sites were set aside at the time of subdivision, a small part of the original landscape would have been preserved. As the impacts of these sites have not been monitored or fully understood, there may be some unknown hazards which may arise in the future. The site itself may become unstable because of the movement of wastes. There may be hazardous substances slowly leaching out into surrounding watercourses and through the soil into neighbouring houses. Tyres and pieces of metal eventually find their way to the surface of the site, providing a hazard for those using the site for recreational activities. These unknowns make it difficult to pinpoint the disadvantages associated with old tip sites.

This study was meant to provide a background discussion to the more complicated process of scientifically evaluating environmental impacts. A

more in-depth study would require more resources and time than was available to the author. For example, the study of the settlement and stability of a site would take many years of monitoring including the need for boreholes at regular intervals which would be impossible due to the site's present use. The testing of leachate and groundwater requires laboratory analysis of many different parameters over a long period of time. Possible problems and scenarios have been identified and should be treated as a starting point for any further studies to be made.

A number of unknowns still exist. We cannot be sure of what exactly is contained within these old tips and we may never know. Past environmental performance cannot be ascertained from the sites themselves and there are no records kept of this. The focus on environmental issues came too late for the performance of these sites to be recorded. We do have records of the nuisance caused by the sites which is a small clue to their impact.

This study is also significant as a matter of interest for Hobart's citizens. Many people today are fascinated by the actions and attitudes of the people of early Hobart Town and their way of life. Time is the variable factor which has changed the city and its people's way of life. A study of old tips has given the author an insight into the very different Hobart of the past. This documented information will provide a background to archaeologists now and in the future paint a reasonably accurate picture of life in Hobart from settlement.

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