# 2. Catchment Description

## 2.1 Historical Context

Prior to European settlement, it has been estimated that about 1,500 aborigines inhabited the Port Jackson/Botany Bay area. The Aboriginal population fished, gathered shellfish, hunted and undertook subsistence cropping along the Cooks River (Muir, undated). The Darug people, who were the traditional inhabitants of the Sydney region claim to be the traditional owners of most of the Sydney Basin, including the Cooks River catchment (Hyder Consulting, 1997)

Captain Cook was the first recorded non-native to enter the Cooks River. In 1770, Captain Cook reported on "a fine stream of fresh water" entering the Bay and suggested that the lands within the river's catchment offered fertile lands that were appropriate for agriculture. However, in 1788, colonists looking to open up the area as a site for potential agriculture found "low and boggy" country that was not seen as being conducive to traditional European agricultural practices (Cooks River Catchment Management Committee, 1993a).

However, colonisation went ahead, and initially the catchment was used for farming, timber gathering, fishing and recreational pursuits. Major industries during the early nineteenth century included fishing and lime burning for making mortar (Muir, undated). During 1839, a dam was constructed at Tempe by convict labourers to provide a constant supply of fresh water for Sydney. However, the water above the dam remained saline and was found to be unsuitable as a water supply. The prevention of tidal flushing and the sedimentation upstream of the dam had deleterious effects on the aquatic ecology so the dam was removed (Muir, undated).

A second dam was built in Canterbury during the 1840s to service the Australian Sugar Company's refinery. Following establishment of the refinery, infrastructure and service amenities were built to cater for the industry workers. The sugar refinery closed in 1855. However, wool washes, tanneries and rendering works were established along Alexandra Canal and Cup and Saucer Creek and provided continuous sources of pollution (Muir, undated).

By the middle of the nineteenth century, several thousand people had settled in the catchment and there was a thriving industrial village. The wastes generated from this large settlement included overflowing septic tanks, household wastes and effluent derived from industries including slaughter houses, soap factories, sewage farms, tanning factories and chemical manufacturing (Cooks River Catchment Management Committee 1993a).

In 1886, Alexandra Canal was dredged and channelised to enable boat transportation. It was during this period that sewerage and stormwater infrastructure was constructed in the Sydney region. This infrastructure brought some improvement to the health of the catchment (Cooks River Catchment Management Committee 1993a).

During the 1920s, erosion of the banks was identified as a major source of sediment contributing to siltation of the river and tributaries. The government authorities opted to protect the banks by installing training walls and concreting much of the waterways, particularly in the upper reaches of the catchment (Cooks River Catchment Management Committee 1993a). These works resulted in many undesirable effects including reduction in dry weather flow velocities and a corresponding reduction in the catchments' flushing ability. Conversely, during wet weather flows, the greatly increased flow velocities caused major flood damage (Cooks River Catchment Management Committee 1993a).

In 1946, the *Cooks River Improvement Act* was gazetted with its primary aim being to control flows and prevent degradation of the banks. The upstream banks were sealed with concrete and, during the 1950s, the lower reaches of the river and Alexandra Canal were diverted to allow for the draining of land for the enlargement of Sydney Airport (Cooks River Catchment Management Committee 1993a).

Over the 200 years of European settlement, the Cooks River has been altered and degraded by a wide variety of activities including:

- vegetation clearing;
- draining of wetlands;
- diversion of natural drainage;
- concrete lining of channels and banks;
- dredging;
- industrial activities;
- roads and transport routes;
- development of residential areas;
- dumping of wastes;
- landfilling; and
- sewage contamination (Cooks River Catchment Management Committee 1993a).

## 2.2 Location

The Cooks River catchment is located in the southern suburbs of Sydney and covers an area of 10,000 hectares (Cooks River Catchment Management Committee 1993b) (*Figure 2*). The Cooks River originates near Graf Park in Bankstown and flows 23 kilometres east to discharge into Botany Bay just south of Sydney Airport (Webb 1994).

The major tributaries of the Cooks River are Wolli and Bardwell Creeks, Muddy Creek (also called Kyeemagh Canal), Alexandra Canal and Sheas Creek, Cup and Saucer Creek, Cox's Creek and Freshwater Creek. These tributaries and their sub-catchments are identified on *Figure 2* and detailed below.

Figure 2

**Cooks River Catchment Location**

### 2.2.1 Tributaries

Wolli Creek and Bardwell Creek, are located within the local government areas of Hurstville, Rockdale, and Canterbury. The Wolli Creek Sub-catchment drains stormwater from Narwee, Penshurst, Hurstville, Beverly Hills, Kingsgrove, Bexley, Bardwell Park and Turrella. The combined catchment area for Wolli Creek and Bardwell Creek is 21.9 square kilometres (Cooks River Catchment Management Committee 1997).

Muddy Creek flows through Rockdale, Hurstville and Kogarah Council areas in a north-easterly direction and drains to a tidally flushed estuary. The total catchment area is 5.6 square kilometres (Cooks River Catchment Management Committee 1997).

Alexandra Canal flows in a south-westerly direction and drains part of Botany Bay, Marrickville, and South Sydney Council areas, and the Sydney Airport (Water Board, undated). Sheas Creek is the engineered stormwater drain which flows into Alexandra Canal. Sheas Creek drains a catchment containing portions of the southern Sydney suburbs of Surry Hills, Alexandria, Waterloo, Zetland, Beaconsfield and Redfern (South Sydney Council 1997; Webb 1991). Alexandra Canal and Sheas Creek have a combined catchment area of 16.6 square kilometres. The catchment constitutes approximately 39 percent of South Sydney City Council. It also extends into a small part of Kensington in the Randwick City Council Local Government Area (South Sydney Council 1997).

Cup and Saucer Creek is located within the Canterbury Local Government Area and has a catchment area of 5.5 square kilometres stretching from the Cooks River at Canterbury to the Canary Road reservoir near Roselands (Water Board 1992). The Creek is little-more than an open drain that extends from Lakemba through South Belmore, Earlwood and Clempton Park to the Cooks River at Canterbury.

Cox's Creek has a catchment area of 8.8 square kilometres in the Strathfield Local Government Area. The creeks flows in a north-easterly direction starting at the Enfield Marshalling Yards and meeting the Cooks River at Strathfield South.

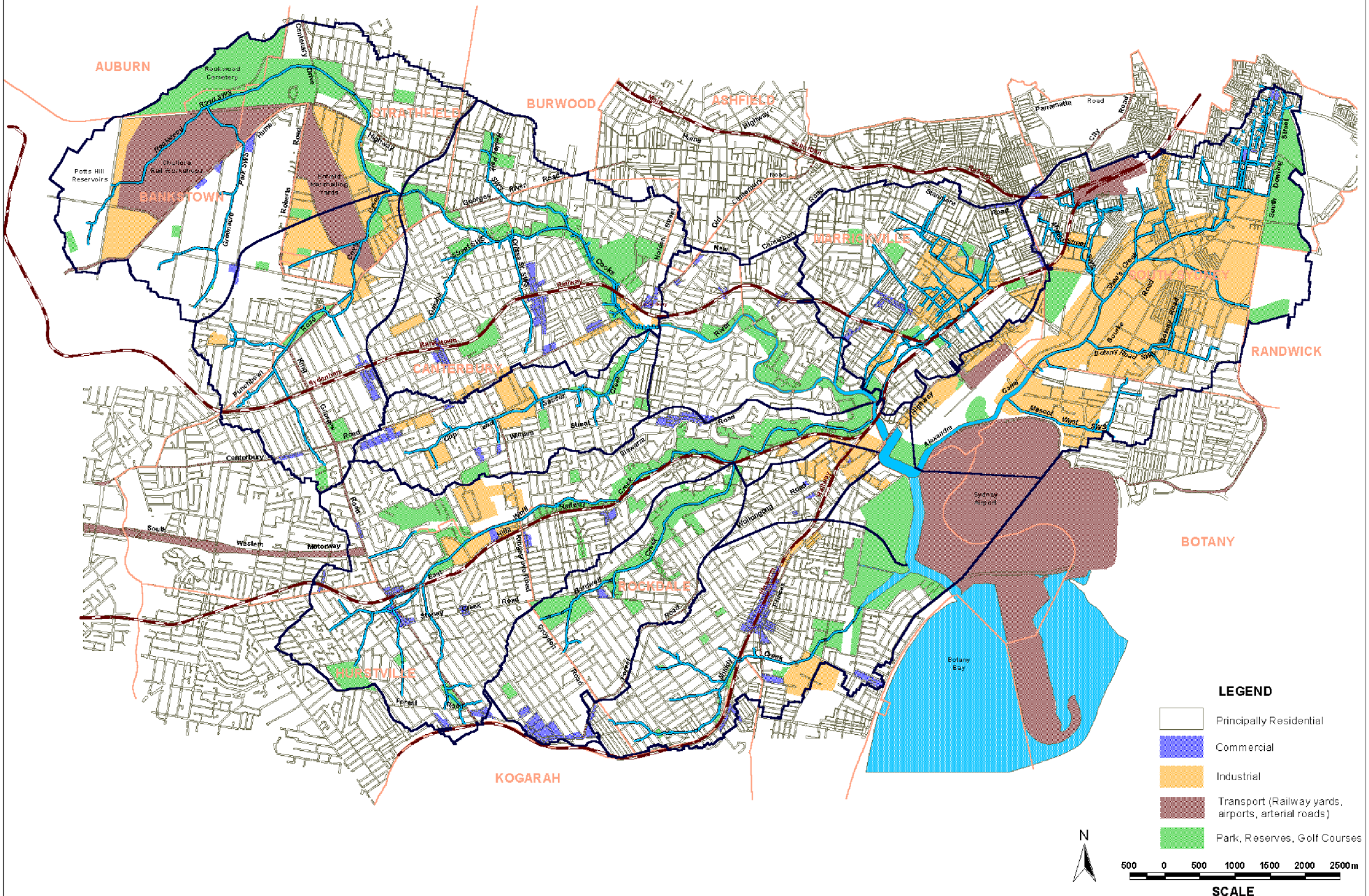
Freshwater Creek is also located at the head waters of the catchment in the Strathfield Local Government Area. It flows in a south-easterly direction from Strathfield Golf Course and becomes the Cooks River in Strathfield South. The total catchment area is 13.1 square kilometres

## 2.3 Land Use

The Cooks River catchment area is highly developed, providing home to almost 400,000 people with 130,000 dwellings and over 100,000 commercial and industrial premises (CRCMC 1993a). The catchment is occupied by a variety of uses, ranging from industrial to open space. The existing land zonings are illustrated in *Figure 3* and discussed in detail below.

Figure 3

**Cooks River Catchment Landuse**



The major land uses within each of the sub-catchments of the Cooks River were surveyed during *The Cooks River Catchment Pollution Source Inventory* (Cooks River Catchment Management Committee, 1997) as identified in *Table 2.1*.

### 2.3.1 Residential Land Use

Residential land use is the predominant zoning within the catchment with the highest portion of residential developments being detached low density dwellings. Within the past decade there has been increased intensity of development with medium to high density residential developments occurring, particularly in Canterbury, South Sydney and Marrickville local government areas (CRCMC 1993b).

### 2.3.2 Industrial Land Use

The major portion of industrially zoned land is concentrated in the Port Botany area, along Alexandra Canal, within Tempe, and the southern portion of Strathfield local government area (*Figure 3*). Industrial developments also occur along both East Hills and the South Coast railway line and Canterbury Road (CRCMC 1993b).

The major industrial activities within the catchment are:

- fabricated metal products;
- machinery and equipment;
- paper, paper products and printing;
- clothing and footwear; and
- petro-chemical and liquid fuel depots (CRCMC 1993b).

There is also a heavy concentration of freight depots in the catchment, concentrated adjacent to Port Botany, Enfield, Tempe and along Alexandra Canal (CRCMC 1993b).

Commercial and industrial premises located within each sub-catchment of the Cooks River are quantified in *Table 2.2*.

Table 2.1: Land Uses within each of the Sub Catchments of the Cooks River

| Land Use ($km^2$) | Freshwater Creek | Cox's Creek | Cup & Saucer Creek | Marrickville/ Sydenham | Wolli Creek | Bardwell Creek | Alexandra Canal | Muddy Creek | Cooks River | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Significant open space | 1.30 | 0.37 | 0.23 | 0.42 | 1.51 | 1.03 | 1.57 | 0.75 | 3.28 | 10.5 |
| Industrial area | 1.25 | 0.98 | 0.58 | 2.13 | 1.47 | 0.08 | 7.34 | 0.48 | 0.51 | 14.8 |
| Commercial area | 0.42 | 0.15 | 0.04 | 0.27 | 0.24 | 0.23 | 0.36 | 0.31 | 0.66 | 2.7 |
| Significant special use | 4.01 | 0.20 | 0.00 | 0.43 | 0.61 | 0.01 | 2.61 | 0.39 | 0.70 | 9.0 |
| Residential | 6.11 | 7.06 | 4.66 | 4.02 | 11.68 | 5.00 | 4.72 | 7.04 | 16.38 | 66.7 |
| TOTAL ($km^2$) | 13.10 $km^2$ | 8.77 $km^2$ | 5.51 $km^2$ | 7.28 $km^2$ | 15.52 $km^2$ | 6.36 $km^2$ | 16.60 $km^2$ | 8.97 $km^2$ | 21.53 $km^2$ | 103.6 $km^2$ |
| Approximate Area ($km^2$) of: | | | | | | | | | | |
| Roads | 1.79 | 2.01 | 1.29 | 1.52 | 3.31 | 1.33 | 2.75 | 1.95 | 4.40 | 20.4 |
| Roofs | 2.82 | 2.91 | 1.83 | 2.89 | 4.71 | 1.70 | 6.76 | 2.65 | 5.70 | 32.0 |

*Source: The Cooks River Catchment Pollution Source Inventory (Cooks River Catchment Management Committee, 1997).*

Table 2.2: Numbers of Various Types of Commercial/Industrial Premises within each Sub-catchment

| Land Use | Freshwater Creek | Cox's Creek | Cup & Saucer Creek | Marrickville /Sydenham | Wolli Creek | Bardwell Creek | Alexandra Canal | Muddy Creek | Cooks River | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Boating | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 4 |
| Building | 5 | 3 | 1 | 14 | 8 | 0 | 54 | 1 | 3 | 89 |
| Chemicals | 8 | 2 | 2 | 18 | 14 | 1 | 56 | 1 | 8 | 110 |
| Commercial | 605 | 454 | 166 | 1,171 | 1,248 | 1,526 | 3,016 | 908 | 1,894 | 10,988 |
| Food Outlets | 77 | 70 | 8 | 204 | 190 | 185 | 398 | 177 | 342 | 1,651 |
| Food Processing | 8 | 7 | 1 | 48 | 7 | 0 | 53 | 1 | 7 | 132 |
| Fuel | 18 | 15 | 10 | 11 | 11 | 19 | 62 | 13 | 46 | 205 |
| Laundries | 17 | 10 | 2 | 61 | 26 | 27 | 81 | 23 | 42 | 289 |
| Medical | 5 | 0 | 2 | 16 | 11 | 10 | 2 | 13 | 12 | 71 |
| Metals | 32 | 11 | 10 | 51 | 41 | 3 | 125 | 3 | 19 | 295 |
| Misc manufacturing | 64 | 23 | 19 | 314 | 104 | 4 | 658 | 18 | 65 | 1,269 |
| Motor vehicle repairs | 105 | 8 | 8 | 47 | 39 | 39 | 130 | 17 | 56 | 4,49 |
| Motor vehicle, other | 86 | 19 | 43 | 50 | 62 | 86 | 216 | 67 | 117 | 7,46 |
| Nurseries | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| Printers | 16 | 12 | 8 | 105 | 52 | 23 | 228 | 30 | 51 | 5,25 |
| Transport | 35 | 10 | 1 | 16 | 14 | 0 | 166 | 0 | 7 | 2,49 |
| Waste | 0 | 0 | 0 | 0 | 1 | 0 | 14 | 1 | 0 | 16 |
| Animals | 0 | 0 | 4 | 4 | 6 | 2 | 15 | 6 | 19 | 56 |
| Unclassified | 104 | 108 | 41 | 205 | 225 | 231 | 527 | 171 | 355 | 1,967 |
| Total | 1,185 | 752 | 326 | 2,335 | 2,061 | 2,156 | 5,803 | 1,451 | 3,043 | 19,112 |

Note: These numbers are approximate only based on an industrial directory.

*Source: The Cooks River Catchment Pollution Source Inventory (Cooks River Catchment Management Committee, 1997)*

### 2.3.3 Open Space and Recreation Land Use

A thin corridor of open space fringing the Cooks River, Cox's Creek, Wolli and Freshwater Creek has survived development pressures as a result of topography and soil condition. This corridor constitutes a significant portion of the open space in the Cooks River catchment as shown in *Figure 3*. The foreshores of Muddy Creek, Alexandra Canal, Shea's Creek and Cup and Saucer Creek are more developed with less open space areas.

A portion of this significant open space corridor is owned by State Authorities including Sydney Water Corporation, Department of Public Works and Services, Department of Land and Water Conservation, Department of Urban Affairs and Planning, and the Roads and Traffic Authority. The State owned lands along the south bank of Cooks River and Wolli Creek are used by the community for passive recreation and contain remnants of natural bushland (CRCMC 1993b). A proposal is currently being prepared by National Parks and Wildlife Service for these foreshore open space areas to form a Regional Park.

### 2.3.4 Transport Land Use

The Cooks River catchment contains some major national and state highways, railway corridors and Sydney's airport.

Major roads in the catchment include Hume Highway, Princes Highway, and General Holmes Drive as illustrated on *Figure 3*. In addition, the M5 East Motorway is currently under construction and will pass through the floodplain of Wolli Creek. Also under construction is the Eastern Distributor which will pass through Surry Hills, Moore Park, Zetland, Rosebery, Kensington, Eastlakes and Mascot.

Four rail lines occur within the catchment area: East Hills, Bankstown, Illawarra and Botany. In addition, three major rail service areas occur: the Enfield Marshalling Yards in Strathfield, the Chullora Railway Workshops in Bankstown, and the Eveleigh Railway Workshops located in South Sydney Council area. The New Southern Railway Line is currently under construction and will tunnel under the Cooks River to Tempe.

Sydney (Kingsford-Smith) airport which covers approximately 660 hectares of reclaimed land, also lies within the catchment (*Figure 3*).

## 2.4 Topography

The topography of the Cooks River catchment varies from gently undulating to hilly around the urban upper reaches. The western half of the catchment is flat to gently undulating land. In contrast, the eastern section of the catchment is predominated by the high sandstone plateau around Wolli Creek.

The river starts at a height of 60 metres Australian Height Datum (AHD) at it's highest point approximately 1.5 kilometres south of Potts Hill, at a point now occupied by Graf Park, Yagoona. It flows north-east to Strathfield Golf Course, then turns and runs roughly south-east to its mouth in Botany Bay. The river stays close to the low northern boundary of the catchment, which is generally below 40 metres AHD. As a consequence, few significant tributaries exist on this side of the river. On the southern side, the dividing ridge is significantly higher being generally over 50 metres AHD (Total Environment Centre 1976). All the main tributaries are on the south side of the river, with the exception of Alexandra Canal.

The Cooks River valley floor is flat and low, allowing tidal influence to extend to Georges River Road, a point well over halfway up the river. As such, the lower reaches of the river are saline (Total Environment Centre 1976).

Topography is a natural factor dictating the velocity of run-off and the rate at which the discharge flows through the catchment and out into Botany Bay. The flatter the slopes the longer the time lag for water movement. Topography also influences depression storage areas which help to reduce peak flows during floods by storing some of the run-off. While most of the natural depression areas of the Cooks River have been infilled, Barton Park and parts of the Marrickville Basin provide significant areas of depression storage (Total Environment Centre 1976).

## 2.5 Climate

There are several climate stations around the periphery of the Cooks River catchment, operated by The Bureau of Meteorology (Sydney Airport, Bankstown, and Sydney Regional Office). The following is a summary of the long term average climate information extracted from these station records.

The average annual rainfall over the catchment is approximately 1100 millimetres. There are some slight variations in annual rainfall averages between the stations, typically showing that less rainfall occurs over the western parts of the catchment. On average, the highest rainfall occurs between January and June (with highest rainfall in March) and the lowest rainfall between July and December (with lowest rainfall in September).

There is very little variation in temperature across the catchment. The morning temperature ranges from an average of 10 degrees in July up to 22 degrees in the summer months (December to February).

Long term climate data for Sydney Airport are summarised in *Table 2.3*.

Table 2.3: Climate Averages

| Month | Mean Monthly Rainfall (millimetres) | Highest Daily Rainfall (millimetres) | Mean 9am Temperature (°C) | Mean Monthly Evaporation (millimetres) | Mean Daily Sunshine (hours) |
|---|---|---|---|---|---|
| January | 98 | 157 | 22 | 217 | 7.4 |
| February | 112 | 216 | 22 | 179 | 7.2 |
| March | 125 | 202 | 21 | 161 | 6.9 |
| April | 106 | 174 | 18 | 123 | 6.8 |
| May | 97 | 166 | 14 | 90 | 5.8 |
| June | 126 | 151 | 12 | 75 | 6.0 |
| July | 67 | 133 | 10 | 84 | 6.6 |
| August | 78 | 207 | 12 | 115 | 7.9 |
| September | 63 | 115 | 15 | 141 | 7.8 |
| October | 74 | 112 | 18 | 177 | 7.9 |
| November | 93 | 143 | 20 | 195 | 7.8 |
| December | 77 | 182 | 22 | 229 | 8.1 |
| Annual Average | (total) 1106 | 216 | 17 | (total)1744 | 7.2 |

*Source: Bureau of Meteorology (Station 066037, Sydney Airport)*

## 2.6 Geology and Soils

### 2.6.1 Geology

The Cooks River catchment lies close to the transitional zone between two major geological groups:

- Hawkesbury Sandstone Group - composed of highly lenticular beds of quartz rich sandstone. The group reaches its maximum depth just north of Sydney at 240 metres. The Narrabeen formation, while part of the overall Hawkesbury series does not appear as part of the surface geology (Total Environment Centre 1976); and
- Wianamatta Group - composed of a sequence of interbedded grey shales and lithic sandstones and may be divided into two sub-groups: the Liverpool Sub-group (pre-dominantly shale) and the Ashfield Shales. These shales, some 60 metres thick, are black mudstones and silty shales with frequent sidentic mudstone (clay ironstone) banks (Total Environment Centre 1976).

### 2.6.2 Soils

In *Soil Landscapes of the Sydney 1:100,000 Sheet* (Chapman & Murphy, 1989), nine soil landscape groups were identified within the Cooks River catchment:

1. Gymea: this highly erosive and infertile soil type lies on undulating to rolling rises and low hills (with slope gradients of around 10-25 percent) of the Hawkesbury Sandstone geological group. The soils are characteristically shallow to moderately deep (30-100 centimetres) yellow earths and earthy sands on crests and inside of benches; shallow (less than 20 centimetres) siliceous sands on leading edges of benches; localised gleyed podzolic soils and yellow podzolic soils on shale lenses; shallow to moderately deep siliceous sands and leached sands along drainage lines
2. Hawkesbury: this highly erosive soil type lies on the rugged, rolling to very steep hills (slopes of more than 25 percent) of the Hawkesbury Sandstone. The soils are characteristically shallow (less than 50 centimetres) discontinuous lithosols/ siliceous sands associated with rock outcrop; earthy sands, yellow earths and some yellow podzolic soils on inside of benches and along joints and fractures; localised yellow and red podzolic soils associated with shale lenses; siliceous sands and secondary yellow earths along drainage lines.
3. Lambert: this highly erosive soil type lies on the undulating to rolling low hills (slopes of less than 20 percent) of the Hawkesbury Sandstone. The soils are characteristically shallow (less than 50 centimetres), discontinuous earth soils and yellow earths on crests and on the inside of benches; shallow (less than 20 centimetres) siliceous sands/lithosols on leading edges; shallow to moderately deep (less than 150 centimetres) leached sands, grey earths and gleyed podzolic soils in poorly drained areas; localised yellow podzolic soils associated with shale lenses.
4. Newport: this infertile and highly erosive soil lies on gently undulating plains to rolling rises (slope gradients of less than 10 percent) of Holocene sands mantling other soil materials or bedrock. The soils are shallow (less than 50 centimetres), well sorted siliceous sands overlying moderately deep (less than 150 centimetres) buried soils including yellow podzolic soils with sandy topsoils on crests and gentle slopes; deep (more than 200 centimetres) podzols on steep slopes, lower slopes and in depressions.
5. Oxford Falls: this poorly drained, highly erosive and permeable relatively infertile soil lies on the hanging valleys (with slopes of less than 15 percent) on Hawkesbury Sandstone. This soil type is characterised by moderately deep to deep (50 to 150 centimetres) earthy sands, yellow earths, siliceous sands on slopes; deep (more than 200 centimetres) leached sands, podzols and grey earths on valley floors.
6. Blacktown: this poorly drained and infertile soil type lies on gently undulating rises (with slopes generally less than five percent but up to 10 percent) of the Wianamatta geological group. This soil type is characterised by shallow to moderately deep (less than 100 centimetres) red and brown podzolic soils on crests, upper slopes and well drained areas; deep (150-30 centimetres) yellow podzolic soils and sloths on lower slopes and in areas of poor drainage.
7. Tuggerah: this infertile soil type lies on gently undulating to rolling coastal dunefields (slope gradients generally one to 10 percent). The soils are deep (more than 200 centimetres) podzols on dunes and podzol/humus podzol intergrades on swales. This soil type is highly susceptible to wind erosion and is highly permeable.

8. Birrong: this fairly infertile soil type lies on level to gently undulating (slope gradients of less than three percent) alluvial floodplains and is dominated by silt and clay sized alluvial materials derived from the Wianamatta geological group. The soils are characteristically deep (more than 250 centimetres) yellow podzolic soils and yellow solodic soils on older alluvial; deep (more than 250 centimetres) solodic soils and yellow solonetzic soils on the existing floodplain. It is subjected to localised flooding, erosion and waterlogging.
9. Warriewood: this water logged soil type lies on level to gently undulating swales, depressions and infilled lagoons (slopes of less than three percent) on Quaternary sands. The soils are characteristically deep (more than 150 centimetres), well sorted, sandy humus podzols and dark, mottled siliceous sands, overlying buried acid peats in depressions; deep (more than 200 centimetres) podzols and pale siliceous sands on sandy rises.

Today the soils in the catchment differ in many ways from their original condition. The major changes have resulted from the wide-spread clearing of native vegetation and the filling of low lying areas along the River. Land clearing has resulted in exposure of the topsoil to surface run-off, decrease in levels of infiltration, and an increase in run-off velocity.

Most of the original low-lying saline mangrove and mudflat areas adjacent to the river have been drained and reclaimed. Reclamation has led to many problems, notably:

- Ground Instability, which often lasts for many years after the fill material is deposited. It can take up to ten years for dredged silt which has been covered with clay based material to sufficiently subside to the point where it is able to carry vehicular traffic. This effectively renders the land geotechnically unsafe as construction sites (Total Environment Centre 1976);
- Contamination from garbage and other polluted fill materials that continue to leach into the river for many years. Marine based sediments can have a similar effect if they contain iron pyrite which, when oxidised, can also leach into the surrounding soils (acid sulphate soils); and
- Re-establishment by native vegetation is often difficult if not impossible to achieve on reclaimed land. There are a number of factors responsible for this including changes in soil chemistry, water absorption, and soil horizon structure. The heterogeneous (that is, variable) composition of most fill material, unlike the relatively homogenous natural soils, may vary with each load of material moved.

## 2.7 Vegetation

The aquatic and terrestrial ecosystems have been significantly altered since European settlement. The original native plant communities in the catchment have been identified based on historical records, community remnants and soil landscape modelling (Clouston 1997a). Seven communities have been identified as follows:

- Clay Plain Scrub Forest - This community was originally found along the broad, shallow valleys of the upper Cooks River and Wolli Creek on Wianamatta Shale.

The community structure was open-forest to low woodland, generally with a characteristic shrubby or scrubby understorey usually dominated by paperbarks such as Melaleuca nodosa and Melaleuca decora. Canopy species would have included ironbarks such as Broad-leaved Ironbark (Eucalyptus fibrosa), Grey Gum (Eucalyptus punctata), Woollybutt (Eucalyptus longifolia) and Turpentine (Syncarpia glomulifera) (Clouston 1997a);

- Turpentine - Ironbark Forest - This community was commonly found throughout much of the northern, western and southern sections of the Cooks River Catchments on the well-drained soils of the Wianamatta Shale. The dominant canopy species included Turpentine and Broad-leaved Ironbark and Grey Ironbark (Eucalyptus paniculata), with a generally grassy understorey (Clouston 1997a);
- Cooks River Sandstone Vegetation - This community was commonly found on the Hawkesbury Sandstone from Dulwich Hill through Earlwood to Bexley North and Arncliffe. Vegetation structures would have ranged from forest on the sheltered slopes to woodland and heath on the exposed sites, as well as local sedge swamps. Forest trees would have included Blackbutt (Eucalyptus pillularis), Sydney Peppermint (Eucalyptus piperita) and Smooth-barked Apple (Angophora costata) (Clouston 1997a);
- Floodplain Forest - This community was found on the floodplain on the Cooks River, enclosed within a sandstone valley, that extended from Canterbury to Tempe. The forest here would have been dominated by Swamp Oak (Casuarina glauca), with patches of Swamp Mahogany (Eucalyptus robusta) and Paperbarks (Melaleuca sp) (Clouston 1997a);
- Freshwater and Brackish Swamps - These communities were found on deep sandy country behind Lady Robinsons Beach and draining to Muddy Creek were swamps and heath areas occur (Clouston 1997a);
- Mangroves and Saltmarsh - Mangrove and saltmarsh flats were common in the estuary of the Cooks River, downstream of Tempe. These areas have now been filled, and developed and in places the channel of the river diverted. Grey Mangroves (Avicennia marina), still occur along Wolli Creek, Muddy Creek as well as along the Cooks River as far upstream as Canterbury. The only remaining saltmarsh remnants occur along Wolli Creek and Muddy Creek, and within the Eve Street wetlands, Firmstone Gardens, and the Landing Light wetlands.
- Banksia Scrub - The Banksia Scrub community was commonly found on Pleistocene/Holocene sand sheet of the eastern suburbs extends westward into the Cooks River Catchment from Surrey Hills to Mascot. This area drains to Sheas Creek. Vegetation here would have been Banksia Scrub with Banksia aemula as the dominant species (Clouston 1997a).

Further detail of the ecological values of the Cooks River is provided in Chapter 3.

## 2.8 Stormwater Drainage System

The Cooks River channel is so highly modified it functions more like a stormwater drainage system than a river system. Virtually the entire length of the River is concrete lined or piped, and the channel itself has been straightened and realigned in a number of places.

A number of authorities are responsible for the management of the river, its tributaries and the stormwater system. The upper drainage reaches are the responsibilities of the Councils whereas most of the main stormwater channels are the responsibility of Sydney Water Corporation. Cooks River above Church Street, Canterbury comes under the jurisdiction of Sydney Water but below Church Street, the reaches are the responsibility of the Department of Public Works and Services (Webb 1994). Other authorities with responsibilities for drainage include Waterways Authority, Roads and Traffic Authority, and Rail Access Corporation (Water Board, undated).

The existing stormwater infrastructure is illustrated in *Figure 4* and discussed on a sub-catchment basis in the sections below.

### 2.8.1 Upper Cooks River

The Upper Cooks River sub-catchment drains the suburbs of Greenacre, Chullora, Strathfield, South Strathfield, Wiley Park and Punchbowl, within the Local Government Areas of Bankstown and Strathfield. The south-east corner of Rookwood Cemetery, within Auburn Local Government Area, also drains to the Upper Cooks River.

The drainage system comprises a network of minor street drains which are the responsibility of the Councils, and major trunk drainage lines which are generally controlled by Sydney Water Corporation. The main exceptions are the channels within Chullora Workshops and the Enfield Marshalling Yards which are controlled by Rail Access Corporation, and unlined watercourses, such as those through Strathfield Golf Course.

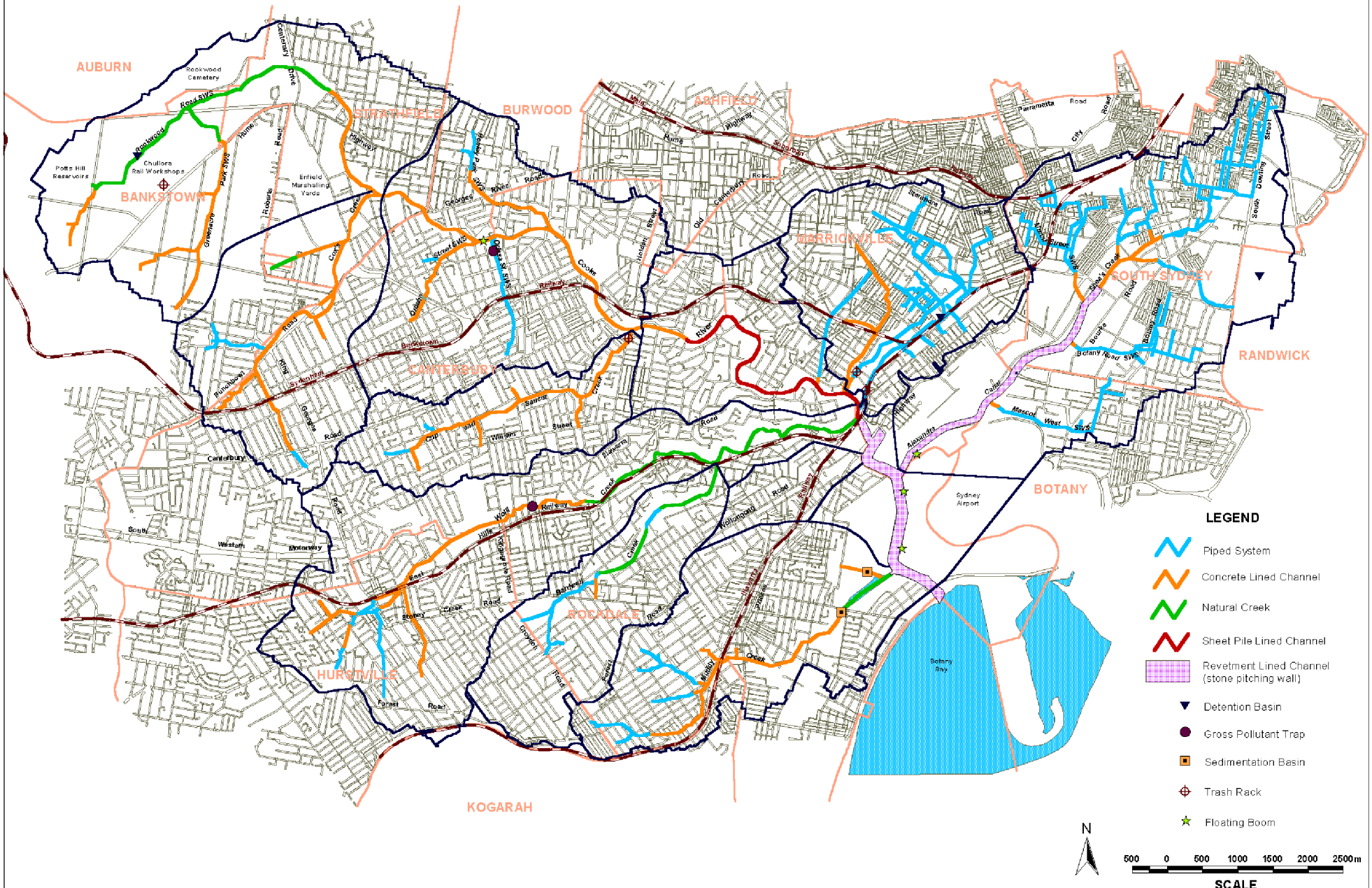
Most of the trunk branches are concrete/brick lined and were constructed in the 1930's, while the Cooks River Branch downstream of Strathfield Golf Course (Hedges Avenue, Strathfield) was constructed in the 1960's. There are four main drainage lines in the sub-catchment, these include: the Cooks River Branch, Rookwood Road Branch, Greenacre Park Branch and Punchbowl Road Branch (Water Board 1991).

Cooks River Branch (includes Freshwater Creek)

The upper reach of this branch through Strathfield Golf Course is unlined. Downstream of the golf course (Hedges Avenue), the river is an open lined channel which continues past the Upper Cooks River Catchment outlet (Water Board 1991).

Figure 4

**Cooks River Catchment**
**Existing Stormwater Infrastructure**



Rookwood Road Branch

This is generally an open lined channel draining parts of the Potts Hill reservoir and Bankstown north-east through to the Chullora Workshops. Downstream of the Chullora Workshops the channel joins the Greenacre Park Branch before flowing into the Cooks River Branch (Water Board 1991).

Greenacre Park Branch

This branch drains parts of Chullora and Greenacre to the north-east. Pipes and channels in the upper areas drain into an open lined channel which extends from Greenacre Road to the Hume Highway. Downstream of the Highway, the channel enters through the Chullora Workshops and is mostly unlined (Water Board, undated).

Punchbowl Road Branch (Cox's Creek)

This is generally an open lined channel draining parts of Lakemba, Greenacre, Wiley Park, Belfield and Enfield. Collector pipes and smaller channels feed into the main channel, which runs in a northerly direction to discharge into the Cooks River Branch at Water Street, Strathfield (Water Board 1991).

### 2.8.2 Cooks River (Cox's Creek to Cup & Saucer Creek Junctions)

The stormwater system from Cox's Creek to the Cup and Saucer Creek confluence drains the suburbs of Lakemba, Belmore, Strathfield, Belfield, Campsie, Enfield, and Croydon Park, within the Local Government Areas of Canterbury and Burwood. The system comprises a network of minor street drains which are the responsibility of the Councils, and trunk drainage lines which are generally controlled by Sydney Water Corporation. Culverts located under the railway crossings are the responsibility of Rail Access Corporation. There are four main drainage lines in the sub-catchment.

Cooks River Branch

The Cooks River is fully concrete lined to Beamish Street, Campsie. Thereafter the channel has concrete lined side walls and a natural invert.

Omaha Street Branch

This is generally an open lined channel draining parts of Lakemba, Belmore and Belfield before entering the Cooks River opposite Flockhart Park. There are a number of culverts which are controlled by Council (Water Board, undated).

Orissa Street Branch

This is a fully piped network which passes north, draining part of Campsie before discharging to the Cooks River at Fifth Avenue. Most of the main channel was constructed in 1918. The drainage in the upper catchment reaches is controlled by Canterbury Council (Water Board, undated).

A catchment management plan was prepared for the Orissa Street Branch by Sydney Water and Canterbury Council in 1990.

Henley Park Branch

This is generally an open channel draining part of Enfield and Croydon Park. The channel upstream of Tangarra Street was recently amplified and a detention basin constructed in Henley Park to protect downstream properties from frequent flooding. The channel enters the Cooks River just downstream of Brighton Avenue, Croydon Park (Water Board, undated).

### 2.8.3 Cup and Saucer Creek

Cup and Saucer Creek drains parts of Lakemba, Belmore, Clempton Park, Earlwood, Campsie, and Canterbury, mostly within the Canterbury Local Government Area. The sub-catchment extends from the Cooks River at Canterbury up to Sydney Water's Canarys Road reservoir near Roselands (Water Board 1992).

The creek is generally an open concrete drain constructed in the 1930's with 11 branch channels located in parkland and open space that join the creek along its length.

The main sections of these channels and the main trunk drainage are controlled by Sydney Water Corporation, but the local street drainage system is controlled by Canterbury Council (Water Board 1992).

From the upper end of the catchment down to Northcote Road, Canterbury, the channel is located between residential and industrial properties with very little natural floodplain. From Northcote Road to Fore Street the channel is mainly located in a well grassed parkland which forms a natural floodplain. There is a major sewer overflow outlet which enters the channel and a sewer aqueduct just upstream of Fore Street (Water Board 1992). The sewer aqueduct is a large concrete structure and is part of the Canterbury Submain. The open channel downstream of Fore Street extends past residential properties and through the parkland adjacent to the Cooks River confluence.

Features of the channel downstream of Fore Street include a trash rack, a drop in the invert of two metres where a waterfall once was located and channel walls formed of the natural rock formation (Water Board 1992). The remainder of the main channel consists of a mixture of open brick walled and concrete invert channel, Tonkin type channels and sections of covered channel.

### 2.8.4 Cooks River (Cup & Saucer Creek to Wolli Creek Junction)

The stormwater system from Cup and Saucer Creek to Wolli Creek drains the suburbs of Hurlstone Park, Dulwich Hill, and Marrickville, within the Local Government Areas of Marrickville and Canterbury. The system comprises a network of minor street drains which are the responsibility of the Councils. Sydney Water Corporation controls the Marrickville Valley Stormwater Channels, to the north of the Cooks River.

The Cooks River over this section has a concrete embankment lining and an earth bottom ending near Church Street, Canterbury (Soil Conservation Service 1991). The

river bank downstream of this point is mostly reinforced with sheet piling and is the responsibility of Public Works (Total Environment Centre 1995).

#### Marrickville Valley Branch

The Eastern, Central, and Western Channels are three drainage systems which combine to drain the areas of Marrickville, Enmore, Newtown, St Peters, Sydenham and Tempe.

The Eastern Channel is generally a twin, open channel that enters the Cooks River near Tempe railway station. A detention basin located near Sydenham railway station forms part of this system (Water Board, undated).

The Central Channel is open at the upstream end, through railway land, and covered at the downstream end adjacent to Carrington Street. This system is controlled by two pumping stations which pump excess run-off to the Eastern Channel, and directly to the Cooks River (Water Board, undated).

The Western Channel comprises two systems including an open channel which enters the Cooks River at Mackey Park, and a tunnel which drains the top end of the catchment above Sydenham and Livingstone Roads, Marrickville (Water Board, undated).

### 2.8.5 Wolli Creek

Wolli Creek, with its tributary Bardwell Creek, drains the suburbs of Narwee, Penshurst, Hurstville, Beverly Hills, Kingsgrove, Bexley, Bardwell Park, Arncliffe and Turrella, within the Local Government Areas of Rockdale, Canterbury and Hurstville (Water Board, undated).

The stormwater system comprises a network of minor street drains which are the responsibility of the Councils, and main trunk drainage lines which are controlled by Sydney Water Corporation. These trunk drainage lines include underground and exposed concrete/brick rectangular channels which were constructed in the early 1940's.

Wolli Creek is a lined channel downstream of Kingsgrove Road to Bexley Road. Thereafter the lower reaches of the creek to the Cooks River is largely in a "natural" state forming a defined but winding watercourse through the Wolli Valley. The Creek continues in an east northeasterly direction, gradually widening until it enters the Cooks River at Tempe Railway Bridge (Water Board, undated).

#### Bardwell Creek

Bardwell Creek is the major tributary of Wolli Creek, with its confluence located at Arncliffe some 2.5 kilometres upstream of the Cooks River junction (Webb 1996).

The upper reaches of Bardwell Creek arise in Hurstville to drain in a north-easterly direction through the suburbs of Hurstville, Bexley North, Bardwell Park and Turrella. Upstream of Croydon Road, there are two sub-catchments drained by brick/concrete open rectangular channels. Downstream of Croydon Road, these two branches run in

box culverts before merging into a lined channel passing through culverts to Ellerslie Road. Downstream of Ellerslie Road, the creek runs in a semi-natural watercourse.

The open channel between Croydon Road and Ellerslie Road was constructed during the mid 1930's and is presently controlled by Sydney Water (Webb 1996).

### 2.8.6 Lower Cooks River (Wolli Creek to Botany Bay)

The Cooks River between Wolli Creek to Botany Bay drains Alexandria Canal and Muddy Creek, and part of Arncliffe. The river banks comprise a combination of stone block revetments and rocky shoreline (Soil Conservation Service 1991).

Most of the river bank was built between the late 1940's to the early 1950's as part of the river diversion works associated with the construction of the Sydney Airport. The mouth of the Cooks River was relocated 1.6 kilometres west to its current position during these works. The river section is currently controlled by Public Works and Department of Land and Water Conservation (Total Environment Centre 1995).

#### Bonnie Doon Branch

Bonnie Doon is an ill-defined catchment of one square kilometre between Wolli Creek and the Cooks River at Arncliffe within the Local Government Area of Rockdale. The area contains a piped drainage system which passes to the east through conduits across the Illawarra railway line. The bottom of the catchment is drained by the Bonnie Doon Channel which extends east of the railway line through Cahill Park, draining to the Cooks River. This system is managed by Rockdale Council.

### 2.8.7 Alexandra Canal/Sheas Creek

Alexandra Canal was constructed in the late 1800's along the line of Sheas Creek. It drains a catchment area of about 16.5 square kilometres comprising the industrial and residential suburbs of Waterloo, Alexandria, Redfern, and Moore Park within the Local Government Areas of Botany, Randwick, and South Sydney (Water Board, undated).

The Canal is a tidal channel approximately 60 metres wide, with a water depth between one and three metres. At the confluence of Sheas Creek with Alexandra Canal, the width of Sheas Creek is 12 metres and the invert of the channel is at 0.7 metres AHD.

The Canal is owned by Sydney Water who also control the four main trunk drainage systems that enter the Canal. Numerous minor drains in the Alexandra Canal sub-catchment are managed by South Sydney, Marrickville and Botany Councils. A Water Environment Plan to improve water quality in the Canal was prepared in 1997 (Hyder 1997). Sydney Airport is currently preparing its own Stormwater Management Plan.

The main drainage lines were constructed during the 1920s and early 1930s. However, significant upgrading and amplification of the lines have occurred since that time (Webb1991).

#### Botany Road Branch

This branch drains a predominantly industrial area west from Rosebery across the Canal.

#### Munni Street Branch

This branch drains the Erskineville/St Peters area extending up to the Eveleigh railway yards.

#### Mascot West Branch

This drains part of the Mascot industrial area, north of the airport.

#### Sheas Creek

Sheas Creek drains a catchment containing portions of the southern Sydney suburbs of Surry Hills, Alexandria, Waterloo, Zetland, Beaconsfield and Redfern. Sheas Creek has a catchment area of approximately 6.6 square kilometres to its confluence with Alexandra Canal (South Sydney 1997).

There are three main drainage reaches in this system including the Alexandria-MacDonaldtown Branch, Main Branch, and Victoria Branch (Webb 1991). The Main Branch is mostly a piped line from the upper region of Waterloo and Redfern which passes south-west to join the open channel downstream of Bowden Street. The Alexandria -MacDonaldtown Branch is a piped line from the north, whilst the Victoria Branch is a mostly a piped line from the east draining Zetland. Both these lines join the channel downstream of Bowden Street and continue for some 700 metres before joining Alexandra Canal.

### 2.8.8 Muddy Creek

Muddy Creek drains stormwater run-off to the north-east from the suburbs of Carlton, Kogarah, Rockdale, Banksia, Brighton-Le-Sands and Kyeemagh, within the Local Government Areas of Hurstville, Kogarah and Rockdale (Water Board, undated).

The upper catchment to Botany Street, Hurstville comprises a number of drainage systems combining open concrete channels and pipes (Australian Water and Coastal Studies 1997). Downstream of Botany Street, these systems join a main concrete channel that continues to the Cooks River. A number of open and piped side channels feed into the main channel. The lined channel from Hurstville to Bestic Street is generally under the control of Sydney Water, with the exception of some road and railway culverts (Water Board, undated). From Bestic Street to Barton Park, the waterway is under the control of the Waterways Authority.

#### Spring Street Branch

The Spring Street catchment is located within the Rockdale Local Government Area and drains the suburbs of Banksia and Rockdale to Muddy Creek. The catchment has an area of approximately 2.7 square kilometres.

The drainage system mainly consists of pipes with some box culverts in the lower catchment. The drainage system passes to the east across the Illawarra Railway Line through six stormwater culverts, to eventually join the open lined channel extending through to Muddy Creek (Lawson and Treloar 1997).

### 2.8.9 Stormwater Management Facilities

Based on the review of documents and a series of meetings with Councils, information has been collated on the range of stormwater quantity and quality management facilities presently used within the catchment. These facilities are summarised in *Table 2.4* and their location illustrated in *Figure 4*.

Table 2.4: Summary of Existing Structural Stormwater Management Facilities

| Authority | Device Type | Constructed | Location |
|---|---|---|---|
| Sydney Water | Gross pollutant trap and Drainage Pumping Station/Detention Pit | 1940 | Brickpit, Railway Parade, Sydenham |
| Sydney Water | Drainage Pumping Station/Detention Pit | 1963 | Carrington Road, Marrickville |
| Bankstown City Council | Detention Basin | In design stage | Chullora Railway Workshops |
| Sydney Water | Trash Rack | 1990 | Cup & Saucer Creek-Canterbury |
| Sydney Water | Gross pollutant trap | 1991 | Orissa St Drain, Fifth Ave, Campsie |
| Sydney Water | Trash Rack | 1991 | Mackey Park, Marrickville |
| Sydney Water | Gross pollutant trap | 1992 | Wolli Creek, Kingsgrove |
| Cooks River Valley Association | Floating boom | 1995 | Fifth Ave, Campsie |
| Marrickville Council | Drainage Pumping Station /Detention Pit and silt screen | Date Unknown | May Road, St Peters |
| South Sydney Council | Gully Pit Traps | 1997-8 | 80 percent of road drains throughout catchment |
| Canterbury Council | Pollutec Litter Trap | Planned | Tasker Park, Canterbury |
| Bankstown City Council | Trash rack | 1996 | Muir Road, Chullora |
| Canterbury Council | Pollutec litter trap | 1996 | Park, near Belmore Rugby League field |
| Marrickville Council | Pollutant trap | Planned | Tennyson St sub-catchment |