

Aquatic Plant Services

Management of Arrowhead in the Murray River

2004

**Confluence of Ovens & Murray
River - Torrumbarry Weir**

Table of Contents

1	The Problem.....	3
1.1	Incidence.....	3
1.2	Arrowhead – an emerging aquatic weed.....	4
1.3	Characteristics.....	7
2	Endangered flora and fauna.....	7
2.1	Flora.....	7
2.2	Fauna.....	7
3	Weed Control.....	9
3.1	Product Information.....	9
3.2	Permits.....	9
3.3	Measures to minimise exceedence of water quality limits, and effects on native flora and fauna.....	9
4	Water quality.....	10
4.1	Water quality limits for aquatic life, and irrigation & drinking water.....	10
4.2	Arrowhead control around pump suction.....	11
4.3	Water sampling.....	11
5	Public Response.....	11
6	Appendix 1. Water flows in Murray and National Channel at Torrumbarry Weir.....	13

1 The Problem

Arrowhead (*Sagittaria graminea*) poses a major threat to the Murray River, its associated wetlands and irrigation and drainage systems downstream of the confluence of the Ovens and Murray Rivers. Currently, the Shepparton and Murray Valley Irrigation Areas spend more than \$250 K per year on arrowhead control. Goulburn Murray Water wish to embark on a control program to prevent the establishment of the weed in the Torrumbarry Irrigations system. This would involve 3 treatments per irrigation season with glyphosate to approximately 0.2 ha. In the future, Goulburn-Murray Water may extend the program of control from Echuca to the confluence of the Murray and Ovens rivers (ie the source of the infestation); in this situation, application would be limited to 20 L of glyphosate product per day.

1.1 *Incidence*

In 1996 no arrowhead was observed in the Murray River when a survey was conducted from Torrumbarry to Echuca. However, by December 2002, 653 arrowhead sites had established and the area totalled 3.3 ha between Torrumbarry and Echuca. In conjunction with the Central Murray County Council, Goulburn-Murray Water embarked on a pilot program to control arrowhead. This has involved 3 applications of glyphosate per irrigation season for 2 years. The number of sites has been reduced to 263 with the area being contained to 0.2 ha.

The section of river from Echuca to the confluence of Murray and Ovens Rivers has not been surveyed for 2 years. Three hectares of arrowhead was identified in 2002, however, as a result of favourable growing conditions over the past 2 years and the absence of a control program, the area is believed to be more than 6 ha.

1.2 *Arrowhead – an emerging aquatic weed*

Since arrowhead was identified in 1962 in the Nine Mile Creek at Wunghnu, it has spread throughout the channel and drainage network and is now the most dominant and threatening aquatic weed in the Murray Valley (Cobram–Numurkah), Shepparton and Deniliquin-Finley Irrigation areas. It has also established in the Broken Creek, and Goulburn and Murray Rivers. Apart from restricting flow of water, it threatens native aquatic flora and fauna by reducing plant biodiversity.



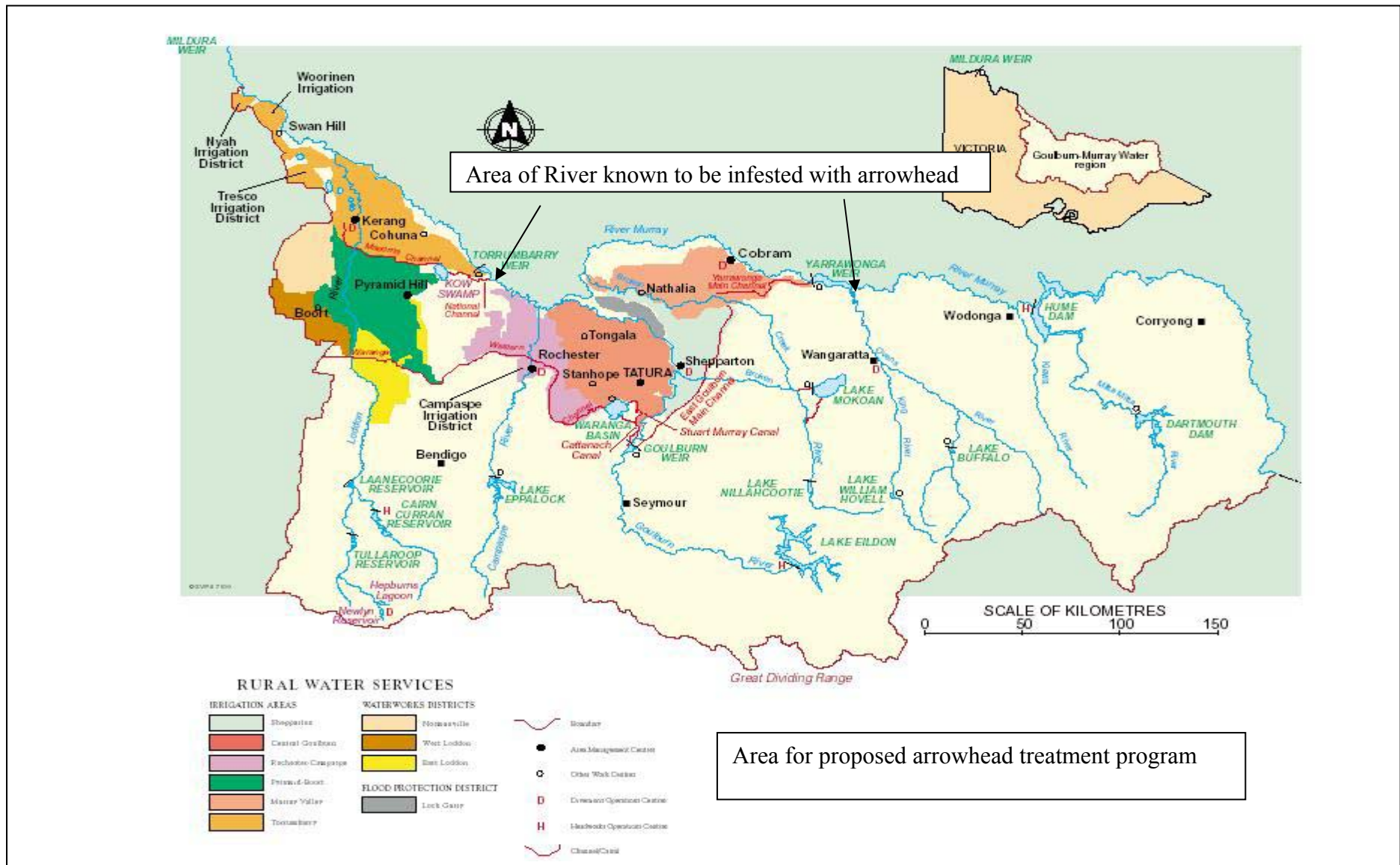
Arrowhead in Broken Creek near Numurkah, Victoria

In the irrigation network, the erect forms of arrowhead choke channels, restrict water delivery and promote deposition of silt. In drains, arrowhead limits flow and in the case of a large rainfall event severe inundation may occur.

Goulburn Murray Water has an ongoing commitment to research and development focusing on “Arrowhead- Biology and Control”. To date, Goulburn-Murray Water (with contributions from Murray Irrigation, Goulburn Broken Catchment Management Authority, Department of Primary Industry, Keith Turnbull Research Institute, Charles Sturt University) has committed more than \$500K to the project and has identified aspects of plant physiology and herbicide response that can be manipulated to vastly improve control and decrease regrowth. Stage 1 of R&D has just been completed and a draft of the final report is available upon request.



Arrowhead in a channel near Cobram, Victoria



1.3 *Characteristics*

The characteristics of the plant are summarised in a pamphlet (Appendix 2)



Arrowhead in the Murray River near Gunbower

2 Endangered flora and fauna

2.1 *Flora*

Damage to endangered native flora along the edge of the river will be minimised by using a closely directed spot spraying technique. The herbicide will be applied from shallow bottom aluminium spray punt that allows close directed spray application. The product will be applied using a low-pressure spray pump fitted with a hand lance that incorporates a foam jet nozzle. The low pressure pump & foam jet nozzle eliminates the fine droplets and produces a spray stream that allows for targeted specific application when spot sprayed.

2.2 *Fauna*

The Southern Bell Frog (*Litoria reniformis*) is an endangered species that inhabits the lagoons and billabongs that are frequently subject to inundation along the Murray River. These frogs are rarely found in the fast flowing sections of the river proper. In general, they are not active along the river during the months of January-April (Wassens, Pers. Comm¹). Spray operators will be trained to identify the frog and its call (refer overleaf)

¹ Wassens, School of Science and Technology, Charles Sturt University, NSW.

Spray application will be suspended if frogs are located. Only glyphosate with an aquatic registration will be used in order to minimise the impact on any sensitive aquatic species. Goulburn Murray Water will liaise with the National Parks and Wild Life Service² for location of known sites.



The Southern Bell Frog

² National Parks and Wild Life Service, Melanie Bannerman, ph. 0268 835 342.

3 Weed Control

The most efficient and effective method of controlling arrowhead is with the use of glyphosate with an aquatic registration. Applications will be conducted at 3 intervals from December to May each year.

3.1 *Product Information*

Weedmaster Duo (or an equivalent product) which has an aquatic registration will be used for all spray treatment. The Label and MSDS information is listed on the Nufarm Web Site. <http://www.nufarm.com.au/web/nufarmcomau/nufarmcomauhp.nsf/web/index.html>.

3.2 *Permits*

A minor use permit from the Agricultural Products and Veterinary Medicines Association (APVMA) has been obtained for use of Weedmaster Duo at the elevated dose of up to 10 L per 100 L of water or 40 L/ha. The Permit is attached and can be found on the APVMA web site. <http://www.nra.gov.au/permits/permits.shtml>, Permit 6875.

3.3 *Measures to minimise exceedence of water quality limits, and effect on native flora and fauna.*

The following measures will be adopted to minimise contamination of water and the effect on native flora and fauna:

- Glyphosate use will be limited to less than 20 L during any day of treatment,
- Mixing to be done on-shore on land and boat is moored to minimize spillage into waters,
- Spraying should will not be carried out in windy conditions to reduce spray drift into waters and vegetation,
- The herbicide will be applied from shallow bottom aluminium spray punt that allows close directed spray application,
- The product will be applied using a low-pressure spray pump fitted with a hand lance that incorporates a foam jet nozzle. The low pressure pump & foam jet nozzle eliminates the fine droplets and produces a spray stream that allows for targeted specific application when spot sprayed,
- Product will be applied when there is minimal activity on the river, which minimises the potential herbicide contamination as a result of wave action,
- If Arrowhead is found in amongst other vegetation, i.e. Cumbungi or Phragmites, then spraying must be undertaken with extreme care to ensure that minimum amount of potential habitat of the Southern Bell Frog is disturbed,
- Spraying will not be conducted during local flooding or when the river rises,
- Monitoring will carried out by taking water samples at surface and 1 metre depths, upstream 50 metres, spraying zone and 50 metres downstream and analysed for glyphosate (to be conducted at one site per season).
- All sites should be mapped (using GPS).

4 Water quality

Using the most stringent trigger levels for Aquatic Life, and the Drinking and Irrigation Water Limits, the amount of glyphosate that will be applied to control arrowhead will be less 1% of the respective limits. The terms of reference, concentrations used, river flow rates and information used for calculations are shown below.

4.1 *Water quality limits for aquatic life, and irrigation & drinking water*

Limits- aquatic life, irrigation & drinking water	Trigger Values for Aquatic Ecosystems in fresh water (mg/L)				Limit for irrigation water (mg/L) ^{#2}	Limit for Drinking water (mg/L) ^{#3}
	Level of protection (% species) ^{#1}					
	99%	95%	90%	80%		
Glyphosate (mg/L)	0.37	1.2	2	3.6	0.1	0.1
Amount of glyphosate product required to match respective limit (L)	5139	16667	27778	50000	1389	1389
Daily flow in section of Murray treated with glyphosate for arrowhead control (Megalitres) ^{#4}	5000	Sample calculation Docs # 1258065				
Conversion Megalitres to Litres (L)	5.00E+09					
Area of Arrowhead to be controlled (Ha) ^{#5}	0.5					
Rate of glyphosate to be used (L/Ha) ^{#6}	40					
Amount of glyphosate used (L)	20					
Percentage of product entering water (%) ^{#7}	100%					
Active ingredient of glyphosate (g/L) ^{#8}	360					
Amount of glyphosate entering water (g)	7200					
Concentration of glyphosate in water assuming complete mixing (mg/L)	0.0014					

^{#1} The trigger values derived using the statistical distribution methods were calculated at four different protection levels. The protection level signifies the percentage of species expected to be protected. The decision to apply a certain protection level to a specific ecosystem is the prerogative of each particular jurisdiction or catchment manager, in consultation with community and stake holders. Extracted from Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2000

^{#2} The Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2000 do not list a trigger value for glyphosate in irrigation water. However, the hazard from residues at maximum concentration likely to be found in irrigation water are termed 'low' in the case of glyphosate. Goulburn Murray Water commissioned an external Biocides Audit on its herbicide use; the consultants deem that 0.1 mg/l was an appropriate safety margin for irrigation water based on scientific literature and available information. The label rate of glyphosate in terrestrial situations for annual weeds is 2-3 l/ha (700-1.4 L/100 L) which equates to 2520 mg/L. As calculated above, the concentration of glyphosate

used for Arrowhead control will less than 0.0015 mg/L. This figure would probably further diminish as a result of the turbid water which caused inactivation of the active ingredient.

#3 The limit has been extracted from the Australian Drinking Water Guidelines, the limit is based on 10% of the Acceptable Daily Intake which is 1 mg/L

#4 During the treatment period (December to May) water flows in the area to be treated range between 5000-12000 ML per day, in the past 3 years. The calculations above use the conservative figure of 5000 ML/day. Appendix 1 shows the daily flows for the past 3 years.

#5 A survey of the Murray River in Dec. 2003 showed that the area of arrowhead is approximately 0.2 ha.

#6 Arrowhead is a very difficult aquatic weed to control and elevated dose of glyphosate are necessary for satisfactory control. A permit from the APVMA for use at 40 L/Ha has been. The volume of glyphosate product required to control 0.5 ha equates to 20 L. The permit can be viewed at <http://www.nra.gov.au/permits/permits.shtml>, Permit 6875

#7 A worst case scenario has been used in the calculations, with the assumption that all product used enters the water. In general situation, we assume that 20% of the product enters the water.

#8 The glyphosate product will have and aquatic registration and contains 360 g/L of glyphosate present as the isopropylamine salt.

4.2 Arrowhead control around pump suction

According to the survey conducted in Dec. 2003, no pump suction were located within 100 m of an arrowhead infestation. If an infestation was established close to a pump suction, Goulburn-Murray Water would notify the respective owner by phone or letter giving details of the spray program and the likely time of application.

4.3 Water sampling

Although we do not expect and detectable glyphosate residues to be present after spray application, we will conduct a sampling program in a particular site in order to verify our procedures on an annual basis.

5 Public Response

Holiday makers (house boats, campers and speed boats enthusiasts) utilize the Murray River for leisure activities which coincide with the Christmas / New Year period, the Australia Day and Labour Day long weekends. Arrowhead control will not be implemented during these periods. If the situation arises when holiday makers are close to an arrowhead infestation, spraying will be postponed. The location of the site will be locate by GPS and treated at a later date.

If concern was raised by the public, Goulburn-Murray Water would respond in an open frank manner and endeavour to explain the background and necessity of adopting these control measures. General information will be provided to explain the situation. A pamphlet is currently being drafted to provide general information regarding weed control issues and control measures.

6 Appendix 1.
Water flows in
Murray and National
Channel at
Torrumbarry Weir

Abbreviations: ML/D -
Megalitres of Water per day

Date	Murray Flow ML/D	Nat Chnl Flow ML/D	Total Flow ML/D
1-Jan-02	4050	3600	7650
2-Jan-02	4103	3600	7703
3-Jan-02	4109	3600	7709
4-Jan-02	4684	3600	8284
5-Jan-02	4934	3600	8534
6-Jan-02	5000	3600	8600
7-Jan-02	4772	3600	8372
8-Jan-02	4761	3500	8261
9-Jan-02	4640	3500	8140
10-Jan-02	4581	3500	8081
11-Jan-02	4162	3700	7862
12-Jan-02	4015	3800	7815
13-Jan-02	3830	3800	7630
14-Jan-02	3840	3800	7640
15-Jan-02	3909	3800	7709
16-Jan-02	4251	3800	8051
17-Jan-02	4128	3800	7928
18-Jan-02	4053	4100	8153
19-Jan-02	4174	4100	8274
20-Jan-02	4100	4100	8200
21-Jan-02	4034	4100	8134
22-Jan-02	3733	4100	7833
23-Jan-02	3716	4100	7816
24-Jan-02	3877	3850	7727
25-Jan-02	4566	3850	8416
26-Jan-02	5353	3850	9203
27-Jan-02	5426	3850	9276
28-Jan-02	5499	3850	9349
29-Jan-02	5479	3850	9329
30-Jan-02	5181	3850	9031
31-Jan-02	5020	3850	8870
1-Feb-02	4493	3850	8343
2-Feb-02	4140	3850	7990
3-Feb-02	3820	3850	7670
4-Feb-02	3462	3850	7312
5-Feb-02	3253	3850	7103
6-Feb-02	3452	3850	7302
7-Feb-02	3475	3850	7325
8-Feb-02	3575	3850	7425
9-Feb-02	5130	3850	8980
10-Feb-02	5211	3850	9061

11-Feb-02	5473	3850	9323
12-Feb-02	5623	3850	9473
13-Feb-02	5706	3850	9556
14-Feb-02	5282	3850	9132
15-Feb-02	4866	3850	8716
16-Feb-02	5463	3850	9313
17-Feb-02	5147	3850	8997
18-Feb-02	4810	3850	8660
19-Feb-02	4562	3850	8412
20-Feb-02	4034	3850	7884
21-Feb-02	4081	3850	7931
22-Feb-02	3932	3850	7782
23-Feb-02	4230	3850	8080
24-Feb-02	4119	4000	8119
25-Feb-02	3844	4000	7844
26-Feb-02	3099	4400	7499
27-Feb-02	3002	4400	7402
28-Feb-02	2601	4400	7001
1-Mar-02	2621	4400	7021
2-Mar-02	2168	4400	6568
3-Mar-02	2416	4400	6816
4-Mar-02	2791	4400	7191
5-Mar-02	3029	4400	7429
6-Mar-02	3236	4400	7636
7-Mar-02	3322	4400	7722
8-Mar-02	3322	4400	7722
9-Mar-02	3308	4400	7708
10-Mar-02	3025	4400	7425
11-Mar-02	3039	4400	7439
12-Mar-02	2926	4400	7326
13-Mar-02	2905	4400	7305
14-Mar-02	3099	4400	7499
15-Mar-02	3122	4400	7522
16-Mar-02	3419	4400	7819
17-Mar-02	3426	4400	7826
18-Mar-02	3521	4400	7921
19-Mar-02	3651	4400	8051
20-Mar-02	3416	4400	7816
21-Mar-02	3568	4400	7968
22-Mar-02	3524	4400	7924
23-Mar-02	3550	4400	7950
24-Mar-02	3462	4400	7862
25-Mar-02	3393	4400	7793
26-Mar-02	3482	4400	7882
27-Mar-02	3675	4400	8075
28-Mar-02	3850	3930	7780
29-Mar-02	3964	3930	7894
30-Mar-02	4062	3930	7992
31-Mar-02	4162	3930	8092
1-Apr-02	4233	3930	8163
2-Apr-02	4283	3000	7283
3-Apr-02	4255	3000	7255
4-Apr-02	4241	3000	7241
5-Apr-02	4065	3000	7065
6-Apr-02	3877	3000	6877

7-Apr-02	3850	3000	6850
8-Apr-02	3817	3000	6817
9-Apr-02	3644	3000	6644
10-Apr-02	3322	2800	6122
11-Apr-02	2905	2800	5705
12-Apr-02	3190	2800	5990
13-Apr-02	3409	2800	6209
14-Apr-02	3284	2800	6084
15-Apr-02	3212	2800	6012
16-Apr-02	3180	2400	5580
17-Apr-02	3243	2400	5643
18-Apr-02	3148	2400	5548
19-Apr-02	3190	2400	5590
20-Apr-02	3122	2400	5522
21-Apr-02	2929	2000	4929
22-Apr-02	2705	2000	4705
23-Apr-02	2871	2000	4871
24-Apr-02	2807	2000	4807
25-Apr-02	2891	2000	4891
26-Apr-02	2862	2000	4862
27-Apr-02	2804	2000	4804
28-Apr-02	2621	2000	4621
29-Apr-02	2597	2000	4597
30-Apr-02	2458	2000	4458
1-May-02	2449	2000	4449
2-May-02	2481	1200	3681
3-May-02	2395	1200	3595
4-May-02	1755	1200	2955
		1200	1200
		0	0
		0	0
8-May-02	1686	0	1686
		0	0
10-May-02	1651	0	1651
11-May-02	1829	0	1829
12-May-02	2052	0	2052
13-May-02	2218	0	2218
14-May-02	2376	0	2376
15-May-02	2312	0	2312
16-May-02	2335	0	2335
17-May-02	2734	0	2734
18-May-02	3260	0	3260
19-May-02	3945	0	3945
20-May-02	4815	0	4815
21-May-02	5844	0	5844
22-May-02	6689	0	6689
23-May-02	7376	0	7376
24-May-02	7982	0	7982
25-May-02	8402	0	8402
26-May-02	8721	0	8721
27-May-02	8874		8874
28-May-02	8712		8712
29-May-02	8519		8519
30-May-02	8483		8483
31-May-02	8398		8398

1-Jun-02	7658		7658	26-Jul-02	1929	2000	3929	19-Sep-02	7633	3000	10633
2-Jun-02	6492		6492	27-Jul-02	2099	2000	4099	20-Sep-02	7681	3000	10681
3-Jun-02	5259		5259	28-Jul-02	2141	2000	4141	21-Sep-02	7670	3000	10670
4-Jun-02	4269		4269	29-Jul-02	2242	2000	4242	22-Sep-02	7626	3000	10626
5-Jun-02	3644		3644	30-Jul-02	2160	2000	4160	23-Sep-02	7546	3200	10746
6-Jun-02	3225		3225	31-Jul-02	2270	2000	4270	24-Sep-02	7369	3200	10569
7-Jun-02	2874		2874	1-Aug-02	2487	3500	5987	25-Sep-02	7304	3200	10504
8-Jun-02	2747		2747	2-Aug-02	2899	3500	6399	26-Sep-02	6834	3200	10034
9-Jun-02	2807		2807	3-Aug-02	3156	3500	6656	27-Sep-02	6722	3800	10522
10-Jun-02	2544		2544	4-Aug-02	3383	3500	6883	28-Sep-02	6297	3800	10097
11-Jun-02	2517		2517	5-Aug-02	3716	3500	7216	29-Sep-02	6297	3800	10097
12-Jun-02	2566		2566	6-Aug-02	4085	3500	7585	30-Sep-02	6283	3800	10083
13-Jun-02	2449		2449	7-Aug-02	3773	3500	7273	1-Oct-02	6416	3800	10216
14-Jun-02	2579		2579	8-Aug-02	4204	3500	7704	2-Oct-02	6450	3800	10250
15-Jun-02	2605		2605	9-Aug-02	4049	3500	7549	3-Oct-02	6522	3800	10322
16-Jun-02	2605		2605	10-Aug-02	3370	4000	7370	4-Oct-02	6589	3800	10389
17-Jun-02	2602		2602	11-Aug-02	3363	4000	7363	5-Oct-02	6648	3800	10448
18-Jun-02	2441		2441	12-Aug-02	3428	4000	7428	6-Oct-02	6578	3800	10378
19-Jun-02	2568		2568	13-Aug-02	3553	4000	7553	7-Oct-02	6631	3800	10431
20-Jun-02	2534		2534	14-Aug-02	3485	4000	7485	8-Oct-02	6634	3600	10234
21-Jun-02	2775		2775	15-Aug-02	3455	4000	7455	9-Oct-02	6992	3500	10492
22-Jun-02	3397		3397	16-Aug-02	3451	4000	7451	10-Oct-02	7173	3500	10673
23-Jun-02	4431		4431	17-Aug-02	3455	4000	7455	11-Oct-02	7273	3500	10773
24-Jun-02	5399		5399	18-Aug-02	3214	4000	7214	12-Oct-02	7339	3500	10839
25-Jun-02	6219		6219	19-Aug-02	2732	4000	6732	13-Oct-02	7231	3500	10731
26-Jun-02	6526		6526	20-Aug-02	2772	4000	6772	14-Oct-02	7435	3500	10935
27-Jun-02	6385		6385	21-Aug-02	2793	4200	6993	15-Oct-02	7550	3500	11050
28-Jun-02	6091		6091	22-Aug-02	2974	4200	7174	16-Oct-02	7906	3000	10906
29-Jun-02	5687		5687	23-Aug-02	2875	4200	7075	17-Oct-02	7828	3000	10828
30-Jun-02	5065		5065	24-Aug-02	3126	4200	7326	18-Oct-02	7865	3000	10865
1-Jul-02	4803		4803	25-Aug-02	3207	4200	7407	19-Oct-02	7828	3000	10828
2-Jul-02	4503		4503	26-Aug-02	3411	4200	7611	20-Oct-02	7865	3000	10865
3-Jul-02	4305		4305	27-Aug-02	3583	4200	7783	21-Oct-02	7777	3000	10777
4-Jul-02	4103		4103	28-Aug-02	3757	4200	7957	22-Oct-02	7784	3000	10784
5-Jul-02	4038		4038	29-Aug-02	4042	4200	8242	23-Oct-02	7788	3000	10788
6-Jul-02	4071		4071	30-Aug-02	4111	4200	8311	24-Oct-02	7928	3000	10928
7-Jul-02	4404		4404	31-Aug-02	4348	4200	8548	25-Oct-02	7997	3000	10997
8-Jul-02	4341		4341	1-Sep-02	4476	4200	8676	26-Oct-02	8119	2600	10719
9-Jul-02	4212		4212	2-Sep-02	5746	4200	9946	27-Oct-02	8108	2600	10708
10-Jul-02	4132		4132	3-Sep-02	5772	3200	8972	28-Oct-02	8111	2600	10711
11-Jul-02	3920		3920	4-Sep-02	6512	2800	9312	29-Oct-02	8188	2600	10788
12-Jul-02	4008		4008	5-Sep-02	6585	2800	9385	30-Oct-02	8324	2600	10924
13-Jul-02	4469		4469	6-Sep-02	6778	2800	9578	31-Oct-02	8291	2600	10891
14-Jul-02	5021		5021	7-Sep-02	6903	2800	9703	1-Nov-02	8305	2600	10905
15-Jul-02	5001		5001	8-Sep-02	7339	2800	10139	2-Nov-02	8294	2600	10894
16-Jul-02	4730		4730	9-Sep-02	7416	2800	10216	3-Nov-02	8382	2600	10982
17-Jul-02	4544		4544	10-Sep-02	7542	2800	10342	4-Nov-02	8335	2600	10935
18-Jul-02	4493		4493	11-Sep-02	7515	3000	10515	5-Nov-02	8466	2600	11066
19-Jul-02	3913		3913	12-Sep-02	7519	3000	10519	6-Nov-02	8423	2600	11023
20-Jul-02	2147		2147	13-Sep-02	7242	3000	10242	7-Nov-02	8254	2600	10854
21-Jul-02	2053		2053	14-Sep-02	7061	3000	10061	8-Nov-02	8203	2600	10803
22-Jul-02	2044		2044	15-Sep-02	7077	3000	10077	9-Nov-02	8265	2600	10865
23-Jul-02	1973	2000	3973	16-Sep-02	7092	3000	10092	10-Nov-02	8192	2600	10792
24-Jul-02	2134	2000	4134	17-Sep-02	7246	3000	10246	11-Nov-02	8053	2600	10653
25-Jul-02	1960	2000	3960	18-Sep-02	7412	3000	10412	12-Nov-02	7946	3000	10946

13-Nov-02	7946	3000	10946	7-Jan-03	6375	3000	9375	3-Mar-03	5706	2400	8106
14-Nov-02	7902	3000	10902	8-Jan-03	6205	3000	9205	4-Mar-03	5373	2400	7773
15-Nov-02	7850	3000	10850	9-Jan-03	6074	3000	9074	5-Mar-03	5188	2400	7588
16-Nov-02	7755	3200	10955	10-Jan-03	5588	3000	8588	6-Mar-03	4517	2400	6917
17-Nov-02	7773	3200	10973	11-Jan-03	5433	3000	8433	7-Mar-03	4326	2400	6726
18-Nov-02	7799	3200	10999	12-Jan-03	5396	3000	8396	8-Mar-03	4093	2400	6493
19-Nov-02	7865	3500	11365	13-Jan-03	5233	3000	8233	9-Mar-03	3672	2400	6072
20-Nov-02	7788	3500	11288	14-Jan-03	5154	3200	8354	10-Mar-03	3407	2400	5807
21-Nov-02	7968	3500	11468	15-Jan-03	5061	3200	8261	11-Mar-03	3247	2400	5647
22-Nov-02	8005	3500	11505	16-Jan-03	4998	3200	8198	12-Mar-03	3225	2400	5625
23-Nov-02	8038	3500	11538	17-Jan-03	4859	3200	8059	13-Mar-03	3262	2400	5662
24-Nov-02	8023	3500	11523	18-Jan-03	4932	3200	8132	14-Mar-03	3276	2400	5676
25-Nov-02	8089	3300	11389	19-Jan-03	4740	3200	7940	15-Mar-03	3167	2400	5567
26-Nov-02	8342	3300	11642	20-Jan-03	4720	3200	7920	16-Mar-03	3163	2400	5563
27-Nov-02	8649	3300	11949	21-Jan-03	4710	3200	7910	17-Mar-03	3370	2400	5770
28-Nov-02	8824	3000	11824	22-Jan-03	4615	3200	7815	18-Mar-03	3482	2400	5882
29-Nov-02	9232	2700	11932	23-Jan-03	4551	3200	7751	19-Mar-03	3526	2400	5926
30-Nov-02	9240	2700	11940	24-Jan-03	4625	3200	7825	20-Mar-03	3536	2400	5936
1-Dec-02	9316	2700	12016	25-Jan-03	4683	3200	7883	21-Mar-03	3332	2400	5732
2-Dec-02	9240	2700	11940	26-Jan-03	4683	3200	7883	22-Mar-03	3352	2400	5752
3-Dec-02	9256	2700	11956	27-Jan-03	4653	3200	7853	23-Mar-03	3462	2400	5862
4-Dec-02	9176	3000	12176	28-Jan-03	4575	3200	7775	24-Mar-03	3636	2400	6036
5-Dec-02	9276	3000	12276	29-Jan-03	4646	3200	7846	25-Mar-03	3865	2400	6265
6-Dec-02	9180	3000	12180	30-Jan-03	4743	3200	7943	26-Mar-03	4056	2000	6056
7-Dec-02	9120	3000	12120	31-Jan-03	4680	3200	7880	27-Mar-03	3992	2000	5992
8-Dec-02	9092	3000	12092	1-Feb-03	4341	3200	7541	28-Mar-03	4042	2000	6042
9-Dec-02	9124	3000	12124	2-Feb-03	4158	3200	7358	29-Mar-03	4012	2000	6012
10-Dec-02	8980	3000	11980	3-Feb-03	4341	3200	7541	30-Mar-03	3809	2000	5809
11-Dec-02	8990	3000	11990	4-Feb-03	4438	3200	7638	31-Mar-03	3632	2000	5632
12-Dec-02	9000	3000	12000	5-Feb-03	4425	3200	7625	1-Apr-03	3434	2000	5434
13-Dec-02	8988	3000	11988	6-Feb-03	4394	3200	7594	2-Apr-03	3349	1800	5149
14-Dec-02	8872	3000	11872	7-Feb-03	4810	3200	8010	3-Apr-03	2966	1800	4766
15-Dec-02	8944	3000	11944	8-Feb-03	4833	3200	8033	4-Apr-03	2974	1800	4774
16-Dec-02	8864	3000	11864	9-Feb-03	4717	3200	7917	5-Apr-03	2933	1800	4733
17-Dec-02	8474	3200	11674	10-Feb-03	4770	3200	7970	6-Apr-03	2910	1800	4710
18-Dec-02	8404	3200	11604	11-Feb-03	4747	3200	7947	7-Apr-03	3015	1800	4815
19-Dec-02	8331	3400	11731	12-Feb-03	4830	3000	7830	8-Apr-03	2944	1800	4744
20-Dec-02	8170	3400	11570	13-Feb-03	4863	3000	7863	9-Apr-03	2885	1800	4685
21-Dec-02	7961	3400	11361	14-Feb-03	5173	3000	8173	10-Apr-03	2892	1800	4692
22-Dec-02	7722	3400	11122	15-Feb-03	5072	3000	8072	11-Apr-03	3089	1800	4889
23-Dec-02	7485	3400	10885	16-Feb-03	5076	3000	8076	12-Apr-03	3407	1800	5207
24-Dec-02	7177	3400	10577	17-Feb-03	5188	3000	8188	13-Apr-03	3509	1800	5309
25-Dec-02	7019	3400	10419	18-Feb-03	4965	2800	7765	14-Apr-03	3492	1800	5292
26-Dec-02	6953	3400	10353	19-Feb-03	5080	2800	7880	15-Apr-03	3636	1500	5136
27-Dec-02	6494	3400	9894	20-Feb-03	5206	2400	7606	16-Apr-03	3825	1500	5325
28-Dec-02	6161	3400	9561	21-Feb-03	6042	2400	8442	17-Apr-03	3617	1300	4917
29-Dec-02	5815	3400	9215	22-Feb-03	7235	2400	9635	18-Apr-03	3793	1300	5093
30-Dec-02	5698	3400	9098	23-Feb-03	7585	2400	9985	19-Apr-03	3825	1300	5125
31-Dec-02	5654	3400	9054	24-Feb-03	7496	2400	9896	20-Apr-03	3553	1300	4853
1-Jan-03	6077	3400	9477	25-Feb-03	7339	2400	9739	21-Apr-03	3276	1300	4576
2-Jan-03	6109	3000	9109	26-Feb-03	7327	2400	9727	22-Apr-03	3189	1300	4489
3-Jan-03	6439	3000	9439	27-Feb-03	7142	2400	9542	23-Apr-03	3067	1300	4367
4-Jan-03	6484	3000	9484	28-Feb-03	6988	2400	9388	24-Apr-03	2850	1300	4150
5-Jan-03	6419	3000	9419	1-Mar-03	6961	2400	9361	25-Apr-03	2743	1300	4043
6-Jan-03	6487	3000	9487	2-Mar-03	6056	2400	8456	26-Apr-03	2667	1300	3967

27-Apr-03	2743	1300	4043	21-Jun-03	2843		2843	15-Aug-03	10337	0	10337
28-Apr-03	3074	1300	4374	22-Jun-03	3022		3022	16-Aug-03	9935	0	9935
29-Apr-03	2985	1300	4285	23-Jun-03	3404		3404	17-Aug-03	9436	0	9436
30-Apr-03	2892	1300	4192	24-Jun-03	3499		3499	18-Aug-03	9108	0	9108
1-May-03	2875	1300	4175	25-Jun-03	3566		3566	19-Aug-03	9252	0	9252
2-May-03	2850	1300	4150	26-Jun-03	3583		3583	20-Aug-03	10157	0	10157
3-May-03	2839	1300	4139	27-Jun-03	3414		3414	21-Aug-03	10446	700	11146
4-May-03	2839	0	2839	28-Jun-03	3613		3613	22-Aug-03	10375	700	11075
5-May-03	2437	0	2437	29-Jun-03	3692		3692	23-Aug-03	9901	700	10601
6-May-03	2444	0	2444	30-Jun-03	3597		3597	24-Aug-03	9617	700	10317
7-May-03	2284	0	2284	1-Jul-03	3944		3944	25-Aug-03	9709	700	10409
8-May-03	2252	0	2252	2-Jul-03	3936		3936	26-Aug-03	10346	1500	11846
9-May-03	2252	0	2252	3-Jul-03	4323		4323	27-Aug-03	11002	1500	12502
10-May-03	1953	0	1953	4-Jul-03	4273		4273	28-Aug-03	12831	1500	14331
11-May-03	1908	0	1908	5-Jul-03	4351		4351	29-Aug-03	16127	1500	17627
12-May-03	1599	0	1599	6-Jul-03	4836		4836	30-Aug-03	19778	1500	21278
13-May-03	1450	0	1450	7-Jul-03	5466		5466	31-Aug-03	22281	1500	23781
14-May-03	1355	0	1355	8-Jul-03	5829		5829	1-Sep-03	23289	1500	24789
15-May-03	2871	0	2871	9-Jul-03	5885		5885	2-Sep-03	23167	1500	24667
16-May-03	2228	0	2228	10-Jul-03	5636		5636	3-Sep-03	21651	1500	23151
17-May-03	2228	0	2228	11-Jul-03	5262		5262	4-Sep-03	19887	1500	21387
18-May-03	2543	0	2543	12-Jul-03	4783		4783	5-Sep-03	17934	1500	19434
19-May-03	2885	0	2885	13-Jul-03	4632		4632	6-Sep-03	16825	1500	18325
20-May-03	3174	0	3174	14-Jul-03	4183		4183	7-Sep-03	16668	1500	18168
21-May-03	3170	0	3170	15-Jul-03	3936		3936	8-Sep-03	16779	1500	18279
22-May-03	3152	0	3152	16-Jul-03	3617		3617	9-Sep-03	16749	1500	18249
23-May-03	3130		3130	17-Jul-03	3580		3580	10-Sep-03	16426	1500	17926
24-May-03	3339		3339	18-Jul-03	3733		3733	11-Sep-03	16008	2700	18708
25-May-03	3613		3613	19-Jul-03	3078	1000	4078	12-Sep-03	15441	2700	18141
26-May-03	3801		3801	20-Jul-03	3664	1000	4664	13-Sep-03	14361	2700	17061
27-May-03	3704		3704	21-Jul-03	4201	1000	5201	14-Sep-03	13714	2700	16414
28-May-03	3570		3570	22-Jul-03	4455	1000	5455	15-Sep-03	12896	2700	15596
29-May-03	3468		3468	23-Jul-03	3394	2000	5394	16-Sep-03	12115	2700	14815
30-May-03	3424		3424	24-Jul-03	3603	2000	5603	17-Sep-03	11225	2700	13925
31-May-03	3159		3159	25-Jul-03	3656	2000	5656	18-Sep-03	10350	2700	13050
1-Jun-03	3137		3137	26-Jul-03	4129	2000	6129	19-Sep-03	9671	2700	12371
2-Jun-03	2948		2948	27-Jul-03	4431	2000	6431	20-Sep-03	9036	2700	11736
3-Jun-03	2925		2925	28-Jul-03	5536	2000	7536	21-Sep-03	8796	2700	11496
4-Jun-03	2815		2815	29-Jul-03	9705	1000	10705	22-Sep-03	9084	2700	11784
5-Jun-03	2511		2511	30-Jul-03	14887	1000	15887	23-Sep-03	10165	2700	12865
6-Jun-03	2750		2750	31-Jul-03	18104	1000	19104	24-Sep-03	10606	2700	13306
7-Jun-03	2700		2700	1-Aug-03	19431	1000	20431	25-Sep-03	11039	2700	13739
8-Jun-03	2674		2674	2-Aug-03	19142	2000	21142	26-Sep-03	11166	2700	13866
9-Jun-03	2471		2471	3-Aug-03	16516	2000	18516	27-Sep-03	10686	2700	13386
10-Jun-03	2383		2383	4-Aug-03	13881	2000	15881	28-Sep-03	10720	2700	13420
11-Jun-03	2370		2370	5-Aug-03	11741	1000	12741	29-Sep-03	10678	2700	13378
12-Jun-03	2494		2494	6-Aug-03	11292	1000	12292	30-Sep-03	10539	2700	13239
13-Jun-03	2484		2484	7-Aug-03	10505	1000	11505	1-Oct-03	10199	2700	12899
14-Jun-03	2524		2524	8-Aug-03	10199	1000	11199	2-Oct-03	10144	2700	12844
15-Jun-03	2431		2431	9-Aug-03	10170	1000	11170	3-Oct-03	9868	2700	12568
16-Jun-03	2501		2501	10-Aug-03	10178	1000	11178	4-Oct-03	9621	2700	12321
17-Jun-03	2667		2667	11-Aug-03	10161	1000	11161	5-Oct-03	9380	2700	12080
18-Jun-03	2685		2685	12-Aug-03	10165	1000	11165	6-Oct-03	9088	2700	11788
19-Jun-03	2811		2811	13-Aug-03	10669	0	10669	7-Oct-03	9024	2700	11724
20-Jun-03	2732		2732	14-Aug-03	10757	0	10757	8-Oct-03	9092	2700	11792

9-Oct-03	8852	2700	11552	21-Nov-03	4713	3000	7713	3-Jan-04	5366	3200	8566
10-Oct-03	8848	2700	11548	22-Nov-03	5496	3000	8496	4-Jan-04	4787	3200	7987
11-Oct-03	8848	2700	11548	23-Nov-03	6439	3000	9439	5-Jan-04	4703	3200	7903
12-Oct-03	8649	2700	11349	24-Nov-03	7223	3000	10223	6-Jan-04	4853	3200	8053
13-Oct-03	8280	3200	11480	25-Nov-03	7500	3000	10500	7-Jan-04	4866	3200	8066
14-Oct-03	6884	3200	10084	26-Nov-03	7725	3000	10725	8-Jan-04	4866	3200	8066
15-Oct-03	6355	3200	9555	27-Nov-03	7744	3000	10744	9-Jan-04	5277	3200	8477
16-Oct-03	5920	3200	9120	28-Nov-03	7917	3000	10917	10-Jan-04	5617	3200	8817
17-Oct-03	5551	3200	8751	29-Nov-03	8023	3000	11023	11-Jan-04	5470	3200	8670
18-Oct-03	5151	3200	8351	30-Nov-03	6687	3000	9687	12-Jan-04	5422	3200	8622
19-Oct-03	4747	3200	7947	1-Dec-03	6365	3000	9365	13-Jan-04	5277	3200	8477
20-Oct-03	4455	3200	7655	2-Dec-03	6109	3000	9109	14-Jan-04	5355	3200	8555
21-Oct-03	4085	3200	7285	3-Dec-03	6028	3000	9028	15-Jan-04	5192	3200	8392
22-Oct-03	3873	3200	7073	4-Dec-03	6368	3000	9368	16-Jan-04	5180	3200	8380
23-Oct-03	3761	3200	6961	5-Dec-03	6378	3000	9378	17-Jan-04	5184	3200	8384
24-Oct-03	3560	3200	6760	6-Dec-03	6690	3000	9690	18-Jan-04	5262	3200	8462
25-Oct-03	3563	2500	6063	7-Dec-03	6830	3000	9830	19-Jan-04	5292	3200	8492
26-Oct-03	3563	2500	6063	8-Dec-03	6830	3000	9830	20-Jan-04	5403	3200	8603
27-Oct-03	3519	2500	6019	9-Dec-03	6368	3000	9368	21-Jan-04	4717	3200	7917
28-Oct-03	3421	2500	5921	10-Dec-03	6338	3000	9338	22-Jan-04	4909	3200	8109
29-Oct-03	4642	2500	7142	11-Dec-03	6143	3000	9143	23-Jan-04	5001	3200	8201
30-Oct-03	4886	2500	7386	12-Dec-03	6091	3000	9091	24-Jan-04	5057	3200	8257
31-Oct-03	4962	2500	7462	13-Dec-03	5909	3000	8909	25-Jan-04	5277	3200	8477
1-Nov-03	5047	2500	7547	14-Dec-03	5731	3000	8731	26-Jan-04	5047	3200	8247
2-Nov-03	5683	2500	8183	15-Dec-03	5573	3000	8573	27-Jan-04	5303	3200	8503
3-Nov-03	5746	2500	8246	16-Dec-03	5477	3000	8477	28-Jan-04	5288	3200	8488
4-Nov-03	5779	2500	8279	17-Dec-03	5403	3000	8403	29-Jan-04	5433	3200	8633
5-Nov-03	5818	2500	8318	18-Dec-03	5418	3000	8418	30-Jan-04	5477	3200	8677
6-Nov-03	5340	2500	7840	19-Dec-03	5432	3000	8432	31-Jan-04	5403	3200	8603
7-Nov-03	5247	2500	7747	20-Dec-03	5417	3000	8417	1-Feb-04	5336	3200	8536
8-Nov-03	5214	2500	7714	21-Dec-03	6242	3000	9242	2-Feb-04	5606	3200	8806
9-Nov-03	4479	2500	6979	22-Dec-03	7061	3000	10061	3-Feb-04	5591	3200	8791
10-Nov-03	4266	2500	6766	23-Dec-03	7685	3000	10685	4-Feb-04	5892	3200	9092
11-Nov-03	4294	2500	6794	24-Dec-03	7939	3000	10939	5-Feb-04	5913	3200	9113
12-Nov-03	4298	2500	6798	25-Dec-03	8214	3000	11214	6-Feb-04	5864	3200	9064
13-Nov-03	4118	2500	6618	26-Dec-03	8368	3000	11368	7-Feb-04	6014	3200	9214
14-Nov-03	4215	2500	6715	27-Dec-03	8210	3000	11210	8-Feb-04	6314	3200	9514
15-Nov-03	4237	2500	6737	28-Dec-03	7442	3000	10442	9-Feb-04	5979	3200	9179
16-Nov-03	4186	2500	6686	29-Dec-03	7442	3000	10442	10-Feb-04	6077	3200	9277
17-Nov-03	4042	3000	7042	30-Dec-03	6599	3000	9599	11-Feb-04	6091	3200	9291
18-Nov-03	4222	3000	7222	31-Dec-03	6487	3000	9487	12-Feb-04	6088	3200	9288
19-Nov-03	4397	3000	7397	1-Jan-04	5775	3000	8775	13-Feb-04	6293		6293
20-Nov-03	4632	3000	7632	2-Jan-04	5672	3000	8672				