APPENDIX A- TEXT FILE INPUTS FOR RIVER2D BOUNDARY CONDITIONS

NOTE: The values reported in Appendix A utilize the unit system of River2D (i.e. metric system). As such, flows are reported in cubic meters per second (cms), elevations and stages in meters (m), and time in seconds (sec). The conversion from m to ft is 1/0.3048 (i.e. ft = m/0.3048), while the conversion from cms to cfs is $1/0.3048^3$ (i.e. cfs = cms/0.3048^3).

Calibration Runs

Northfield Tailrace Boundary

Low Flow: 0 cms

High Flow: 0 cms

4-Units Generating:

Segments 1 and 5

flow hydrograph for tailrace boundary

first column is time in seconds

second column is discharge in cubic meters per second

(

0	0
900	0
1800	0.35
2700	0.4
3600	0.45
4500	0.3
5400	1.65
6300	2.8
7200	2.8
8100	2.8
9000	2.8
9900	2.85
10800	2.85
11700	2.9
12600	2.9
13500	2.9
14400	2.9

)

Segments 2 and 4

flow hydrograph for tailrace boundary

first column is time in seconds

second column is discharge in cubic meters per second

(

0 0

900 0

1800 14.7

2700 18.55

3600 19.6

4500 14.35

5400 72.1

6300 124.6

7200 124.95

8100 125.55

9000 126

9900 126.05

10800 126.9

11700 127.7

12600 127.75

13500 128.35

14400 128.75

)

Segment 3

flow hydrograph for tailrace boundary

first column is time in seconds

second column is discharge in cubic meters per second

(

0 0

900 0

1800 36.2

2700 45.8

3600 48.4

4500 35.4

5400 177.8

6300 307.3

7200 308.2

8100 309.6

9000 310.6
9900 310.8
10800 313
11700 315
12600 315.1
13500 316.5
14400 317.5
)

4-Units Pumping:

Segments 1 and 5

flow hydrograph for tailrace boundary
first column is time in seconds
second column is discharge in cubic meters per second
(
0 0
900 0
1800 -4.55
2700 -4.5
3600 -13.05
4500 -17.2
5400 -16.95
6300 -17.05
7200 -17
8100 -16.8
9000 -16.8
9900 -16.7
10800 -16.75
11700 -16.7
)

Segments 2 and 4

flow hydrograph for tailrace boundary
first column is time in seconds
second column is discharge in cubic meters per second
(
0 0

900 0
1800 -29.7
2700 -29.5
3600 -84.7
4500 -111.3
5400 -110.1
6300 -110.7
7200 -110.1
8100 -108.9
9000 -109
9900 -108.4
10800 -108.6
11700 -108.1
)

Segment 3

flow hydrograph for tailrace boundary
first column is time in seconds
second column is discharge in cubic meters per second
(
0 0
900 0
1800 -33.3
2700 -33
3600 -94.8
4500 -124.7
5400 -123.3
6300 -123.9
7200 -123.3
8100 -122
9000 -122
9900 -121.4
10800 -121.7
11700 -121.1
)

Downstream Boundary

Low Flow: 54.60 m

High Flow: 55.34 m

4-Units Generating:

stage hydrograph for downstream boundary

first column is time in seconds

second column is water surface elevation in meters

(

0 54.95

900 54.95

1800 54.96

2700 54.94

3600 54.93

4500 54.90

5400 54.90

6300 54.94

7200 54.98

8100 55.04

9000 55.09

9900 55.14

10800 55.19

11700 55.24

12600 55.30

13500 55.36

14400 55.41

)

4-Units Pumping:

stage hydrograph for downstream boundary

first column is time in seconds

second column is water surface elevation in meters

(

0 55.65

900 55.65

1800 55.66

2700 55.65

3600 55.65
4500 55.62
5400 55.56
6300 55.50
7200 55.45
8100 55.42
9000 55.39
9900 55.36
10800 55.33
11700 55.29
)

Upstream Boundary

Low Flow: 62 cms

High Flow: 856 cms

4-Units Generating:

flow hydrograph for tailrace boundary
first column is time in seconds
second column is discharge in cubic meters per second
(
0 259.7
900 259.7
1800 268.3
2700 260.1
3600 260.4
4500 269.1
5400 273.2
6300 185.6
7200 53.5
8100 37.7
9000 43.8
9900 43.3
10800 45.8
11700 55.1
12600 67.7

13500 63.4
14400 58.4
)

4-Units Pumping:

flow hydrograph for tailrace boundary
first column is time in seconds
second column is discharge in cubic meters per second
(
0 85.8
900 85.8
1800 92.6
2700 131.9
3600 120.2
4500 166.0
5400 179.2
6300 175.1
7200 196.8
8100 239.2
9000 247.9
9900 245.5
10800 238.4
11700 234.7
)

Millers River Boundary

Low Flow: 9 cms

High Flow: 28 cms

4-Units Generating:

flow hydrograph for millers river boundary
first column is time in seconds
second column is discharge in cubic meters per second
(
0 19
900 19
1800 19

2700 19
3600 19
4500 18
5400 18
6300 18
7200 18
8100 18
9000 18
9900 18
10800 18
11700 18
12600 18
13500 18
14400 18
)

4-Units Pumping:

flow hydrograph for millers river boundary
first column is time in seconds
second column is discharge in cubic meters per second
(
0 21
900 21
1800 21
2700 21
3600 21
4500 21
5400 21
6300 21
7200 21
8100 21
9000 21
9900 21
10800 21
11700 21
)

Scenarios

Northfield Tailrace Boundary

2-Units Generating:

Segments 1 and 5

discharge hydrograph for tailrace boundary
first column is time in seconds
second column is discharge in cms
(
0 0.0
900 0.0
1800 1.4
100000 1.4
)

Segments 2 and 4

discharge hydrograph for tailrace boundary
first column is time in seconds
second column is discharge in cms
(
0 0.0
900 0.0
1800 62.8
100000 62.8
)

Segment 3

discharge hydrograph for tailrace boundary
first column is time in seconds
second column is discharge in cms
(
0 0.0
900 0.0
1800 154.8
100000 154.8
)

2-Units Pumping:

Segments 1 and 5

discharge hydrograph for tailrace boundary

first column is time in seconds

second column is discharge in cms

(

0 0.0

900 0.0

1800 -9.7

100000 -9.7

)

Segments 2 and 4

discharge hydrograph for tailrace boundary

first column is time in seconds

second column is discharge in cms

(

0 0.0

900 0.0

1800 -62.75

100000 -62.75

)

Segment 3

discharge hydrograph for tailrace boundary

first column is time in seconds

second column is discharge in cms

(

0 0.0

900 0.0

1800 -70.3

100000 -70.3

)

4-Units Generating:

Segments 1 and 5

discharge hydrograph for tailrace boundary

first column is time in seconds

second column is discharge in cms

(
0 0.0
900 0.0
1800 2.8
100000 2.8
)

Segments 2 and 4

discharge hydrograph for tailrace boundary
first column is time in seconds
second column is discharge in cms
(
0 0.0
900 0.0
1800 125.55
100000 125.55
)

Segment 3

discharge hydrograph for tailrace boundary
first column is time in seconds
second column is discharge in cms
(
0 0.0
900 0.0
1800 309.6
100000 309.6
)

4-Units Pumping:

Segments 1 and 5

discharge hydrograph for tailrace boundary
first column is time in seconds
second column is discharge in cms
(
0 0.0
900 0.0
1800 -19.4

100000 -19.4

)

Segments 2 and 4

discharge hydrograph for tailrace boundary

first column is time in seconds

second column is discharge in cms

(

0 0.0

900 0.0

1800 -125.5

100000 -125.5

)

Segment 3

discharge hydrograph for tailrace boundary

first column is time in seconds

second column is discharge in cms

(

0 0.0

900 0.0

1800 -140.6

100000 -140.6

)

Downstream Boundary

95% Exceedance Flow

2-Units Generating:

stage hydrograph for downstream boundary

first column is time in seconds

second column is water surface elevation in meters

(

0 53.64

900 53.64

1680 53.65

2820 53.72

9000 54.04

20040 54.52
35280 55.10
46140 55.49
56040 55.84
86400 56.85
)

2-Units Pumping:

stage hydrograph for downstream boundary
first column is time in seconds
second column is water surface elevation in meters
(
0 56.39
900 56.39
1380 56.39
2700 56.34
32340 55.57
50700 55.06
65100 54.64
78600 54.20
87360 53.87
96360 53.50
)

4-Units Generating:

stage hydrograph for downstream boundary
first column is time in seconds
second column is water surface elevation in meters
(
0 56.08
1800 56.08
2460 56.09
3660 56.21
4740 56.32
5640 56.39
7080 56.46
8400 56.52)

4-Units Pumping:

stage hydrograph for downstream boundary

first column is time in seconds

second column is water surface elevation in meters

(

0 53.95

900 53.95

1560 53.95

1860 53.93

2880 53.82

3360 53.76

4500 53.62

5880 53.47)

75% Exceedance Flow

2-Units Generating:

stage hydrograph for downstream boundary

first column is time in seconds

second column is water surface elevation in meters

(

0 53.64

900 53.64

1980 53.68

2880 53.73

9840 54.13

13740 54.32

24720 54.81

34380 55.19

49260 55.74

86400 57.00

)

2-Units Pumping:

stage hydrograph for downstream boundary

first column is time in seconds

second column is water surface elevation in meters

(

0 56.39
900 56.39
1320 56.39
2640 56.35
17340 55.96
30240 55.61
47100 55.13
67200 54.49
81900 53.94
89460 53.60
)

4-Units Generating:

stage hydrograph for downstream boundary
first column is time in seconds
second column is water surface elevation in meters
(
0 53.64
900 53.64
1920 53.69
2880 53.79
14040 54.86
18180 55.21
22920 55.57
25200 55.73
48900 57.32
60480 58.06
)

4-Units Pumping:

stage hydrograph for downstream boundary
first column is time in seconds
second column is water surface elevation in meters
(
0 53.95
900 53.95
1680 53.95

3180 53.78
3540 53.72
4380 53.60
4680 53.57
6180 53.39)

50% Exceedence Flow

2-Units Generating:

stage hydrograph for downstream boundary
first column is time in seconds
second column is water surface elevation in meters
(
0 53.64
900 53.64
1260 53.67
2220 53.71
3180 53.77
7380 54.06
15720 54.53
38700 55.51
56280 56.15
86400 57.17
)

2-Units Pumping:

stage hydrograph for downstream boundary
first column is time in seconds
second column is water surface elevation in meters
(
0 56.39
900 56.39
1380 56.39
2880 56.35
16620 55.98
29220 55.62
47940 55.06
64620 54.49

78360 53.93
86400 53.52
)

4-Units Generating:

stage hydrograph for downstream boundary
first column is time in seconds
second column is water surface elevation in meters
(
0 53.64
900 53.64
2100 53.73
2880 53.80
14700 55.03
22440 55.67
25860 55.92
40680 56.95
51840 57.68
64560 58.47
)

4-Units Pumping:

stage hydrograph for downstream boundary
first column is time in seconds
second column is water surface elevation in meters
(
0 56.39
900 56.39
1500 56.39
2700 56.30
6000 56.09
11160 55.82
16380 55.51
23580 55.07
35340 54.22
42960 53.50
)

25% Exceedence Flow

2-Units Generating:

stage hydrograph for downstream boundary

first column is time in seconds

second column is water surface elevation in meters

(

0 53.64

900 53.64

1260 53.74

2580 53.80

4200 53.93

9000 54.29

16140 54.74

30600 55.46

54720 56.42

86400 57.53

)

2-Units Pumping:

stage hydrograph for downstream boundary

first column is time in seconds

second column is water surface elevation in meters

(

0 56.39

900 56.39

1620 56.40

2820 56.38

8040 56.24

19080 55.91

36900 55.35

54720 54.71

75660 53.72

86400 53.00

)

4-Units Generating:

stage hydrograph for downstream boundary

first column is time in seconds

second column is water surface elevation in meters

(

0 53.64

900 53.64

2220 53.81

3540 53.96

6900 54.39

9600 54.72

13920 55.20

19740 55.75

23340 56.05

29880 56.54

)

4-Units Pumping:

stage hydrograph for downstream boundary

first column is time in seconds

second column is water surface elevation in meters

(

0 56.39

900 56.39

1380 56.40

2760 56.33

8040 56.01

15000 55.58

25620 54.85

33720 54.17

39960 53.50

43740 52.99

)

5% Exceedence Flow

2-Units Generating:

stage hydrograph for downstream boundary

first column is time in seconds

second column is water surface elevation in meters

(
0 53.64
900 53.64
1020 54.14
4500 54.45
10320 54.97
20160 55.67
33540 56.42
46560 57.02
63420 57.70
86400 58.51
)

2-Units Pumping:

stage hydrograph for downstream boundary
first column is time in seconds
second column is water surface elevation in meters
(
0 56.39
900 56.39
2640 56.51
3900 56.52
7020 56.50
16200 56.21
28560 55.73
43260 55.09
50340 54.75
66060 53.82
)

4-Units Generating:

stage hydrograph for downstream boundary
first column is time in seconds
second column is water surface elevation in meters
(
0 53.64
900 53.64

2460 54.28
4680 54.61
14340 55.94
18660 56.45
20520 56.65
25320 57.10
30120 57.51
37860 58.09
)

4-Units Pumping:

stage hydrograph for downstream boundary
first column is time in seconds
second column is water surface elevation in meters
(
0 56.39
900 56.39
1020 56.47
2760 56.47
5580 56.38
10020 56.11
16200 55.64
24420 54.94
31440 54.21
33900 53.90
)

Upstream Boundary

95% Exceedence Flow

2-Units Generating:

discharge hydrograph for upstream boundary
first column is time in seconds
second column is discharge in cms
(
0 46.00
900 46.00

1680 45.79
2820 -63.48
9000 -82.36
20040 -80.63
35280 -93.99
46140 -95.84
56040 -98.21
86400 -98.97
)

2-Units Pumping:

discharge hydrograph for upstream boundary
first column is time in seconds
second column is discharge in cms
(
0 46.00
900 46.00
1380 46.59
2700 145.89
32340 153.46
50700 148.65
65100 143.50
78600 136.67
87360 130.45
96360 121.12
)

4-Units Generating:

discharge hydrograph for upstream boundary
first column is time in seconds
second column is discharge in cms
(
0 46.00
1800 46.00
2460 37.97
3660 -224.73
4740 -199.62

5640 -253.24

7080 -326.72

8400 -342.58)

4-Units Pumping:

discharge hydrograph for upstream boundary

first column is time in seconds

second column is discharge in cms

(

0 46.00

900 46.00

1560 47.12

1860 55.35

2880 150.23

3360 163.07

4500 151.19

5880 159.44)

75% Exceedence Flow

2-Units Generating:

discharge hydrograph for upstream boundary

first column is time in seconds

second column is discharge in cms

(

0 132.00

900 132.00

1980 132.22

2880 44.85

9840 20.50

13740 14.80

24720 7.02

34380 -2.20

49260 -9.99

86400 -12.92

)

2-Units Pumping:

discharge hydrograph for upstream boundary

first column is time in seconds

second column is discharge in cms

(

0 132.00

900 132.00

1320 132.64

2640 230.69

17340 239.74

30240 235.33

47100 229.73

67200 219.20

81900 207.38

89460 197.30

)

4-Units Generating:

discharge hydrograph for upstream boundary

first column is time in seconds

second column is discharge in cms

(

0 132.00

900 132.00

1920 128.94

2880 -88.83

14040 -114.11

18180 -128.54

22920 -149.09

25200 -153.08

48900 -158.46

60480 -161.61

)

4-Units Pumping:

discharge hydrograph for upstream boundary

first column is time in seconds

second column is discharge in cms

(

0 132.00
900 132.00
1680 137.61
3180 227.75
3540 226.91
4380 211.66
4680 209.69
6180 220.59)

50% Exceedence Flow

2-Units Generating:

discharge hydrograph for upstream boundary
first column is time in seconds
second column is discharge in cms
(
0 225.00
900 225.00
1260 229.67
2220 225.64
3180 155.64
7380 137.97
15720 116.11
38700 91.66
56280 84.48
86400 80.87
)

2-Units Pumping:

discharge hydrograph for upstream boundary
first column is time in seconds
second column is discharge in cms
(
0 225.00
900 225.00
1380 228.43
2880 337.06
16620 327.55

29220 324.15
47940 316.24
64620 305.30
78360 292.38
86400 280.20
)

4-Units Generating:

discharge hydrograph for upstream boundary
first column is time in seconds
second column is discharge in cms
(
0 225.00
900 225.00
2100 219.26
2880 39.38
14700 -12.54
22440 -46.73
25860 -53.87
40680 -62.23
51840 -65.06
64560 -71.74
)

4-Units Pumping:

discharge hydrograph for upstream boundary
first column is time in seconds
second column is discharge in cms
(
0 225.00
900 225.00
1500 232.17
2700 414.62
6000 460.67
11160 424.22
16380 416.70
23580 404.97

35340 373.62
42960 339.61
)

25% Exceedence Flow

2-Units Generating:

discharge hydrograph for upstream boundary
first column is time in seconds
second column is discharge in cms
(
0 418.00
900 418.00
1260 430.08
2580 415.87
4200 363.67
9000 344.04
16140 325.44
30600 300.46
54720 280.41
86400 275.47
)

2-Units Pumping:

discharge hydrograph for upstream boundary
first column is time in seconds
second column is discharge in cms
(
0 418.00
900 418.00
1620 438.39
2820 551.15
8040 518.54
19080 512.17
36900 503.64
54720 490.36
75660 470.04
86400 452.83

)

4-Units Generating:

discharge hydrograph for upstream boundary

first column is time in seconds

second column is discharge in cms

(

0 418.00

900 418.00

2220 417.41

3540 249.74

6900 237.32

9600 232.09

13920 210.29

19740 173.04

23340 157.91

29880 140.56

)

4-Units Pumping:

discharge hydrograph for upstream boundary

first column is time in seconds

second column is discharge in cms

(

0 418.00

900 418.00

1380 429.14

2760 626.91

8040 614.78

15000 595.06

25620 569.62

33720 542.30

39960 516.32

43740 495.53

)

5% Exceedence Flow

2-Units Generating:

stage hydrograph for downstream boundary

first column is time in seconds

second column is water surface elevation in meters

(

0 53.64

900 53.64

1020 54.14

4500 54.45

10320 54.97

20160 55.67

33540 56.42

46560 57.02

63420 57.70

86400 58.51

)

2-Units Pumping:

discharge hydrograph for upstream boundary

first column is time in seconds

second column is discharge in cms

(

0 1072.00

900 1072.00

2640 1308.26

3900 1285.90

7020 1191.44

16200 1151.29

28560 1142.60

43260 1130.81

50340 1124.04

66060 1110.08

)

4-Units Generating:

discharge hydrograph for upstream boundary

first column is time in seconds

second column is discharge in cms

(
0 1072.00
900 1072.00
2460 1100.99
4680 949.43
14340 910.54
18660 877.77
20520 864.02
25320 836.96
30120 820.84
37860 801.55
)

4-Units Pumping:

discharge hydrograph for upstream boundary
first column is time in seconds
second column is discharge in cms
(
0 1072.00
900 1072.00
1020 1094.77
2760 1387.91
5580 1297.82
10020 1238.51
16200 1214.30
24420 1187.93
31440 1164.91
33900 1157.08
)

Millers River Boundary

95% Exceedence Flow: 4 cms

75% Exceedence Flow: 7 cms

50% Exceedence Flow: 14 cms

25% Exceedence Flow: 27 cms

5% Exceedence Flow: 64 cms