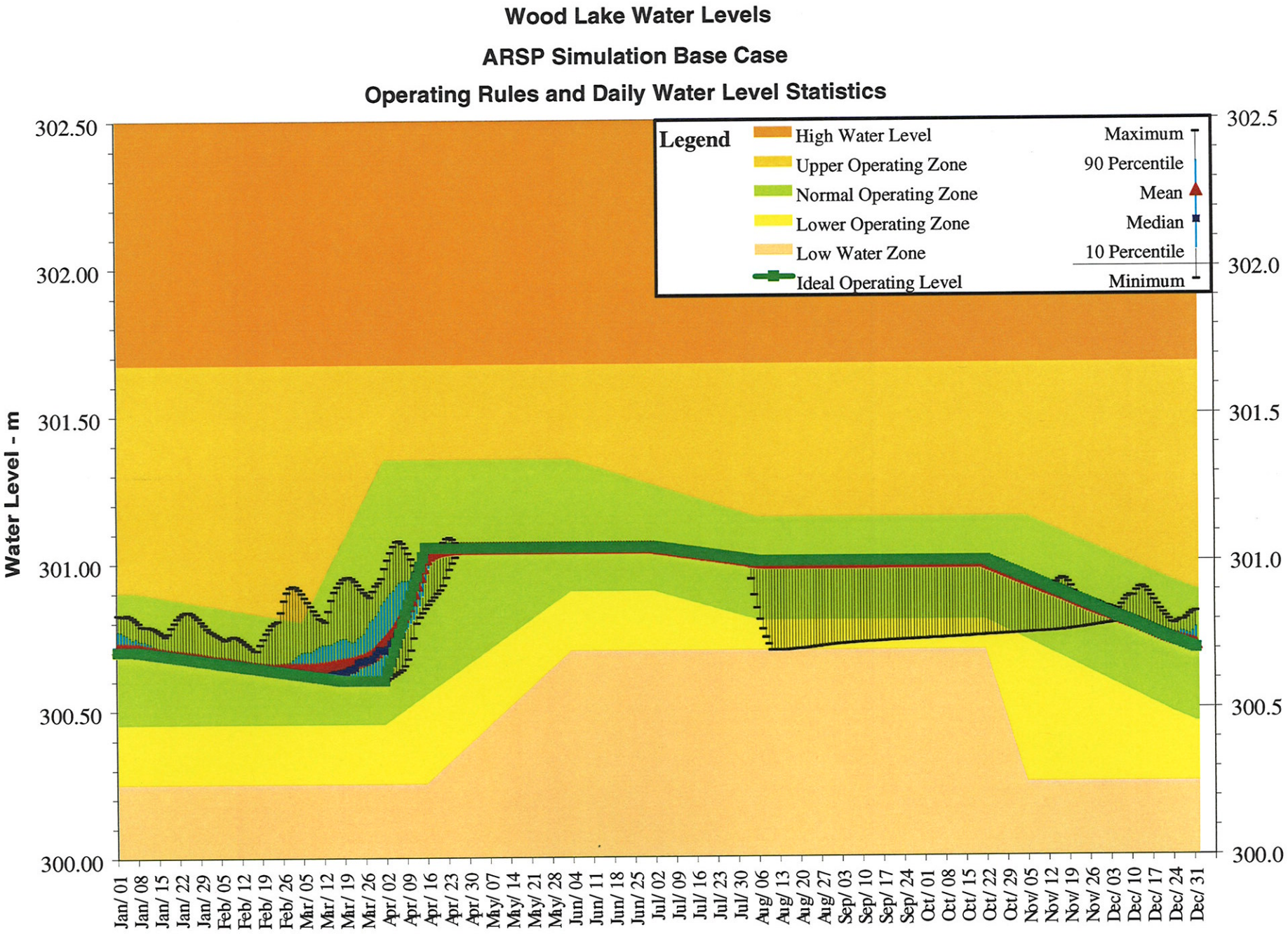
Appendix F

Option Development Process
ARSP Modeling and Analysis
of Lake Levels and River Flows

- **ARSP Base Case**
- **ARSP Case One**
- **ARSP Case Two**

Wood Lake


Wood Lake Water Levels
ARSP Simulation Base Case
Operating Rules and Daily Water Level Statistics
Legend
High Water Level
Upper Operating Zone
Normal Operating Zone
Lower Operating Zone
Low Water Zone
Ideal Operating Level
Maximum
90 Percentile
Mean
Median
10 Percentile
Minimum
Water Level - m
302.50
302.00
301.50
301.00
300.50
300.00
302.5
302.0
301.5
301.0
300.5
300.0
Jan/ 01
Jan/ 08
Jan/ 15
Jan/ 22
Jan/ 29
Feb/ 05
Feb/ 12
Feb/ 19
Feb/ 26
Mar/ 05
Mar/ 12
Mar/ 19
Mar/ 26
Apr/ 02
Apr/ 09
Apr/ 16
Apr/ 23
Apr/ 30
May/ 07
May/ 14
May/ 21
May/ 28
Jun/ 04
Jun/ 11
Jun/ 18
Jun/ 25
Jul/ 02
Jul/ 09
Jul/ 16
Jul/ 23
Jul/ 30
Aug/ 06
Aug/ 13
Aug/ 20
Aug/ 27
Sep/ 03
Sep/ 10
Sep/ 17
Sep/ 24
Oct/ 01
Oct/ 08
Oct/ 15
Oct/ 22
Oct/ 29
Nov/ 05
Nov/ 12
Nov/ 19
Nov/ 26
Dec/ 03
Dec/ 10
Dec/ 17
Dec/ 24
Dec/ 31

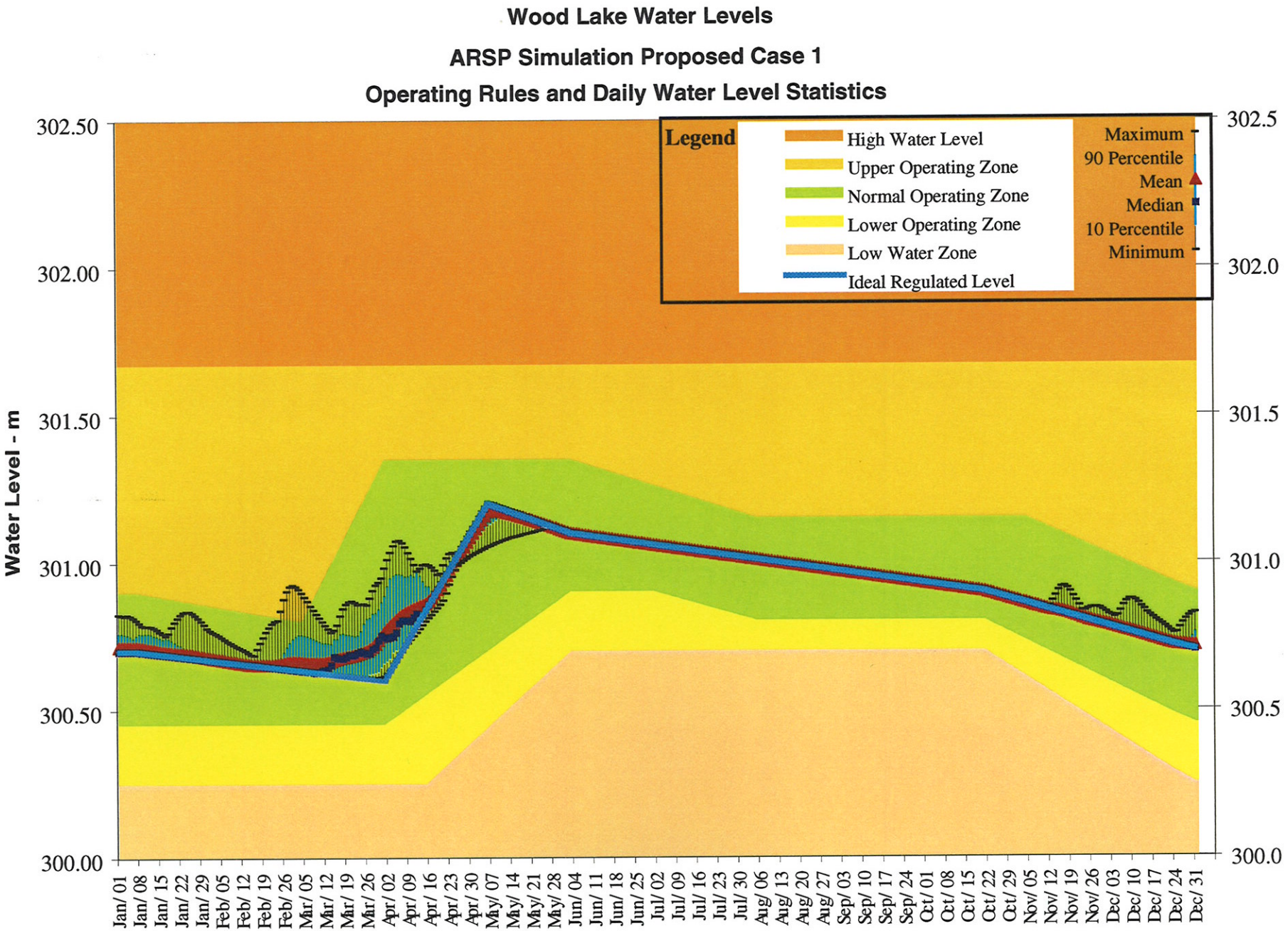
Wood Lake Water Levels
ARSP Simulation Base Case

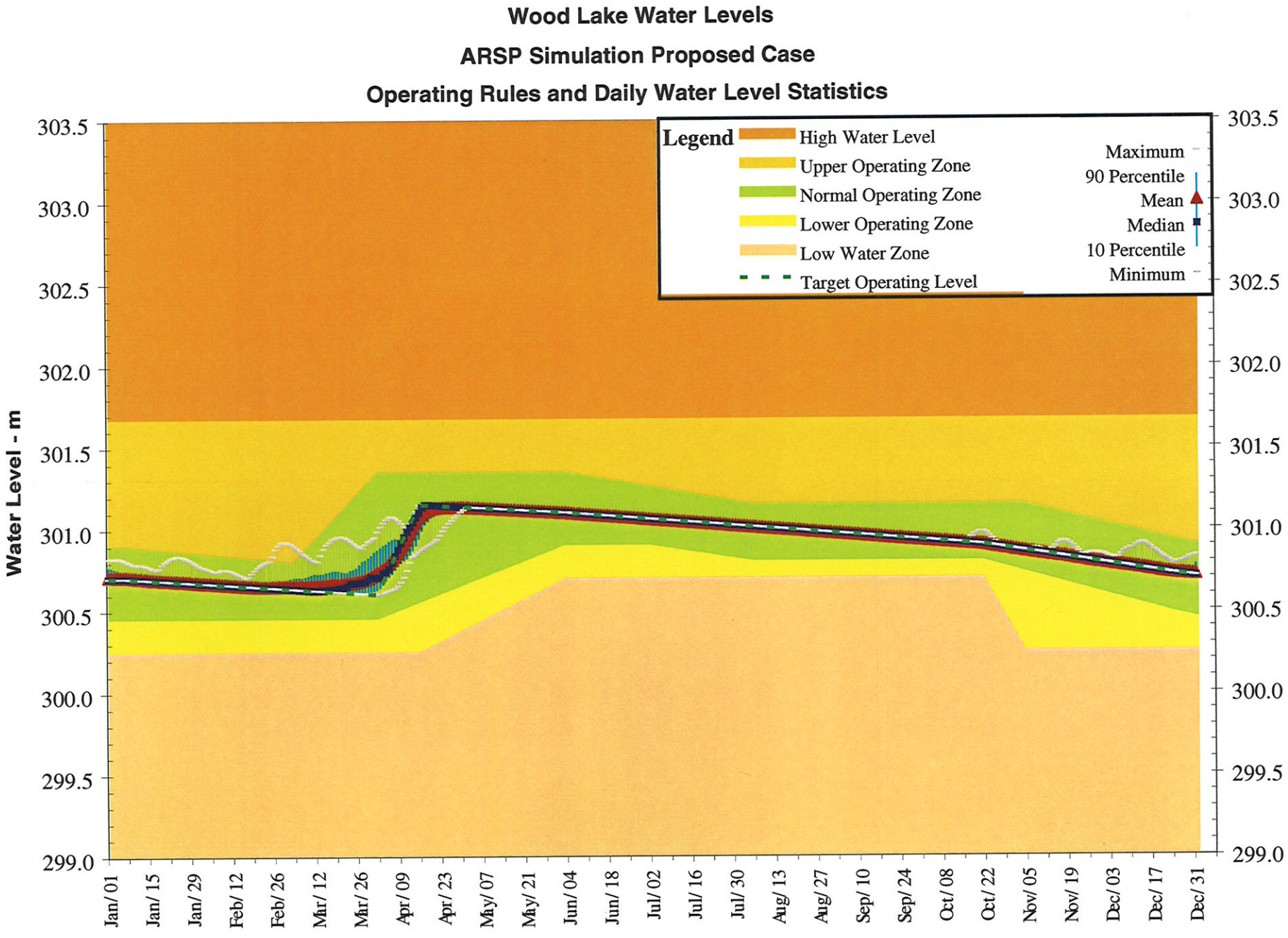
Peak Water Levels	
HWZ	301.67
No of Days in Exceedance	0
No of Years Exceeded	0
Maximum WL	301.09

Time of spring peak levels before April 30	
Percentile	0.90
Peak percentile WL	301.05
Date of peak	15-Apr
Tolerance	0
Tolerated WL	301.05
Date tolerated exceeded	15-Apr

Summer recreation levels Jun-15 to Sep-30	
90 and 10 percentile range	
Max 90%	301.05
Min 10%	301.00
Range	0.05

Median range	
Max Median	301.05
Min Median	301.00
Range	0.05


Wood Lake Water Levels
ARSP Simulation Proposed Case 1
Operating Rules and Daily Water Level Statistics
Legend
High Water Level
Upper Operating Zone
Normal Operating Zone
Lower Operating Zone
Low Water Zone
Ideal Regulated Level
Maximum
90 Percentile
Mean
Median
10 Percentile
Minimum
Water Level - m
302.50
302.00
301.50
301.00
300.50
300.00
302.5
302.0
301.5
301.0
300.5
300.0
Jan/ 01
Jan/ 08
Jan/ 15
Jan/ 22
Jan/ 29
Feb/ 05
Feb/ 12
Feb/ 19
Feb/ 26
Mar/ 05
Mar/ 12
Mar/ 19
Mar/ 26
Apr/ 02
Apr/ 09
Apr/ 16
Apr/ 23
Apr/ 30
May/ 07
May/ 14
May/ 21
May/ 28
Jun/ 04
Jun/ 11
Jun/ 18
Jun/ 25
Jul/ 02
Jul/ 09
Jul/ 16
Jul/ 23
Jul/ 30
Aug/ 06
Aug/ 13
Aug/ 20
Aug/ 27
Sep/ 03
Sep/ 10
Sep/ 17
Sep/ 24
Oct/ 01
Oct/ 08
Oct/ 15
Oct/ 22
Oct/ 29
Nov/ 05
Nov/ 12
Nov/ 19
Nov/ 26
Dec/ 03
Dec/ 10
Dec/ 17
Dec/ 24
Dec/ 31


Wood Lake Water Levels
ARSP Simulation Proposed Case
Operating Rules and Daily Water Level Statistics
Water Level - m
303.5
303.0
302.5
302.0
301.5
301.0
300.5
300.0
299.5
299.0
Legend
High Water Level
Upper Operating Zone
Normal Operating Zone
Lower Operating Zone
Low Water Zone
Target Operating Level
Maximum
90 Percentile
Mean
Median
10 Percentile
Minimum
Jan/ 01
Jan/ 15
Jan/ 29
Feb/ 12
Feb/ 26
Mar/ 12
Mar/ 26
Apr/ 09
Apr/ 23
May/ 07
May/ 21
Jun/ 04
Jun/ 18
Jul/ 02
Jul/ 16
Jul/ 30
Aug/ 13
Aug/ 27
Sep/ 10
Sep/ 24
Oct/ 08
Oct/ 22
Nov/ 05
Nov/ 19
Dec/ 03
Dec/ 17
Dec/ 31

Wood Lake Water Levels
ARSP Simulation Proposed Case

Peak Water Levels	
HWZ	301.67
No of Days in Exceedance	0
No of Years Exceeded	0
Maximum WL	301.15

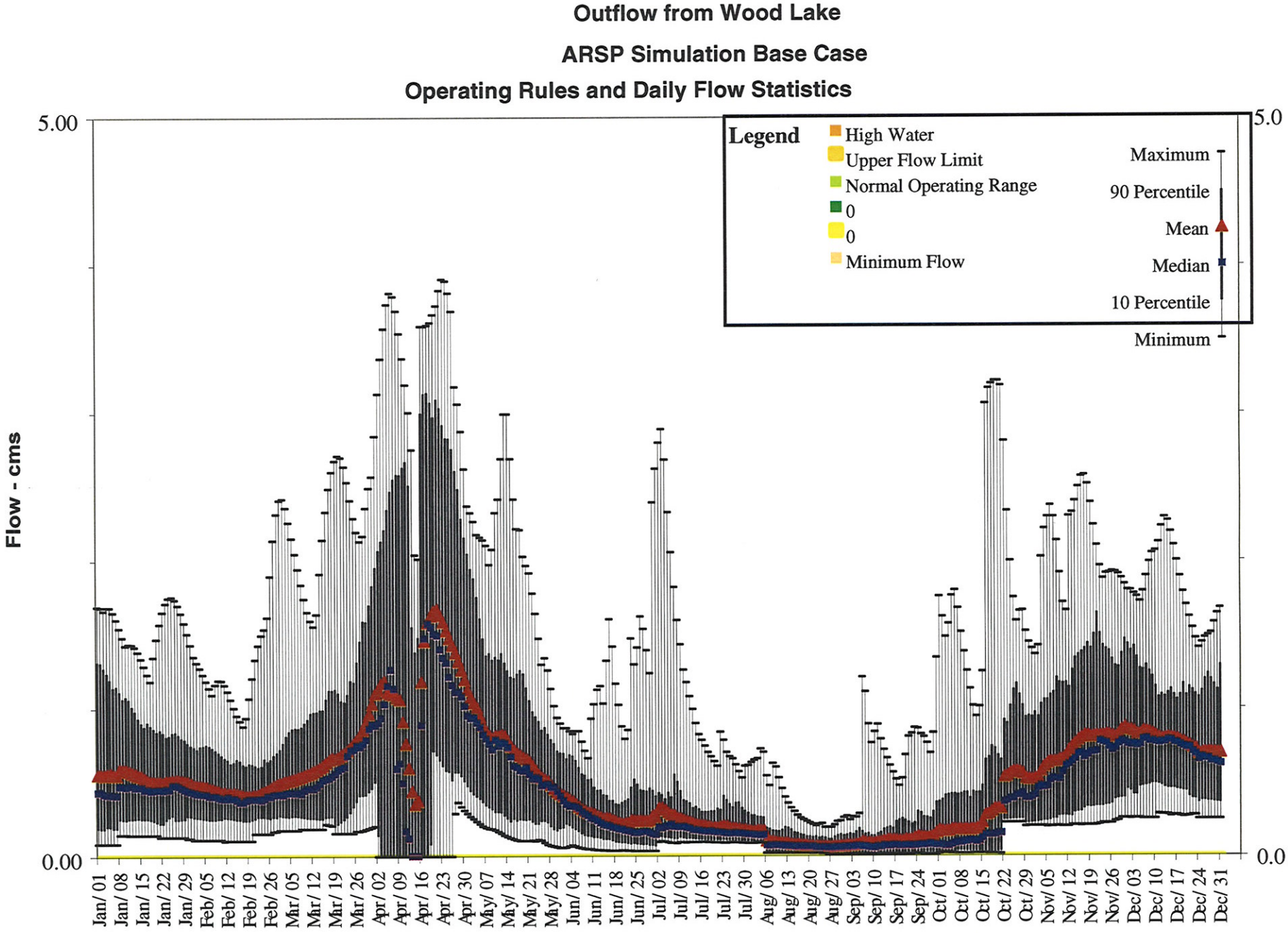
Time of spring peak levels before April 30	
Percentile	0.90
Peak percentile WL	301.15
Date of peak	15-Apr
Tolerance	0
Tolerated WL	301.15
Date tolerated exceeded	15-Apr

Summer recreation levels Jun-15 to Sep-30	
90 and 10 percentile range	
Max 90%	301.08
Min 10%	300.93
Range	0.15

Median range	
Max Median	301.08
Min Median	300.93
Range	0.15

Spring Peak Water Level

Maximum - 50 yr Average	301.15
Date - 50 yr Average	17/Apr
Summer Average Level	301.02


Outflow from Wood Lake
ARSP Simulation Base Case
Operating Rules and Daily Flow Statistics
Flow - cms
5.00
0.00
5.0
0.0
Legend
High Water
Upper Flow Limit
Normal Operating Range
0
0
Minimum Flow
Maximum
90 Percentile
Mean
Median
10 Percentile
Minimum
Jan/ 01
Jan/ 08
Jan/ 15
Jan/ 22
Jan/ 29
Feb/ 05
Feb/ 12
Feb/ 19
Feb/ 26
Mar/ 05
Mar/ 12
Mar/ 19
Mar/ 26
Apr/ 02
Apr/ 09
Apr/ 16
Apr/ 23
Apr/ 30
May/ 07
May/ 14
May/ 21
May/ 28
Jun/ 04
Jun/ 11
Jun/ 18
Jun/ 25
Jul/ 02
Jul/ 09
Jul/ 16
Jul/ 23
Jul/ 30
Aug/ 06
Aug/ 13
Aug/ 20
Aug/ 27
Sep/ 03
Sep/ 10
Sep/ 17
Sep/ 24
Oct/ 01
Oct/ 08
Oct/ 15
Oct/ 22
Oct/ 29
Nov/ 05
Nov/ 12
Nov/ 19
Nov/ 26
Dec/ 03
Dec/ 10
Dec/ 17
Dec/ 24
Dec/ 31

Flow Evaluation

Yellow cells indicate values that can be changed for analysis

Outflow from Wood Lake
ARSP Simulation Base Case
Daily Flows Model Results 1951 to 2000

Walleye Spawning

Min Flow **0** m³/s Achieved 100% of time

No of days above minumum flow

First half of season

Min	14	days
Avg	23.74	days
Years Provided	64%	

Last half of season

Min	24	days
Avg	24	days
Years Provided	100%	

For whole season

Min	38	days
Avg	47.74	days
Years Provided	64%	

From flow duration curve

%	Flow		*No of days*			
99%	-	m³/s	*min flow is achievd*		90%	*percentile peak flow*
95%	0.15	m³/s	38	days	2	m3/s

Summer Minimum 7-day Flow

	Maximum	0.12	m³/s
	Minimum	0.01	m³/s
90%	Percentile	0.08	m³/s
10%	Percentile	0.02	m³/s
	Median	0.04	m³/s

Mean 0.05 m³/s

Maximum Flows

Regulatory Flood Outflow		No of years exceeded	Maximum Daily Flow	
N/A	m³/s	0	3.91	m³/s

Minumum Flows

Min Daily flow		*7-day minimums*			
		2	10	20	return period
		-yr 7Q2	-yr 7Q10	-yr 7Q20	
0.00	m³/s	0.02	0.00	0.00	m³/s

Summer Fluctuations

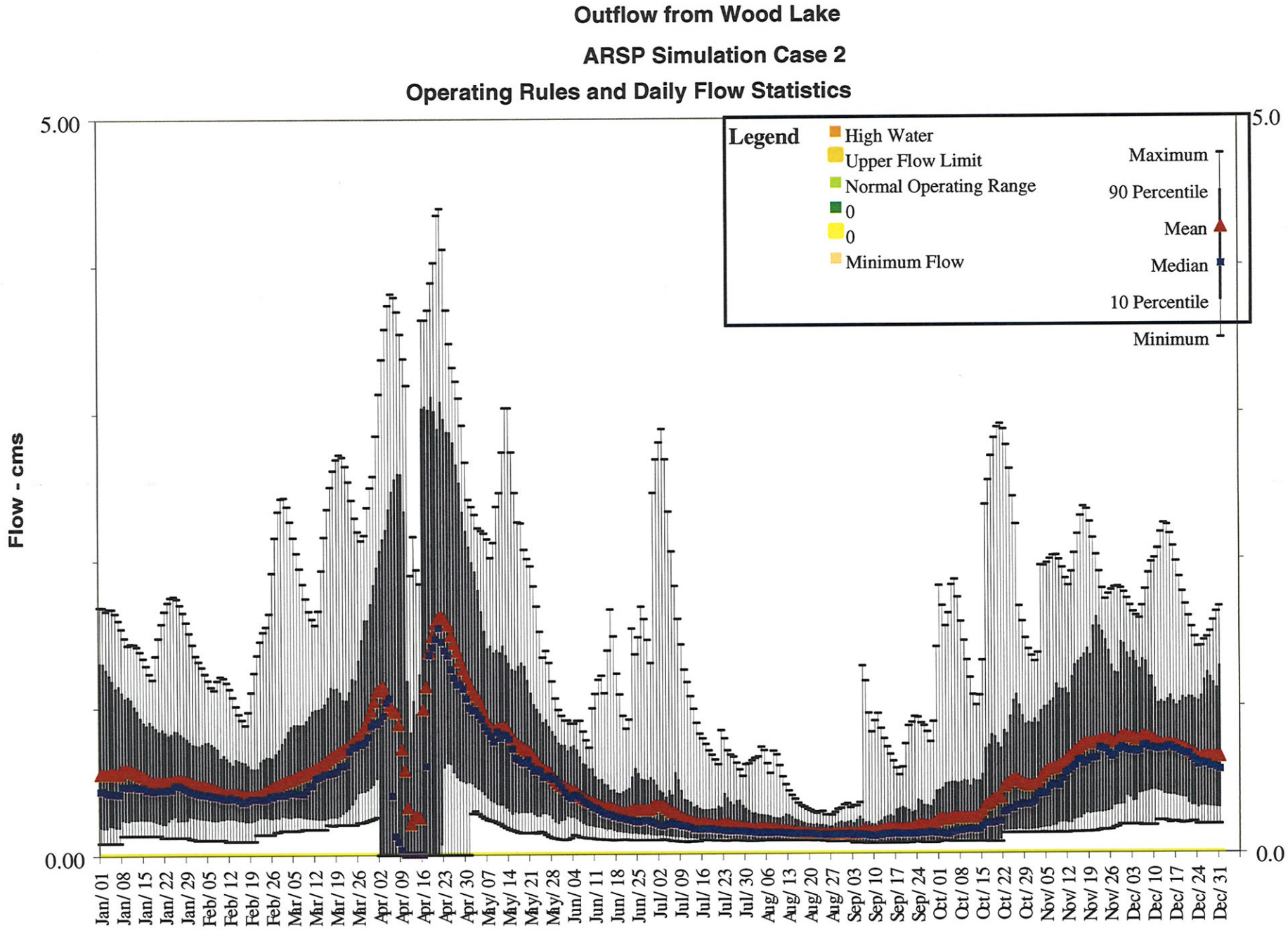
Delta Flow	Average number of daily flow fluctuations per year		
1	0.02		
3	0.00		
5	0.00		
>0.057	5.64	0.5	ratio of summer median

Water Usage

Median Flow		*10% Percentile*	
summer	winter	summer	winter
m³/s	m³/s	m³/s	m³/s
0.16	0.57	0.04	0.00

Power Generation

	Quarter				
	1	2	3	4	Annual
Flow	0.55	0.73	0.14	0.61	0.51 m³/s


Outflow from Wood Lake
ARSP Simulation Case 2
Operating Rules and Daily Flow Statistics
Flow - cms
5.00
0.00
5.0
0.0
Legend
High Water
Upper Flow Limit
Normal Operating Range
0
0
Minimum Flow
Maximum
90 Percentile
Mean
Median
10 Percentile
Minimum
Jan/ 01
Jan/ 08
Jan/ 15
Jan/ 22
Jan/ 29
Feb/ 05
Feb/ 12
Feb/ 19
Feb/ 26
Mar/ 05
Mar/ 12
Mar/ 19
Mar/ 26
Apr/ 02
Apr/ 09
Apr/ 16
Apr/ 23
Apr/ 30
May/ 07
May/ 14
May/ 21
May/ 28
Jun/ 04
Jun/ 11
Jun/ 18
Jun/ 25
Jul/ 02
Jul/ 09
Jul/ 16
Jul/ 23
Jul/ 30
Aug/ 06
Aug/ 13
Aug/ 20
Aug/ 27
Sep/ 03
Sep/ 10
Sep/ 17
Sep/ 24
Oct/ 01
Oct/ 08
Oct/ 15
Oct/ 22
Oct/ 29
Nov/ 05
Nov/ 12
Nov/ 19
Nov/ 26
Dec/ 03
Dec/ 10
Dec/ 17
Dec/ 24
Dec/ 31

Flow Evaluation

Yellow cells indicate values that can be changed for analysis

Outflow from Wood Lake
ARSP Simulation Case
2
Daily Flows Model Results 1951 to 2000

Walleye Spawning

Min Flow **0** m³/s Achieved 100% of time

No of days above minumum flow

First half of season			*Last half of season*			*For whole season*		
Min	9	days	Min	24	days	Min	33	days
Avg	22.52	days	Avg	24	days	Avg	46.52	days
Years Provided	44%		Years Provided	100%		Years Provided	44%	

From flow duration curve

%	Flow		*No of days*				
						percentile peak	
99%	-	m³/s	*min flow is achievd*			90% *flow*	
95%	-	m³/s	33	days		2	m3/s

Summer Minimum 7-day Flow

	Maximum	0.19	m³/s
	Minimum	0.07	m³/s
90%	Percentile	0.14	m³/s
10%	Percentile	0.08	m³/s
	Median	0.11	m³/s
	Mean	0.11	m³/s

Maximum Flows

Regulatory Flood Outflow		No of years exceeded	Maximum Daily Flow	
N/A	m³/s	0	4.39	m³/s

Minumum Flows

Min Daily flow		*7-day minimums*			
		2	10	20	return period
		-yr 7Q2	-yr 7Q10	-yr 7Q20	
0.00	m³/s	0.00	0.00	0.00	m³/s

Summer Fluctuations

Delta Flow	Average number of daily flow fluctuations per year		
1	0.02		
3	0.00		
5	0.00		
>0.074	3.14	0.5	ratio of summer median

Water Usage

Median Flow		*10% Percentile*	
summer	winter	summer	winter
m³/s	m³/s	m³/s	m³/s
0.19	0.53	0.10	0.00

Power Generation

	Quarter					
	1	2	3	4	Annual	
Flow	0.55	0.73	0.18	0.58	0.51	m³/s