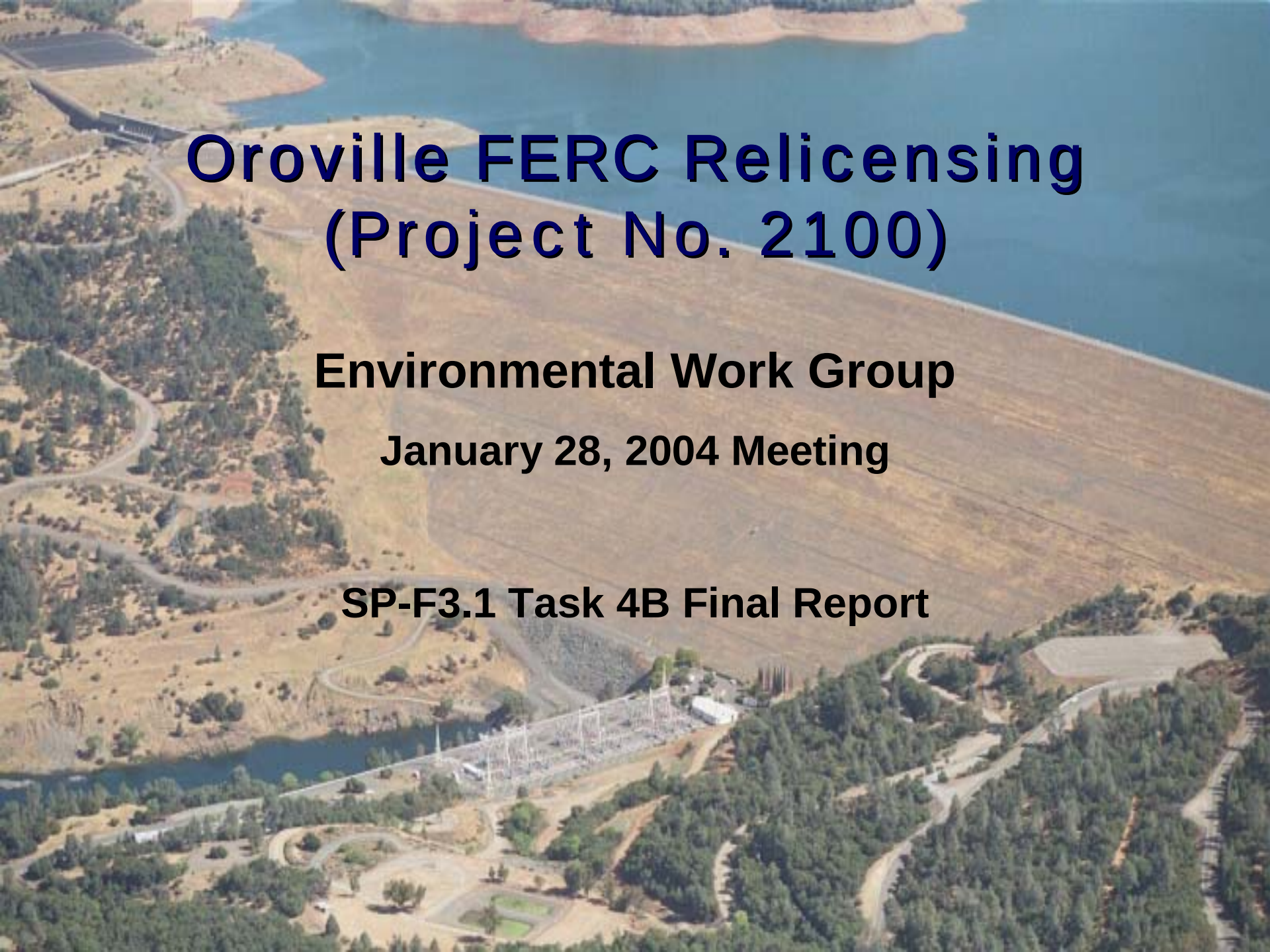


Oroville FERC Relicensing (Project No. 2100)

Environmental Work Group

January 28, 2004 Meeting

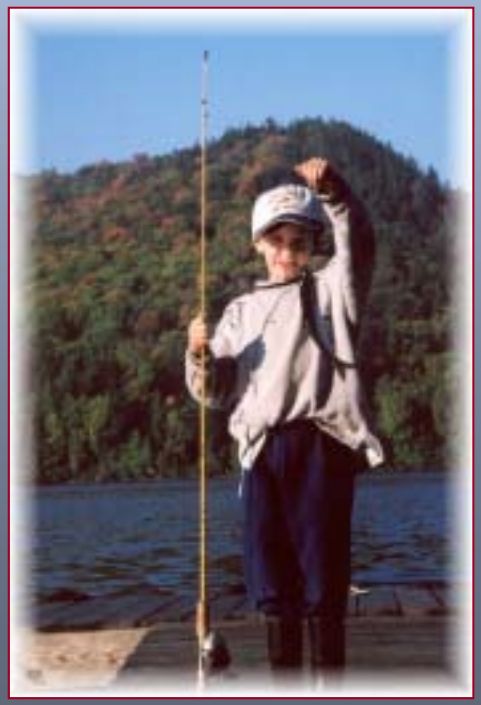
SP-F3.1 Task 4B Final Report

CHARACTERIZATION OF COLD WATER POOL AVAILABILITY IN THE THERMALITO AFTERBAY

SP-F3.1 Task 4B Final Report

Study Objectives

- **Characterize the Cold Water Pool Availability in the Thermalito Afterbay to Support a Year-round Coldwater Fishery**

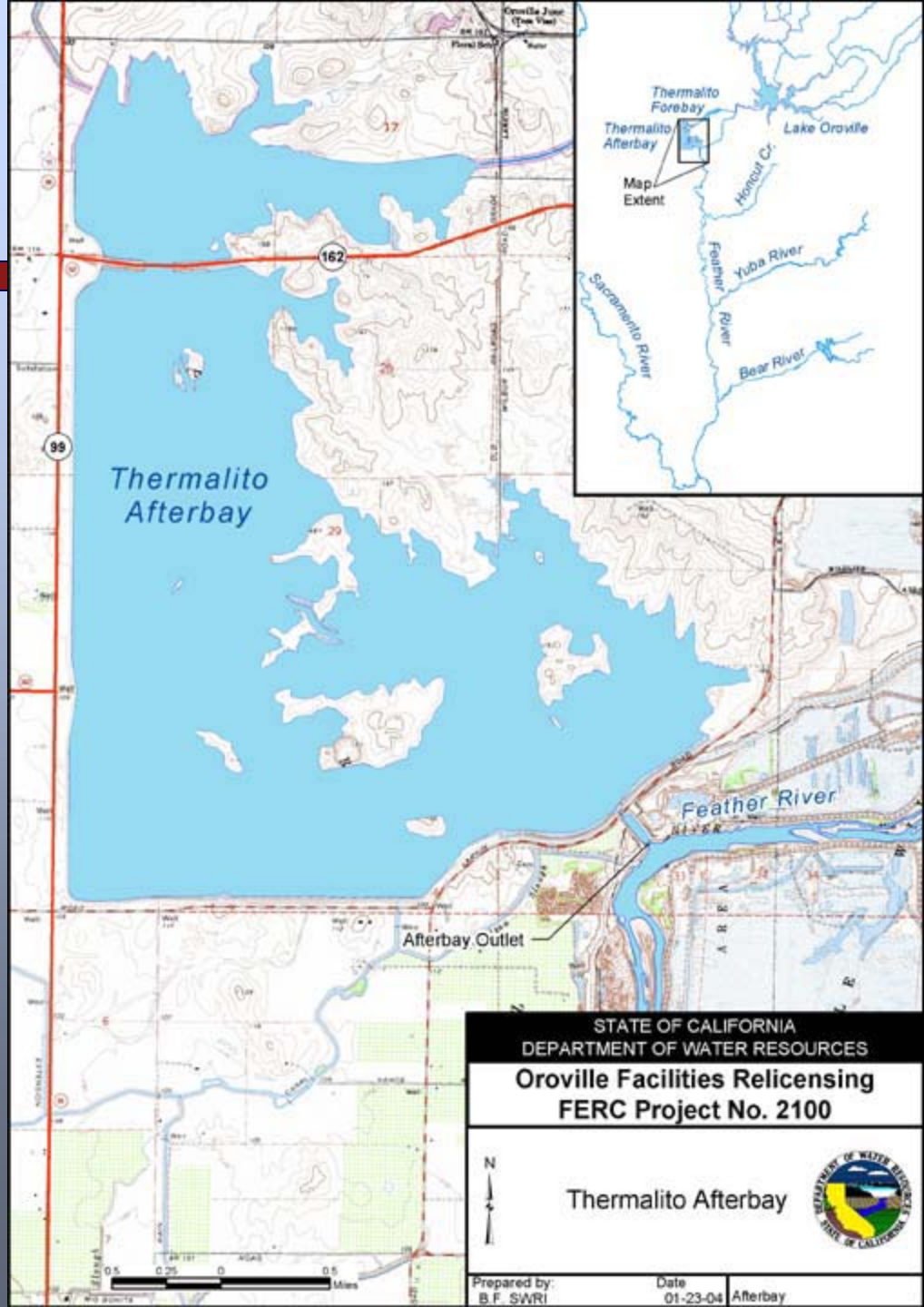


Report Overview

- Evaluate Potential For Cold Water Fishery in Thermalito Afterbay
- Two Types of Fisheries
  - Put-and-Grow
  - Put-and-Take
- Selection of Water Temperature Criteria
- Data Collection
- Analysis
  - June, July, August

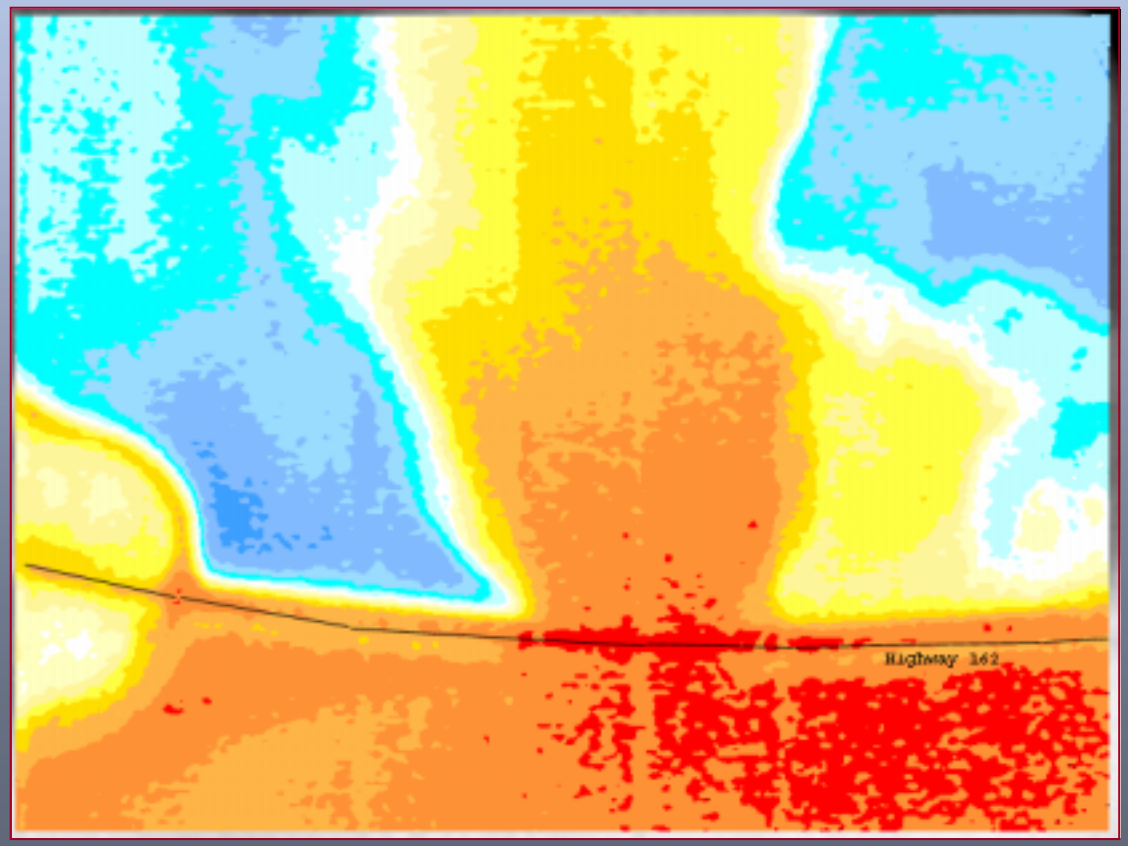
Introduction
Study Area

- **Thermalito Afterbay**



Introduction
Thermalito Afterbay

- **Physical Description**
- **Operations**
- **History**



Methodology
Study Design

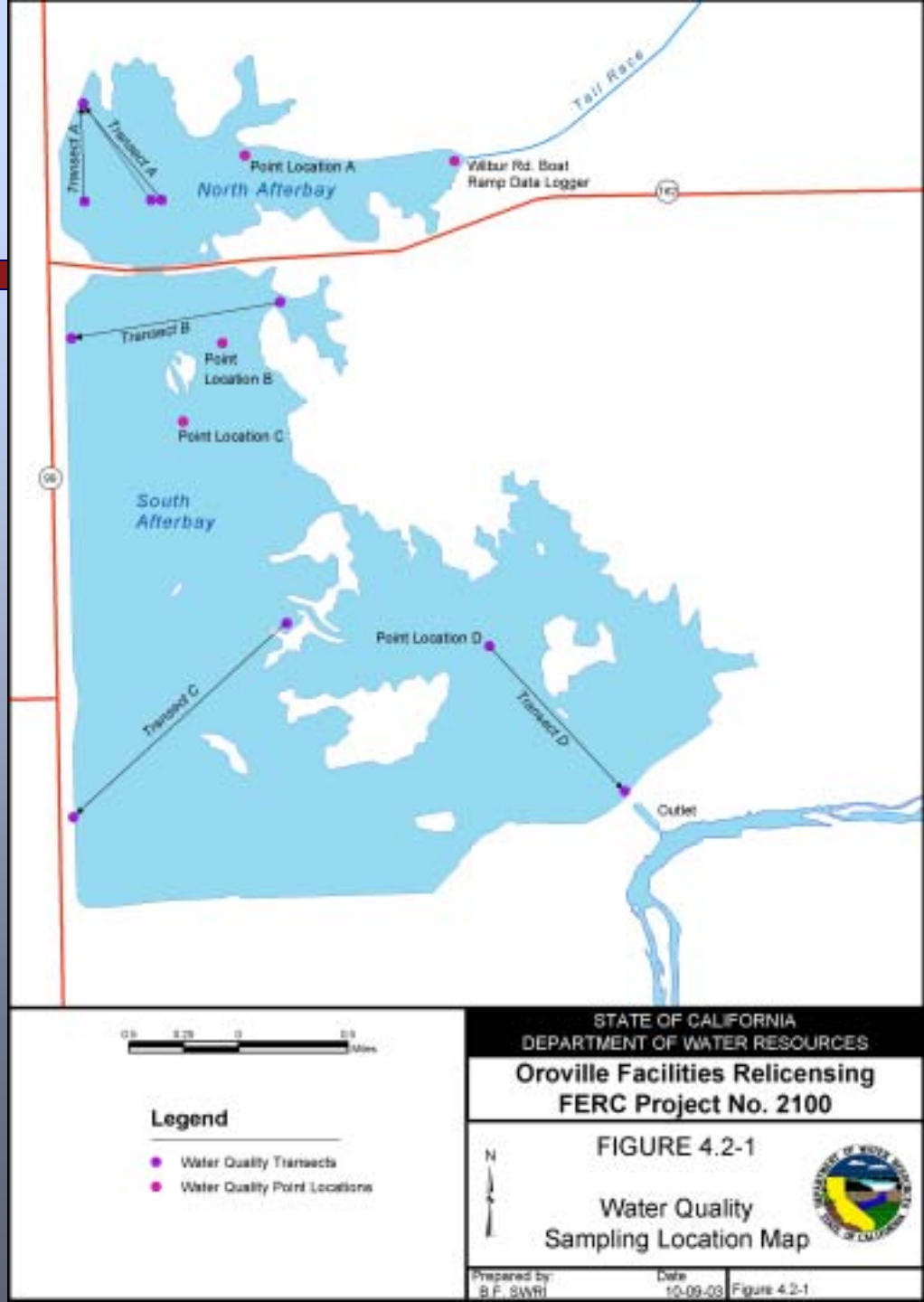
- **Water Temperature Criteria**
  - **EPA Criteria for Coho Salmon**
    - **Max. Weekly Average for Growth ≤ 18°C (64.4°F)**
    - **Max. Weekly Average for Survival ≤ 24°C (75.2°F)**
  - **Water Temperature Ranges**
    - **Put-and-Grow ≤ 18°C**
    - **Put-and-Take 18.1°C ≤ 23.9°C**
    - **Unsuitable ≥ 24°C**

Methodology
Study Design (cont.)

- **Dissolved Oxygen Criteria**
  - **EPA Criteria for Salmonids**
    - **Min. 30-day exposure – 6.5mg/L**
      - **Most protective EPA criteria available for salmonids**
- **Usable Cold Water**
  - **Defined as any portion of the Thermalito Afterbay in which both dissolved oxygen and water temperature criteria were met concurrently.**

Methodology
Data Collection

- **Water Quality Data**
  - **Collected by DWR**
  - **Four Transects**
  - **Four Point Profiles**
  - **One Surface Data Logger**



Methodology
Data Collection (cont.)

- Data Collection
  - YSI Water Quality Probe
  - Multi-Parameter Probe
- Period Of Record
  - 11 Months
  - In-Depth Analysis
    - June, July, and August 2002

Analytical Approach

- **Volumetric analysis of coldwater pool not conducted due to data limitations and dynamic nature of reservoir elevation fluctuations.**
- **Cold water availability analysis was conducted based on proportions of water temperature readings that met the criteria as an index of the proportions of coldwater availability.**

Results

- **Water Temperatures - June 6, 2002**

Transect A

Depth (m)	Water Temperature (°C) per Profile 1	2	3	4	5	6	7	8	9	10
0	13.6	12.7	12.8	13.5	13.6	14.5	14.7	14.7	16.4	14.9
0.5	(13.5)	(12.7)	(12.8)	(13.2)	(13.1)	(14.1)	(13.9)	(14.0)	(15.8)	(14.8)
1	13.3	12.6	12.8	12.8	12.5	13.7	13.0	13.2	15.1	14.7
1.5	13.0	12.6	12.8	12.8	12.7	13.0	13.0	13.2	14.6	14.4
2		12.6	12.7	12.7	12.6	12.8	12.9	13.1	13.9	14.4
2.5		12.6	12.7	12.7	(12.6)	(12.8)		13.1	(13.6)	(14.4)
3			12.7		12.6	12.7			13.3	14.3
3.5			12.7		12.6				13.2	(14.2)
4										14.0
4.5										(13.8)
5										13.6
5.5										(13.4)
6										13.2
6.5										13.1
7										
7.5										
8										

Transect B

Depth (m)	Water Temperature (°C) per Profile 1	2	3	4	5	6	7	8	9	10
0	18.0	17.9	17.0	17.8	15.7	13.7	13.7	14.1	14.1	14.1
0.5	(17.6)	(17.5)	(16.2)	(16.2)	(15.0)	(13.7)	(13.7)	(14.1)	(14.1)	(14.0)
1	17.1	17.1	15.4	14.5	14.3	13.6	13.6	14.0	14.0	13.9
1.5	15.9	15.8	14.5	13.7	13.6	13.5	13.6	13.9	13.7	13.7
2					13.6	13.5	13.6	13.8	13.5	13.5
2.5							13.5	13.7	13.4	13.5
3							13.5	13.7	13.4	13.4
3.5							13.5	13.7	13.3	13.4
4									13.3	13.3
4.5									13.3	13.3
5										
5.5										
6										
6.5										
7										
7.5										
8										

Transect C

Depth (m)	Water Temperature (°C) per Profile 1	2	3	4	5	6	7	8	9	10
0	22.3	17.9	20.1	18.8	18.3	18.0	18.2	17.9	17.5	17.2
0.5	(20.0)	(17.9)	(17.8)	(17.3)	(16.8)	(17.0)	(18.1)	(17.7)	(17.4)	(17.0)
1	17.7	17.9	15.5	15.8	15.3	16.0	18.0	17.5	17.3	16.8
1.5	17.6	17.4	15.2	15.5	15.2	(15.7)	(17.5)	(17.3)	(17.1)	(16.7)
2				15.2	15.1	15.4	17.0	17.0	16.8	16.5
2.5				15.1	(15.1)	(15.4)	(16.4)	(16.8)	(16.6)	(16.4)
3				15.1	15.0	15.4	15.8	16.6	16.4	16.3
3.5								(16.3)	(16.2)	(16.2)
4								16.0	16.0	16.1
4.5								(17.0)	(15.9)	(16.0)
5								18.0	15.8	15.9
5.5									15.6	
6										
6.5										
7										
7.5										
8										

Transect D

Depth (m)	Water Temperature (°C) per Profile 1	2	3	4	5	6	7	8	9	10
0	24.7	23.8	23.8	23.7	22.9	23.5	22.3	21.0	20.2	22.1
0.5	(22.0)	(21.4)	(21.2)	(21.2)	(20.6)	(20.9)	(20.5)	(20.0)	(19.7)	(21.4)
1	19.2	18.9	18.6	18.7	18.2	18.2	18.7	18.9	19.1	20.6
1.5	18.4	(18.5)	18.3	18.1	(18.1)	(18.1)	(18.4)	(18.6)	(18.7)	(19.6)
2	18.2	18.1	18.1	17.9	18.0	17.9	18.0	18.3	18.3	18.6
2.5	18.1	(18.1)			(17.9)	(17.8)	(17.9)	(18.1)	18.1	(18.5)
3		18.0			17.8	17.7	17.8	17.9		18.3
3.5					17.6					
4										
4.5										
5										
5.5										
6										
6.5										
7										
7.5										
8										

Isolated Profiles

Depth (m)	Water Temperature (°C) per Profile	A		B		C		D	
0		14.7		20.0		16.9		24.7	
0.5		(14.4)		(17.8)		(16.3)		(22.0)	
1		14.1		15.5		15.6		19.2	
1.5		14.0				15.5		18.2	
2		14.0				15.4		18.2	
2.5		14.0						18.1	
3									
3.5									
4									
4.5									
5									
5.5									
6									
6.5									
7									
7.5									
8									

	≥ 24 °C Unsuitable
	18.1 °C - 23.9 °C Put-and-Take Fishery
	≤ 18 °C Put-and-Grow Fishery

Water temperatures in parentheses indicate values interpolated as an average value of the surrounding values.

Results (cont.)

- **Water Temperatures - July 2 and July 31, 2002**

Isolated Profiles - July 2, 2002				
	Water Temperature (°C) per Profile			
Depth (m)	A	B	C	D
0	19.7	17.5	18.7	22.0
0.5	(18.6)	(16.8)	(18.3)	(21.0)
1	17.4	16.1	17.8	19.9
1.5	17.0	16.1	17.2	19.1
2			16.9	18.9
2.5				
3				
3.5				
4				
4.5				
5				
5.5				
6				
6.5				
7				
7.5				
8				

Transect D - July 31, 2002										
	Water Temperature (°C) per Profile									
Depth (m)	1	2	3	4	5	6	7	8	9	10
0	23.2	22.5	22.5							
0.5	(22.2)	(21.6)	(21.5)							
1	21.1	20.6	20.4							
1.5	19.5	19.3	18.9							
2		19.0	18.4							
2.5										
3										
3.5										
4										
4.5										
5										
5.5										
6										
6.5										
7										
7.5										
8										

Isolated Profiles - July 31, 2002				
	Water Temperature (°C) per Profile			
Depth (m)	A	B	C	D
0		17.4	16.8	23.2
0.5		(16.8)	(16.6)	(22.2)
1		16.2	16.3	21.2
1.5				19.5
2				
2.5				
3				
3.5				
4				
4.5				
5				
5.5				
6				
6.5				
7				
7.5				
8				

	≥ 24 ºC Unsuitable
	18.1 ºC - 23.9 ºC Put-and-Take Fishery
	≤ 18 ºC Put-and-Grow Fishery

Water temperatures in parentheses indicate values interpolated as an average value of the surrounding values.

Results (cont.)

- **Water Temperatures - August 1 and August 29, 2002**

Transect A - August 1, 2002

Depth (m)	Water Temperature (°C) per Profile									
	1	2	3	4	5	6	7	8	9	10
0	14.2	14.6	13.9	15.1	14.9	14.9	15.7	16.6	17.2	16.8
0.5	(14.0)	(14.1)	(13.8)	(14.8)	(14.8)	(14.9)	(15.3)	(15.9)	(16.2)	(16.7)
1	13.7	13.5	13.6	14.4	14.7	14.8	14.8	15.1	15.2	16.6
1.5	13.4	13.5	13.5	13.8	14.0	(14.3)	(14.4)	(14.6)	(15.0)	(15.9)
2	13.3	13.4	13.4	13.5	13.9	13.8	13.9	14.1	14.7	15.2
2.5		(13.4)	(13.4)	13.5		(13.8)	13.8	14.0	(14.5)	(15.0)
3		13.4	13.4			13.7			14.3	14.8
3.5			(13.4)			(13.7)			(14.2)	(14.7)
4			13.4			13.7			14.1	14.6
4.5										(14.6)
5										14.5
5.5										(14.4)
6										14.2
6.5										(14.2)
7										14.2
7.5										
8										

Transect C - August 1, 2002

Depth (m)	Water Temperature (°C) per Profile									
	1	2	3	4	5	6	7	8	9	10
0	17.0	16.3	16.0	16.1	16.1	15.7	15.3	15.4	15.3	15.8
0.5	(16.4)	(16.3)	(16.0)	(16.1)	(15.8)	(15.5)	(15.1)	(15.2)	(15.2)	(15.5)
1	15.8	16.2	15.9	16.0	15.5	15.3	14.9	14.9	15.0	15.2
1.5		(16.0)	(15.6)	(15.5)	(15.1)	(15.0)	(14.8)	(14.7)	(14.9)	(15.0)
2		15.8	15.3	15.0	14.6	14.6	14.6	14.5	14.7	14.7
2.5		(15.7)	(15.2)	(14.8)	(14.4)	(14.4)	(14.3)	(14.3)	(14.6)	14.4
3		15.5	15.1	14.6	14.2	14.1	14.0	14.0	14.4	
3.5					14.2	(14.1)	(13.9)	(14.0)	(14.4)	
4						14.1	13.8	13.9	14.3	
4.5						14.0		13.8	(14.3)	
5									14.3	
5.5									14.2	
6										
6.5										
7										
7.5										
8										

Isolated Profile - August 1, 2002

Depth (m)	Water Temperature (°C) per Profile							
		A		B		C		D
0		19.8						
0.5		(17.4)						
1		15.0						
1.5		14.8						
2		14.7						
2.5								
3								
3.5								
4								
4.5								
5								
5.5								
6								
6.5								
7								
7.5								
8								

Transect D

Depth (m)	Water Temperature (°C) per Profile									
	1	2	3	4	5	6	7	8	9	10
0	21.1	20.9	21.2	20.9	20.7	20.9	19.9	19.4	19.3	19.3
0.5	(21.0)	(20.9)	(21.0)	(20.2)	(19.9)	(20.7)	(19.7)	(19.0)	(19.3)	(19.3)
1	20.9	20.8	20.7	19.4	19.0	20.4	19.4	18.6	19.3	19.2
1.5	20.7	(20.6)	(20.2)	18.9	(18.7)	(19.3)	(18.8)	(18.5)	(19.0)	(19.1)
2	20.6	20.4	19.6	18.7	18.3	18.2	18.1	18.4	18.7	19.0
2.5		(20.0)	(19.4)		(18.3)	18.2	(18.1)	(18.4)	(18.6)	(18.6)
3		19.5	19.1		18.2		18.1	18.4	18.4	18.1
3.5									18.2	18.0
4										
4.5										
5										
5.5										
6										
6.5										
7										
7.5										
8										

Isolated Profiles - August 29, 2002

Depth (m)	Water Temperature (°C) per Profile							
		A		B		C		D
0		20.6		17.8		18.4		21.1
0.5		(20.4)		(17.7)		(18.3)		(21.0)
1		20.2		17.5		18.1		20.9
1.5		19.3		17.2		17.9		20.7
2				17.0		17.7		20.6
2.5						17.5		
3								
3.5								
4								
4.5								
5								
5.5								
6								
6.5								
7								
7.5								
8								

	≥ 24 ºC Unsuitable
	18.1 ºC - 23.9 ºC Put-and-Take Fishery
	≤ 18 ºC Put-and-Grow Fishery

Water temperatures in parentheses indicate values interpolated as an average value of the surrounding values.

Conclusions

- **Dissolved oxygen concentration was always above 6.5mg/L.**
- **Thermal stratification was not observed in the water temperature profile data available and may not occur in this shallow reservoir.**
- **Water temperatures appropriate to support a put-and-grow and a put-and take salmonid fishery exist in the Afterbay in all of the water temperature profile data available.**