City of Winnipeg
Water and Waste Department
Nitrification Study
Conceptual Design Report

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BIOLOGICAL NUTRIENT REMOVAL

NEWPCC

CAPITAL COST ESTIMATE **Date: June 22, 2000**

Plant **NEWPCC**
Level of Ammonia Control: **Best Practicable (2 mg/L Summer)**
Upgrade Option: **Single Stage Nitrification**

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	General Conditions	5,000,000	8,400,000	12,000,000	8,433,000	1,167,000	1,361,889,000,000		
2	Bioreactors	15,000,000	19,400,000	26,200,000	19,800,000	1,867,000	3,485,689,000,000		
3	Clarifiers and Building	31,000,000	40,000,000	49,000,000	40,000,000	3,000,000	9,000,000,000,000		
4	Exhaust Stack	450,000	560,000	670,000	560,000	37,000	1,369,000,000		
5	Dewatering Building Modifications	550,000	790,000	1,100,000	802,000	92,000	8,464,000,000		
6	Effluent Outfall	3,000,000	3,500,000	5,000,000	3,667,000	333,000	110,889,000,000		
Sub-Total		55,000,000	72,650,000	93,970,000	73,262,000				
7	Contingencies (20%)	11,000,000	14,530,000	18,794,000	14,652,000	1,299,000	1,687,401,000,000		
Sub-Total		66,000,000	87,180,000	112,764,000	87,914,000				
8	Engineering (15%)	9,900,000	13,077,000	16,915,000	13,187,000	1,169,000	1,366,561,000,000		
9	City & Administration Costs (3%)	1,980,000	2,615,000	3,383,000	2,637,000	234,000	54,756,000,000		
TOTAL COST		77,880,000	102,872,000	133,062,000	103,738,000		4,132,000	**107,900,000**	**112,000,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) = $\sqrt{\sum s2}$
7. GST not included

CAPITAL COST ESTIMATE **Date: June 22, 2000**

Plant **NEWPCC**
Level of Ammonia Control: **High (8 mg/L Summer)**
Upgrade Option: **Single Stage Nitrification**

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	General Conditions	4,100,000	6,900,000	10,400,000	7,017,000	1,050,000	1,102,500,000,000		
2	Bioreactors	11,660,000	15,300,000	20,400,000	15,543,000	1,457,000	2,122,849,000,000		
3	Clarifiers and Building	21,900,000	28,200,000	35,200,000	28,317,000	2,217,000	4,915,089,000,000		
4	Exhaust Stack	340,000	420,000	500,000	420,000	27,000	729,000,000		
5	Dewatering Building Modifications	550,000	790,000	1,100,000	802,000	92,000	8,464,000,000		
6	Effluent Outfall	3,000,000	3,500,000	5,000,000	3,667,000	333,000	110,889,000,000		
7	Centrate Treatment	3,300,000	4,970,000	7,340,000	5,087,000	673,000	452,929,000,000		
Sub-Total		44,850,000	60,080,000	79,940,000	60,853,000				
8	Contingencies (20%)	8,970,000	12,016,000	15,988,000	12,170,000	1,170,000	1,368,900,000,000		
Sub-Total		53,820,000	72,096,000	95,928,000	73,022,000				
9	Engineering (15%)	8,073,000	10,814,000	14,389,000	10,953,000	1,053,000	1,108,809,000,000		
10	City & Administration Costs (3%)	1,615,000	2,163,000	2,878,000	2,191,000	211,000	44,521,000,000		
TOTAL COST		63,508,000	85,073,000	113,195,000	86,166,000		3,352,000	**89,500,000**	**92,900,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) = $\sqrt{\sum s2}$
7. GST not included

CAPITAL COST ESTIMATE **Date: June 22, 2000**

Plant **NEWPCC**
Level of Ammonia Control: **Modest (14 mg/L Summer)**
Upgrade Option: **Single Stage Nitrification**

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	General Conditions	3,700,000	6,300,000	9,400,000	6,383,000	950,000	902,500,000,000		
2	Bioreactors	7,800,000	10,200,000	13,600,000	10,367,000	967,000	935,089,000,000		
3	Clarifiers and Building	21,900,000	28,200,000	35,200,000	28,317,000	2,217,000	4,915,089,000,000		
4	Exhaust Stack	340,000	420,000	500,000	420,000	27,000	729,000,000		
5	Dewatering Building Modifications	550,000	790,000	1,100,000	802,000	92,000	8,464,000,000		
6	Effluent Outfall	3,000,000	3,500,000	5,000,000	3,667,000	333,000	110,889,000,000		
7	Centrate Treatment	3,300,000	4,970,000	7,340,000	5,087,000	673,000	452,929,000,000		
Sub-Total		40,590,000	54,380,000	72,140,000	55,043,000				
8	Contingencies (20%)	8,118,000	10,876,000	14,428,000	11,008,000	1,052,000	1,106,704,000,000		
Sub-Total		48,708,000	65,256,000	86,568,000	66,050,000				
9	Engineering (15%)	7,306,000	9,788,000	12,985,000	9,907,000	947,000	896,809,000,000		
10	City & Administration Costs (3%)	1,461,000	1,958,000	2,597,000	1,982,000	189,000	35,721,000,000		
TOTAL COST		57,475,000	77,002,000	102,150,000	77,939,000		3,060,000	**81,000,000**	**84,100,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) = $\sqrt{\sum s2}$
7. GST not included

O&M COST ESTIMATE **Date: January 21, 2000**

Plant **NEWPCC**
Level of Ammonia Control: **Best Practicable (2 mg/L Summer)**
Upgrade Option: **Single Stage Nitrification**

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	Labour	525,000	790,000	790,000	746,000	44,000	1,936,000,000		
2	Power	600,000	600,000	600,000	600,000	0	0		
3	Utilities	510,000	510,000	510,000	510,000	0	0		
4	Consumables	55,000	73,000	90,000	73,000	6,000	36,000,000		
5	E&M Materials	80,000	100,000	150,000	105,000	12,000	144,000,000		
6	Miscellaneous	3,000	17,000	48,000	20,000	8,000	64,000,000		
					0	0	0		
TOTAL COST		1,773,000	2,090,000	2,188,000	2,054,000		47,000	**2,100,000**	**2,150,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) =$\sqrt{\sum s2}$

O&M COST ESTIMATE **Date: June 22, 2000**

Plant **NEWPCC**
Level of Ammonia Control: **High (8 mg/L Summer)**
Upgrade Option: **Single Stage Nitrification**

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	Labour	350,000	525,000	525,000	496,000	29,000	841,000,000		
2	Power	520,000	520,000	520,000	520,000	0	0		
3	Utilities	370,000	370,000	370,000	370,000	0	0		
4	Consumables	231,000	293,000	350,000	292,000	20,000	400,000,000		
5	E&M Materials	61,000	76,000	91,000	76,000	5,000	25,000,000		
6	Miscellaneous	6,000	37,000	88,000	40,000	14,000	196,000,000		
					0	0	0		
TOTAL COST		1,538,000	1,821,000	1,944,000	1,794,000		38,000	**1,830,000**	**1,870,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) =$\sqrt{\sum s2}$
7. GST not included

O&M COST ESTIMATE **Date: June 22, 2000**

Plant **NEWPCC**
Level of Ammonia Control: **Modest (14 mg/L Summer)**
Upgrade Option: **Single Stage Nitrification**

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	Labour	350,000	400,000	400,000	392,000	8,000	64,000,000		
2	Power	438,000	438,000	438,000	438,000	0	0		
3	Utilities	370,000	370,000	370,000	370,000	0	0		
4	Consumables	231,000	293,000	350,000	292,000	20,000	400,000,000		
5	E&M Materials	49,000	61,000	73,000	61,000	4,000	16,000,000		
6	Miscellaneous	2,000	13,000	33,000	15,000	5,000	25,000,000		
					0	0	0		
TOTAL COST		1,440,000	1,575,000	1,664,000	1,567,000		22,000	**1,590,000**	**1,610,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) = $\sqrt{\sum s2}$
7. GST not included

TOTAL COST ESTIMATE (95% CONFIDENCE) **Date: June 22, 2000**

Plant **NEWPCC**
Level of Ammonia Control: **Best Practicable (2 mg/L Summer)**
Upgrade Option: **Single Stage Nitrification**

Year	Calander Year	Initial Capital Cost $	O & M Cost $ 4%	O & M Cost $ 7%	O & M Cost $ 10%	Future Impacts & Replacement Cost $ 4%	Future Impacts & Replacement Cost $ 7%	Future Impacts & Replacement Cost $ 10%	Notes
0	2000	112,000,000	2,150,000	2,150,000	2,150,000				
1	2001		2,067,000	2,067,000	2,067,000				
5	2006		9,571,000	8,475,000	7,836,000				
10	2011		17,438,000	14,518,000	12,701,000				
15	2016		23,905,000	18,826,000	15,722,000				
20	2021		29,219,000	21,898,000	17,598,000	5,200,000	5,200,000	5,200,000	Blowers, Pumps, and Centrifuges (3) are replace
30	2031		37,178,000	25,649,000	19,485,000				
40	2041		42,555,000	27,557,000	20,213,000				
Initial Capital Cost		112,000,000							
Net PV Cost (Total of 40 Years)			42,555,000	27,557,000	20,213,000				
Future Impacts & Replacement Costs						2,373,000	1,344,000	773,000	

TOTAL COST @4% **156,900,000**
TOTAL COST @7% **140,900,000**
TOTAL COST @10% **133,000,000**

Note: All costs shown are of 95% confidence

TOTAL COST ESTIMATE (95% CONFIDENCE) **Date: June 22, 2000**

Plant **NEWPCC**
Level of Ammonia Control: **High (8 mg/L Summer)**
Upgrade Option: **Single Stage Nitrification**

Year	Calander Year	Initial Capital Cost $	O & M Cost $ 4%	O & M Cost $ 7%	O & M Cost $ 10%	Future Impacts & Replacement Cost $ 4%	Future Impacts & Replacement Cost $ 7%	Future Impacts & Replacement Cost $ 10%	Notes
0	2000	92,900,000	1,870,000	1,870,000	1,870,000				
1	2001		1,798,000	1,798,000	1,798,000				
5	2006		8,325,000	7,372,000	6,816,000				
10	2011		15,167,000	12,628,000	11,048,000				
15	2016		20,791,000	16,376,000	13,676,000				
20	2021		25,414,000	19,048,000	15,307,000	4,100,000	4,100,000	4,100,000	Blowers, Pumps, and Centrifuges (3) are replace
30	2031		32,336,000	22,311,000	16,950,000				
40	2041		37,013,000	23,970,000	17,583,000				
Initial Capital Cost		92,900,000							
Net PV Cost (Total of 40 Years)			37,013,000	23,970,000	17,583,000				
Future Impacts & Replacement Costs						1,871,000	1,060,000	609,000	

TOTAL COST @4% **131,800,000**
TOTAL COST @7% **117,900,000**
TOTAL COST @10% **111,100,000**

Note: All costs shown are of 95% confidence

TOTAL COST ESTIMATE (95% CONFIDENCE) **Date: June 22, 2000**

Plant **NEWPCC**
Level of Ammonia Control: **Modest (14 mg/L Summer)**
Upgrade Option: **Single Stage Nitrification**

Year	Calander Year	Initial Capital Cost $	O & M Cost $ 4%	O & M Cost $ 7%	O & M Cost $ 10%	Future Impacts & Replacement Cost $ 4%	Future Impacts & Replacement Cost $ 7%	Future Impacts & Replacement Cost $ 10%	Notes
0	2000	84,100,000	1,610,000	1,610,000	1,610,000				
1	2001		1,548,000	1,548,000	1,548,000				
5	2006		7,167,000	6,347,000	5,868,000				
10	2011		13,059,000	10,873,000	9,512,000				
15	2016		17,901,000	14,099,000	11,774,000				
20	2021		21,880,000	16,400,000	13,179,000	3,000,000	3,000,000	3,000,000	Blowers, Pumps, and Centrifuges (3) are replace
30	2031		27,840,000	19,209,000	14,593,000				
40	2041		31,866,000	20,637,000	15,138,000				
Initial Capital Cost		84,100,000							
Net PV Cost (Total of 40 Years)			31,866,000	20,637,000	15,138,000				
Future Impacts & Replacement Costs						1,369,000	775,000	446,000	

TOTAL COST @4% **117,300,000**
TOTAL COST @7% **105,200,000**
TOTAL COST @10% **99,200,000**

Note: All costs shown are of 95% confidence

SEWPCC

CAPITAL COST ESTIMATE **Date: June 22, 2000**

Plant **SEWPCC**
Level of Ammonia Control: **Best Practicable (2 mg/L Summer)**
Upgrade Option: **Single Stage Nitrification**

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	General Conditions	1,520,000	2,500,000	3,610,000	2,522,000	348,000	121,104,000,000		
2	Bioreactors	6,240,000	7,830,000	9,800,000	7,893,000	593,000	351,649,000,000		
3	DAF Thickening Buiding	1,500,000	1,800,000	2,230,000	1,822,000	122,000	14,884,000,000		
4	Clarifier	5,600,000	7,400,000	9,300,000	7,417,000	617,000	380,689,000,000		
5	Blower Building	1,120,000	1,320,000	1,610,000	1,335,000	82,000	6,724,000,000		
6	Sludge Storage/Truck Bay	310,000	400,000	530,000	407,000	37,000	1,369,000,000		
7	Electrical Room	260,000	330,000	500,000	347,000	40,000	1,600,000,000		
8	Foul Air Duct Relocation	100,000	120,000	130,000	118,000	5,000	25,000,000		
Sub-Total		16,650,000	21,700,000	27,710,000	21,860,000				
9	Contingencies (20%)	3,330,000	4,340,000	5,542,000	4,372,000	369,000	136,161,000,000		
Sub-Total		19,980,000	26,040,000	33,252,000	26,232,000				
10	Engineering (15%)	2,997,000	3,906,000	4,988,000	3,935,000	332,000	110,224,000,000		
11	City & Administration Costs (3%)	599,000	781,000	998,000	787,000	67,000	4,489,000,000		
TOTAL COST		23,576,000	30,727,000	39,238,000	30,954,000		1,063,000	**32,000,000**	**33,100,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) =$\sqrt{\sum s2}$
7. GST not included

CAPITAL COST ESTIMATE **Date: June 22, 2000**

Plant **SEWPCC**
Level of Ammonia Control: **High (8 mg/L Summer)**
Upgrade Option: **Single Stage Nitrification**

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	General Conditions	960,000	1,530,000	2,220,000	1,550,000	210,000	44,100,000,000		
2	Bioreactors	6,340,000	7,830,000	9,800,000	7,910,000	577,000	332,929,000,000		
3	DAF Thickening Buiding	1,500,000	1,800,000	2,230,000	1,822,000	122,000	14,884,000,000		
4	Clarifier*	0	0	0	0	0	0		
5	Blower Building	1,120,000	1,320,000	1,610,000	1,335,000	82,000	6,724,000,000		
6	Sludge Storage/Truck Bay	310,000	400,000	530,000	407,000	37,000	1,369,000,000		
7	Electrical Room	260,000	330,000	500,000	347,000	40,000	1,600,000,000		
8	Foul Air Duct Relocation	100,000	120,000	130,000	118,000	5,000	25,000,000		
Sub-Total		10,590,000	13,330,000	17,020,000	13,488,000				
9	Contingencies (20%)	2,118,000	2,666,000	3,404,000	2,698,000	214,000	45,796,000,000		
Sub-Total		12,708,000	15,996,000	20,424,000	16,186,000				
10	Engineering (15%)	1,906,000	2,399,000	3,064,000	2,428,000	193,000	37,249,000,000		
11	City & Administration Costs (3%)	381,000	480,000	613,000	486,000	39,000	1,521,000,000		
TOTAL COST		14,995,000	18,875,000	24,101,000	19,099,000		697,000	**19,800,000**	**20,500,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) =$\sqrt{\sum s2}$
7. GST not included

* The cost of the additional clarifier is not included as it is required for the baseline condition.

CAPITAL COST ESTIMATE **Date: June 22, 2000**

Plant **SEWPCC**
Level of Ammonia Control: **Modest (14 mg/L Summer)**
Upgrade Option: **Single Stage Nitrification**

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	General Conditions	710,000	1,100,000	1,500,000	1,102,000	132,000	17,424,000,000		
2	Bioreactors	4,200,000	4,800,000	5,100,000	4,750,000	150,000	22,500,000,000		
3	DAF Thickening Buiding	1,500,000	1,800,000	2,230,000	1,822,000	122,000	14,884,000,000		
4	Clarifier*	0	0	0	0	0	0		
5	Blower Building	750,000	990,000	1,300,000	1,002,000	92,000	8,464,000,000		
6	Sludge Storage/Truck Bay	310,000	400,000	530,000	407,000	37,000	1,369,000,000		
7	Electrical Room	260,000	330,000	500,000	347,000	40,000	1,600,000,000		
8	Foul Air Duct Relocation	100,000	120,000	130,000	118,000	5,000	25,000,000		
Sub-Total		7,830,000	9,540,000	11,290,000	9,547,000				
9	Contingencies (20%)	1,566,000	1,908,000	2,258,000	1,909,000	115,000	13,225,000,000		
Sub-Total		9,396,000	11,448,000	13,548,000	11,456,000				
10	Engineering (15%)	1,409,000	1,717,000	2,032,000	1,718,000	104,000	10,816,000,000		
11	City & Administration Costs (3%)	282,000	343,000	406,000	343,000	21,000	441,000,000		
TOTAL COST		11,087,000	13,508,000	15,986,000	13,518,000		301,000	**13,800,000**	**14,100,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) = $\sqrt{\sum s2}$
7. GST included

* The cost of the additional clarifier is not included as it is required for the baseline condition.

O&M COST ESTIMATE **Date: January 21, 2000**

Plant **SEWPCC**
Level of Ammonia Control: **Best Practicable (2 mg/L Summer)**
Upgrade Option: **Single Stage Nitrification**

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	Labour	113,000	135,000	180,000	139,000	11,000	121,000,000		
2	Power	310,000	310,000	310,000	310,000	0	0		
3	Utilities	75,000	75,000	75,000	75,000	0	0		
4	Consumables	20,000	25,000	34,000	26,000	2,000	4,000,000		
5	E&M Materials	26,000	33,000	38,000	33,000	2,000	4,000,000		
6	Miscellaneous	1,000	6,000	14,000	7,000	2,000	4,000,000		
TOTAL COST		545,000	584,000	651,000	589,000		12,000	**601,000**	**613,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) =$\sqrt{\sum s2}$

O&M COST ESTIMATE **Date: June 22, 2000**

Plant **SEWPCC**
Level of Ammonia Control: **High (8 mg/L Summer)**
Upgrade Option: **Single Stage Nitrification**

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	Labour	90,000	111,000	132,000	111,000	7,000	49,000,000		
2	Power	290,000	290,000	290,000	290,000	0	0		
3	Utilities	15,000	15,000	15,000	15,000	0	0		
4	Consumables	20,000	25,000	34,000	26,000	2,000	4,000,000		
5	E&M Materials	22,000	28,000	34,000	28,000	2,000	4,000,000		
6	Miscellaneous	1,000	5,000	14,000	6,000	2,000	4,000,000		
TOTAL COST		438,000	474,000	519,000	476,000		8,000	**484,000**	**492,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) = $\sqrt{\sum s2}$
7. GST not included

O&M COST ESTIMATE **Date: June 22, 2000**

Plant **SEWPCC**
Level of Ammonia Control: **Modest (14 mg/L Summer)**
Upgrade Option: **Single Stage Nitrification**

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	Labour	90,000	99,000	111,000	100,000	4,000	16,000,000		
2	Power	263,000	263,000	263,000	263,000	0	0		
3	Utilities	15,000	15,000	15,000	15,000	0	0		
4	Consumables	20,000	25,000	34,000	26,000	2,000	4,000,000		
5	E&M Materials	17,000	21,000	25,000	21,000	1,000	1,000,000		
6	Miscellaneous	1,000	4,600	12,000	5,000	2,000	4,000,000		
TOTAL COST		406,000	427,600	460,000	429,000		5,000	**434,000**	**439,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) = $\sqrt{\sum s2}$
7. GST not included

TOTAL COST ESTIMATE (95% CONFIDENCE) **Date: June 22, 2000**

Plant **SEWPCC**
Level of Ammonia Control: **Best Practicable (2% mg/L Summer)**
Upgrade Option: **Single Stage Nitrification**

Year	Calander Year	Initial Capital Cost $	O & M Cost $ 4%	O & M Cost $ 7%	O & M Cost $ 10%	Future Impacts & Replacement Cost $ 4%	Future Impacts & Replacement Cost $ 7%	Future Impacts & Replacement Cost $ 10%	Notes
0	2000	33,100,000	613,000	613,000	613,000				
1	2001		589,000	589,000	589,000				
5	2006		2,729,000	2,415,000	2,233,000				
10	2011		4,972,000	4,137,000	3,619,000				
15	2016		6,816,000	5,365,000	4,480,000				
20	2021		8,331,000	6,240,000	5,015,000	1,600,000	1,600,000	1,600,000	Blowers, RAS Pump, and DAF are to be replaced after year 20
30	2031		10,600,000	7,309,000	5,552,000				
40	2041		12,133,000	7,852,000	5,760,000				
Initial Capital Cost		33,100,000							
Net PV Cost (Total of 40 Years)			12,133,000	7,852,000	5,760,000				
Future Impacts & Replacement Costs						730,000	413,000	238,000	

TOTAL COST @4% **46,000,000**
TOTAL COST @7% **41,400,000**
TOTAL COST @10% **39,100,000**

Note: All costs shown are of 95% confidence

TOTAL COST ESTIMATE (95% CONFIDENCE) **Date: June 22, 2000**

Plant **SEWPCC**
Level of Ammonia Control: **High (8 mg/L Summer)**
Upgrade Option: **Single Stage Nitrification**

Year	Calander Year	Initial Capital Cost $	O & M Cost $ 4%	O & M Cost $ 7%	O & M Cost $ 10%	Future Impacts & Replacement Cost $ 4%	Future Impacts & Replacement Cost $ 7%	Future Impacts & Replacement Cost $ 10%	Notes
0	2000	20,500,000	492,000	492,000	492,000				
1	2001		473,000	473,000	473,000				
5	2006		2,190,000	1,939,000	1,793,000				
10	2011		3,991,000	3,322,000	2,906,000				
15	2016		5,470,000	4,308,000	3,598,000				
20	2021		6,686,000	5,011,000	4,027,000	1,400,000	1,400,000	1,400,000	Blowers, RAS Pump, and DAF are to be replac
30	2031		8,508,000	5,869,000	4,459,000				after year 20
40	2041		9,738,000	6,306,000	4,626,000				
Initial Capital Cost		20,500,000							
Net PV Cost (Total of 40 Years)			9,738,000	6,306,000	4,626,000				
Future Impacts & Replacement Costs						639,000	362,000	208,000	

TOTAL COST @4% **30,900,000**
TOTAL COST @7% **27,200,000**
TOTAL COST @10% **25,300,000**

Note: All costs shown are of 95% confidence

TOTAL COST ESTIMATE (95% CONFIDENCE) **Date: June 22, 2000**

Plant **SEWPCC**
Level of Ammonia Control: **Modest (14 mg/L Summer)**
Upgrade Option: **Single Stage Nitrification**

Year	Calander Year	Initial Capital Cost $	O & M Cost $ 4%	O & M Cost $ 7%	O & M Cost $ 10%	Future Impacts & Replacement Cost $ 4%	Future Impacts & Replacement Cost $ 7%	Future Impacts & Replacement Cost $ 10%	Notes
0	2000	14,100,000	439,000	439,000	439,000				
1	2001		422,000	422,000	422,000				
5	2006		1,954,000	1,730,000	1,600,000				
10	2011		3,561,000	2,964,000	2,593,000				
15	2016		4,881,000	3,844,000	3,210,000				
20	2021		5,966,000	4,471,000	3,593,000	1,200,000	1,200,000	1,200,000	Blowers, RAS Pump, and DAF are to be replaced after year 20
30	2031		7,591,000	5,237,000	3,978,000				
40	2041		8,689,000	5,626,000	4,127,000				
Initial Capital Cost		14,100,000							
Net PV Cost (Total of 40 Years)			8,689,000	5,626,000	4,127,000				
Future Impacts & Replacement Costs						548,000	310,000	178,000	

TOTAL COST @4% **23,300,000**
TOTAL COST @7% **20,000,000**
TOTAL COST @10% **18,400,000**

Note: All costs shown are of 95% confidence

WEWPCC

CAPITAL COST ESTIMATE **Date: January 21, 2000**

Plant **WEWPCC**
Level of Ammonia Control: **Best Practicable (2 mg/L Summer)**
Upgrade Option: **Single Stage Nitrification**

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	General Conditions	200,000	330,000	630,000	358,000	72,000	5,184,000,000		
2	Aeration Basin Modifications								
	Structural	327,000	400,000	483,000	402,000	26,000	676,000,000		
	Process Mechanical	336,000	422,000	514,000	423,000	30,000	900,000,000		
	Electrical & Controls	60,000	100,000	120,000	97,000	10,000	100,000,000		
3	DAF System	660,000	940,000	1,200,000	937,000	90,000	8,100,000,000		
4	Septic Facility	250,000	350,000	400,000	342,000	25,000	625,000,000		
Sub-Total		1,833,000	2,542,000	3,347,000	2,558,000				
5	Contingencies (20%)	367,000	508,000	669,000	511,000	50,000	2,500,000,000		
Sub-Total		2,200,000	3,050,000	4,016,000	3,069,000				
6	Engineering (15%)	330,000	458,000	602,000	461,000	45,000	2,025,000,000		
7	City & Administration Costs (3%)	66,000	92,000	120,000	92,000	9,000	81,000,000		
TOTAL COST		2,596,000	3,600,000	4,738,000	3,622,000		142,000	**3,760,000**	**3,910,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) =$\sqrt{\sum s2}$

O&M COST ESTIMATE **Date: January 21, 2000**

Plant **WEWPCC**
Level of Ammonia Control: **Best Practicable (2 mg/L Summer)**
Upgrade Option:

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	Labour	11,300	16,500	22,000	17,000	2,000	4,000,000		
2	Power	55,000	55,000	55,000	55,000	0	0		
3	Utilities	0	0	0	0	0	0		
4	Consumables	7,300	10,000	12,000	10,000	1,000	1,000,000		
5	E&M Materials	2,400	6,000	12,000	6,000	2,000	4,000,000		
6	Miscellaneous	0	2,000	5,000	2,000	1,000	1,000,000		
TOTAL COST		76,000	89,500	106,000	90,000		3,000	**93,000**	**96,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) =$\sqrt{\sum s2}$

TOTAL COST ESTIMATE (95% CONFIDENCE) **Date: January 21, 2000**

Plant **WEWPCC**
Level of Ammonia Control: **Best Practicable (2 mg/L Summer)**
Upgrade Option: **Single Stage Nitrification**

Year	Calander Year	Initial Capital Cost $	O & M Cost $ 4%	O & M Cost $ 7%	O & M Cost $ 10%	Future Impacts & Replacement Cost $ 4%	Future Impacts & Replacement Cost $ 7%	Future Impacts & Replacement Cost $ 10%	Notes
0	2000	3,910,000	96,000	96,000	96,000				
1	2001		92,000	92,000	92,000				
5	2006		427,000	377,000	349,000				
10	2011		779,000	646,000	565,000				
15	2016		1,067,000	838,000	700,000				
20	2021		1,305,000	975,000	783,000	730,000	730,000	730,000	Blowers, DAF and Mixers are to be replaced after Year 20
30	2031		1,660,000	1,142,000	867,000				
40	2041		1,900,000	1,227,000	900,000				
Initial Capital Cost		3,910,000							
Net PV Cost (Total of 40 Years)			1,900,000	1,227,000	900,000				
Future Impacts & Replacement Costs						333,000	189,000	109,000	

TOTAL COST @4% **6,140,000**
TOTAL COST @7% **5,330,000**
TOTAL COST @10% **4,920,000**

Note: All costs shown are of 95% Confidence

NEWPCC – CENTRATE TREATMENT

CAPITAL COST ESTIMATE **Date: June 22, 2000**

Plant **NEWPCC**
Upgrade Option: **Centrate Treatment**

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	General Conditions	330,000	650,000	1,100,000	672,000	128,000	16,384,000,000		
2	Bioreactors	1,930,000	2,940,000	4,540,000	3,038,000	435,000	189,225,000,000		
3	Clarifiers and Building	1,370,000	2,030,000	2,800,000	2,048,000	238,000	56,644,000,000		
Sub-Total		3,630,000	5,620,000	8,440,000	5,758,000				
7	Contingencies (20%)	726,000	1,124,000	1,688,000	1,152,000	160,000	25,600,000,000		
Sub-Total		4,356,000	6,744,000	10,128,000	6,910,000				
8	Engineering (15%)	653,000	1,012,000	1,519,000	1,037,000	144,000	20,736,000,000		
9	City & Administration Costs (3%)	131,000	202,000	304,000	207,000	29,000	841,000,000		
TOTAL COST		5,140,000	7,958,000	11,951,000	8,154,000		556,000	**8,700,000**	**9,300,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) =$\sqrt{\sum s2}$
7. GST not included

O&M COST ESTIMATE **Date: June 22, 2000**

Plant **NEWPCC**
Upgrade Option: **Centrate Treatment**

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	Labour	88,000	110,000	175,000	117,000	15,000	225,000,000		
2	Power	140,000	140,000	140,000	140,000	0	0		
3	Utilities	38,000	38,000	38,000	38,000	0	0		
4	Consumables	176,000	220,000	260,000	219,000	14,000	196,000,000		
5	E&M Materials	40,000	50,000	60,000	50,000	3,000	9,000,000		
6	Miscellaneous	1,000	5,000	12,000	6,000	2,000	4,000,000		
					0	0	0		
TOTAL COST		483,000	563,000	685,000	570,000		21,000	**590,000**	**610,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) =$\sqrt{\sum s2}$
7. GST not included

TOTAL COST ESTIMATE (95% CONFIDENCE) **Date: June 22, 2000**

Plant **NEWPCC**
Upgrade Option: **Centrate Treatment**

Year	Calander Year	Initial Capital Cost $	O & M Cost $ 4%	O & M Cost $ 7%	O & M Cost $ 10%	Future Impacts & Replacement Cost $ 4%	Future Impacts & Replacement Cost $ 7%	Future Impacts & Replacement Cost $ 10%	Notes
0	2000	9,300,000	610,000	610,000	610,000				
1	2001		587,000	587,000	587,000				
5	2006		2,716,000	2,407,000	2,225,000				
10	2011		4,948,000	4,123,000	3,607,000				
15	2016		6,782,000	5,346,000	4,465,000				
20	2021		8,290,000	6,219,000	4,997,000	1,000,000	1,000,000	1,000,000	Blowers, Pumps, Lime System are replaced
30	2031		10,548,000	7,284,000	5,534,000				
40	2041		12,074,000	7,826,000	5,740,000				
Initial Capital Cost		9,300,000							
Net PV Cost (Total of 40 Years)			12,074,000	7,826,000	5,740,000				
Future Impacts & Replacement Costs						456,000	258,000	149,000	

TOTAL COST @4% **21,800,000**
TOTAL COST @7% **17,400,000**
TOTAL COST @10% **15,200,000**

Note: All costs shown are of 95% confidence

CHEMICAL PHOSPHORUS REMOVAL

CAPITAL COST ESTIMATE **Date: May 10, 2001**

Plant **NEWPCC**
Upgrade Option: **Chemical Phosphorus Removal**

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	General Conditions	890,000	1,505,000	2,650,000	1,593,000	293,000	85,849,000,000		
2	Sludge Thickening Building	4,455,000	5,955,000	8,716,000	6,165,000	710,000	504,100,000,000		
3	Digester	2,820,000	4,190,000	5,800,000	4,230,000	497,000	247,009,000,000		
4	Chemical Storage & Feed Buildin	1,600,000	2,400,000	3,150,000	2,392,000	258,000	66,564,000,000		
Sub-Total		9,765,000	14,050,000	20,316,000	14,380,000				
8	Contingencies (20%)	1,953,000	2,810,000	4,063,000	2,876,000	352,000	123,904,000,000		
Sub-Total		11,718,000	16,860,000	24,379,000	17,256,000				
9	Engineering (15%)	1,758,000	2,529,000	3,657,000	2,589,000	317,000	100,489,000,000		
10	City & Administration Costs (3%)	352,000	506,000	731,000	518,000	63,000	3,969,000,000		
TOTAL COST		13,828,000	19,895,000	28,767,000	20,363,000		1,064,000	**21,400,000**	**22,500,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) = $\sqrt{\sum s2}$
7. GST not included

O&M COST ESTIMATE **Date: May 10, 2001**

Plant **NEWPCC**
Upgrade Option: **Chemical Phosphorus Removal**

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	Labour	73,000	110,000	146,000	110,000	12,000	144,000,000		
2	Power	49,000	65,000	80,000	65,000	5,000	25,000,000		
3	Utilities	17,000	25,000	34,000	25,000	3,000	9,000,000		
4	Consumables	1,513,000	1,780,000	2,050,000	1,781,000	90,000	8,100,000,000		
5	E&M Materials	70,000	85,000	120,000	88,000	8,000	64,000,000		
6	Sludge Hauling & Disposal	372,000	372,000	372,000	372,000	0	0		
7	Miscellaneous	1,500	4,500	7,500	5,000	1,000	1,000,000		
TOTAL COST		2,095,500	2,441,500	2,809,500	2,445,000		91,000	**2,540,000**	**2,630,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) = $\sqrt{\sum s2}$

TOTAL COST ESTIMATE (95% CONFIDENCE) **Date: May 10, 2001**

Plant **NEWPCC**
Upgrade Option: **Chemical Phosphorus Removal**

Year	Calander Year	Initial Capital Cost $	O & M Cost $ 4%	O & M Cost $ 7%	O & M Cost $ 10%	Future Impacts & Replacement Cost $ 4%	Future Impacts & Replacement Cost $ 7%	Future Impacts & Replacement Cost $ 10%	Notes
0	2000	22,500,000	2,630,000	2,630,000	2,630,000				
1	2001		2,529,000	2,529,000	2,529,000				
5	2006		11,708,000	10,369,000	9,587,000				
10	2011		21,332,000	17,763,000	15,540,000				
15	2016		29,241,000	23,034,000	19,236,000				
20	2021		35,742,000	26,792,000	21,531,000	4,000,000	4,000,000	4,000,000	Equipment replacement after Ye
30	2031		45,478,000	31,382,000	23,841,000				
40	2041		52,055,000	33,716,000	24,731,000				
Initial Capital Cost		22,500,000							
Net PV Cost (Total of 40 Years)			52,055,000	33,716,000	24,731,000				
Future Impacts & Replacement Costs						1,826,000	1,034,000	595,000	

TOTAL COST @4% **76,400,000**
TOTAL COST @7% **57,300,000**
TOTAL COST @10% **47,800,000**

Note: All costs shown are of 95% confidence

CAPITAL COST ESTIMATE **Date: May 10, 2001**

Plant **SEWPCC**
Upgrade Option: **Chemical Phosphorus Removal**

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	General Conditions	390,000	682,000	1,155,000	712,000	128,000	16,384,000,000		
3	Sludge Thickening Building	2,760,000	4,055,000	5,570,000	4,092,000	468,000	219,024,000,000		
4	Chemical Storage & Feed Building	1,130,000	1,630,000	2,130,000	1,630,000	167,000	27,889,000,000		
Sub-Total		4,280,000	6,367,000	8,855,000	6,434,000				
5	Contingencies (20%)	856,000	1,273,000	1,771,000	1,287,000	153,000	23,409,000,000		
Sub-Total		5,136,000	7,640,000	10,626,000	7,720,000				
6	Engineering (15%)	770,000	1,146,000	1,594,000	1,158,000	137,000	18,769,000,000		
7	City & Administration Costs (3%)	154,000	229,000	319,000	232,000	28,000	784,000,000		
TOTAL COST		6,060,000	9,015,000	12,539,000	9,110,000		553,000	**9,700,000**	**10,200,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) = $\sqrt{\sum s2}$
7. GST not included
8. The clairfier cost is not included as it is required for the baseline condition for 2041.

O&M COST ESTIMATE **Date: May 10, 2001**

Plant **SEWPCC**
Upgrade Option: **Chemical Phosphorue Removal**

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	Labour	43,500	66,000	88,000	66,000	7,000	49,000,000		
2	Power	29,000	39,000	48,000	39,000	3,000	9,000,000		
3	Utilities	10,000	15,000	20,000	15,000	2,000	4,000,000		
4	Consumables	660,000	780,000	890,000	778,000	38,000	1,444,000,000		
5	E&M Materials	20,000	52,000	98,000	54,000	13,000	169,000,000		
6	Sludge Hauling	64,000	64,000	64,000	64,000	0	0		
7	Miscellaneous	1,000	3,000	5,000	3,000	1,000	1,000,000		
TOTAL COST		827,500	1,019,000	1,213,000	1,019,000		41,000	**1,060,000**	**1,101,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) = $\sqrt{\sum s2}$
7. GST not included

TOTAL COST ESTIMATE (95% CONFIDENCE) **Date: May 10, 2001**

Plant **SEWPCC**
Upgrade Option: **Chemical Phosphorus Removal**

Year	Calander Year	Initial Capital Cost $	O & M Cost $ 4%	O & M Cost $ 7%	O & M Cost $ 10%	Future Impacts & Replacement Cost $ 4%	Future Impacts & Replacement Cost $ 7%	Future Impacts & Replacement Cost $ 10%	Notes
0	2000	10,200,000	1,101,000	1,101,000	1,101,000				
1	2001		1,059,000	1,059,000	1,059,000				
5	2006		4,901,000	4,342,000	4,014,000				
10	2011		8,930,000	7,438,000	6,507,000				
15	2016		12,241,000	9,645,000	8,055,000				
20	2021		14,963,000	11,219,000	9,016,000	2,700,000	2,700,000	2,700,000	Dewatering & clarifier equipment replacement
30	2031		19,038,000	13,141,000	9,983,000				after year 20
40	2041		21,792,000	14,118,000	10,356,000				
Initial Capital Cost		10,200,000							
Net PV Cost (Total of 40 Years)			21,792,000	14,118,000	10,356,000				
Future Impacts & Replacement Costs						1,232,000	698,000	401,000	

TOTAL COST @4% **33,200,000**
TOTAL COST @7% **25,000,000**
TOTAL COST @10% **21,000,000**

Note: All costs shown are of 95% confidence

CAPITAL COST ESTIMATE **Date: May 10, 2001**

Plant **WEWPCC**
Upgrade Option: **Chemical Phosphorus Removal**

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	General Conditions	70,000	113,000	183,000	118,000	19,000	361,000,000		
2	Chemical Storage & Feed Building	670,000	945,000	1,220,000	945,000	92,000	8,464,000,000		
Sub-Total		740,000	1,058,000	1,403,000	1,063,000				
3	Contingencies (20%)	148,000	212,000	281,000	213,000	22,000	484,000,000		
Sub-Total		888,000	1,270,000	1,684,000	1,275,000				
4	Engineering (15%)	133,000	191,000	253,000	192,000	20,000	400,000,000		
5	City & Administration Costs (3%)	27,000	38,000	51,000	38,000	4,000	16,000,000		
TOTAL COST		1,048,000	1,499,000	1,988,000	1,505,000		99,000	**1,600,000**	**1,700,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) = $\sqrt{\sum s2}$

O&M COST ESTIMATE **Date: May 10, 2001**

Plant **WEWPCC**
Upgrade Option: **Chemical Phosphorus Removal**

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	Labour	5,400	7,500	11,000	8,000	1,000	1,000,000		
2	Power	3,000	4,500	6,000	5,000	1,000	1,000,000		
3	Utilities	0	0	0	0	0	0		
4	Consumables	200,000	250,000	300,000	250,000	17,000	289,000,000		
5	E&M Materials	1,000	2,000	3,000	2,000	0	0		
	Sludge Hauling	16,000	16,000	16,000	16,000	0	0		
6	Miscellaneous	0	1,000	1,500	1,000	0	0		
TOTAL COST		225,400	281,000	337,500	281,000		17,000	**298,000**	**315,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) = $\sqrt{\sum s2}$

TOTAL COST ESTIMATE (95% CONFIDENCE) **Date: May 10, 2001**

Plant **WEWPCC**
Upgrade Option: **Chemical Phosphorus Removal**

Year	Calander Year	Initial Capital Cost $	O & M Cost $ 4%	O & M Cost $ 7%	O & M Cost $ 10%	Future Impacts & Replacement Cost $ 4%	Future Impacts & Replacement Cost $ 7%	Future Impacts & Replacement Cost $ 10%	Notes
0	2000	1,700,000	315,000	315,000	315,000				
1	2001		303,000	303,000	303,000				
5	2006		1,402,000	1,242,000	1,149,000				
10	2011		2,555,000	2,128,000	1,862,000				
15	2016		3,502,000	2,760,000	2,305,000				
20	2021		4,281,000	3,210,000	2,580,000	150,000	150,000	150,000	Miscellaneous equipment to be replaced after Year 20
30	2031		5,447,000	3,760,000	2,856,000				
40	2041		6,235,000	4,040,000	2,963,000				
Initial Capital Cost		1,700,000							
Net PV Cost (Total of 40 Years)			6,235,000	4,040,000	2,963,000				
Future Impacts & Replacement Costs						68,000	39,000	22,000	

TOTAL COST @4% **8,000,000**
TOTAL COST @7% **5,780,000**
TOTAL COST @10% **4,690,000**

Note: All costs shown are of 95% Confidence

BIOLOGICAL NUTRIENT REMOVAL

CAPITAL COST ESTIMATE **Date: May 10, 2001**

Plant **NEWPCC**
Upgrade Option: **Biological Nutrient Removal**

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	General Conditions	5,577,000	8,771,000	15,097,000	9,293,000	1,587,000	2,518,569,000,000		
2	Bioreactors	16,000,000	20,365,000	27,404,000	20,811,000	1,901,000	3,613,801,000,000		
3	Clarifiers and Building	31,567,000	40,686,000	51,000,000	40,885,000	3,239,000	10,491,121,000,000		
4	Fermenters and Building	4,860,000	7,020,000	9,240,000	7,030,000	730,000	532,900,000,000		
5	Exhaust Stack	340,000	420,000	500,000	420,000	27,000	729,000,000		
6	Miscellaneous Site Pipeworks	2,500,000	4,000,000	5,000,000	3,917,000	417,000	173,889,000,000		
7	Existing Tankage Modifications	500,000	600,000	750,000	608,000	42,000	1,764,000,000		
Sub-Total		61,344,000	81,862,000	108,991,000	82,964,000				
8	Contingencies (20%)	12,269,000	16,372,000	21,798,000	16,593,000	1,588,000	2,521,744,000,000		
Sub-Total		73,613,000	98,234,000	130,789,000	99,556,000				
9	Engineering (15%)	11,042,000	14,735,000	19,618,000	14,933,000	1,429,000	2,042,041,000,000		
10	City & Administration Costs (3%)	2,208,000	2,947,000	3,924,000	2,987,000	286,000	81,796,000,000		
TOTAL COST		86,863,000	115,916,000	154,331,000	117,476,000		4,688,000	**122,200,000**	**126,900,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) = $\sqrt{\sum s2}$
7. GST not included

O&M COST ESTIMATE **Date: May 10, 2001**

Plant **NEWPCC**
Upgrade Option: **Biological Nutrient Removal**

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	Labour	413,000	600,000	600,000	569,000	31,000	961,000,000		
2	Power	560,000	560,000	560,000	560,000	0	0		
3	Utilities	420,000	420,000	420,000	420,000	0	0		
4	Consumables	55,000	73,000	90,000	73,000	6,000	36,000,000		
5	E&M Materials	70,000	85,000	120,000	88,000	8,000	64,000,000		
6	Miscellaneous	3,000	17,000	48,000	20,000	8,000	64,000,000		
					0	0	0		
TOTAL COST		1,521,000	1,755,000	1,838,000	1,730,000		34,000	**1,760,000**	**1,800,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) = $\sqrt{\sum s2}$

TOTAL COST ESTIMATE (95% CONFIDENCE) **Date: May 10, 2001**

Plant **NEWPCC**
Upgrade Option: **Biological Nutrient Removal**

Year	Calander Year	Initial Capital Cost $	O & M Cost $ 4%	O & M Cost $ 7%	O & M Cost $ 10%	Future Impacts & Replacement Cost $ 4%	Future Impacts & Replacement Cost $ 7%	Future Impacts & Replacement Cost $ 10%	Notes
0	2000	126,900,000	1,800,000	1,800,000	1,800,000				
1	2001		1,731,000	1,731,000	1,731,000				
5	2006		8,013,000	7,097,000	6,562,000				
10	2011		14,600,000	12,158,000	10,636,000				
15	2016		20,013,000	15,766,000	13,166,000				
20	2021		24,463,000	18,338,000	14,737,000	4,000,000	4,000,000	4,000,000	Equipment replacement after Ye
30	2031		31,126,000	21,480,000	16,318,000				
40	2041		35,627,000	23,077,000	16,928,000				
Initial Capital Cost		126,900,000							
Net PV Cost (Total of 40 Years)			35,627,000	23,077,000	16,928,000				
Future Impacts & Replacement Costs						1,826,000	1,034,000	595,000	

TOTAL COST @4% **164,400,000**
TOTAL COST @7% **151,000,000**
TOTAL COST @10% **144,400,000**

Note: All costs shown are of 95% confidence

CAPITAL COST ESTIMATE **Date: May 10, 2001**

Plant **SEWPCC**
Upgrade Option: **Biological Nutrient Removal**

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	General Conditions	2,039,000	3,297,000	5,216,000	3,407,000	530,000	280,900,000,000		
2	Bioreactors	10,574,000	14,090,000	17,656,000	14,098,000	1,180,000	1,392,400,000,000		
3	Clarifier and Building	5,600,000	7,400,000	9,300,000	7,417,000	617,000	380,689,000,000		
4	Fermenters and Building	3,240,000	4,680,000	6,160,000	4,687,000	487,000	237,169,000,000		
5	Misc Modifications & Siteworks	971,000	1,309,000	1,656,000	1,311,000	114,000	12,996,000,000		
Sub-Total		22,424,000	30,776,000	39,988,000	30,920,000				
6	Contingencies (20%)	4,485,000	6,155,000	7,998,000	6,184,000	586,000	343,396,000,000		
Sub-Total		26,909,000	36,931,000	47,986,000	37,103,000				
7	Engineering (15%)	4,036,000	5,540,000	7,198,000	5,566,000	527,000	277,729,000,000		
8	City & Administration Costs (3%)	807,000	1,108,000	1,440,000	1,113,000	106,000	11,236,000,000		
TOTAL COST		31,752,000	43,579,000	56,624,000	43,782,000		1,714,000	**45,500,000**	**47,200,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) = $\sqrt{\sum s2}$
7. GST not included

O&M COST ESTIMATE **Date: May 10, 2001**

Plant **SEWPCC**
Upgrade Option: **Biological Nutrient removal**

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	Labour	130,000	160,000	200,000	162,000	12,000	144,000,000		
2	Power	300,000	300,000	300,000	300,000	0	0		
3	Utilities	35,000	35,000	35,000	35,000	0	0		
4	Consumables	20,000	25,000	34,000	26,000	2,000	4,000,000		
5	E&M Materials	23,000	30,000	35,000	30,000	2,000	4,000,000		
6	Miscellaneous	1,000	5,000	14,000	6,000	2,000	4,000,000		
TOTAL COST		509,000	555,000	618,000	558,000		12,000	**570,000**	**582,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) = $\sqrt{\sum s2}$
7. GST not included

TOTAL COST ESTIMATE (95% CONFIDENCE) **Date: May 10, 2001**

Plant **SEWPCC**
Upgrade Option: **Biological Nutrient Removal**

Year	Calander Year	Initial Capital Cost $	O & M Cost $ 4%	O & M Cost $ 7%	O & M Cost $ 10%	Future Impacts & Replacement Cost $ 4%	Future Impacts & Replacement Cost $ 7%	Future Impacts & Replacement Cost $ 10%	Notes
0	2000	47,200,000	582,000	582,000	582,000				
1	2001		560,000	560,000	560,000				
5	2006		2,591,000	2,296,000	2,123,000				
10	2011		4,721,000	3,933,000	3,441,000				
15	2016		6,471,000	5,100,000	4,259,000				
20	2021		7,910,000	5,933,000	4,768,000	1,000,000	1,000,000	1,000,000	Equipment replacement
30	2031		10,064,000	6,949,000	5,279,000				after year 20
40	2041		11,519,000	7,466,000	5,476,000				
Initial Capital Cost		47,200,000							
Net PV Cost (Total of 40 Years)			11,519,000	7,466,000	5,476,000				
Future Impacts & Replacement Costs						456,000	258,000	149,000	

TOTAL COST @4% **59,200,000**
TOTAL COST @7% **54,900,000**
TOTAL COST @10% **52,800,000**

Note: All costs shown are of 95% confidence

CAPITAL COST ESTIMATE **Date: May 10, 2001**

Plant **WEWPCC**
Upgrade Option: **Biological Nutrient Removal**

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	General Conditions	277,000	456,000	756,000	476,000	80,000	6,400,000,000		
2	Aeration Basin Modifications								
	Structural	360,000	450,000	530,000	448,000	28,000	784,000,000		
	Process Mechanical	500,000	600,000	750,000	608,000	42,000	1,764,000,000		
	Electrical & Controls	107,000	210,000	320,000	211,000	36,000	1,296,000,000		
3	Fermenters	840,000	1,200,000	1,690,000	1,222,000	142,000	20,164,000,000		
4	DAF Facility	660,000	940,000	1,200,000	937,000	90,000	8,100,000,000		
5	Sludge Storage	200,000	250,000	350,000	258,000	25,000	625,000,000		
6	Site Pipework	100,000	150,000	200,000	150,000	17,000	289,000,000		
Sub-Total		3,044,000	4,256,000	5,796,000	4,311,000				
7	Contingencies (20%)	609,000	851,000	1,159,000	862,000	92,000	8,464,000,000		
Sub-Total		3,653,000	5,107,000	6,955,000	5,173,000				
8	Engineering (15%)	548,000	766,000	1,043,000	776,000	83,000	6,889,000,000		
9	City & Administration Costs (3%)	110,000	153,000	209,000	155,000	17,000	289,000,000		
TOTAL COST		4,311,000	6,026,000	8,207,000	6,104,000		235,000	**6,340,000**	**6,570,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) = $\sqrt{\sum s2}$

O&M COST ESTIMATE **Date: May 10, 2001**

Plant **WEWPCC**
Upgrade Option: **Biological Nutrient Removal**

Item No.	Item Description	Low Estimate $	Most Likely Estimate $	High Estimate $	Expected Value $	Standard Deviation s	Variance s2	67% Confidence $	95% Confidence $
1	Labour	17,000	19,000	22,000	19,000	1,000	1,000,000		
2	Power	72,000	72,000	72,000	72,000	0	0		
3	Utilities	0	0	0	0	0	0		
4	Consumables	8,000	10,000	12,000	10,000	1,000	1,000,000		
5	E&M Materials	3,000	8,000	15,000	8,000	2,000	4,000,000		
6	Miscellaneous	0	3,000	7,000	3,000	1,000	1,000,000		
TOTAL COST		100,000	112,000	128,000	113,000		3,000	**116,000**	**119,000**

Note:
1. Expected Value (E) = (L+4M+H)/6
2. L = Low or Optimistic Estimate
3. H = High or Pessimistic Estimate
4. M = Most Likely Estimate
5. Standard Deviation s = (H-L)/6
6. Standard Deviation S (Whole project) = $\sqrt{\sum s2}$

TOTAL COST ESTIMATE (95% CONFIDENCE) **Date: May 10, 2001**

Plant **WEWPCC**
Upgrade Option: **Biological Nutrient Removal**

Year	Calander Year	Initial Capital Cost $	O & M Cost $ 4%	O & M Cost $ 7%	O & M Cost $ 10%	Future Impacts & Replacement Cost $ 4%	Future Impacts & Replacement Cost $ 7%	Future Impacts & Replacement Cost $ 10%	Notes
0	2000	6,570,000	119,000	119,000	119,000				
1	2001		114,000	114,000	114,000				
5	2006		530,000	467,000	432,000				
10	2011		965,000	801,000	700,000				
15	2016		1,323,000	1,038,000	867,000				
20	2021		1,617,000	1,208,000	971,000	900,000	900,000	900,000	Blowers, DAF and Mixers are to be replaced after Year 20
30	2031		2,058,000	1,415,000	1,075,000				
40	2041		2,355,000	1,520,000	1,115,000				
Initial Capital Cost		6,570,000							
Net PV Cost (Total of 40 Years)			2,355,000	1,520,000	1,115,000				
Future Impacts & Replacement Costs						411,000	233,000	134,000	

TOTAL COST @4% **9,340,000**
TOTAL COST @7% **8,320,000**
TOTAL COST @10% **7,820,000**

Note: All costs shown are of 95% Confidence