

TABLE 5.2 Concept 1 Alternative 2B – Harbor Injection Technology (73 Speece Cones with scheduled maintenance shutdowns)

Cost Assessment for Design Phase I Step 2

**Identification and Screening Level Evaluation of Measures to Improve Dissolved Oxygen in the Savannah River Estuary
Savannah Harbor Expansion Project & Savannah Harbor Ecosystem Restoration Study
Chatham County, Georgia**

MAJOR ASSUMPTIONS

Present TMDL requirements based on current Georgia DO standard and current (1999) BOD loadings
 Required Point Source BOD reduction is 635,500 lbs/day
 Required Nonpoint Source BOD reduction is 90,000 lbs/day
Total Oxygen Requirements = 725,500 lbs/day
 Supplemental DO needed during summer months
 Harbor injection technology capable of 730,000 lbs O₂/day
 Inject harbor near midpoint of Hutchinson Island and via mobile barge
 Barge available for use and no storage expense
 Rolling maintenance shut downs for 8 weeks reduces Speece cone O&M
 50 % BOD loading reduction from an individual discharger during the scheduled facility maintenance period
 (assumes 2-weeks to perform required facility maintenance for top five dischargers)
 Additional load reduction may be possible if shutdowns are implemented basin wide for every discharger
 O&M costs were based on a 90 day operation schedule. However, based on river flows, operation may be limited
 and thereby substantially reducing O&M costs.
Costs NOT included in the estimate:
 Land Acquisition/Right of Way and required local, state and federal permitting
 Construction for electrical service or costs for diesel generators

Item	Quantity	Unit	Unit Cost	Opinion of Probable Cost
CAPITAL COSTS				
Harbor injection technology (Speece Cone)	73	cone	\$ 425,000	\$ 31,025,000
Harbor injection technology (PSA O2 plant)	73	cone	\$ 325,000	\$ 23,725,000
Discharge Collection Network 30-day HRT Pond	0	network	\$ 39,556,271	\$ -
Rolling Maintenance Shut Down (IP Augusta)	2	weeks	\$ -	\$ -
Rolling Maintenance Shut Down (GA Pacific)	2	weeks	\$ -	\$ -
Rolling Maintenance Shut Down (Weyerhaeuser)	2	weeks	\$ -	\$ -
Rolling Maintenance Shut Down (IP Savannah)	2	weeks	\$ -	\$ -
				\$ -
			Subtotal	\$ 54,750,000
			Oversight (15%)	\$ 8,212,500
			Contingency (50%)	\$ 27,375,000
			TOTAL CAPITAL COSTS	\$ 90,337,500
ANNUAL COSTS				
Speece Cone O&M plus O2 generation energy	34	day	\$ 35,040	\$ 1,191,360
Speece Cone O&M plus O2 generation energy (IP Augusta shutdown)	14	day	\$ 31,680	\$ 443,520
Speece Cone O&M plus O2 generation energy (GA Pacific shutdown)	14	day	\$ 34,080	\$ 477,120
Speece Cone O&M plus O2 generation energy (Weyerhaeuser shutdown)	14	day	\$ 34,560	\$ 483,840
Speece Cone O&M plus O2 generation energy (IP Savannah shutdown)	14	day	\$ 28,800	\$ 403,200
Supplemental Oxygen Injection (energy required)	0	day	\$ 1,780	\$ -
Supplemental Oxygen Injection (O&M)	0		\$ 40,500	\$ -
				\$ -
			Subtotal	\$ 2,999,040
			Oversight & Reporting (30%)	\$ 899,712
			TOTAL ANNUAL COSTS	\$ 3,898,752

DO - dissolved oxygen
 BOD - biochemical oxygen demand
 O&M - Operations and Maintenance

CAPITAL COSTS	\$	90,337,500
ANNUAL COSTS	\$	3,898,752
TOTAL OPINION OF PROBABLE COSTS	\$	94,236,252
TOTAL OPINION OF PROBABLE COSTS FOR 20 YEARS	\$	168,312,540

Prepared By:
 Checked By:

TABLE 5.2 Concept 1 Alternative 2C – Speece Cones with Discharge Network and Storage System

**Cost Assessment for Design Phase I Step 2
Identification and Screening Level Evaluation of Measures to Improve Dissolved Oxygen in the Savannah River Estuary
Savannah Harbor Expansion Project & Savannah Harbor Ecosystem Restoration Study
Chatham County, Georgia**

MAJOR ASSUMPTIONS

Present TMDL requirements based on current Georgia DO standard and current (1999) BOD loadings
Required Point Source BOD reduction is 635,500 lbs/day
Required Nonpoint Source BOD reduction is 90,000 lbs/day
Total Oxygen Requirements = 725,500 lbs/day
Supplemental DO needed during summer months
Harbor injection technology capable of 400,000 lbs O₂/day
Inject harbor near midpoint of Hutchinson Island and via mobile barge
Discharge Collection Network (Includes Weyerhaeuser, IP Savannah, and President St. discharge) (327,500 lbs/day rerouted)
Supplemental oxygen injection for 10 miles capable of 80,000 lbs O₂/day
(requires 22 injectors and 44 nozzles every 2400 feet)
 Storage pond system (30-day retention)
Barge available for use and no storage expense
Rolling maintenance shut downs for 8 weeks reduces Speece cone O&M
50 % BOD loading reduction from discharger during the scheduled facility maintenance period
(assumes 2-weeks to perform required facility maintenance for top five dischargers)
Additional load reduction may be possible if shutdowns are implemented basin wide for every discharger
O&M costs were based on a 90 day operation schedule. However, based on river flows, operation may be limited
and thereby substantially reducing O&M costs.
Costs NOT included in the estimate:
Land Acquisition/Right of Way and required local, state and federal permitting
Construction for electrical service or costs for diesel generators

Item	Quantity	Unit	Unit Cost	Opinion of Probable Cost
CAPITAL COSTS				
Harbor injection technology (Speece Cone)	40	cone	\$ 425,000	\$ 17,000,000
Harbor injection technology (PSA O2 plant)	40	cone	\$ 325,000	\$ 13,000,000
Discharge Collection Network 30-day HRT Pond (Option 1-B)	1	network	\$ 39,556,271	\$ 39,556,271
Supplemental Oxygen Injection	10	mile	\$ 40,500	\$ 405,000
Rolling Maintenance Shut Down (IP Augusta)	2	weeks	\$ -	\$ -
Rolling Maintenance Shut Down (GA Pacific)	2	weeks	\$ -	\$ -
Rolling Maintenance Shut Down (Weyerhaeuser)	2	weeks	\$ -	\$ -
Rolling Maintenance Shut Down (IP Savannah)	2	weeks	\$ -	\$ -
				\$ -
			Subtotal	\$ 69,961,271
			Oversight (15%)	\$ 10,494,191
			Contingency (50%)	\$ 34,980,636
			TOTAL CAPITAL COSTS	\$ 115,436,097
ANNUAL COSTS				
Speece Cone O&M plus O2 generation energy	34	day	\$ 19,200	\$ 652,800
Speece Cone O&M plus O2 generation energy (IP Augusta shutdown)	14	day	\$ 15,840	\$ 221,760
Speece Cone O&M plus O2 generation energy (GA Pacific shutdown)	14	day	\$ 18,240	\$ 255,360
Speece Cone O&M plus O2 generation energy (Weyerhaeuser shutdown)	14	day	\$ 18,720	\$ 262,080
Speece Cone O&M plus O2 generation energy (IP Savannah shutdown)	14	day	\$ 12,960	\$ 181,440
Supplemental Oxygen Injection (energy required)	90	day	\$ 1,780	\$ 160,200
Supplemental Oxygen Injection (O&M)	0.1		\$ 40,500	\$ 4,050
				\$ -
			Subtotal	\$ 1,737,690
			Oversight & Reporting (30%)	\$ 521,307
			TOTAL ANNUAL COSTS	\$ 2,258,997

DO - dissolved oxygen
 BOD - biochemical oxygen demand
 O&M - Operations and Maintenance

CAPITAL COSTS	\$ 115,436,097
ANNUAL COSTS	\$ 2,258,997
TOTAL OPINION OF PROBABLE COSTS	\$ 117,695,094
TOTAL OPINION OF PROBABLE COSTS FOR 20 YEARS	\$ 160,616,037

Prepared By:
 Checked By:

TABLE 5.3 Concept 1 Alternative 3A – Harbor Injection Technology (7 Speece cones)

Cost Assessment for Design Phase I Step 3

**Identification and Screening Level Evaluation of Measures to Improve Dissolved Oxygen in the Savannah River Estuary
Savannah Harbor Expansion Project & Savannah Harbor Ecosystem Restoration Study
Chatham County, Georgia**

MAJOR ASSUMPTIONS

TMDL proposed DO Standard requirements and current (1999) BOD loadings

Required Point Source BOD reduction 68,250 lbs/day

Required Nonpoint Source BOD reduction is Not Applicable

Total Oxygen Requirements = 68,250 lbs/day

Supplemental DO needed during summer months

Harbor injection technology capable of 70,000 lbs O₂/day

Inject near midpoint of Hutchinson Island

Rolling maintenance shut downs for 8 weeks reduces Speece cone O&M

50 % BOD loading reduction from discharger during the scheduled facility maintenance period

(assumes 2-weeks to perform required facility maintenance for top five dischargers)

Additional load reduction may be possible if shutdowns are implemented basin wide for every discharger

O&M costs were based on a 90 day operation schedule. However, based on river flows, operation may be limited and thereby substantially reducing O&M costs.

Costs NOT included in the estimate:

Land Acquisition/Right of Way and required local, state and federal permitting

Construction for electrical service or costs for diesel generators

Item	Quantity	Unit	Unit Cost	Opinion of Probable Cost
CAPITAL COSTS				
Harbor injection technology (Speece Cone)	7	cone	\$ 425,000	\$ 2,975,000
Harbor injection technology (PSA O2 plant)	7	cone	\$ 325,000	\$ 2,275,000
Rolling Maintenance Shut Down (IP Augusta)	2	weeks	\$ -	\$ -
Rolling Maintenance Shut Down (GA Pacific)	2	weeks	\$ -	\$ -
Rolling Maintenance Shut Down (Weyerhaeuser)	2	weeks	\$ -	\$ -
Rolling Maintenance Shut Down (IP Savannah)	2	weeks	\$ -	\$ -
			Subtotal	\$ 5,250,000
			Oversight (15%)	\$ 787,500
			Contingency (50%)	\$ 2,625,000
			TOTAL CAPITAL COSTS	\$ 8,662,500
ANNUAL COSTS				
Speece Cone O&M plus O2 generation energy	90	day	\$ 3,360	\$ 302,400
Speece Cone O&M plus O2 generation energy (IP Augusta shutdown)	0	day	\$ -	\$ -
Speece Cone O&M plus O2 generation energy (GA Pacific shutdown)	0	day	\$ 2,400	\$ -
Speece Cone O&M plus O2 generation energy (Weyerhaeuser shutdown)	0	day	\$ 2,880	\$ -
Speece Cone O&M plus O2 generation energy (IP Savannah shutdown)	0	day	\$ -	\$ -
Supplemental Oxygen Injection (energy required)	0	day	\$ 1,780	\$ -
Supplemental Oxygen Injection (O&M)	0		\$ 40,500	\$ -
			Subtotal	\$ 302,400
			Oversight & Reporting (30%)	\$ 90,720
			TOTAL ANNUAL COSTS	\$ 393,120

DO - dissolved oxygen

BOD - biochemical oxygen demand

O&M - Operations and Maintenance

CAPITAL COSTS	\$	8,662,500
ANNUAL COSTS	\$	393,120
TOTAL OPINION OF PROBABLE COSTS	\$	9,055,620
TOTAL OPINION OF PROBABLE COSTS FOR 20 YEARS	\$	16,524,900

Prepared By:

Checked By:

TABLE 5.3 Concept 1 Alternative 3B – Harbor Injection Technology (7 Speece cones with scheduled maintenance shut downs)

Cost Assessment for Design Phase I Step 3

**Identification and Screening Level Evaluation of Measures to Improve Dissolved Oxygen in the Savannah River Estuary
Savannah Harbor Expansion Project & Savannah Harbor Ecosystem Restoration Study
Chatham County, Georgia**

MAJOR ASSUMPTIONS

TMDL proposed DO Standard requirements and current (1999) BOD loadings

Required Point Source BOD reduction 68,250 lbs/day

Required Nonpoint Source BOD reduction is Not Applicable

Total Oxygen Requirements = 68,250 lbs/day

Supplemental DO needed during summer months

Harbor injection technology capable of 70,000 lbs O₂/day

Inject near midpoint of Hutchinson Island

Rolling maintenance shut downs for 8 weeks reduces Speece cone O&M

50 % BOD loading reduction from discharger during the scheduled facility maintenance period

(assumes 2-weeks to perform required facility maintenance for top five dischargers)

Additional load reduction may be possible if shutdowns are implemented basin wide for every discharger

O&M costs were based on a 90 day operation schedule. However, based on river flows, operation may be limited and thereby substantially reducing O&M costs.

Costs NOT included in the estimate:

Land Acquisition/Right of Way and required local, state and federal permitting

Construction for electrical service or costs for diesel generators

Item	Quantity	Unit	Unit Cost	Opinion of Probable Cost
CAPITAL COSTS				
Harbor injection technology (Speece Cone)	7	cone	\$ 425,000	\$ 2,975,000
Harbor injection technology (PSA O2 plant)	7	cone	\$ 325,000	\$ 2,275,000
Rolling Maintenance Shut Down (IP Augusta)	2	weeks	\$ -	\$ -
Rolling Maintenance Shut Down (GA Pacific)	2	weeks	\$ -	\$ -
Rolling Maintenance Shut Down (Weyerhaeuser)	2	weeks	\$ -	\$ -
Rolling Maintenance Shut Down (IP Savannah)	2	weeks	\$ -	\$ -
			Subtotal	\$ 5,250,000
			Oversight (15%)	\$ 787,500
			Contingency (50%)	\$ 2,625,000
			TOTAL CAPITAL COSTS	\$ 8,662,500
ANNUAL COSTS				
Speece Cone O&M plus O2 generation energy	34	day	\$ 3,360	\$ 114,240
Speece Cone O&M plus O2 generation energy (IP Augusta shutdown)	14	day	\$ -	\$ -
Speece Cone O&M plus O2 generation energy (GA Pacific shutdown)	14	day	\$ 2,400	\$ 33,600
Speece Cone O&M plus O2 generation energy (Weyerhaeuser shutdown)	14	day	\$ 2,880	\$ 40,320
Speece Cone O&M plus O2 generation energy (IP Savannah shutdown)	14	day	\$ -	\$ -
Supplemental Oxygen Injection (energy required)	0	day	\$ 1,780	\$ -
Supplemental Oxygen Injection (O&M)	0		\$ 40,500	\$ -
			Subtotal	\$ 188,160
			Oversight & Reporting (30%)	\$ 56,448
			TOTAL ANNUAL COSTS	\$ 244,608

DO - dissolved oxygen

BOD - biochemical oxygen demand

O&M - Operations and Maintenance

CAPITAL COSTS	\$	8,662,500
ANNUAL COSTS	\$	244,608
TOTAL OPINION OF PROBABLE COSTS	\$	8,907,108
TOTAL OPINION OF PROBABLE COSTS FOR 20 YEARS	\$	13,554,660

Prepared By:

Checked By:

TABLE 5.3 Concept 1 Alternative 3C - Seaward Discharge

Cost Assessment for Design Phase I Step 4

**Identification and Screening Level Evaluation of Measures to Improve Dissolved Oxygen in the Savannah River Estuary
Savannah Harbor Expansion Project & Savannah Harbor Ecosystem Restoration Study
Chatham County, Georgia**

MAJOR ASSUMPTIONS

TMDL proposed DO Standard requirements and current (1999) BOD loadings

Required Point Source BOD reduction 68,250 lbs/day

Required Nonpoint Source BOD reduction is Not Applicable

Total Oxygen Requirements = 68,250 lbs/day

Supplemental DO needed during summer months

Harbor injection technology capable of 70,000 lbs O₂/day

Inject near midpoint of Hutchinson Island

Rolling maintenance shut downs for 8 weeks reduces Speece cone O&M

50 % BOD loading reduction from discharger during the scheduled facility maintenance period

(assumes 2-weeks to perform required facility maintenance for top five dischargers)

Additional load reduction may be possible if shutdowns are implemented basin wide for every discharger

O&M costs were based on a 90 day operation schedule. However, based on river flows, operation may be limited and thereby substantially reducing O&M costs.

Costs NOT included in the estimate:

Land Acquisition/Right of Way and required local, state and federal permitting

Construction for electrical service or costs for diesel generators

Item	Quantity	Unit	Unit Cost	Opinion of Probable Cost
CAPITAL COSTS				
Harbor injection technology (Speece Cone)	0	cone	\$ 425,000	\$ -
Harbor injection technology (PSA O2 plant)	0	cone	\$ 325,000	\$ -
Supplemental Oxygen Injection	0	mile	\$ 40,500	\$ -
Discharge Collection Network Seaward Pipeline with Timed Tidal	1	network	\$ 33,116,016	\$ 33,116,016
Rolling Maintenance Shut Down (IP Augusta)	2	weeks	\$ -	\$ -
Rolling Maintenance Shut Down (GA Pacific)	2	weeks	\$ -	\$ -
Rolling Maintenance Shut Down (Weyerhaeuser)	2	weeks	\$ -	\$ -
Rolling Maintenance Shut Down (IP Savannah)	2	weeks	\$ -	\$ -
Subtotal				\$ 33,116,016
Oversight (15%)				\$ 4,967,402
Contingency (50%)				\$ 16,558,008
TOTAL CAPITAL COSTS				\$ 54,641,426
ANNUAL COSTS				
Speece Cone O&M plus O2 generation energy	0	day	\$ 24,000	\$ -
Speece Cone O&M plus O2 generation energy (IP Augusta shutdown)	0	day	\$ 20,640	\$ -
Speece Cone O&M plus O2 generation energy (GA Pacific shutdown)	0	day	\$ 23,040	\$ -
Speece Cone O&M plus O2 generation energy (Weyerhaeuser shutdown)	0	day	\$ 23,520	\$ -
Speece Cone O&M plus O2 generation energy (IP Savannah shutdown)	0	day	\$ 17,760	\$ -
Supplemental Oxygen Injection (energy required)	90	day	\$ 1,780	\$ 160,200
Supplemental Oxygen Injection (O&M)	0.1		\$ 40,500	\$ 4,050
Subtotal				\$ 164,250
Oversight & Reporting (30%)				\$ 49,275
TOTAL ANNUAL COSTS				\$ 213,525

DO - dissolved oxygen

BOD - biochemical oxygen demand

O&M - Operations and Maintenance

CAPITAL COSTS	\$ 54,641,426
ANNUAL COSTS	\$ 213,525
TOTAL OPINION OF PROBABLE COSTS	\$ 54,854,951
TOTAL OPINION OF PROBABLE COSTS FOR 20 YEARS	\$ 58,911,926

Prepared By:

Checked By:

TABLE 5.4 Concept 1 Alternative 4A - Harbor Injection Technology (50 Speece Cones)

Cost Assessment for Design Phase I Step 4

**Identification and Screening Level Evaluation of Measures to Improve Dissolved Oxygen in the Savannah River Estuary
Savannah Harbor Expansion Project & Savannah Harbor Ecosystem Restoration Study
Chatham County, Georgia**

MAJOR ASSUMPTIONS

TMDL proposed DO Standard requirements and Current (1999) BOD loadings

Required Point Source BOD reduction 503,500 lbs/day

Required Nonpoint Source BOD reduction is Not Applicable

Total Oxygen Requirements = 503,500 lbs/day

Supplemental DO needed during summer months

Harbor injection technology capable of 500,000-503,500 lbs O₂/day

Inject near midpoint of Hutchinson Island

Rolling maintenance shut downs for 8 weeks reduces Speece cone O&M

50 % BOD loading reduction from discharger during the scheduled facility maintenance period

(assumes 2-weeks to perform required facility maintenance for top five dischargers)

Additional load reduction may be possible if shutdowns are implemented basin wide for every discharger

O&M costs were based on a 90 day operation schedule. However, based on river flows, operation may be limited and thereby substantially reducing O&M costs.

Costs NOT included in the estimate:

Land Acquisition/Right of Way and required local, state and federal permitting

Construction for electrical service or costs for diesel generators

Item	Quantity	Unit	Unit Cost	Opinion of Probable Cost
CAPITAL COSTS				
Harbor injection technology (Speece Cone)	50	cone	\$ 425,000	\$ 21,250,000
Harbor injection technology (PSA O2 plant)	50	cone	\$ 325,000	\$ 16,250,000
Supplemental Oxygen Injection	0	mile	\$ 40,500	\$ -
Discharge Collection Network Seaward Pipeline with Timed Tidal	0	network	\$ 33,116,016	\$ -
Rolling Maintenance Shut Down (IP Augusta)	2	weeks	\$ -	\$ -
Rolling Maintenance Shut Down (GA Pacific)	2	weeks	\$ -	\$ -
Rolling Maintenance Shut Down (Weyerhaeuser)	2	weeks	\$ -	\$ -
Rolling Maintenance Shut Down (IP Savannah)	2	weeks	\$ -	\$ -
Subtotal				\$ 37,500,000
Oversight (15%)				\$ 5,625,000
Contingency (50%)				\$ 18,750,000
TOTAL CAPITAL COSTS				\$ 61,875,000
ANNUAL COSTS				
Speece Cone O&M plus O2 generation energy	90	day	\$ 24,000	\$ 2,160,000
Speece Cone O&M plus O2 generation energy (IP Augusta shutdown)	0	day	\$ 20,640	\$ -
Speece Cone O&M plus O2 generation energy (GA Pacific shutdown)	0	day	\$ 23,040	\$ -
Speece Cone O&M plus O2 generation energy (Weyerhaeuser shutdown)	0	day	\$ 23,520	\$ -
Speece Cone O&M plus O2 generation energy (IP Savannah shutdown)	0	day	\$ 17,760	\$ -
Supplemental Oxygen Injection (energy required)	0	day	\$ 1,780	\$ -
Supplemental Oxygen Injection (O&M)	0		\$ 40,500	\$ -
Subtotal				\$ 2,160,000
Oversight & Reporting (30%)				\$ 648,000
TOTAL ANNUAL COSTS				\$ 2,808,000

DO - dissolved oxygen

BOD - biochemical oxygen demand

O&M - Operations and Maintenance

CAPITAL COSTS	\$ 61,875,000
ANNUAL COSTS	\$ 2,808,000
TOTAL OPINION OF PROBABLE COSTS	\$ 64,683,000
TOTAL OPINION OF PROBABLE COSTS FOR 20 YEARS	\$ 118,035,000

Prepared By:

Checked By:

TABLE 5.4 Concept 1 Alternative 4B - Harbor Injection Technology (50 Speece cones with scheduled maintenance shutdowns)

Cost Assessment for Design Phase I Step 4

**Identification and Screening Level Evaluation of Measures to Improve Dissolved Oxygen in the Savannah River Estuary
Savannah Harbor Expansion Project & Savannah Harbor Ecosystem Restoration Study
Chatham County, Georgia**

MAJOR ASSUMPTIONS

TMDL proposed DO Standard requirements and Current (1999) BOD loadings

Required Point Source BOD reduction 503,500 lbs/day

Required Nonpoint Source BOD reduction is Not Applicable

Total Oxygen Requirements = 503,500 lbs/day

Supplemental DO needed during summer months

Harbor injection technology capable of 500,000-503,500 lbs O₂/day

Inject near midpoint of Hutchinson Island

Rolling maintenance shut downs for 8 weeks reduces Speece cone O&M

50 % BOD loading reduction from discharger during the scheduled facility maintenance period

(assumes 2-weeks to perform required facility maintenance for top five dischargers)

Additional load reduction may be possible if shutdowns are implemented basin wide for every discharger

O&M costs were based on a 90 day operation schedule. However, based on river flows, operation may be limited and thereby substantially reducing O&M costs.

Costs NOT included in the estimate:

Land Acquisition/Right of Way and required local, state and federal permitting

Construction for electrical service or costs for diesel generators

Item	Quantity	Unit	Unit Cost	Opinion of Probable Cost
CAPITAL COSTS				
Harbor injection technology (Speece Cone)	50	cone	\$ 425,000	\$ 21,250,000
Harbor injection technology (PSA O2 plant)	50	cone	\$ 325,000	\$ 16,250,000
Supplemental Oxygen Injection	0	mile	\$ 40,500	\$ -
Discharge Collection Network Seaward Pipeline with Timed Tidal	0	network	\$ 33,116,016	\$ -
Rolling Maintenance Shut Down (IP Augusta)	2	weeks	\$ -	\$ -
Rolling Maintenance Shut Down (GA Pacific)	2	weeks	\$ -	\$ -
Rolling Maintenance Shut Down (Weyerhaeuser)	2	weeks	\$ -	\$ -
Rolling Maintenance Shut Down (IP Savannah)	2	weeks	\$ -	\$ -
Subtotal				\$ 37,500,000
Oversight (15%)				\$ 5,625,000
Contingency (50%)				\$ 18,750,000
TOTAL CAPITAL COSTS				\$ 61,875,000
ANNUAL COSTS				
Speece Cone O&M plus O2 generation energy	34	day	\$ 24,000	\$ 816,000
Speece Cone O&M plus O2 generation energy (IP Augusta shutdown)	14	day	\$ 20,640	\$ 288,960
Speece Cone O&M plus O2 generation energy (GA Pacific shutdown)	14	day	\$ 23,040	\$ 322,560
Speece Cone O&M plus O2 generation energy (Weyerhaeuser shutdown)	14	day	\$ 23,520	\$ 329,280
Speece Cone O&M plus O2 generation energy (IP Savannah shutdown)	14	day	\$ 17,760	\$ 248,640
Supplemental Oxygen Injection (energy required)	0	day	\$ 1,780	\$ -
Supplemental Oxygen Injection (O&M)	0		\$ 40,500	\$ -
Subtotal				\$ 2,005,440
Oversight & Reporting (30%)				\$ 601,632
TOTAL ANNUAL COSTS				\$ 2,607,072

DO - dissolved oxygen

BOD - biochemical oxygen demand

O&M - Operations and Maintenance

CAPITAL COSTS	\$ 61,875,000
ANNUAL COSTS	\$ 2,607,072
TOTAL OPINION OF PROBABLE COSTS	\$ 64,482,072
TOTAL OPINION OF PROBABLE COSTS FOR 20 YEARS	\$ 114,016,440

Prepared By:

Checked By:

TABLE 5.4 Concept 1 Alternative 4C - Speece Cone & Seaward Pipeline with Timed Tidal Discharge

Cost Assessment for Design Phase I Step 4

**Identification and Screening Level Evaluation of Measures to Improve Dissolved Oxygen in the Savannah River Estuary
Savannah Harbor Expansion Project & Savannah Harbor Ecosystem Restoration Study
Chatham County, Georgia**

MAJOR ASSUMPTIONS

TMDL proposed DO Standard requirements and Current (1999) BOD loadings
Required Point Source BOD reduction 503,500 lbs/day
Required Nonpoint Source BOD reduction is Not Applicable
Total Oxygen Requirements = 503,500 lbs/day
Supplemental DO needed during summer months
Harbor injection technology capable of 240,000 lbs O₂/day
Inject near midpoint of Hutchinson Island
Discharge Collection Network (Includes IP Savannah discharge)
Supplemental Oxygen Injection for 10 miles capable of 80,000 lbs O₂/day
(requires 22 injectors and 44 nozzles every 2400 feet)
Storage pond system (12-hours retention)
Seaward pipeline with timed tidal discharge at RM 5.5 (reroutes 267,500 lbs/day)
Rolling maintenance shut downs for 8 weeks reduces Speece cone O&M
50 % BOD loading reduction from discharger during the scheduled facility maintenance period
(assumes 2-weeks to perform required facility maintenance for top five dischargers)
Additional load reduction may be possible if shutdowns are implemented basin wide for every discharger
O&M costs were based on a 90 day operation schedule. However, based on river flows, operation may be limited
and thereby substantially reducing O&M costs.
Costs NOT included in the estimate:
Land Acquisition/Right of Way and required local, state and federal permitting
Construction for electrical service or costs for diesel generators

Item	Quantity	Unit	Unit Cost	Opinion of Probable Cost
CAPITAL COSTS				
Harbor injection technology (Speece Cone)	24	cone	\$ 425,000	\$ 10,200,000
Harbor injection technology (PSA O2 plant)	24	cone	\$ 325,000	\$ 7,800,000
Supplemental Oxygen Injection	10	mile	\$ 40,500	\$ 405,000
Discharge Collection Network Seaward Pipeline with Timed Tidal (Option II - A-1)	1	network	\$ 33,116,016	\$ 33,116,016
Rolling Maintenance Shut Down (IP Augusta)	2	weeks	\$ -	\$ -
Rolling Maintenance Shut Down (GA Pacific)	2	weeks	\$ -	\$ -
Rolling Maintenance Shut Down (Weyerhaeuser)	2	weeks	\$ -	\$ -
Rolling Maintenance Shut Down (IP Savannah)	2	weeks	\$ -	\$ -
			Subtotal	\$ 51,521,016
			Oversight (15%)	\$ 7,728,152
			Contingency (50%)	\$ 25,760,508
			TOTAL CAPITAL COSTS	\$ 85,009,676
ANNUAL COSTS				
Speece Cone O&M plus O2 generation energy	34	day	\$ 11,520	\$ 391,680
Speece Cone O&M plus O2 generation energy (IP Augusta shutdown)	14	day	\$ 8,160	\$ 114,240
Speece Cone O&M plus O2 generation energy (GA Pacific shutdown)	14	day	\$ 10,560	\$ 147,840
Speece Cone O&M plus O2 generation energy (Weyerhaeuser shutdown)	14	day	\$ 11,040	\$ 154,560
Speece Cone O&M plus O2 generation energy (IP Savannah shutdown)	14	day	\$ 5,280	\$ 73,920
Supplemental Oxygen Injection (energy required)	90	day	\$ 1,780	\$ 160,200
Supplemental Oxygen Injection (O&M)	0.1		\$ 40,500	\$ 4,050
			Subtotal	\$ 1,046,490
			Oversight & Reporting (30%)	\$ 313,947
			TOTAL ANNUAL COSTS	\$ 1,360,437

DO - dissolved oxygen

BOD - biochemical oxygen demand

O&M - Operations and Maintenance

RM - River Mile

CAPITAL COSTS	\$ 85,009,676
ANNUAL COSTS	\$ 1,360,437

TOTAL OPINION OF PROBABLE COSTS FOR 20 YEARS \$ 86,370,113
\$ 112,218,416

Prepared By:

Checked By:

TABLE 5.4 Concept 1 Alternative 4D - Speece Cone & Discharge Collection Network Alternative

Cost Assessment for Design Phase I Step 4

**Identification and Screening Level Evaluation of Measures to Improve Dissolved Oxygen in the Savannah River Estuary
Savannah Harbor Expansion Project & Savannah Harbor Ecosystem Restoration Study
Chatham County, Georgia**

MAJOR ASSUMPTIONS

TMDL proposed DO Standard requirements and Current (1999) BOD loadings
Required Point Source BOD reduction 503,500 lbs/day
Required Nonpoint Source BOD reduction is Not Applicable
Total Oxygen Requirements = 503,500 lbs/day
Supplemental DO needed during summer months
Harbor injection technology capable of 240,000 lbs O2/day
Inject near midpoint of Hutchinson Island
Discharge Collection Network (Includes Weyerhaeuser, IP Savannah, and President Street discharge)
Supplemental Oxygen Injection for 10 miles capable of 80,000 lbs O2/day
(requires 22 injectors and 44 nozzles every 2400 feet)
Storage pond system (30 day retention) to Direct Outfall Discharge to Back River
Rolling maintenance shut downs for 8 weeks reduces Speece cone O&M
50 % BOD loading reduction from discharger during the scheduled facility maintenance period
(assumes 2-weeks to perform required facility maintenance for top five dischargers)
Additional load reduction may be possible if shutdowns are implemented basin wide for every discharger
O&M costs were based on a 90 day operation schedule. However, based on river flows, operation may be limited
and thereby substantially reducing O&M costs.
Costs NOT included in the estimate:
Land Acquisition/Right of Way and required local, state and federal permitting
Construction for electrical service or costs for diesel generators

Item	Quantity	Unit	Unit Cost	Opinion of Probable Cost
CAPITAL COSTS				
Harbor injection technology (Speece Cone)	24	cone	\$ 425,000	\$ 10,200,000
Harbor injection technology (PSA O2 plant)	24	cone	\$ 325,000	\$ 7,800,000
Supplemental Oxygen Injection	10	mile	\$ 40,500	\$ 405,000
Discharge Collection Network 30-day HRT Pond (Option 1-B)	1	network	\$ 39,556,271	\$ 39,556,271
Rolling Maintenance Shut Down (IP Augusta)	2	weeks	\$ -	\$ -
Rolling Maintenance Shut Down (GA Pacific)	2	weeks	\$ -	\$ -
Rolling Maintenance Shut Down (Weyerhaeuser)	2	weeks	\$ -	\$ -
Rolling Maintenance Shut Down (IP Savannah)	2	weeks	\$ -	\$ -
Subtotal				\$ 57,961,271
Oversight (15%)				\$ 8,694,191
Contingency (50%)				\$ 28,980,636
TOTAL CAPITAL COSTS				\$ 95,636,097
ANNUAL COSTS				
Speece Cone O&M plus O2 generation energy	34	day	\$ 11,520	\$ 391,680
Speece Cone O&M plus O2 generation energy (IP Augusta shutdown)	14	day	\$ 8,160	\$ 114,240
Speece Cone O&M plus O2 generation energy (GA Pacific shutdown)	14	day	\$ 10,560	\$ 147,840
Speece Cone O&M plus O2 generation energy (Weyerhaeuser shutdown)	14	day	\$ 11,040	\$ 154,560
Speece Cone O&M plus O2 generation energy (IP Savannah shutdown)	14	day	\$ 5,280	\$ 73,920
Supplemental Oxygen Injection (energy required)	90	day	\$ 1,780	\$ 160,200
Supplemental Oxygen Injection (O&M)	0.1		\$ 40,500	\$ 4,050
Subtotal				\$ 1,046,490
Oversight & Reporting (30%)				\$ 313,947
TOTAL ANNUAL COSTS				\$ 1,360,437

DO - dissolved oxygen
 BOD - biochemical oxygen demand
 O&M - Operations and Maintenance

CAPITAL COSTS	\$	95,636,097
ANNUAL COSTS	\$	1,360,437
TOTAL OPINION OF PROBABLE COSTS	\$	96,996,534
TOTAL OPINION OF PROBABLE COSTS FOR 20 YEARS	\$	122,844,837

Prepared By:
Checked By:

Summary Information

	Design Alternative	Description	Capital Costs ¹	Annual Operating Costs	Total Life Cycle Costs
			(\$)	(\$)	(\$)
Phase 1, Step 1	Concept 1 Alternative 1A	29 Speece cones	37,516,140	1,628,640	68,460,300
Phase 1, Step 1	Concept 1 Alternative 1B	29 Speece cones + rolling maintenance shutdowns	37,315,212	1,427,712	64,441,740
Phase 1, Step 1	Concept 1 Alternative 1C	Discharge Collection Network 60 day retention	71,671,710	213,525	75,728,685
Phase 1, Step 1	Concept 1 Alternative 1C	Discharge Collection Network 30 day retention	62,495,958	213,525	66,766,458
Phase 1, Step 2	Concept 1 Alternative 2A	73 Speece Cones	94,437,180	4,099,680	172,331,100
Phase 1, Step 2	Concept 1 Alternative 2B	73 Speece Cones + rolling maintenance shutdowns	94,236,252	3,898,752	168,312,540
Phase 1, Step 2	Concept 1 Alternative 2C	Speece Cones with Discharge Network and Storage System	117,695,094	2,258,997	160,616,037
Phase 1, Step 3	Concept 1 Alternative 3A	7 Speece cones	9,055,620	393,120	16,524,900
Phase 1, Step 3	Concept 1 Alternative 3B	7 Speece cones + rolling maintenance shutdowns	8,907,108	244,608	13,554,660
Phase 1, Step 3	Concept 1 Alternative 3C	Seaward Discharge	54,854,951	213,525	58,911,926
Phase 1, Step 4	Concept 1 Alternative 4A	50 Speece Cones	64,683,000	2,808,000	118,035,000
Phase 1, Step 4	Concept 1 Alternative 4B	50 Speece cones + rolling maintenance shutdowns	64,482,072	2,607,072	114,016,440
Phase 1, Step 4	Concept 1 Alternative 4C	Speece Cone & Seaward Pipeline with Timed Tidal Discharge	86,370,113	1,360,437	112,218,416
Phase 1, Step 4	Concept 1 Alternative 4D	Speece Cone & Discharge Collection Network	96,996,534	1,360,437	122,844,837

Notes

1) Cost do not include land acquisition/right of way, required local, state, and federal permitting, construction for electrical service or costs for diesel generators.

TABLE 5.5 Concept 2 Alternative 1A - Harbor Injection Technology

**Cost Assessment for Design Phase II Step 1
Identification and Screening Level Evaluation of Measures to Improve Dissolved Oxygen in the Savannah River Estuary
Savannah Harbor Expansion Project & Savannah Harbor Ecosystem Restoration Project
Chatham County, Georgia**

MAJOR ASSUMPTIONS

Phase I requirements have been met, using one of the first four design packets

Total Oxygen Requirements = 72,818 lbs/day

50 foot barge available for use and no storage expense

O&M costs were based on a 90 day operation schedule. However, based on river flows, operation may be limited to several days per year thereby substantially reducing O&M costs.

Costs NOT included in the estimate:

Land Acquisition/Right of Way and required local, state and federal permitting

Construction for electrical service or costs for diesel generators

Item	Quantity	Unit	Unit Cost	Opinion of Probable Cost
CAPITAL COSTS				
Harbor injection technology (Speece Cone)	8	cone	\$ 425,000	\$ 3,400,000
Harbor injection technology (PSA O ₂ plant)	8	cone	\$ 325,000	\$ 2,600,000
				\$ -
			Subtotal	\$ 6,000,000
			Oversight (15%)	\$ 900,000
			Contingency (50%)	\$ 3,000,000
			TOTAL CAPITAL COSTS	\$ 9,900,000
ANNUAL COSTS				
Speece Cone O&M plus O ₂ generation energy	90	day	\$ 3,840	\$ 345,600
				\$ -
			Subtotal	\$ 345,600
			Oversight & Reporting (30%)	\$ 103,680
			TOTAL ANNUAL COSTS	\$ 449,280

O&M - Operations and Maintenance

CAPITAL COSTS	\$ 9,900,000
ANNUAL COSTS	\$ 449,280
TOTAL OPINION OF PROBABLE COSTS	\$ 10,349,280
TOTAL OPINION OF PROBABLE COSTS FOR 20 YEARS	\$ 18,885,600

Prepared By:

Checked By:

TABLE 5.6 Concept 2 Alternative 2A - Harbor Injection Technology

**Cost Assessment for Design Phase II Step 2
Identification and Screening Level Evaluation of Measures to Improve Dissolved Oxygen in the Savannah River Estuary
Savannah Harbor Expansion Project & Savannah Harbor Ecosystem Restoration Project
Chatham County, Georgia**

MAJOR ASSUMPTIONS

Phase I requirements have been met, using one of the first four design packets

Total Oxygen Requirements = 145,636 lbs/day

50 foot barge available for use and no storage expense

O&M costs were based on a 90 day operation schedule. However, based on river flows, operation may be limited to several days per year thereby substantially reducing O&M costs.

Costs NOT included in the estimate:

Land Acquisition/Right of Way and required local, state and federal permitting

Construction for electrical service or costs for diesel generators

Item	Quantity	Unit	Unit Cost	Opinion of Probable Cost
CAPITAL COSTS				
Harbor injection technology (Speece Cone)	15	cone	\$ 425,000	\$ 6,375,000
Harbor injection technology (PSA O ₂ plant)	15	cone	\$ 325,000	\$ 4,875,000
				\$ -
			Subtotal	\$ 11,250,000
			Oversight (15%)	\$ 1,687,500
			Contingency (50%)	\$ 5,625,000
			TOTAL CAPITAL COSTS	\$ 18,562,500
ANNUAL COSTS				
Speece Cone O&M plus O ₂ generation energy	90	day	\$ 7,200	\$ 648,000
				\$ -
			Subtotal	\$ 648,000
			Oversight & Reporting (30%)	\$ 194,400
			TOTAL ANNUAL COSTS	\$ 842,400

O&M - Operations and Maintenance

CAPITAL COSTS	\$ 18,562,500
ANNUAL COSTS	\$ 842,400
TOTAL OPINION OF PROBABLE COSTS	\$ 19,404,900
TOTAL OPINION OF PROBABLE COSTS FOR 20 YEARS	\$ 35,410,500

Prepared By:

Checked By:

TABLE 5.7 Concept 2 Alternative 3A - Harbor Injection Technology

**Cost Assessment for Design Phase II Step 3
Identification and Screening Level Evaluation of Measures to Improve Dissolved Oxygen in the Savannah River Estuary
Savannah Harbor Expansion Project & Savannah Harbor Ecosystem Restoration Project
Chatham County, Georgia**

MAJOR ASSUMPTIONS

Phase I requirements have been met, using one of the first four design packets

Total Oxygen Requirements = 218,455 lbs/day

50 foot barge available for use and no storage expense

O&M costs were based on a 90 day operation schedule. However, based on river flows, operation may be limited to several days per year thereby substantially reducing O&M costs.

Costs NOT included in the estimate:

Land Acquisition/Right of Way and required local, state and federal permitting

Construction for electrical service or costs for diesel generators

Item	Quantity	Unit	Unit Cost	Opinion of Probable Cost
CAPITAL COSTS				
Harbor injection technology (Speece Cone)	22	cone	\$ 425,000	\$ 9,350,000
Harbor injection technology (PSA O ₂ plant)	22	cone	\$ 325,000	\$ 7,150,000
				\$ -
			Subtotal	\$ 16,500,000
			Oversight (15%)	\$ 2,475,000
			Contingency (50%)	\$ 8,250,000
			TOTAL CAPITAL COSTS	\$ 27,225,000
ANNUAL COSTS				
Speece Cone O&M plus O ₂ generation energy	90	day	\$ 10,560	\$ 950,400
				\$ -
			Subtotal	\$ 950,400
			Oversight & Reporting (30%)	\$ 285,120
			TOTAL ANNUAL COSTS	\$ 1,235,520

O&M - Operations and Maintenance

CAPITAL COSTS	\$	27,225,000
ANNUAL COSTS	\$	1,235,520
TOTAL OPINION OF PROBABLE COSTS	\$	28,460,520
TOTAL OPINION OF PROBABLE COSTS FOR 20 YEARS	\$	51,935,400

Prepared By:
Checked By:

TABLE 5.8 Concept 2 Alternative 4A - Harbor Injection Technology

**Cost Assessment for Design Phase II Step 4
Identification and Screening Level Evaluation of Measures to Improve Dissolved Oxygen in the Savannah River Estuary
Savannah Harbor Expansion Project & Savannah Harbor Ecosystem Restoration Project
Chatham County, Georgia**

MAJOR ASSUMPTIONS

Phase I requirements have been met, using one of the first four design packets

Total Oxygen Requirements = 291,273 lbs/day

50 foot barge available for use and no storage expense

O&M costs were based on a 90 day operation schedule. However, based on river flows, operation may be limited to several days per year thereby substantially reducing O&M costs.

Costs NOT included in the estimate:

Land Acquisition/Right of Way and required local, state and federal permitting

Construction for electrical service or costs for diesel generators

Item	Quantity	Unit	Unit Cost	Opinion of Probable Cost
CAPITAL COSTS				
Harbor injection technology (Speece Cone)	29	cone	\$ 425,000	\$ 12,325,000
Harbor injection technology (PSA O ₂ plant)	29	cone	\$ 325,000	\$ 9,425,000
				\$ -
			Subtotal	\$ 21,750,000
			Oversight (15%)	\$ 3,262,500
			Contingency (50%)	\$ 10,875,000
			TOTAL CAPITAL COSTS	\$ 35,887,500
ANNUAL COSTS				
Speece Cone O&M plus O ₂ generation energy	90	day	\$ 13,920	\$ 1,252,800
				\$ -
			Subtotal	\$ 1,252,800
			Oversight & Reporting (30%)	\$ 375,840
			TOTAL ANNUAL COSTS	\$ 1,628,640

O&M - Operations and Maintenance

CAPITAL COSTS	\$ 35,887,500
ANNUAL COSTS	\$ 1,628,640
TOTAL OPINION OF PROBABLE COSTS	\$ 37,516,140
TOTAL OPINION OF PROBABLE COSTS FOR 20 YEARS	\$ 68,460,300

Prepared By:

Checked By:

Summary Information

	Design Alternative	Description	Capital Costs ¹ (\$)	Annual Operating Costs (\$)	Total Life Cycle Costs (\$)
Phase 2, Step 1	Concept 2 Alternative 1A	8 Speece cones	10,349,280	449,280	18,885,600
Phase 2, Step 2	Concept 2 Alternative 2A	15 Speece cones	19,404,900	842,400	35,410,500
Phase 2, Step 3	Concept 2 Alternative 3A	22 Speece cones	28,460,520	1,235,520	51,935,400
Phase 2, Step 4	Concept 2 Alternative 4A	29 Speece cones	37,516,140	1,628,640	68,460,300

Notes

1) Cost do not include land acquisition/right of way, required local, state, and federal permitting, construction for electrical service or costs for diesel generators.

Prepared By:

Checked By: