

WWTP
Improvements



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SECONDARY PROCESS DISCUSSION

City of Newberg WWTP
Wastewater Master Plan
Monday April 24, 2017



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01 Recap

02 Flows and Loads

03 Technology Options

PURPOSE OF WORKSHOP

- Provide an overview of numerous secondary treatment alternatives to meet planning period
- Shortlist 3 alternatives to detail for Master Plan



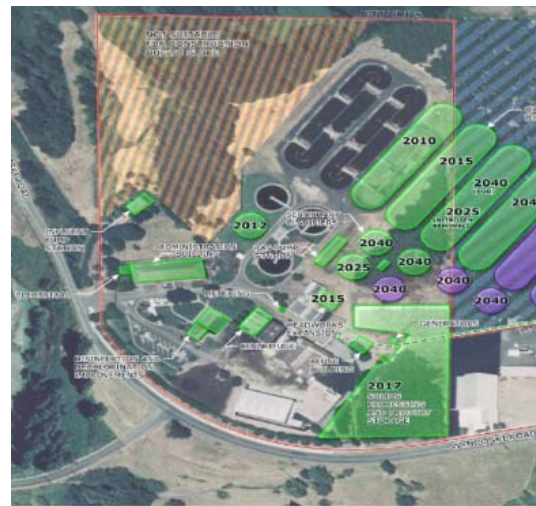
01 RECAP

HISTORICAL TIMELINE

- Sewerage Master Plan Update, June 2007
- Facilities Plan Update, Revised October 2007

- Technologies Considered 2007

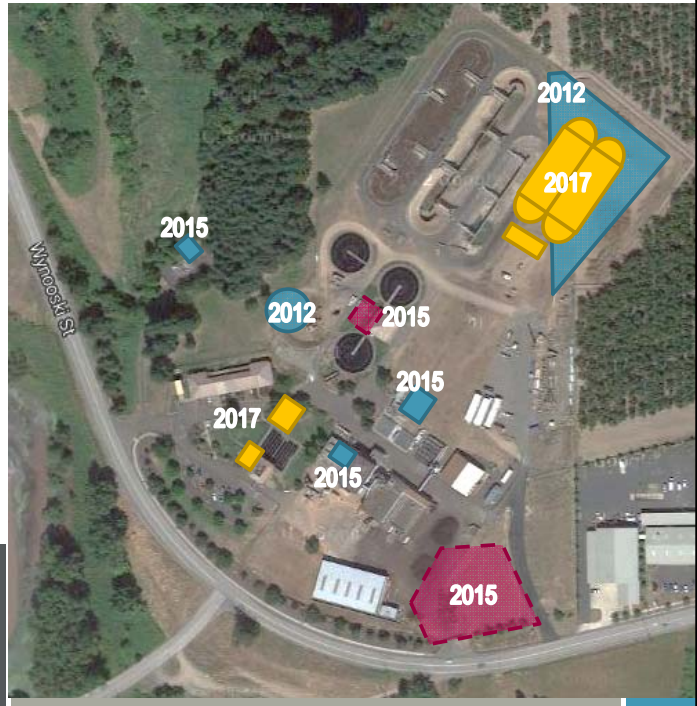
Alternative 1: Conventional oxidation ditch
 Alternative 2: Vertical loop reactors (VLR) oxidation ditch
 Alternative 3: Cannibal
 Alternative 4: Membrane bioreactors (MBRs)



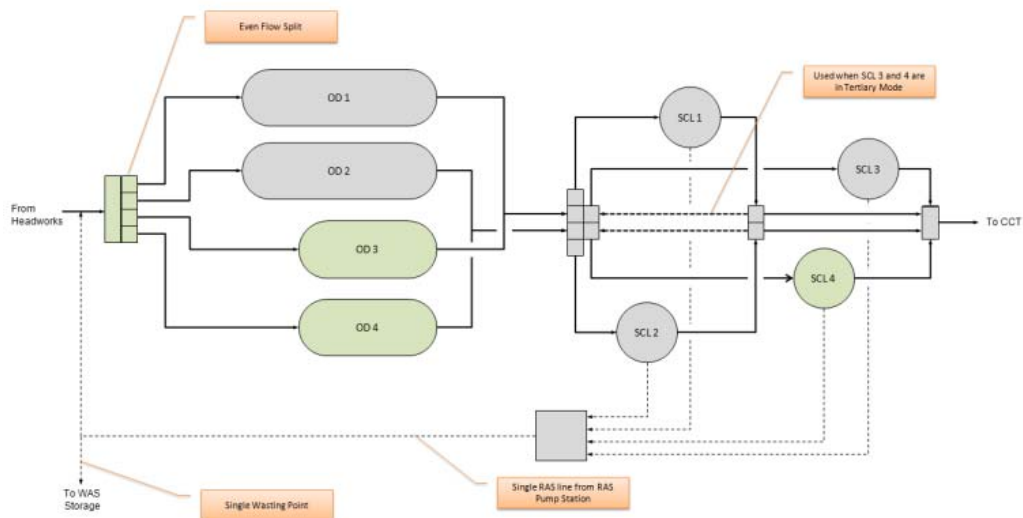
Newberg City 2040 Wastewater Expansion Project

HISTORICAL TIMELINE

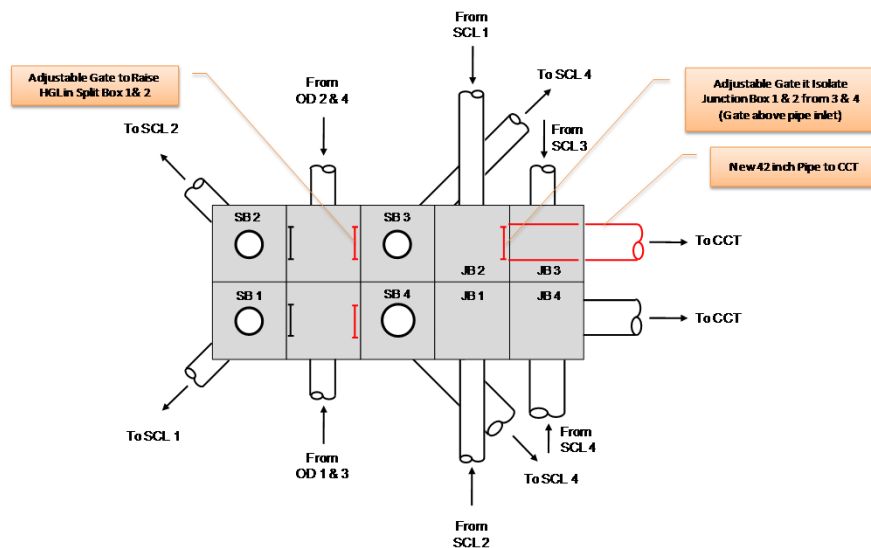
- Sewerage Master Plan Update, June 2007
- Facilities Plan Update, Revised October 2007
- Preliminary Design Report, July 2012
 - 2 new straight wall oxidation ditches
 - New RDS/RAS split box
 - New blower building
 - 2012 Cost = \$14,650,000



EXISTING LIMITATIONS

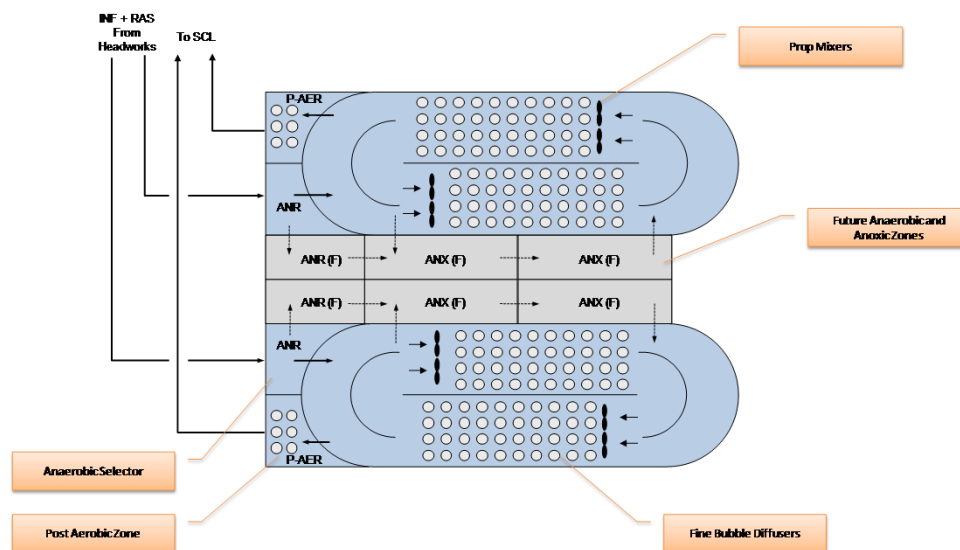


EXISTING LIMITATIONS



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EXISTING LIMITATIONS



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EXISTING LIMITATIONS

- Oxidation Ditches
 - Original Design Capacity
 - Today operated as Conventional Activated Sludge
- Secondary Clarifiers
 - Typical peak loading rate of 1,200 gal/sf/d (max. 24.1 mgd)
 - Max solids load limits MLSS
- Equalization basin leaking
- Reliability and resiliency
- Peak flow management



EXISTING LIMITATIONS

- Clarifiers:
 - 5,000 sf each
 - 24 mgd peak flow @ 1,200 gal/sf/d
 - Max MLSS @ 700 gal/sf/d and 25 lb/sf/d = 2000 mg/L
- Oxidation ditches
 - Max BOD Load @ 2000 mg/L and 12 day SRT = 8,000 lb/d
 - Max Oxygen supply: 2 lb/hp/hr = 19,000 lb/d





02 FLOW AND LOADING PROJECTIONS

WW MASTER PLAN PROJECTIONS

- Uses current flows/loadings and recent population growth projections

Parameter	Unit	2017				2037			
		AAD	MMDW	MMWW	PD	AAD	MMDW	MMWW	PD
INF Flow	MGD	3.50	4.73	9.98	21.9	5.28	7.13	13.0	25.9
INF TSS	lb/d	5,950	8,000	10,150	20,000	9,000	12,050	15,300	30,100
INF BOD	lb/d	3,300	4,300	6,550	7,450	4,950	6,500	9,850	11,250
INF NH4	lb/d	370	450	460	550	550	680	690	830

TREATMENT REQUIREMENTS

Parameters	Current Discharge Requirements	2037 Planning Period
Effluent Requirements		
Dry-Weather (May 1-October 31)		
cBOD ₅ , monthly/weekly averages (mg/L)	10/15	10/15
TSS, monthly/weekly averages (mg/L)	10/15	10/15
Wet-Weather (November 1 to April 30)		
cBOD ₅ , monthly/weekly averages (mg/L)	25/40	25/40
TSS, monthly/weekly averages (mg/L)	30/45	30/45
Year-Round Requirements		
cBOD ₅ and TSS Removal Efficiency	85% Removal	85% Removal
Total Phosphorus (mg/L)	NA	1.0
Toxics (mg/L)	NA	NA ²



03

TECHNOLOGY OPTIONS

OXIDATION DITCH

- OD = Operated as activated sludge with long SRT (>20 days) and long HRT (24 - 48 hours)
- Low yield
- Low oxygen update rate
- Low O&M requirements (hands-off operation)
- Surface aeration
- Shallow basins (12 ft)



OD – OXYSTREAM WESTECH

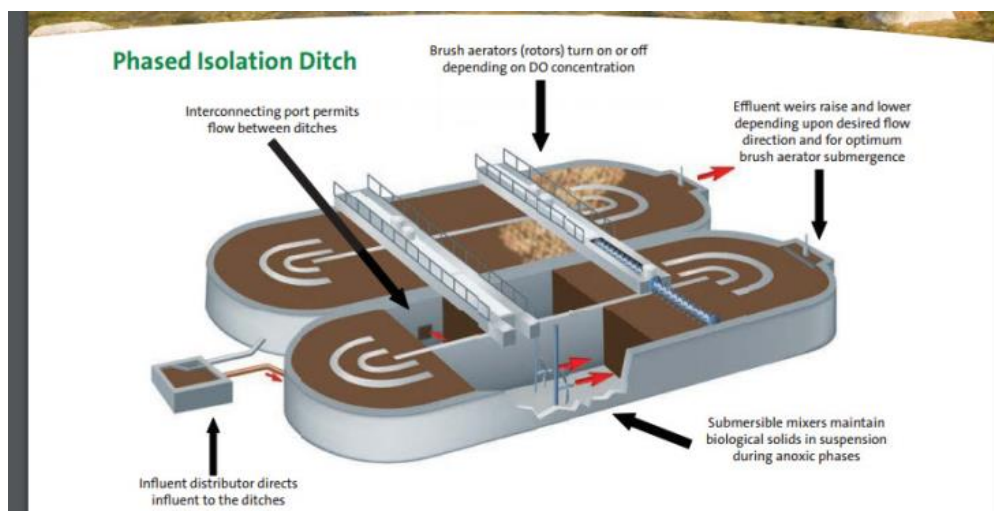


OXIDATION DITCH – ORBAL (EVOQUIA)



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OD – PHASED ISOLATION D. (KRUGER)



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OD – SCREIBER



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OD – BIOLAC (PARSON)



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OD – MORE OF THE SAME

- Add diffusers
- Contact stabilization options
- Equalization basin



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CONVENTIONAL ACTIVATED SLUDGE

- $SRT = f(\text{effluent requirements or targets})$
- Fine bubble diffusers
- Deeper basins
- Higher MLSS
- Higher yields
- Higher OUR
- Custom Solutions to fit site and effluent requirements

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CAS – SILVERTON, OR



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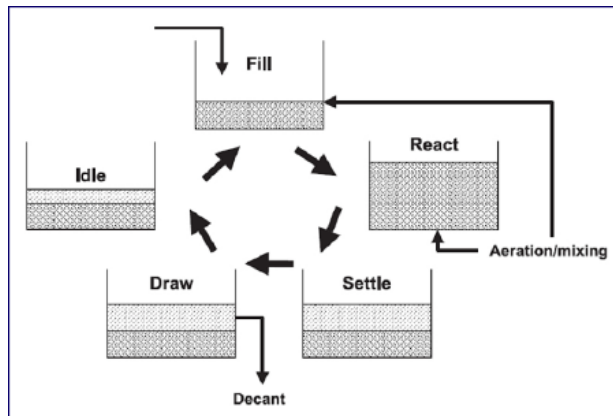
CAS – COLUMBIA FALLS, MT



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SEQUENCING BATCH REACTORS (SBR)

- Activated sludge process
- No clarifiers needed
- Usually fill and draw cycles
- Square or round basins
- Fine bubble diffusers
- Longer sludge ages



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SEQUENCING BATCH REACTORS (SBR)



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MOVING BED BIOFILM REACTOR (MBBR)

- Biofilm Process
- No EBPR
- No clarifiers, no RAS
- Filter or DAFT for solids retention
- Compact process
- Could take peak flows
- Capacity = $f(\text{fill rate})$



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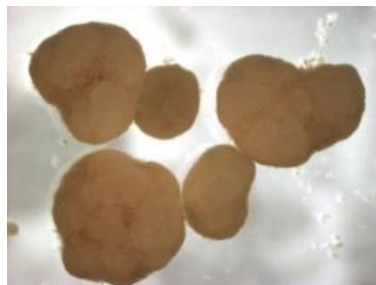
MBBR



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GRANULAR ACTIVATED SLUDGE

- Granular sludge
- No clarifier
- SBR operation
- Small footprint
- Good nutrient removal



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GRANULAR ACTIVATED SLUDGE



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OTHER OPTIONS

- Adding Primary Treatment (i.e. salsness filter)
- Large equalization basin/pond
- CAS with BOD removal only
- Control peak flows outside of plant
 - I&I control?

**HDR**

SUMMARY

- Clarifiers remain main bottleneck
- Rerating clarifiers can increase capacity up to hydraulic limit
- Brush aerators limiting oxygen supply
- Oxidation ditches operate well above original design capacity
- Decision – expanding existing or adding parallel process
- Adding parallel process simpler and easier to expand in the future

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Meeting Minutes

Project: City of Newberg Wastewater Master Plan Update

Subject: Secondary Process Expansion

Date: Monday, April 24, 2017

Location: Newberg WWTP

Attendees: Kaaren Hofmann, Newberg
Craig Pack, Newberg
Terry Hinzman, Newberg
Ed Thomas, Newberg
Sean Surcamp, Newberg
April Catan, Newberg

Karen Bill, HDR
Mario Benisch, HDR

Meeting Purpose

The objective of this workshop was to discuss the development of alternatives for secondary treatment expansion. The goals of the meeting were 1) provide overview of numerous alternatives to meet planning period and 2) narrow alternatives to the top three for further analysis.

Meeting Summary

Overview:

- Provided recap of secondary treatment alternatives considered in 2007 Facilities Plan Update and 2012 Predesign Report
- Discussed existing limitations
 - Secondary clarifier hydraulic loading rate – recommend rerating
 - City comment that solids washout can occur at MLSS of 2,000-2,500 mg/L
 - Oxygen transfer limitation
 - City comment that oxidation ditch hydraulics is the biggest concern
- Review of planning projections and treatment requirements
- Operational considerations
 - City wants to continue to operate in nitrification mode
 - Expansion can either add a parallel plant (new technology) or integrate into the existing process (additional oxidation ditch)
 - Contact stabilization may

Technology Options:

- Oxidation ditch:
 - Reviewed many vendor provided systems compared to City's configuration
- Conventional activated sludge
 - City operates the existing oxidation ditches in a CAS-like mode
- Sequencing batch reactor (SBR)
 - Terry has experience with ABJ continuous flow SBR from previous job

- Talked positively about the process
- MBBR
 - Biofilm process
 - Would operate as a separate from the existing oxidation ditches as a parallel process
 - Good alternative for peak flow treatment
 - City has some hesitation since they have no experience with it
- Granular Activate Sludge
 - Emerging technology in the US
 - Impacts to dewatering and composting are unknown at this time
 - SBR option could possibly be retrofitted with GAS in future
 - City has reservations do to the new technology in US and uncertain impacts to composting system
- A few other options were quickly discussed but were quickly dismissed (i.e. adding primary treatment or large equalization basin).

Decisions:

- Technologies shortlisted to:
 - Oxidation ditch expansion – expansion of existing process to maintain a single plant. Also will likely require additional secondary clarifiers.
 - SBR – Terry's past experience with the process is positive. SBR would eliminate the need for additional clarifiers, as it is an all-in-one approach.
 - MBBR – good option for peak flow management. OK, to keep in for evaluation.

CLASS 5 OPINION OF PROBABLE CONSTRUCTION COSTS**- Summary Sheet**

Project	Newberg WW Master Plan Update	Date	13-Dec-17	
		Estimator	CLR	
Task	Cost Summary	Checked By	MB	
		Updated	KB	18-Jan-17

HDR Engineering, Inc.

Unit Prices updated based upon 20 City ENR Construction Cost Index Ratio

Ratio = 1.000

	1.00	Future Date	1.00
			Total (\$)
Alternative 1B			
Oxidation Ditch			
<i>includes:</i>			
Secondary Clarifier Rerating Study (added after construction Subtotals)			
Oxidation Ditch			\$ 4,630,000
Blower Building			\$ 1,540,000
Secondary Clarifier and RAS Pump Station			\$ 4,060,000
Subtotal A			\$ 10,230,000
Mobilization, Bonds, and Insurance			5% \$ 510,000
Contractor's Overhead and Profit			15% \$ 1,530,000
Subtotal B			\$ 12,270,000
Miscellaneous Items and Contingencies			25% \$ 3,070,000
Subtotal C			\$ 15,340,000
Design Engineering			10% \$ 1,530,000
Engineering Services During Construction			8% \$ 1,230,000
Construction Management and Inspection			5% \$ 770,000
Other Indirect Costs			5% \$ 770,000
Subtotal D			\$ 19,640,000
Sales Tax			0% \$ -
Subtotal E			\$ 19,640,000
Secondary Clarifier Rerating Study			\$ 60,000
Total			\$ 19,700,000
Alternative 2			
Sequencing Batch Reactor			
<i>includes:</i>			
SBR			\$ 10,040,000
Blower Building			\$ 1,540,000
Subtotal A			\$ 11,580,000
Mobilization, Bonds, and Insurance			5% \$ 580,000
Contractor's Overhead and Profit			15% \$ 1,740,000
Subtotal B			\$ 13,900,000
Miscellaneous Items and Contingencies			25% \$ 3,480,000
Subtotal C			\$ 17,380,000
Design Engineering			10% \$ 1,740,000
Engineering Services During Construction			8% \$ 1,390,000
Construction Management and Inspection			5% \$ 870,000
Other Indirect Costs			5% \$ 870,000
Subtotal D			\$ 22,250,000
Sales Tax			0% \$ -
Total			\$ 22,250,000

Alternative No. 3		
Moving Bed Bioreactor		
<i>includes:</i>		
Secondary Clarifier Rerating Study (added after construction Subtotals)		
Fine Screenings Upgrades	\$	498,000
MBBR	\$	4,121,000
Blower Building	\$	1,540,000
Equalization Basin Structural Rehab	\$	500,000
	Subtotal A	\$ 6,659,000
Mobilization, Bonds, and Insurance	5%	\$ 330,000
Contractor's Overhead and Profit	15%	\$ 1,000,000
	Subtotal B	\$ 7,989,000
Miscellaneous Items and Contingencies	25%	\$ 2,000,000
	Subtotal C	\$ 9,989,000
Design Engineering	10%	\$ 1,000,000
Engineering Services During Construction	8%	\$ 800,000
Construction Management and Inspection	5%	\$ 500,000
Other Indirect Costs	5%	\$ 500,000
	Subtotal D	\$ 12,790,000
Sales Tax	0%	\$ -
	Subtotal E	\$ 12,790,000
Secondary Clarifier Rerating Study		\$ 60,000
	Total	\$ 12,850,000

CLASS 5 OPINION OF PROBABLE CONSTRUCTION COSTS**Blower Building****HDR**

Project	Newberg WW Master Plan Update	Date	13-Dec-17
		Estimator	CLR
Task	Blower Building	Checked By	MB
		Updated	KB 18-Jan-17

Ratio = 1.000

Description	Quantity	Unit	Base Unit Price (\$/unit)	Adjusted Price (\$/unit)	Total (\$)
Division 01 - General Requirements					
Blower Building					
General Conditions, Bidding, Submittals, Start-up	1	LS	\$ 15,195	\$ 15,195	\$ 15,195
Division 03 - Concrete					
Blower Building					
Concrete Slab on Grade - Building	9	CY	\$ 850	\$ 850	\$ 7,870
Miscellaneous					
Equipment Bases	9	CY	\$ 750	\$ 750	\$ 6,750
Division 04 - Masonry					
Blower Building					
CMU Walls	1000	SF	\$ 12	\$ 12	\$ 12,000
Division 05 - Metals					
Blower Building					
Miscellaneous (pipe supports, etc.)	1	LS	\$ 10,000	\$ 10,000	\$ 10,000
Division 07 - Thermal and Moisture Protection					
Blower Building					
Vapor Barrier/Damp Proofing	250	SF	\$ 1	\$ 1	\$ 250
Roof Insulation	250	SF	\$ 2	\$ 2	\$ 500
Sealants and Caulking	1	LS	\$ 1,200	\$ 1,200	\$ 1,200
Membrane Roofing System	250	SF	\$ 25	\$ 25	\$ 6,250
Division 08 - Openings					
Blower Building					
Doors	1	LS	\$ 10,000	\$ 10,000	\$ 10,000
Roll-up Doors	2	EA	\$ 6,000	\$ 6,000	\$ 12,000
Division 09 - Finishes					
Blower Building					
Painting	1050	SF	\$ 25	\$ 25	\$ 26,250
Division 13 - Special Construction					
Blower Building					
Identification, Stenciling and Tagging	1	LS	\$ 5,000	\$ 5,000	\$ 5,000
Division 23 - HVAC					
Blower Building					
Exhaust Fans and Ducts	250	SF	\$ 4	\$ 4	\$ 1,000
Louvers and Vents	2.5	SF	\$ 25	\$ 25	\$ 63
Division 26 - Electrical					
Blower Building					
Electrical	1	LS	\$ 360,000	\$ 360,000	\$ 360,000
Division 31 - Earthwork					
Blower Building					
Excavation	28	CY	\$ 12	\$ 12	\$ 333
Backfill	7	CY	\$ 25	\$ 25	\$ 174
Cast Auger Piles and Installation	250	SF	\$ 120	\$ 120	\$ 30,000

CLASS 5 OPINION OF PROBABLE CONSTRUCTION COSTS

Blower Building

HDR

Project Newberg WW Master Plan Update **Date** 13-Dec-17
Estimator CLR
Task Blower Building **Checked By** MB
Updated KB 18-Jan-17

Ratio = 1.000

Description					
	Quantity	Unit	Base Unit Price (\$/unit)	Adjusted Price (\$/unit)	Total (\$)
Division 40 - Process Interconnections					
Blower Building					
SST LPA Piping	840	LF	\$ 288	\$ 288	\$ 241,920
Piping Installation	1	LS	\$ 241,920	\$ 241,920	\$ 241,920
Instrumentation	1	LS	\$ 175,000	\$ 175,000	\$ 175,000
Division 41 - Materials Processing and Handling Equipment					
Blower Building					
Monorail System	1	LS	\$ 40,000	\$ 40,000	\$ 40,000
Installation	1	LS	\$ 16,000	\$ 16,000	\$ 16,000
Division 46 - Water and Wastewater Equipment					
Blowers					
HST Blowers - 75 HP	3	EA	\$ 75,000	\$ 75,000	\$ 225,000
Installation	1	LS	\$ 90,000	\$ 90,000	\$ 90,000
Subtotal A				\$	1,535,000
Mobilization, Bonds, and Insurance				5%	\$ 77,000
Contractor's Overhead and Profit				15%	\$ 230,000
Subtotal B					\$ 1,842,000
Miscellaneous Items and Contingencies				25%	\$ 461,000
Subtotal C					\$ 2,303,000
Design Engineering				10%	\$ 230,000
Engineering Services During Construction				8%	\$ 184,000
Construction Management and Inspection				5%	\$ 115,000
Other Indirect Costs				5%	\$ 115,000
Subtotal D					\$ 2,947,000
Sales Tax				0%	\$ -
Total Estimated Probable Project Cost					\$ 2,947,000

CLASS 5 OPINION OF PROBABLE CONSTRUCTION COSTS**Secondary Clarifier Expansion****HDR**

Project	Newberg WW Master Plan Update	Date	13-Dec-17
		Estimator	CLR
Task	Secondary Clarifier Expansion	Checked By	MB
	and RAS Pump Station	Updated	KB 18-Jan-17

Ratio = 1.000

Description					
	Quantity	Unit	Base Unit Price (\$/unit)	Adjusted Price (\$/unit)	Total (\$)
Division 01 - General Requirements					
Secondary Clarifier Expansion					
General Conditions, Bidding, Submittals, Start-up	1	LS	\$ 40,182	\$ 40,182	\$ 40,182
Division 03 - Concrete					
Secondary Clarifier Expansion					
Concrete Footing and Slab	372	CY	\$ 850	\$ 850	\$ 316,486
Concrete Walls	279	CY	\$ 950	\$ 950	\$ 265,290
RAS Pump Station					
Concrete Footing and Slab	15	CY	\$ 850	\$ 850	\$ 12,593
Concrete Basement Walls	9	CY	\$ 950	\$ 950	\$ 8,444
Equipment Bases	10	CY	\$ 750	\$ 750	\$ 7,500
Concrete Elevated Slab	15	CY	\$ 950	\$ 950	\$ 14,074
SE Junction Box	10	CY	\$ 750	\$ 750	\$ 7,500
Division 04 - Masonry					
RAS Pump Station					
CMU Blocks Walls	3360	SF	\$ 12	\$ 12	\$ 40,320
Division 05 - Metals					
Secondary Clarifier Expansion					
Catwalk	1	EA	\$ 50,000	\$ 50,000	\$ 50,000
RAS Pump Station					
Metal Stairs	100	SF	\$ 60	\$ 60	\$ 6,000
Miscellaneous Metals (handrails, grating, etc.)	1	LS	\$ 10,000	\$ 10,000	\$ 10,000
Division 07 - Thermal and Moisture Protection					
RAS Pump Station					
Vapor Barrier/Damp Proofing	600	SF	\$ 1	\$ 1	\$ 600
Roof Insulation	600	SF	\$ 2	\$ 2	\$ 1,200
Sealants and Caulking	1	LS	\$ 2,500	\$ 2,500	\$ 2,500
Membrane Roofing System	600	SF	\$ 25	\$ 25	\$ 15,000
Division 08 - Openings					
RAS Pump Station					
Doors	1	LS	\$ 15,000	\$ 15,000	\$ 15,000
Division 09 - Finishes					
Secondary Clarifier Expansion					
Coatings	1	LS	\$ 60,000	\$ 60,000	\$ 60,000
Division 13 - Special Construction					
Secondary Clarifier Expansion					
Identification, Stenciling and Tagging	1	LS	\$ 10,000	\$ 10,000	\$ 10,000

CLASS 5 OPINION OF PROBABLE CONSTRUCTION COSTS**Secondary Clarifier Expansion****HDR**

Project	Newberg WW Master Plan Update	Date	13-Dec-17
		Estimator	CLR
Task	Secondary Clarifier Expansion	Checked By	MB
	and RAS Pump Station	Updated	KB 18-Jan-17

Ratio = 1.000

Description	Quantity	Unit	Base Unit Price (\$/unit)	Adjusted Price (\$/unit)	Total (\$)
Division 23 - HVAC					
RAS Pump Station					
Exhaust Fans and Ducts	600	SF	\$ 4	\$ 4	\$ 2,400
Louvers and Vents	6	SF	\$ 25	\$ 25	\$ 150
Division 26 - Electrical					
Secondary Clarifier Expansion and RAS Pump Station					
Electrical	1	LS	\$ 640,000	\$ 640,000	\$ 640,000
Division 31 - Earthwork					
Secondary Clarifier Expansion					
Excavation	2234	CY	\$ 12	\$ 12	\$ 26,808
Dewatering	1	EA	\$ 125,000	\$ 125,000	\$ 125,000
Backfill	800	CY	\$ 25	\$ 25	\$ 20,000
General Site Work	1	LS	\$ 91,664	\$ 91,664	\$ 91,664
Cast Auger Piles and Installation	6100	SF	\$ 120	\$ 120	\$ 732,000
Junction/Split Boxes					
Excavation	500	CY	\$ 12	\$ 12	\$ 6,000
Division 40 - Process Interconnections					
Secondary Clarifier Piping					
36-IN ML Piping	85	LF	\$ 432	\$ 432	\$ 36,720
24-IN SE Piping	300	LF	\$ 288	\$ 288	\$ 86,400
14-IN RAS Piping	250	LF	\$ 168	\$ 168	\$ 42,000
Piping Installation	1	LS	\$ 165,120	\$ 165,120	\$ 165,120
RAS Pump Room					
14-IN RAS Piping	150	LF	\$ 168	\$ 168	\$ 25,200
Plug valves	6	EA	\$ 2,500	\$ 2,500	\$ 15,000
Check valves	2	EA	\$ 3,000	\$ 3,000	\$ 6,000
Water piping and valves	1	LS	\$ 15,000	\$ 15,000	\$ 15,000
Miscellaneous piping (floor drains, etc.)	1	LS	\$ 10,000	\$ 10,000	\$ 10,000
Piping and Valve Installation	1	LS	\$ 71,200	\$ 71,200	\$ 71,200
SE Piping between CDB and CCB					
24-IN SE Piping	250	LF	\$ 288	\$ 288	\$ 72,000
Piping Installation	1	LS	\$ 72,000	\$ 72,000	\$ 72,000
RDS Split Box					
Weir Gates	3	EA	\$ 20,000	\$ 20,000	\$ 60,000
RAS Split Box	3	EA	\$ 20,000	\$ 20,000	\$ 60,000
Instrumentation	1	LS	\$ 200,000	\$ 200,000	\$ 200,000
Division 43 - Process Gas and Liquid Handling, Purification, and Storage Equipment					
RAS Pump Station					
Centrifugal Pumps	2	EA	\$ 50,000	\$ 50,000	\$ 100,000
Equipment Installation	1	LS	\$ 40,000	\$ 40,000	\$ 40,000

CLASS 5 OPINION OF PROBABLE CONSTRUCTION COSTS**Secondary Clarifier Expansion****HDR**

Project	Newberg WW Master Plan Update	Date	13-Dec-17
		Estimator	CLR
Task	Secondary Clarifier Expansion	Checked By	MB
	and RAS Pump Station	Updated	KB 18-Jan-17

Ratio = 1.000

Description					
	Quantity	Unit	Base Unit Price (\$/unit)	Adjusted Price (\$/unit)	Total (\$)
Division 46 - Water and Wastewater Equipment					
Secondary Clarifier Expansion					
Mechanism (304L SST)	1	EA	\$ 250,000	\$ 250,000	\$ 250,000
Launders	1	EA	\$ 75,000	\$ 75,000	\$ 75,000
Equipment Installation	1	LS	\$ 130,000	\$ 130,000	\$ 130,000
Subtotal A					\$ 4,058,000
Mobilization, Bonds, and Insurance 5%					\$ 203,000
Contractor's Overhead and Profit 15%					\$ 609,000
Subtotal B					\$ 4,870,000
Miscellaneous Items and Contingencies 25%					\$ 1,217,500
Subtotal C					\$ 6,087,500
Design Engineering 10%					\$ 609,000
Engineering Services During Construction 8%					\$ 487,000
Construction Management and Inspection 5%					\$ 304,000
Other Indirect Costs 5%					\$ 304,000
Subtotal D					\$ 7,792,000
Sales Tax 0%					\$ -
Total Estimated Probable Project Cost					\$ 7,792,000

CLASS 5 OPINION OF PROBABLE CONSTRUCTION COSTS**Oxidation Ditch****HDR**

Project	Newberg WW Master Plan Update	Date	13-Dec-17
		Estimator	CLR
Task	Oxidation Ditch	Checked By	MB
		Updated	KB 18-Jan-17

Ratio = 1.000

Description					
	Quantity	Unit	Base Unit Price (\$/unit)	Adjusted Price (\$/unit)	Total (\$)
Division 01 - General Requirements					
New Ox ditch					
General Conditions, Bidding, Submittals, Start-up	1	LS	\$ 45,865	\$ 45,865	\$ 45,865
Division 03 - Concrete					
New Ox ditch					
Concrete Outside Walls	385	CY	\$ 950	\$ 950	\$ 365,926
Concrete Footing and Slab	990	CY	\$ 850	\$ 850	\$ 841,751
RDS Split Box Expansion					
Concrete	48	CY	\$ 750	\$ 750	\$ 35,741
RAS Split Box Expansion					
Concrete	48	CY	\$ 750	\$ 750	\$ 35,741
ML Control Box 1	15	CY	\$ 750	\$ 750	\$ 11,250
ML Junction Box 2	10	CY	\$ 750	\$ 750	\$ 7,500
Division 05 - Metals					
New Ox ditch					
Above ground AA pipe supports	1	LS	\$ 20,000	\$ 20,000	\$ 20,000
Miscellaneous Metals (handrails, grating, etc.)	1	LS	\$ 60,000	\$ 60,000	\$ 60,000
Division 13 - Special Construction					
New Ox ditch					
Identification, Stenciling and Tagging	1	LS	\$ 15,000	\$ 15,000	\$ 15,000
Division 26 - Electrical					
New Ox ditch					
Electrical	1	LS	\$ 700,000	\$ 700,000	\$ 700,000
Division 31 - Earthwork					
New Ox ditch					
Excavation	9903	CY	\$ 12	\$ 12	\$ 118,835
Dewatering	1	EA	\$ 100,000	\$ 100,000	\$ 100,000
Backfill	1000	CY	\$ 25	\$ 25	\$ 25,000
Cast Auger Piles and Installation	13369	SF	\$ 120	\$ 120	\$ 1,604,278
Division 40 - Process Interconnections					
New Ox ditch					
24-IN RDS Piping	350	LF	\$ 288	\$ 288	\$ 100,800
36-IN ML Effluent Piping	85	LF	\$ 432	\$ 432	\$ 36,720
16-IN AA Piping	100	LF	\$ 192	\$ 192	\$ 19,200
Miscellaneous piping and valves	1	LS	\$ 20,000	\$ 20,000	\$ 20,000
Piping Installation	1	LS	\$ 176,720	\$ 176,720	\$ 176,720
Instrumentation	1	LS	\$ 250,000	\$ 250,000	\$ 250,000

CLASS 5 OPINION OF PROBABLE CONSTRUCTION COSTS**Oxidation Ditch****HDR**

Project	Newberg WW Master Plan Update	Date	13-Dec-17
		Estimator	CLR
Task	Oxidation Ditch	Checked By	MB
		Updated	KB 18-Jan-17

Ratio = 1.000

Description					
Quantity		Unit	Base Unit Price (\$/unit)	Adjusted Price (\$/unit)	Total (\$)
Division 43 - Process Gas and Liquid Handling, Purification, and Storage Equipment					
New Ox ditch	Mixers	2	EA	\$ 15,000	\$ 30,000
	Mixer Installation	1	LS	\$ 12,000	\$ 12,000
Subtotal A					\$ 4,632,000
Mobilization, Bonds, and Insurance				5%	\$ 232,000
Contractor's Overhead and Profit				15%	\$ 695,000
Subtotal B					\$ 5,559,000
Miscellaneous Items and Contingencies				25%	\$ 1,389,750
Subtotal C					\$ 6,948,750
Design Engineering				10%	\$ 695,000
Engineering Services During Construction				8%	\$ 556,000
Construction Management and Inspection				5%	\$ 347,000
Other Indirect Costs				5%	\$ 347,000
Subtotal D					\$ 8,894,000
Sales Tax				0%	\$ -
Total Estimated Probable Project Cost					\$ 8,894,000

CLASS 5 OPINION OF PROBABLE CONSTRUCTION COSTS**SBR****HDR**

Project	Newberg WW Master Plan Update	Date	13-Dec-17
		Estimator	CLR
Task	SBR	Checked By	MB
		Updated	KB 18-Jan-17

Ratio = 1.000

Ratio = 1.000					
Description					
	Quantity	Unit	Base Unit Price (\$/unit)	Adjusted Price (\$/unit)	Total (\$)
Division 01 - General Requirements					
SBR					
General Conditions, Bidding, Submittals, Start-up	1	LS	\$ 99,368	\$ 99,368	\$ 99,368
Division 03 - Concrete					
SBR					
Concrete Outside Walls	809	CY	\$ 950	\$ 950	\$ 768,444
Concrete Footing and Slab	1886	CY	\$ 850	\$ 850	\$ 1,603,335
Equalization Tank Concrete Outside Walls	202	CY	\$ 950	\$ 950	\$ 192,111
Equalization Tank Concrete Footing and Slab	472	CY	\$ 850	\$ 850	\$ 400,834
RDS Split Box Expansion	48	CY	\$ 750	\$ 750	\$ 36,000
SE Junction Box	10	CY	\$ 750	\$ 750	\$ 7,500
Division 05 - Metals					
SBR					
Above ground AA pipe supports	1	LS	\$ 20,000	\$ 20,000	\$ 20,000
Miscellaneous Metals (handrails, grating, etc.)	1	LS	\$ 60,000	\$ 60,000	\$ 60,000
Division 13 - Special Construction					
SBR					
Identification, Stenciling and Tagging	1	LS	\$ 15,000	\$ 15,000	\$ 15,000
Division 26 - Electrical					
SBR					
Electrical	1	LS	\$ 1,000,000	\$ 1,000,000	\$ 1,000,000
Division 31 - Earthwork					
SBR					
Excavation	19950	CY	\$ 12	\$ 12	\$ 239,399
Dewatering	1	EA	\$ 100,000	\$ 100,000	\$ 100,000
Backfill	2043	CY	\$ 25	\$ 25	\$ 51,075
Cast Auger Piles and Installation	25465	SF	\$ 120	\$ 120	\$ 3,055,768
Division 40 - Process Interconnections					
SBR					
24-IN RDS INF Piping	250	LF	\$ 288	\$ 288	\$ 72,000
24-IN SE Piping	420	LF	\$ 288	\$ 288	\$ 120,960
10-WAS Piping	100	LF	\$ 120	\$ 120	\$ 12,000
16-IN AA Piping	100	LF	\$ 192	\$ 192	\$ 19,200
Miscellaneous piping and valves	1	LS	\$ 20,000	\$ 20,000	\$ 20,000
Piping Installation	1	LS	\$ 244,160	\$ 244,160	\$ 244,160
SE Piping between CDB and CCB					
24-IN SE Piping	250	LF	\$ 288	\$ 288	\$ 72,000
Piping Installation	1	LS	\$ 72,000	\$ 72,000	\$ 72,000
Miscellaneous Instrumentation	1	LS	\$ 150,000	\$ 150,000	\$ 150,000
Division 43 - Process Gas and Liquid Handling, Purification, and Storage Equipment					
SBR					
Slide gates	4	EA	\$ 10,000	\$ 10,000	\$ 40,000
RDS Split Box					
Weir Gates	3	EA	\$ 20,000	\$ 20,000	\$ 60,000

CLASS 5 OPINION OF PROBABLE CONSTRUCTION COSTS**SBR****HDR**

Project	Newberg WW Master Plan Update	Date	13-Dec-17
		Estimator	CLR
Task	SBR	Checked By	MB
		Updated	KB 18-Jan-17

Ratio = 1.000

Description					
Quantity		Unit	Base Unit Price (\$/unit)	Adjusted Price (\$/unit)	Total (\$)
Division 46 - Water and Wastewater Equipment					
SBR	Vendor Equipment and Instrumentation	1	EA	\$ 1,075,000	\$ 1,075,000
	Equipment Installation	1	LS	\$ 430,000	\$ 430,000
Subtotal A					\$ 10,036,000
Design Details and Assumptions:					
Vendor equipment includes blowers and all process equipment and instrumentation					
For estimate, the vendor cost of the blower was removed and the 'Blower Building' estimate form is used.					
Mobilization, Bonds, and Insurance				5%	\$ 502,000
Contractor's Overhead and Profit				15%	\$ 1,505,000
Subtotal B					\$ 12,043,000
Miscellaneous Items and Contingencies				25%	\$ 3,010,750
Subtotal C					\$ 15,053,750
Design Engineering				10%	\$ 1,505,000
Engineering Services During Construction				8%	\$ 1,204,000
Construction Management and Inspection				5%	\$ 753,000
Other Indirect Costs				5%	\$ 753,000
Subtotal D					\$ 19,269,000
Sales Tax				0%	\$ -
Total Estimated Probable Project Cost					\$ 19,269,000

CLASS 5 OPINION OF PROBABLE CONSTRUCTION COSTS**Fine Screening****HDR**

Project	Newberg WW Master Plan Update	Date	13-Dec-17
		Estimator	CLR
Task	Fine Screening	Checked By	MB
		Updated	KB 18-Jan-17

Ratio = 1.000

Description	Quantity	Unit	Base Unit Price (\$/unit)	Adjusted Price (\$/unit)	Total (\$)
Division 01 - General Requirements					
Fine Screening					
General Conditions, Bidding, Submittals, Start-up	1	LS	\$ 4,935	\$ 4,935	\$ 4,935
Division 05 - Metals					
Fine Screening					
Miscellaneous (pipe supports, etc.)	1	LS	\$ 23,450	\$ 23,450	\$ 23,450
Division 13 - Special Construction					
Fine Screening					
Identification, Stenciling and Tagging	1	LS	\$ 1,000	\$ 1,000	\$ 1,000
Division 26 - Electrical					
Fine Screening					
Electrical	1	LS	\$ 75,000	\$ 75,000	\$ 75,000
Division 40 - Process Interconnections					
Fine Screening					
Miscellaneous piping and vales	1	LS	\$ 15,000	\$ 15,000	\$ 15,000
Instrumentation	1	LS	\$ 50,000	\$ 50,000	\$ 50,000
Division 46 - Water and Wastewater Equipment					
Fine Screening					
Plate Replacement	2	EA	\$ 30,000	\$ 30,000	\$ 60,000
Third Mechanical Screen	1	EA	\$ 175,000	\$ 175,000	\$ 175,000
Installation	1	LS	\$ 94,000	\$ 94,000	\$ 94,000
Subtotal A				\$	498,000
Mobilization, Bonds, and Insurance				5%	\$ 25,000
Contractor's Overhead and Profit				15%	\$ 75,000
Subtotal B				\$	598,000
Miscellaneous Items and Contingencies				25%	\$ 150,000
Subtotal C				\$	748,000
Design Engineering				10%	\$ 75,000
Engineering Services During Construction				8%	\$ 60,000
Construction Management and Inspection				5%	\$ 37,000
Other Indirect Costs				5%	\$ 37,000
Subtotal D				\$	957,000
Sales Tax				0%	\$ -
Total Estimated Probable Project Cost				\$	957,000

CLASS 5 OPINION OF PROBABLE CONSTRUCTION COSTS**MBBR****HDR**

Project	Newberg WW Master Plan Update	Date	13-Dec-17
		Estimator	CLR
Task	MBBR	Checked By	MB
		Updated	KB 18-Jan-17

Ratio = 1.000

Description	Quantity	Unit	Base Unit Price (\$/unit)	Adjusted Price (\$/unit)	Total (\$)
Division 01 - General Requirements					
MBBR					
General Conditions, Bidding, Submittals, Start-up	1	LS	\$ 40,799	\$ 40,799	\$ 40,799
Division 03 - Concrete					
MBBR					
Nitrification basin	207	CY	\$ 950	\$ 950	\$ 197,037
Nitrification slab	74	CY	\$ 850	\$ 850	\$ 62,963
Carbon reactor basin	172	CY	\$ 950	\$ 950	\$ 163,259
Carbon reactor slab	136	CY	\$ 850	\$ 850	\$ 115,432
RDS Split Box Expansion	48	CY	\$ 750	\$ 750	\$ 36,000
MBBR Eff Control Box 1	15	CY	\$ 750	\$ 750	\$ 11,250
MBBR Eff Junction Box 2	10	CY	\$ 750	\$ 750	\$ 7,500
SE Junction Box 3	10	CY	\$ 750	\$ 750	\$ 7,500
Division 05 - Metals					
MBBR					
Above ground AA pipe supports	1	LS	\$ 20,000	\$ 20,000	\$ 20,000
Miscellaneous Metals (handrails, grating, etc.)	1	LS	\$ 60,000	\$ 60,000	\$ 60,000
Division 13 - Special Construction					
MBBR					
Identification, Stenciling and Tagging	1	LS	\$ 15,000	\$ 15,000	\$ 15,000
Division 26 - Electrical					
MBBR					
Electrical	1	LS	\$ 700,000	\$ 700,000	\$ 700,000
Division 31 - Earthwork					
MBBR					
Excavation	1889	CY	\$ 12	\$ 12	\$ 22,667
Dewatering	1	EA	\$ 100,000	\$ 100,000	\$ 100,000
Backfill	189	CY	\$ 25	\$ 25	\$ 4,722
Cast Auger Piles and Installation	3000	SF	\$ 120	\$ 120	\$ 360,000
Junction/Split Boxes Excavation	219	CY	\$ 12	\$ 12	\$ 2,628
Backfill	55	CY	\$ 25	\$ 25	\$ 1,369
Division 40 - Process Interconnections					
MBBR					
24-IN RDS INF Piping	240	LF	\$ 288	\$ 288	\$ 69,120
24-IN SE Piping	420	LF	\$ 288	\$ 288	\$ 120,960
16-IN AA Piping	100	LF	\$ 192	\$ 192	\$ 19,200
Miscellaneous piping and valves	1	LS	\$ 50,000	\$ 50,000	\$ 50,000
Piping Installation	1	LS	\$ 259,280	\$ 259,280	\$ 259,280
SE Piping between CDB and CCB					
24-IN SE Piping	250	LF	\$ 288	\$ 288	\$ 72,000
Piping Installation	1	LS	\$ 72,000	\$ 72,000	\$ 72,000

CLASS 5 OPINION OF PROBABLE CONSTRUCTION COSTS

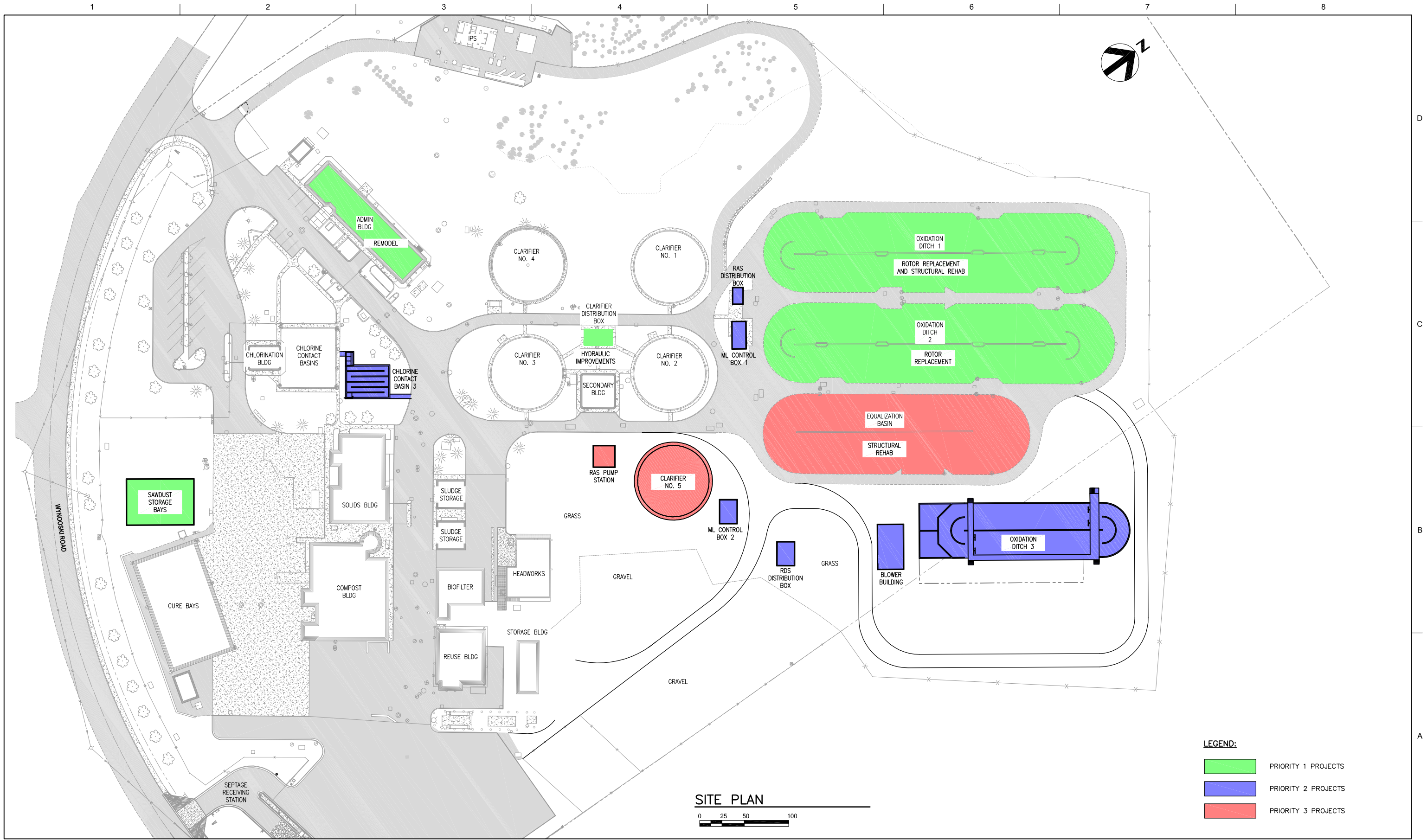
MBBR

HDR

Project	Newberg WW Master Plan Update	Date	13-Dec-17
		Estimator	CLR
Task	MBBR	Checked By	MB
		Updated	KB 18-Jan-17

Ratio = 1.000

Description					
	Quantity	Unit	Base Unit Price (\$/unit)	Adjusted Price (\$/unit)	Total (\$)
Division 43 - Process Gas and Liquid Handling, Purification, and Storage Equipment					
RDS Split Box					
Weir Gates	3	EA	\$ 20,000	\$ 20,000	\$ 60,000
Division 46 - Water and Wastewater Equipment					
MBBR Vendor Equipment and Insurumentation	1	EA	\$ 1,050,000	\$ 1,050,000	\$ 1,050,000
Equipment Installation	1	LS	\$ 420,000	\$ 420,000	\$ 420,000
Subtotal A					\$ 4,121,000
Design Details and Assumptions:					
Mobilization, Bonds, and Insurance		5%	\$ 206,000		
Contractor's Overhead and Profit		15%	\$ 618,000		
Subtotal B			\$ 4,945,000		
Miscellaneous Items and Contingencies		25%	\$ 1,236,250		
Subtotal C			\$ 6,181,250		
Design Engineering		10%	\$ 618,000		
Engineering Services During Construction		8%	\$ 495,000		
Construction Management and Inspection		5%	\$ 309,000		
Other Indirect Costs		5%	\$ 309,000		
Subtotal D			\$ 7,912,000		
Sales Tax		0%	\$ -		
Total Estimated Probable Project Cost					\$ 7,912,000



1	MARCH 2018	WASTEWATER MASTER PLAN
ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	A. MCCASKILL
PROCESS	K. BILL
HDR PROJECT NUMBER	10047939



NEWBERG WASTEWATER MASTER PLAN

PROPOSED SITE LAYOUT



FILENAME	C-01.dwg
SCALE	AS NOTED