

# MWMC Eugene-Springfield WPCF Facility Plan – Biosolids and Effluent Reuse Cost Estimates and Recommended Phasing

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## Executive Summary

The recommended phasing plan and project costs for recommended process additions and improvements through 2025, related to the Metropolitan Wastewater Management Commission's (MWMC's) biosolids management and effluent reuse programs, are shown in Table 1. Major process additions are based on ensuring process capacity for upper limit flow and load projections, and meeting regulatory requirements. Process improvements are based on providing process optimization, additional program flexibility, and/or general process repair. Project costs are order-of-magnitude estimates in 2004 dollars. The project costs are composed of construction costs, a 25 percent construction contingency, and 25 percent for engineering. Included in Attachment A are detailed cost estimates for the majority of the projects shown in Table 1.

**TABLE 1**  
Project Costs, Phasing, and Descriptions for Solids Management and Effluent Reuse Projects through Year 2025  
*MWMC Facility Plan, Eugene-Springfield*

<b>Project Phase (Design/Construction Years)<sup>a</sup></b>	<b>Description</b>	<b>Project Cost<sup>b</sup></b>
<b><u>Unit Process Additions/Expansions</u></b>		
Gravity Belt Thickener (2005/2006)	Add one gravity belt thickener, one waste activated sludge (WAS) pump, one thickened WAS (TWAS) pump, one Polyblend unit, and expand the thickening building.	\$2,500,000
Anaerobic Digester (2010/2011)	Add one anaerobic digester and appurtenant equipment. The new digester may be an advanced digestion process that will produce Class A biosolids.	\$13,800,000 <sup>c</sup>

**TABLE 1**  
Project Costs, Phasing, and Descriptions for Solids Management and Effluent Reuse Projects through Year 2025  
*MWMC Facility Plan, Eugene-Springfield*

<b>Project Phase (Design/Construction Years)<sup>a</sup></b>	<b>Description</b>	<b>Project Cost<sup>b</sup></b>
<b><u>Process Improvements/Modifications</u></b>		
Digester Mixing Improvements (2004/2005)	Replace the existing digester mixing system (gas mixing) on the three digesters with a new mixing system. Type to be determined.	\$2,000,000
Biocycle Farm Phase 2 (2005)	Expand the Biocycle Farm 130 acres.	\$300,000
Biocycle Farm Distribution Equipment (2006)	Purchase four additional hose reels to allow for land application of biosolids in Phases 2 and 3 of the Biocycle Farm expansion.	\$260,000
Effluent Reuse at the Seasonal Industrial Waste Facility (2006)	Modifications/additions to allow for Level II effluent reuse at the SIWF.	\$400,000
Lagoon Relining – Phase 1 (2006)	Reline the southwest lagoon located at the Biosolids Management Facility.	\$1,200,000
Level IV Reuse – Phase 1 (2006/2007)	Provide 0.5-1.0 mgd of Level IV reuse in 2-mile proximity to the E-S WPCF.	\$2,100,000
Biocycle Farm Phase 3 (2007)	Final 130 acre Biocycle Farm expansion.	\$300,000
Effluent Reuse at the Biocycle Farm (2009/2010)	Construct infrastructure to allow for 1.5 mgd of Level II reuse at the Biocycle Farm.	\$3,600,000
Lagoon Relining – Phase 2 (2010)	Reline second lagoon located at the Biosolids Management Facility.	\$1,200,000
Lagoon Relining – Phase 3 (2011)	Reline third lagoon located at the Biosolids Management Facility.	\$1,200,000
Lagoon Relining – Phase 4 (2012)	Reline fourth lagoon located at the Biosolids Management Facility.	\$1,200,000
Biosolids Force Main Improvements (2013)	Repair and/or replace sections of the 8.5-inch biosolids force main.	\$1,000,000
Level IV Reuse – Phase 2 (2013-2015)	Provide for 2.5 mgd of permanent Level IV reuse to local greenspaces and community areas.	\$4,100,000
Composting Process Expansion (2016/2017)	Expand the capacity of the composting facility/process located at the Biosolids Management Facility.	\$650,000
Level IV Reuse – Phase 3 (2016-2018)	Provide 2.5-5 mgd of Level IV reuse.	\$9,800,000
<b>TOTAL</b>		<b>\$45,610,000</b>

<sup>a</sup>Design/construction years based on fiscal years.

<sup>b</sup>2004 dollars.

<sup>c</sup>Includes cost for constructing an advanced digestion process.

## Introduction

This technical memorandum has been prepared as part of the 2003/2004 Metropolitan Wastewater Management Commission (MWMC) Eugene-Springfield Water Pollution Control Facility (E-S WPCF) Facilities Plan Update (MWMC Project No. 80010). The purpose of this document is to present recommended improvements, phasing, and costs for solids-related processes and facilities, and for effluent reuse projects through the design period (2025). The recommended improvements are intended to meet projected wastewater flows and loads, and future regulatory requirements. Projects are located primarily at the WPCF, the Biosolids Management Facility (BMF), the Biocycle Farm (BF), and the Seasonal Industrial Waste Facility (SIWF).

## Recommended Improvements

Table 2 summarizes the recommended improvements associated with MWMC’s solids management and effluent reuse programs, and identifies the year the improvements need to be online. In general, projects associated with new unit processes are a result of ensuring that capacity and regulatory requirements are met. Other projects represent general improvements and/or provide for future process optimization or flexibility. Brief project descriptions are included in Table 2. Upper limit flow and load projections have been used in determining when recommended improvements need to be online.

TABLE 2  
Summary of Solids Management and Effluent Reuse Recommended Improvements through Year 2025  
*MWMC Facility Plan, Eugene-Springfield*

Project (Year Online)	Description
<b><u>Unit Process Additions/Expansions</u></b>	
Gravity Belt Thickener (2006)	Add one gravity belt thickener, one WAS pump, one TWAS pump, one Polyblend unit, and expand the thickening building.
Anaerobic Digester (2011)	Add one anaerobic digester and appurtenant equipment. The new digester may be an advanced digestion process that will produce Class A biosolids.
<b><u>Process Improvements/Modifications</u></b>	
Digester Mixing Improvements (2006)	Replace the existing digester mixing system (gas mixing) on the three digesters with a new mixing system. Type to be determined.
Biocycle Farm Phase 2 (2006)	Expand the Biocycle Farm 130 acres. Site preparation is required.
Biocycle Farm Distribution Equipment (2006)	Purchase four additional hose reels to allow for land application of biosolids in Phases 2 and 3 of the Biocycle Farm expansion.
Effluent Reuse at the Seasonal Industrial Waste Facility (2007)	Allow for Level II effluent reuse at the SIWF. Piping and mechanical modifications will be required. The existing nozzles on the three center pivots will be replaced.

**TABLE 2**  
 Summary of Solids Management and Effluent Reuse Recommended Improvements through Year 2025  
*MWMC Facility Plan, Eugene-Springfield*

<b>Project (Year Online)</b>	<b>Description</b>
Lagoon Relining – Phase 1 (2007)	Reline the southwest lagoon located at the Biosolids Management Facility.
Level IV Reuse – Phase 1 (2008)	Provide 0.5-1.0 mgd of Level IV reuse in 2-mile proximity to the E-S WPCF. A moveable filtration and UV unit will be required, as well as installation of a conveyance pipeline and site distribution systems.
Biocycle Farm Phase 3 (2008)	Final 130 acre Biocycle Farm expansion. Site preparation is required.
Effluent Reuse at the Biocycle Farm (2011)	Construct infrastructure to allow for 1.5 mgd of Level II reuse. Installation of dedicated reuse irrigation pipeline, microspray system, and two new irrigation pumps are required.
Lagoon Relining – Phase 2 (2011)	Reline second lagoon located at the Biosolids Management Facility.
Lagoon Relining – Phase 3 (2012)	Reline third lagoon located at the Biosolids Management Facility.
Lagoon Relining – Phase 4 (2013)	Reline fourth lagoon located at the Biosolids Management Facility.
Biosolids Forcemain Improvements (2013)	Repair and/or replace sections of the 8.5-inch biosolids force main where struvite deposits limit pipe diameter and cannot be removed by acid wash cleaning.
Level IV Reuse – Phase 2 (2016)	Provide for 2.5 mgd of permanent Level IV reuse to local greenspaces and community areas. Modify/install UV system capable of 3 mgd and modify/increase piping system installed in Level IV Phase 1.
Composting Process Expansion (2018)	Expand the capacity of the composting facility/process located at the Biosolids Management Facility.
Level IV Reuse – Phase 3 (2019)	Provide 2.5-5 mgd of Level IV reuse. Increase pumping capacity, reuse pipeline, and UV system.

Abbreviations:  
 WAS = Waste Activated Sludge  
 TWAS = Thickened waste activated sludge  
 UV = Ultraviolet

## Project Descriptions

Projects identified in Table 2 are described in more detail in the following section.

## Unit Process Additions/Expansions

Major process additions have been identified for waste activated sludge (WAS) thickening and anaerobic digestion. These expansions are discussed below.

### **Gravity Belt Thickener (2006)**

One new 3-meter gravity belt thickener (GBT) will be added as part of this project. To accommodate the new unit, the thickening building will need to be expanded. Addition of the third GBT will also require that a third WAS and a third thickened waste activated sludge (TWAS) pump be installed. A third Polyblend unit will be added in the basement of the thickening building. Predesign evaluations related to gravity thickening of primary sludge may alter the extent of this project.

### **Anaerobic Digester (2011)**

One new digester with approximately 1,200,000 gallons of capacity (based on mesophilic digestion temperatures) will be added. Major equipment associated with the digester includes a new sludge recirculation pump(s), a sludge water/sludge heat exchanger(s), a digester mixing pump(s), a digested sludge pump(s), and hot water recirculation pump(s). To provide for future biosolids flexibility, an advanced digestion process to allow for Class A biosolids production and further reduction of volatile solids may be constructed. In this event, a fourth mesophilic digester will not be constructed. Instead of the fourth mesophilic digester, thermophilic tanks will be constructed to allow for a batch fill-hold-draw process. Costs shown in this document represent a transition to an advanced digestion process. Temperature-phased anaerobic digestion (TPAD) represents the cost basis.

## **Process Improvements/Modifications**

Projects other than major process additions or expansions are identified below. These projects are based on general process repairs needed because of age, providing additional program and/or operational flexibility, or optimizing existing processes.

### **Digester Mixing Improvements (2006)**

Replace the existing digester gas mixing system with a new mix system. The type of mixing system has yet to be determined. For costing purposes, pump mixing with adjustable speed drives on the pumps was assumed.

### **Biocycle Farm Expansion – Phase 2 and 3 (2006 and 2008)**

The BF is 595 acres. Phase 1 will be online in the summer of 2004 and represents approximately 260 acres. Phases 2 and 3 will further develop the site (130 acres per phase). Future development includes site preparation and planting of grass and poplars. Roads and biosolids distribution systems are constructed.

### **Biocycle Farm Distribution Equipment (2006)**

Liquid biosolids are applied to Biocycle Farm Phase 1 through four hose reel application systems. Four additional hose reels will be needed for Phases 2 and 3. As part of the Phase 2 expansion, all four hose reels will be purchased.

### **Level II Reuse – Seasonal Industrial Waste Facility (2007)**

The reclaimed water main is currently connected to the SIWF. This project will allow for application of effluent (Level II quality) on the existing grass hay fields at the SIWF. Modifications to the existing piping and mechanical system are required. The effluent will

be applied to the fields through the existing three center pivots. Spray nozzle replacement on the pivots is required.

### **Level II Reuse – Biocycle Farm (2011)**

The reclaimed water main is also connected to the BF pump station located at the BMF. This project creates a dedicated effluent (Level II quality) irrigation system at the BF. The project will include installation of a new 14-inch effluent irrigation pipeline with a microspray application system. Two new irrigation pumps will also be installed at the BF pump station.

### **Lagoon Relining – Phases 1, 2, 3, and 4 (2007, 2011, 2012, and 2013)**

This is a replacement project for the existing liners at the four lagoons located at the BMF. It is assumed that the southwest lagoon will be relined first and that the remaining three lagoons will be relined, if needed. Liner leaking is the basis for replacement. Relining of the lagoons will be conducted in four phases, such that three lagoons will be online at any one time. The lagoon being relined will need to be completely emptied.

### **Level IV Reuse – Phases 1, 2, and 3 (2008, 2016, and 2019)**

Three Level IV reuse projects will be constructed in subsequent phases. Phase 1 represents a local (2-mile radius of E-S WPCF) reuse demonstration project. Phase 1 will require installation of temporary filtration and ultraviolet (UV) disinfection systems and construction of a new conveyance pipeline and site distribution equipment. Phase 2 will provide for a dedicated Level IV reuse building, where UV and conveyance pumps will be located. The existing piping infrastructure installed in Phase 1 will be expanded to accommodate the increased Level IV reuse production, as will the UV and pumping capacity. Phase 3 represents full build-out Level IV reuse. The reuse UV system will be expanded and additional piping and pumping capacity will be required. It is likely the Phase 3 improvements will expand Level IV reuse beyond urban and suburban areas to rural areas.

### **Biosolids Force Main Improvements (2013)**

This project improves the capacity of the biosolids force main. Buildup of struvite in the line at various locations is causing reduced line capacity. Sections of the pipe with severe struvite buildup may be repaired and/or replaced. This project may also provide for additional digested sludge pumping capacity, if required.

### **Composting Process Expansion (2018)**

The existing composting process located at the BMF will be expanded to allow for composting of 5 to 10 percent of the annual biosolids production. This project will provide a permanent, covered composting storage structure, an upgrade to the aeration and electrical capacity of the aerated static pile process, and will provide for a dedicated static compost mixer.

## **Project Costs**

The project costs estimated for each project are order-of-magnitude estimates in 2004 dollars. The project costs are composed of construction costs, a 25 percent construction

contingency, and 25 percent for engineering. Construction costs are based on previous estimates or bid tabulations from similar projects. Costs for individual processes include site work, mechanical, electrical, instrumentation and controls (I&C), and contractor overhead. The 25 percent construction contingency is intended to cover unidentified and/or unknown items not anticipated at this planning phase. Table 3 summarizes the costs associated with each project.

**TABLE 3**  
Project Costs for Solids Management and Effluent Reuse Projects through Year 2025  
*MWWC Facility Plan, Eugene-Springfield*

<b>Project (Design/Construction Years)</b>	<b>Project Cost (2004 \$)</b>
<b><u>Unit Process Additions/Expansions</u></b>	
Gravity Belt Thickener (2005/2006)	\$2,500,000
Anaerobic Digester (2010/2011)	\$13,800,000*
<b><u>Process Improvements/Modifications</u></b>	
Digester Mixing Improvements (2004/2005)	\$2,000,000
Biocycle Farm Phase 2 (2005)	\$300,000
Biocycle Farm Distribution Equipment (2006)	\$260,000
Effluent Reuse at the Seasonal Industrial Waste Facility (2006)	\$400,000
Lagoon Relining – Phase 1 (2006)	\$1,200,000
Level IV Reuse – Phase 1 (2006/2007)	\$2,100,000
Biocycle Farm – Phase 3 (2007)	\$300,000
Effluent Reuse at the Biocycle Farm (2009/2010)	\$3,600,000
Lagoon Relining – Phase 2 (2010)	\$1,200,000
Lagoon Relining – Phase 3 (2011)	\$1,200,000
Lagoon Relining – Phase 4 (2012)	\$1,200,000
Biosolids Force Main Improvements (2013)	\$1,000,000
Level IV Reuse – Phase 2 (2013-2015)	\$4,100,000
Composting Process Expansion (2016/2017)	\$650,000

**TABLE 3**  
 Project Costs for Solids Management and Effluent Reuse Projects through Year 2025  
*MWMC Facility Plan, Eugene-Springfield*

<b>Project (Design/Construction Years)</b>	<b>Project Cost (2004 \$)</b>
Level IV Reuse – Phase 3 (2016-2018)	\$9,800,000
<b>TOTAL</b>	<b>\$45,610,000</b>

\*Represents costs for constructing advanced digestion system.

Attachment A  
**Detailed Cost Data**

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Item Description	Quantity	Unit Price	Line Total	Costing Assumptions
<b>Digester Mixing Improvements--Three Digesters Total</b>				
<b>General Conditions</b>				
General Conditions	1 LS	\$108,063	\$108,000	Allow 10% of Total Contract Amount
Bonds/Insurance	1 LS	22,750	23,000	Allow 2% of Total Contract Amount
Mobilization/Demobilization/Site Facilities	1 LS	34,125	34,000	Allow 3% of Total Contract Amount
<b>Replace Gas Mixing System with Pump Mixing System</b>				
Remove Existing Gas Mixing System	1 LS	60,000	60,000	Allowance \$20,000/unit + 2 new @ \$10K/
<b>New Pump Mixing System</b>				
New Pump Mixing Materials Packages	3 EA	200,000	600,000	Per Designer
Installation of Equipment	3 EA	50,000	150,000	Assumed equal to 25% of equipment cost
Electrical/Instrumentation Upgrades	1 LS	100,000	100,000	Allowance
<b>Subtotal Opinion of Construction Cost--Digester Mixing Improvements</b>			<b>\$1,075,000</b>	
+ Contingency @ 50%			538,000	
<b>Subtotal Opinion of Construction Cost--Digester Mixing Improvements</b>			<b>\$1,613,000</b>	
+ Engineering, Legal & Administration @ 25%			407,000	
<b>Total Opinion of Construction Cost--Digester Mixing Improvements</b>			<b>\$2,020,000</b>	

The cost estimates shown have been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The final costs of the project will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule and other variable factors. As a result, the final project costs will vary from the estimates presented herein. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper project financial decisions to help ensure proper project evaluation and adequate funding.

Item Description	Quantity	Unit Price	Line Total	Costing Assumptions
<b>Gravity Belt Thickener No. 3</b>				
<b>General Conditions</b>				
General Conditions	1 LS	\$144,697	\$145,000	Allow 10% of Total Contract Amount
Bonds/Insurance	1 LS	30,463	30,000	Allow 2% of Total Contract Amount
Mobilization/Demobilization/Site Facilities	1 LS	45,694	46,000	Allow 3% of Total Contract Amount
<b>Landscaping/Visual Screening</b>	<b>\$ 143,950</b>			
Landscaping, fences, walls, and berming	1 LS	143,950 \$	143,950	Allowance (10% of other construction subtotals)
<b>Earthwork/Yard Piping/Demolition</b>	<b>\$200,000</b>			
Demolition/Protection of Existing/Temp Pumping	1 LS	50,000	50,000	Allowance
Water & Dust Control	1 LS	25,000	25,000	Allowance
Building Earthwork				
Building Excavation	2,400 CY	5	12,000	
Building Backfill	1,400 CY	30	42,000	
Yard piping WAS line 8"	1,000 lf	50	50,000	
Valves				
Misc Unquantified Earthwork	1 LS	21,000	21,000	
<b>Structures</b>	<b>\$358,500</b>			
Slab On Grade--24"	120 CY	300	36,000	
Walls--18"	130 CY	750	97,500	
Above Grade Structure	1,000 SF	125	125,000	
WAS wet well structure	1 LS	100,000	100,000	
<b>Equipment/Process Support</b>	<b>\$660,000</b>			
Gravity Belt Thickener	1 EA	400,000	400,000	Per Rock Creek 5B
Misc Equipment	1 LS	100,000	100,000	Allowance
Mechanical--Gates/Wall Spools/et al	1 LS	100,000	100,000	Allowance
Electrical Upgrades	1 LS	60,000	60,000	Allowance
<b>Subtotal Opinion of Construction Cost--Gravity Belt Thickener No. 3</b>			<b>\$1,583,450</b>	
+ Contingency @ 25%			395,550	
<b>Subtotal Opinion of Construction Cost--Gravity Belt Thickener No. 3</b>			<b>\$1,979,000</b>	
+ Engineering, Legal & Administration @ 25%			491,000	
<b>Total Opinion of Construction Cost--Gravity Belt Thickener No. 3</b>			<b>\$2,470,000</b>	

Item Description	Quantity	Unit Price	Line Total
<b>Anaerobic Digester</b>			
General Conditions	1 LS	\$430,000	\$430,000
Sitework	1 LS	175,000	175,000
Concrete	1 LS	1,100,000	1,100,000
Metals	1 LS	25,000	25,000
Process			
Digester Structure	1 LS	750,000	750,000
Equipment--Biosolids Compressor	1 LS	60,000	60,000
Mechanical	1 LS	50,000	50,000
Electrical/I & C	1 LS	260,000	260,000
Unquantified items	1 LS	95,000	95,000
<b>Subtotal Anaerobic Digester</b>			<b>\$2,945,000</b>
+ Contingency @ 25%			736,250
<b>Total Anaerobic Digester</b>			<b>\$3,681,250</b>
+ Engineering (Design & CM) @ 25%			920,313
<b>Total Project Cost</b>			<b>\$ 4,600,000</b>
<b>Class A Thermophilic Batch Allowance (200%)</b>			<b>9,200,000</b>
(four thermo tanks - 345K gal each, 4 sludge heat exchangers, 1 heat exchanger, 4 sludge recirc pumps, 1 recycle pump)			
			<b>\$ 13,800,000</b>





**Project Description**

**Level IV Effluent Reuse Phase 3 - Grass Application**

The reuse of 5.0 MGD of Level IV water from July to August would require a new pipeline to serve up to 1250 acres of grass. The main pipeline would be sized for a flow of 20800 gpm (42") with several 18" submains branching off.

**Cost (Does not include Land Acquisition)**

Item	Unit Cost	Unit	Qty	Grass Cost
UV and misc Equipment	\$1,600,000	unit	1	\$1,600,000
UV and misc Equipment	\$1,100,000	unit	1	
42" pipeline	\$152	LF	0	\$0
18" pipeline	\$56	LF	42240	\$2,379,802
50 psi BPS	\$2,000	HP	458	\$916,347
Poplar	\$5,000	acre	903	
Grass	\$1,000	acre	1249	\$1,248,502
<b>Subtotal</b>				<b>\$6,144,651</b>
Mob Demob				2% \$122,893
Construction Contingency				25% \$1,536,162.67
				\$7,803,706
ELA (on subtotal)				25% \$1,950,927
<b>TOTAL</b>				<b>\$9,754,633</b>

**Data**  
Monthly ETc & Net Irrigation Requirements for 5 mgd 3500 gpm

Date	Grass Irrig Req	Grass Land Req.	Turf Iri Req	Turf Land Req.	Poplar Iri Req	Poplar Land Req.
Feb-03	0.00	-	0.00	-	0.00	-
Mar-03	0.00	-	0.00	-	0.00	-
Apr-03	0.00	-	0.00	-	0.12	-
May-03	1.17		1.90		1.33	
Jun-03	2.97	1857	3.74	1478	3.68	1503
Jul-03	5.26	1050	6.26	882	7.18	769
Aug-03	4.42	1249	5.34	1035	6.12	903
Sep-03	2.24	2469	2.95	1870	3.61	1529
Oct-03	0.00		0.00		0.00	
	14.9	6624.5	18.3	5265.4	20.6	4703.4

**Project Description**

**Level IV Effluent Reuse Phase 3 - Poplar Application**

The reuse of 2.5 MGD of Level IV water from July to August would require a new pipeline to serve up to 450 acres of poplars. The main pipeline would be sized for a flow of 20800 gpm (42") with several 18" submains branching off

**Cost (Does not include Land Acquisition)**

Item	Unit Cost	Unit	Qty	Poplar Cost
UV and misc Equipment	\$1,600,000	unit	1	
UV and misc Equipment	\$1,100,000	unit	1	\$1,100,000
42" pipeline	\$152	LF	0	\$0
18" pipeline	\$56	LF	42240	\$2,379,802
50 psi BPS	\$2,000	HP	223	\$445,083
Poplar	\$5,000	acre	451	\$2,257,421
Grass	\$1,000	acre	624	
<b>Subtotal</b>				<b>\$6,182,306</b>
Mob Demob				\$123,646
Construction Contingency				\$1,545,576
				\$7,851,528
ELA (on subtotal)				\$1,962,882
<b>TOTAL</b>				<b>\$9,814,410</b>

**Data**

**Monthly ETc & Net Irrigation Requirements for**

2.5 mgd  
1700 gpm

Date	Grass Irrig Req	Grass Land Req.	Turf Irrig Req	Turf Land Req.	Poplar Iri Req	Poplar Land Req.
Feb-03	0.00	-	0.00	-	0.00	-
Mar-03	0.00	-	0.00	-	0.00	-
Apr-03	0.00	-	0.00	-	0.12	-
May-03	1.17		1.90		1.33	
Jun-03	2.97	929	3.74	739	3.68	751
Jul-03	5.26	525	6.26	441	7.18	385
Aug-03	4.42	624	5.34	517	6.12	451
Sep-03	2.24	1235	2.95	935	3.61	764
Oct-03	0.00		0.00		0.00	
	14.9	3312.3	18.3	2632.7	20.6	2351.7

## Costs

Costs of UV systems vary from manufacturer to manufacturer. Lamp costs range from \$40 to \$75 per lamp, depending on the volume purchased. The costs given in Tables 4 and 5 are based on budget prices provided by different manufacturers for different system sizes. For system preliminary cost estimating, the following tables can serve as guidelines. Costs only include equipment supplied by manufacturer and freight. The equipment costs are based on budget price quotes in Oregon and Washington (ENR = 5138, Seattle, June 1992). Caution should be taken in using these costs as prices may vary. Contact manufacturers' representatives for current price quotes.

Table 4

### Total Equipment Cost

Peak Flow (mgd)	200 fecal std.	2.2 Total Coliform
	Equipment Cost per mgd	Equipment Cost per mgd
< 1	\$54,000	\$162,000
1 - 3	\$47,000	\$141,000
3 - 6	\$40,000	\$120,000
6 - 10	\$37,000	\$111,000
10 - 20	\$30,000	\$90,000
>20	\$27,000	\$81,000

Table 5

### Total UV System Costs

Plant Type	Equipment	Modify	Disinfection Channels	Miscellaneous*	Total
		Chlorine Tank			
Retrofit	40%	25%	—	35%	100%
New Plant	50%	—	15%	35%	100%

\*Includes bridge crane, cleaning blower and basins, and emergency generator and building

June 1992 ENR = 5138  
March 2004 ENR = 7910

	Cost
2.5 MGD of reuse => use 3 mgd	162,000
Flow to treat 1	162,000
Mechanical 35%	56700
Miscellaneous 35%	56700
	275,400
\$	423,981

## Costs

Costs of UV systems vary from manufacturer to manufacturer. Lamp costs range from \$40 to \$75 per lamp, depending on the volume purchased. The costs given in Tables 4 and 5 are based on budget prices provided by different manufacturers for different system sizes. For system preliminary cost estimating, the following tables can serve as guidelines. Costs only include equipment supplied by manufacturer and freight. The equipment costs are based on budget price quotes in Oregon and Washington (ENR = 5138, Seattle, June 1992). Caution should be taken in using these costs as prices may vary. Contact manufacturers' representatives for current price quotes.

**Table 4**

Peak Flow (mgd)	Total Equipment Cost	
	200 fecal std. Equipment Cost	2.2 Total Coliform Equipment Cost
	per mgd	per mgd
< 1	\$54,000	\$162,000
1 - 3	\$47,000	\$141,000
3 - 6	\$40,000	\$120,000
6 - 10	\$37,000	\$111,000
10 - 20	\$30,000	\$90,000
>20	\$27,000	\$81,000

**Table 5**

Total UV System Costs					
Plant Type	Equipment	Modify	Disinfection Channels	Miscellaneous*	Total
		Chlorine Tank			
Retrofit	40%	25%	—	35%	100%
New Plant	50%	—	15%	35%	100%

\*Includes bridge crane, cleaning blower and basins, and emergency generator and building

June 1992 ENR = 5138  
March 2004 ENR = 7910

Total Level IV = 6 mgd. 3 mgd of UV constructed during phase 1.

3 MGD of reuse => use 3 mgd		Cost	141,000
Flow to treat	3		423,000
Mechanical		35%	148050
Miscellaneous		35%	148050
			719,100
			\$ 1,107,061

Level II Effluent Reuse on Biocycle Farm

Costs estimated based on Woodburn poplar farm

	Cost	Acreage	Cost/acre	Number cost/unit	
Distribution System			\$266.69	AC	
Submain System			\$890.19	12730 LF	\$16.16
Application System			\$1,156.14		
Manifold System (includes I&C)			\$926.79		
Pump Station			\$585.59		
Mobilization			\$323.98		
<b>TOTAL CONSTRUCTION COST</b>	<b>\$584,516</b>	<b>80</b>	<b>\$4,149.38</b>	<b>&lt;--Not all cost/acre values above are used. Values in yellow not used</b>	

Number of Acres:		555	
		\$2,302,903	Estimate for developing future BF expansion phases
Contingency	25%	\$ 575,726	
		\$2,878,629	
ELA	25%	\$ 719,657	
		<b>\$3,598,286</b>	<b>Total</b>