Orenco Liquid Only Sewers

Design and life Cycle Costing

04/17/19 #1

1

Discussion Topics

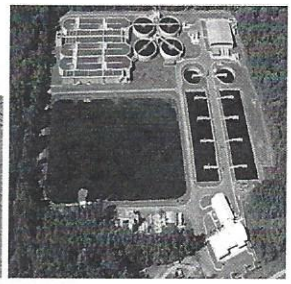
- System Overview
- Planning
- On-lot Design
- Right of Way Design
- Life Cycle Cost Comparison

04/17/19 #2

2

Wastewater Systems
Traditional Method

- Gravity Collection
- Treatment Plant



04/17/19 #3

3

Wastewater Systems
Traditional Method

- Gravity collection
  - Recommended Standards for Wastewater Facilities (2004 Ed.)
    - *"…Minimum 8" dia pipe…"*
    - *"…Minimum slope of 0.4ft/100ft…"*
    - *"…Manholes at 400ft intervals, terminal ends, and changes in grade, size, or alignment…"*
    - *"…multiple pumps shall be provided…"*

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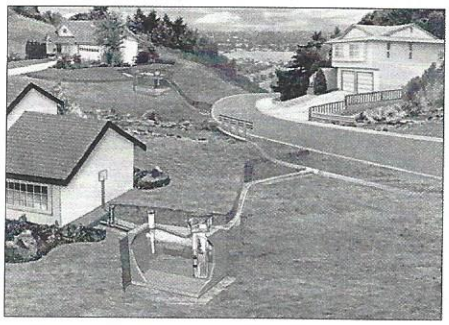
System Design
Overview



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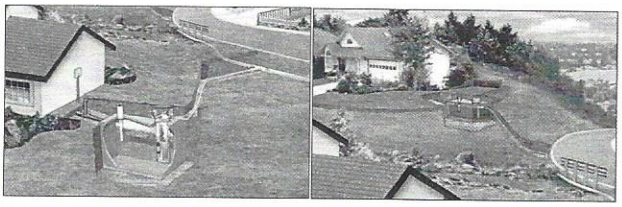
System Overview
What is STEP?

- Septic Tank Effluent Pumping
- Septic Tank Effluent Gravity



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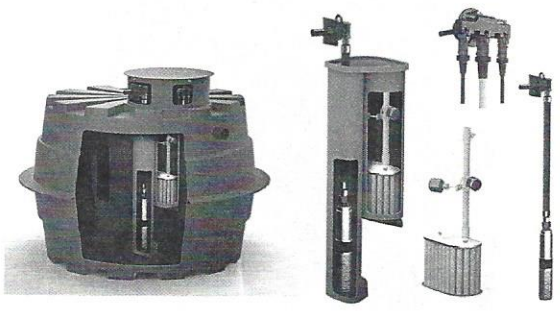
New Orenco Effluent Sewer System:
Decentralized Liquid Only Sewer = Delos Processor



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Effluent Sewer: Quality of Treatment

- The ONLY collection technology that provides treatment
  - ~ 70 to 90% reduction in waste strength
- Collection and treatment technology integration
  - ~ Reduced hydraulic and biological loading to treatment facility

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Other Issues to Address

- Disruption to Residents and Traffic During Construction
- Future Extensions of Service
- Groundwater
- Odor and Corrosion Potential

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Rights of Way, Access and Easements

- Collection lines built in public right of way
- Access needed for inspection and maintenance
- Easement options
  - ~ Blanket easement
  - ~ Deeded easement
  - ~ Centerline easement

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Discussion Topics

- System Overview
- Planning
- On-lot Design
- Right of Way Design
- Life Cycle Cost Comparison

04/17/19 #19

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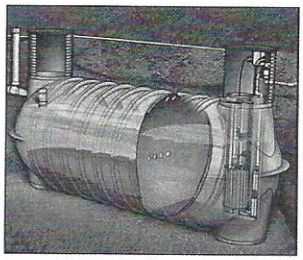
ProSTEP™ Effluent Pumping Systems

- Watertight tank
- Biotube® pump vault
- High-head effluent pump
- Control panel
- Splice box
- Float assembly
- Discharge assembly
- Risers, lids



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Fiberglass Tanks Require Quality Control Too

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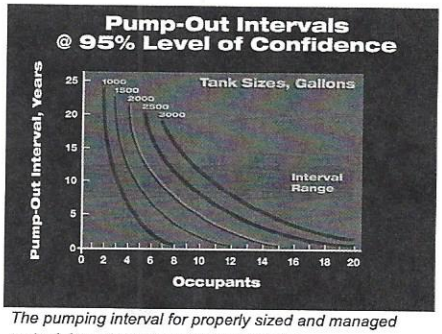
Properly Sized Tanks Reduce Pumping



The pumping interval for properly sized and managed watertight tanks is about 12 to 20 years.

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Delos Liquid Only Sewer Components
Delos Processor Tanks

- Primary treatment in processor tanks
- 1000-gallon tank per residence
- 70% removal of fats, oils, and greases
- 24-hour emergency storage
- 12-year pumpout with 95% confidence
- Abuses stay in interceptor tank
- Chemical sources easier to identify

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Delos Processor Tank

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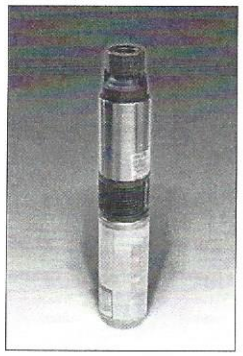
High-Head Effluent Pumps

- Lightweight
- Stainless steel/thermoplastic
- Floating stack
- UL listed/CSA certified
- Removable liquid end
- 1/2 hp, 115V, 10 to 50gpm
- Steep pump curve



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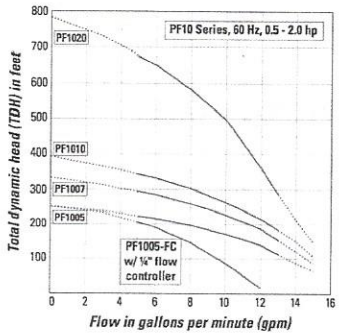
Selecting Standard Pump Model

Determine the head capability of the pump model being used. This value can be used to determine the maximum allowable head loss for any particular critical point.



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Tanks for High Flow Installations

- Tanks should be sized for a minimum of two (2) days detention, based on maximum day design flow
- Pump tanks should be sized for a minimum of 25% of maximum day design flow
- Filters should be sized based upon:

Equation 11 $$A_F = (0.0044)(P_c * Q_c)(MTBC)$$

where: A_f = *Filter Area, ft²*
P_c = *Population density, capita/EDU*
Q_c = *Daily per capita flow value, gpcd*
$MTBC$ = *Mean time between filter cleaning, years*

Table 5. Filter and Flow Area Chart

Series	Filter Area, ft² (m2)	Flow Area, ft² m²
FT15-36	50.5 (4.7)	15.2 (1.4)
FT12-36	30.0 (2.8)	9.0 (0.84)
FT08-36	14.6 (1.4)	4.4 (0.41)
FT04-36	5.1 (0.5)	1.5 (0.14)

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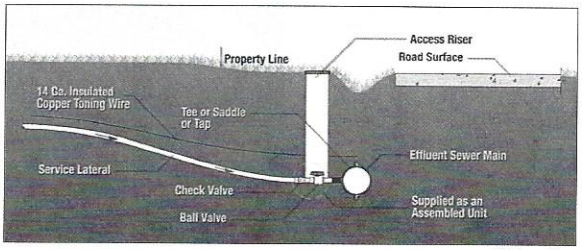
Service Connections

- Comprised of check valves and ball valves
- Access to the surface required
- Allows for isolation of on-lot components



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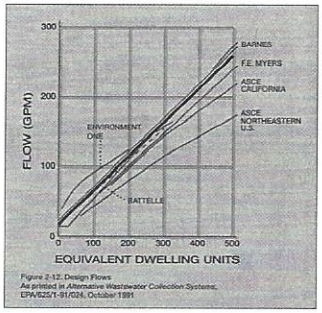
Calculating Peak Flows

- Simplified equation
  Qgpm = (EDUs / 2) + 15



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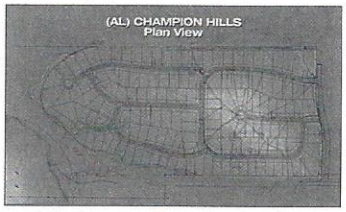
Plan View

- The plan view outlines ...
  - ~ Site characteristics
  - ~ Lot locations
  - ~ Road locations
  - ~ Contours



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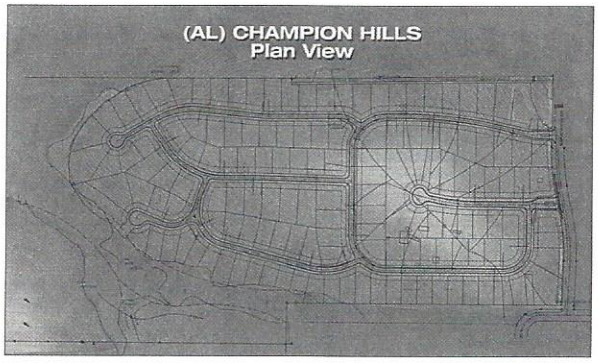
Plan View



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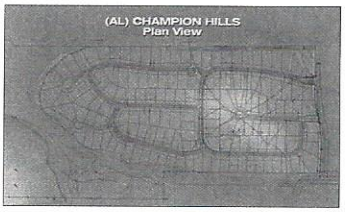
Main and Branch Line Layout

- Identify discharge point
- Identify mainline
- Label line segments
- Label station points
- Determine number of connections



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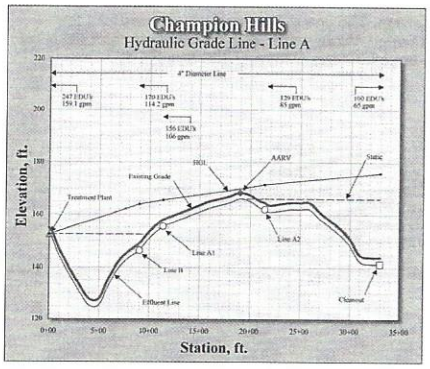
Calculating the Hydraulic Grade Line (HGL)



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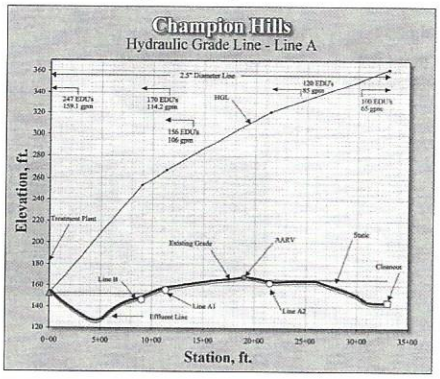
Calculating the Hydraulic Grade Line (HGL)



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Piping

- Piping materials
  - ~ PVC
    - Fairly rigid
    - Thin, smooth walls with low frictional losses
    - Most common type for open trench construction
  - ~ HDPE
    - Flexible
    - Thicker walls, higher frictional loss than PVC
    - Most common type for directional bore construction

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Piping and Fittings, cont.

- PVC fittings
  - 6" (150 mm) and smaller, socket-type PVC
  - Larger fittings typically PVC, epoxy coated ductile iron, stainless steel, or bronze/brass
- HDPE fittings
  - Fittings typically PVC body, HDPE body, stainless steel, or bronze/brass

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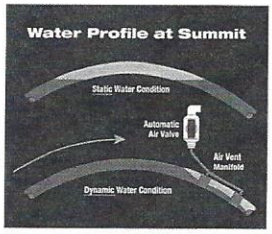
Automatic Air Valves

- Considerations
  - ~ Manual vs. automatic
  - ~ Air release vs. combination valve
  - ~ Proper sizing
  - ~ Open base enclosure for drainage
  - ~ Filter on enclosure for venting



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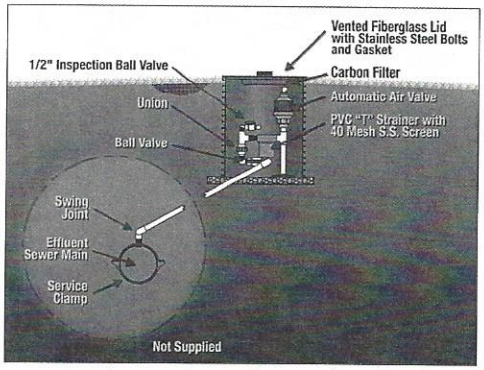
Automatic Air Valves



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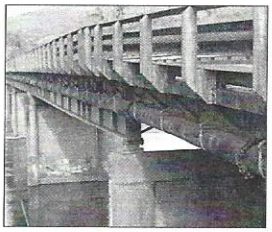
Freeze and Damage Prevention

- Underground components should be buried below the frost line or protected by insulation or heating tape
- Components in the right of way should be located to allow access for O&M activities, but also to reduce the likelihood of accidental damage



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Discussion Topics

- System Overview
- Planning
- On-lot Design
- Right of Way Design
- Life Cycle Cost Comparison

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Comparison of Collection Technologies

	Effluent Sewer	Conventional Gravity Sewer	Grinder Pressure Sewer
Excavation	Minimal disturbance	Significant disturbance	Minimal disturbance
Waste Stream	Liquid stream only	Full stream plus I&I	Macerated stream
Community Vision and Growth	Expandable	Future capacity built in and costs borne by current users	Expandable, but oversizing lines may cause maintenance impacts*

Source: WERF Performance & Cost of Decentralized Unit Processes Fact Sheets C1, C2, & C3
*added by author

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Evaluating Wastewater Systems
Up-Front and Life-Cycle Costs

- Up-front capital costs
  - ~ Includes engineering, construction (including land costs), startup/commissioning
  - ~ Generally *similar* for pressure sewer technologies
- Life-cycle costs
  - ~ Represent the ***total*** cost of owning infrastructure
  - ~ Includes engineering, construction, R&R, and O&M
  - ~ *Varies* significantly for decentralized technologies

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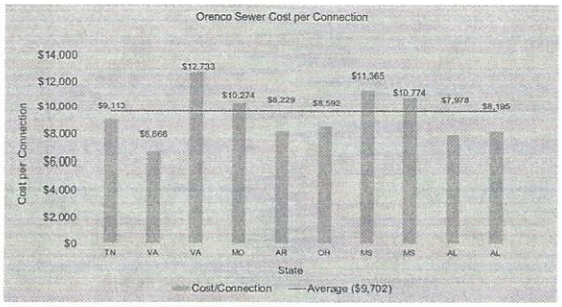
Total Collection System Cost:
Effluent Sewers



Note: All costs shown are for Orenco Sewers

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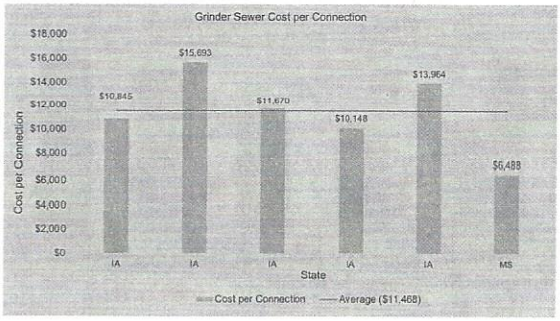
Total Collection System Cost:
Grinder Sewers



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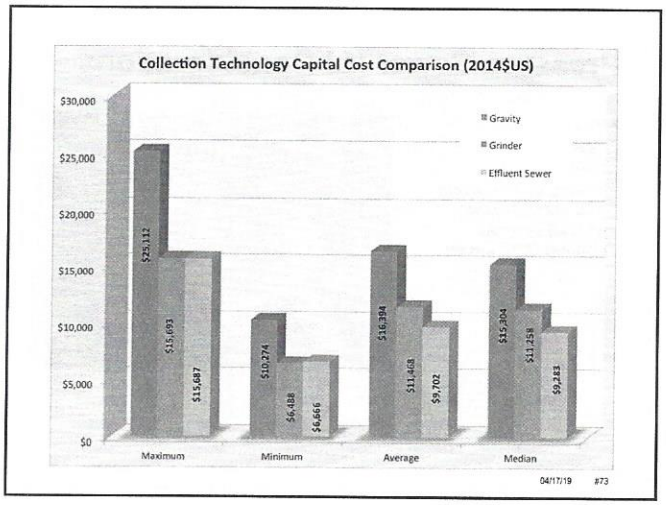

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Water Research Foundation

- Independent scientific research organization
  - Wastewater and stormwater issues
- Focused on results for the next generation of science and Technology
  - Research Costs
  - Developed excel cost estimating tool
    - Capital and O&M Costs
- WRF fact sheets
  - Gravity Sewer Systems
  - Pressure Sewers [Grinder]
  - Effluent Sewers
  - *"Performance & Cost of Decentralized Unit Processes," 2010*
  - http://www.werf.org/i/c/DecentralizedCost/Decentralized_Cost.aspx

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WRF Agrees:
O&M Costs Are Equal for Effluent Sewer & Gravity

	Effluent Sewer	Conventional Gravity Sewer	Grinder Pressure Sewer
Materials/Install	$0.90-1.35 M	$2.43-3.64 M	$1.34-2.01 M
Annual O&M	$60,000-90,000	$65,000-97,000	$106,000-159,000
60 Year Life Cycle Cost – Present Value (2009 Dollars)	$2.45-3.68 M	$4.47-6.71 M	$4.71-6.11 M

Source: WRF Fact Sheets C1, C2, & C3
"Performance & Cost of Decentralized Unit Processes," 2010
Data based on 50,000 gpd or 200 homes

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Capital Cost Summary

- Small communities face enormous challenges when constructing and maintaining wastewater infrastructure
- Gravity collection systems for small communities typically result in a cost that exceeds affordability thresholds (1.5 to 3% of MHI)
- Effluent sewers ($9,702/connection) have resulted in an average savings of $1,762 (15%) when compared to grinder sewers ($11,468/connection) and $6,692 (41%) when compared to gravity sewers ($16,394/connection)

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Reactive Maintenance (RM): STEP and Grinder

Effluent Sewers		Grinder Sewers	
Uniform Equivalent Monthly RM	1.5 hours/month/100 EDUs	Uniform Equivalent Monthly RM	1 service call per (8) years – 3 hour service call
Cost	$40.00/hr	Cost	$60.00/hr – (some immediate response)
UEM RM Cost	**$0.60/month/EDU**	**UEM RM Cost**	**$1.90/month/EDU**

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Equipment Repair and Replacement (R&R)

	Effluent Sewers*			Grinder Sewers		
Component	Freq.	Cost/ Event	4% Amortized	Freq.	Cost/ Event	4% Amortized
Pump Replacement	20 yrs	$600	$1.62/mo/EDU	20 yrs	$2,500	$7.00/mo/EDU
Pump Repair	N/A	N/A	N/A	10 yrs	$800	$5.22/mo/EDU
Float Replacement	10 yrs	$100	$0.68/mo/EDU	10 yrs	$100	$0.68/mo/EDU
Misc. Components	10 yrs	$75	$0.51/mo/EDU	10 yrs	$75	$0.51/mo/EDU
		Total:	**$2.81/mo/EDU**		**Total:**	**$13.41/mo/EDU**

* Cost shown associated with Effluent Sewer pump systems. Costs for gravity Effluent Sewer systems are a fraction of this value

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Solids Management: ES Systems

ES Systems				
Component	Freq.	Tank Size	Cost/Event	4% Amortized
Tank Pump-out	10 yrs	1,000 gal	$300	$2.04/mo/EDU
			Total:	**$2.04/mo/EDU**

Grinder systems manage solids at the wastewater treatment plant.

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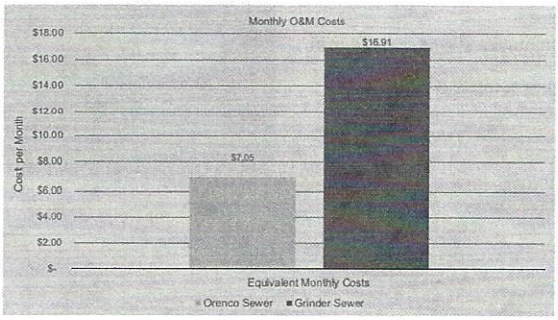
O&M Cost Estimate
Orenco Sewer & Grinder Sewer



NOTE: All costs $/month/EDU.

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Aggressive Maintenance Approach

- Full Service Maintenance (FSM)
- All new systems inspected
- Bioxide injection at all STEP discharge points
- Tanks pumped and cleaned on a 3-year cycle

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The Right Balance

- In 2007 a team was formed to evaluate STEP
- Modern equipment decreases cost associated with FSM
- Alternatives to Bioxide (Aeration); better design principles
- Tanks pumped on an on-demand basis

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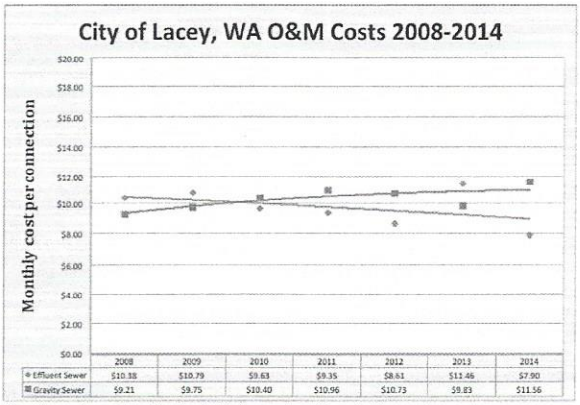
City of Lacey, WA O&M Costs 2008-2014



	2008	2009	2010	2011	2012	2013	2014
Effluent Sewer	$10.38	$10.79	$9.63	$9.35	$8.61	$11.46	$7.90
Gravity Sewer	$9.21	$9.75	$10.40	$10.96	$10.73	$9.83	$11.56

*Based on odor control costs allocated by the number of households served.

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Additional Services

- Design support
  - ~ Plan review
  - ~ Specifications
  - ~ Case studies
  - ~ Bid tabulations
- Installation support
  - ~ Installer training
- O&M support
  - ~ Operator training
  - ~ Asset management

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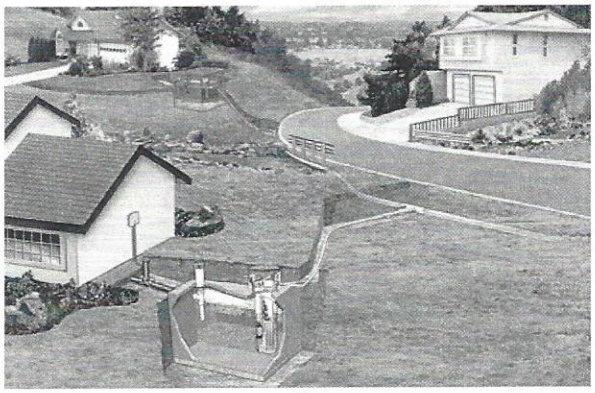

Effluent Sewer Design

Wed., Jan. 16th, 9-11am Pacific Time

This two-hour webinar explains the ins and outs of designing an effluent sewer system. Topics include how to design hydraulic grade lines, designing and selecting pump systems, transport-line sizing, and other key details for successful effluent sewer design.

Register Today!

This submission is a

Revised version of an existing webinar.

SR

Orenco® SYSTEMS *Presenter's Bio*

Garry-Lee Espinosa

Garry-Lee Espinosa is a Municipal Systems Project Manager with Orenco Systems® Inc., a wastewater equipment manufacturing firm based in Sutherlin, Oregon. In this role, he uses his 17 years of experience to assist customers in determining needs related to the design, development, installation, and maintenance of Orenco's wastewater handling equipment. He also prepares proposals, develops cost estimates, reviews projects, and promotes commercial sales in his territory. Prior to joining Orenco, Garry-Lee worked as an AutoCAD draftsman for the Department of Veterans Affairs and managed a distillation plant aboard a U.S. Navy ship during Operation Desert Storm.

Garry-Lee has an associate's degree in manufacturing engineering from Umpqua Community College. He is a retired rodeo performer and now spends his free time fishing, golfing, and scuba diving.