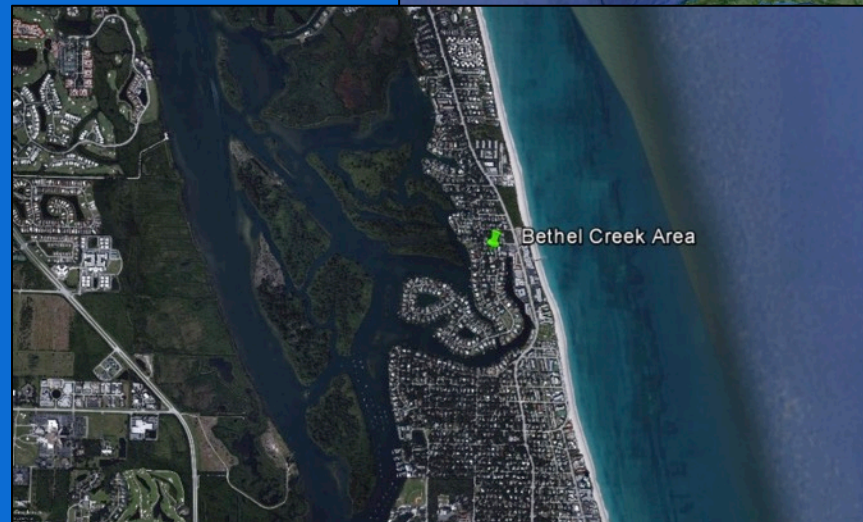
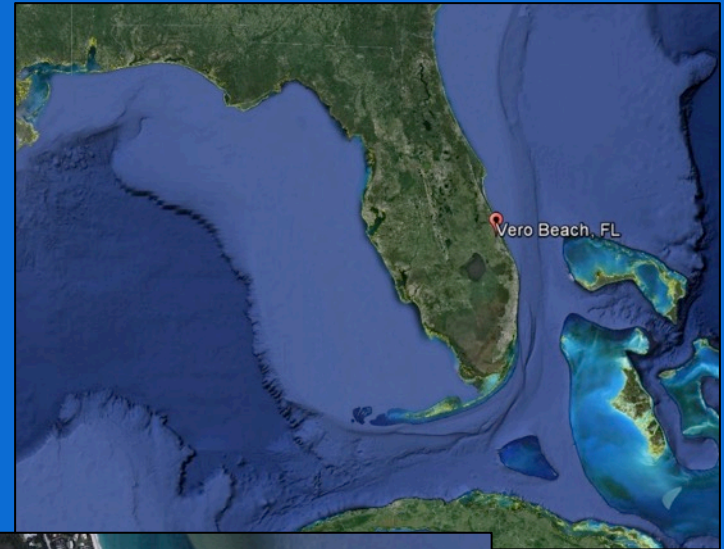


# An Economical, Low-Impact Wastewater Collection system

*A Case Study of Vero Beach, FL*

# Background Location

- Vero Beach, Florida
  - ~ Indian River County
- Eastern Florida
- Between Indian River Lagoon and Atlantic Ocean



## Background (Continued) Demographics

- Total population: 15,220
  - ~ Densely populated
- Median Household Income: \$51,761
- City is mostly gravity sewer with a centralized treatment plant
  - ~ Large portions of the city use on-site sewers
- Mature vegetation



## Background (Continued)

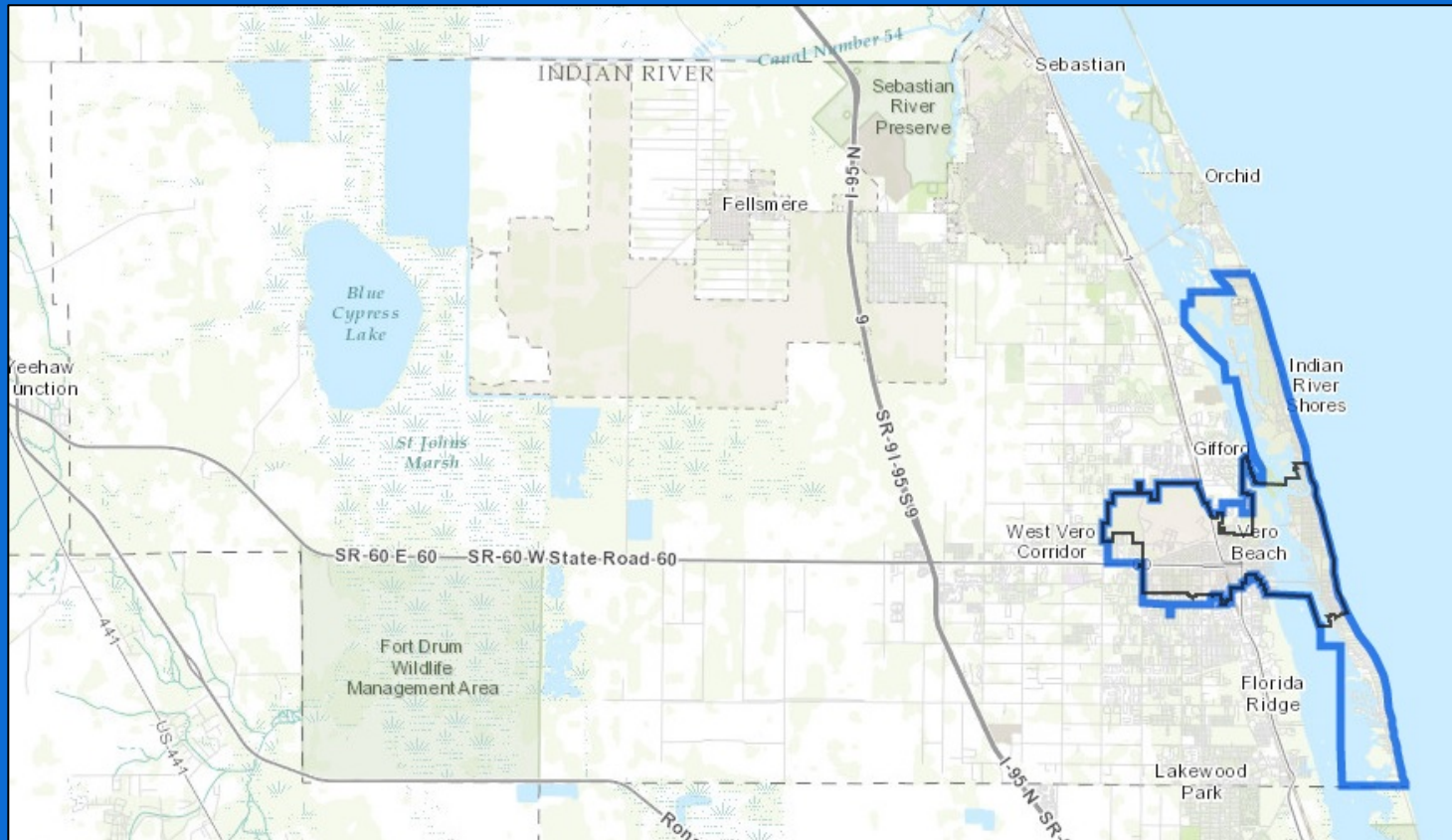
### Existing Wastewater Management Systems

- 1,500 homes use septic systems
  - ~ Many were antiquated and failing
  - ~ Small parcels
- Environmental concern
- Nutrient runoff into the Indian River Lagoon
  - ~ Excess nitrogen, phosphorus, and bacteria
  - ~ Possibly tied to deaths of manatees and dolphins



# Background (Continued)

## Existing Wastewater Management Systems



## Background *(Continued)*

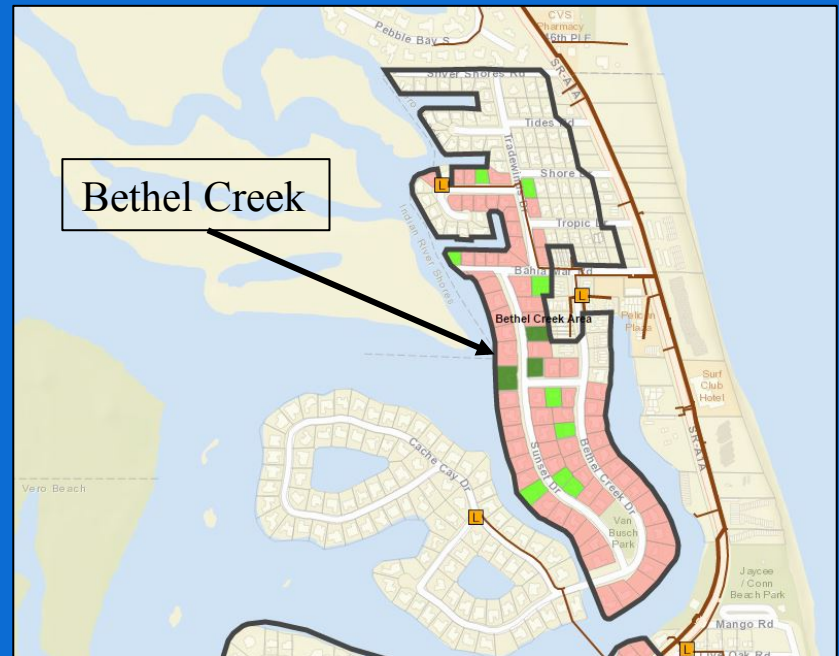
### *Septic System Variables*

- Density (lot size)
- Proximity to lagoon
- Elevation of water table
- Flow direction of groundwater
- Distance from the septic tank to water's edge
- Year house was built (pre-1983 homes are priority)
- Irrigation systems that use shallow wells

# Background (Continued)

## Existing Wastewater Management Systems (Continued)

Lot Size (acres)	# of Homes
0.00 - 0.15	4
0.16 - 0.2	3
0.2 - 0.3	82
0.3 - 0.4	38
0.4 - 0.5	18



# Evaluation *Alternatives*

- Collection System Alternatives
  - ~ Gravity
  - ~ Low Pressure Septic Tank Effluent Pump Sewers (STEP)
- Based on preliminary research, City Engineer eliminated grinder and vacuum as viable alternatives



# Evaluation

## *Gravity Sewers Overview*

- 4” or 6” lateral pipe at 1% – 2% grade from home to collection main
- Collection main min. pipe diameter is 8”, laid at a slope
- Manholes
- Maximum manhole spacing is 400 feet for pipe diameters of 15 inches or less
- Must consider infiltration and inflow



# Evaluation

## *Gravity Sewers Overview (continued)*

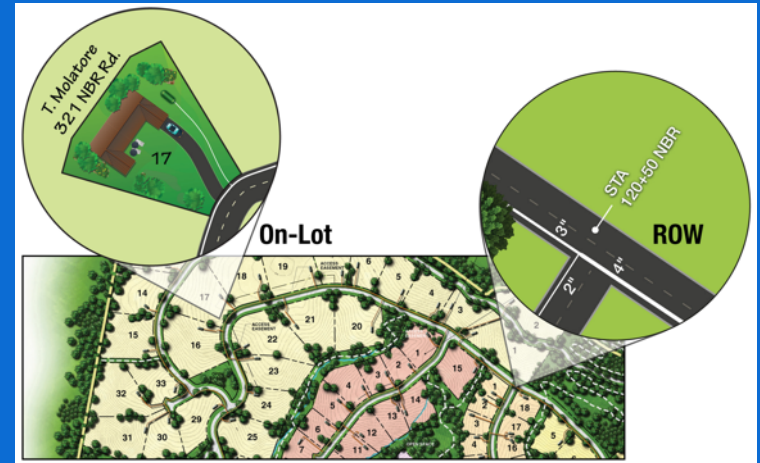
- Lift pumps are designed to handle 3" diameter solids
- Force mains must be at least 4" diameter
- Minimum pump flow must be approximately 80 gpm to maintain 2 ft per second velocity
- At least two pumps are required and must be able to pump the peak hourly flow with any one unit out of service



# Evaluation

## Effluent Sewers

- Small diameter (2"-4" dia.) low pressure sewer mains, buried below frost, laid to contour of land
- Solids are retained and digested in septic tank on site
- Only clear septic tank effluent is pumped to the treatment plant
- Flexible in design



# Evaluation

## *Key Considerations*

- Life Cycle Cost
  - ~ (Present Worth Analysis)
- Availability Cost
  - ~ Cost to construct mainlines, excluding on-lot equipment
- Social Cost



## Evaluation *(Continued)*

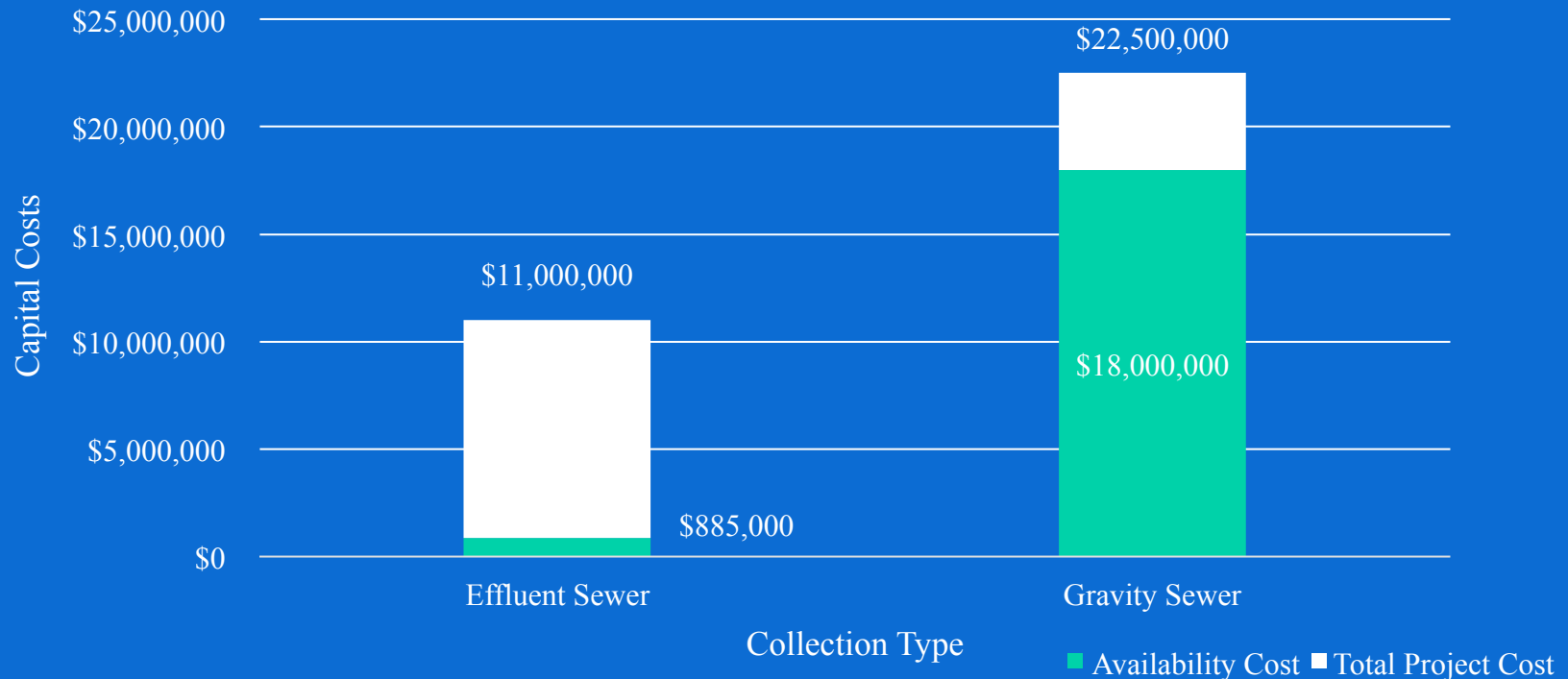
### *Life Cycle Economics*

- User charges must include
  - ~ Capital costs and associated debt repayment
  - ~ Yearly O&M costs
  - ~ Repair/Replacement Costs

# Evaluation (Continued)

## Upfront Capital Cost Estimates

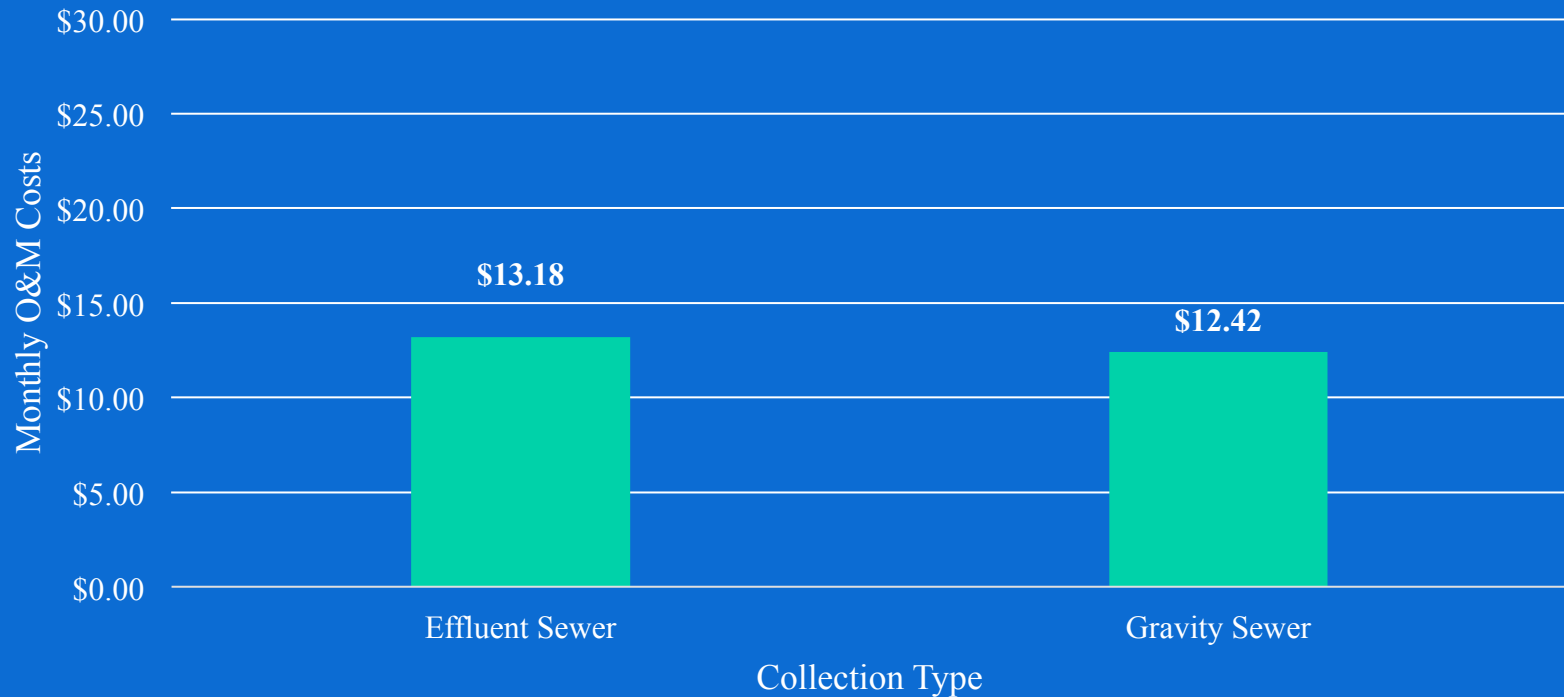
Capital Costs: Effluent Sewer vs. Gravity



# Evaluation (Continued)

## O&M Cost Comparison

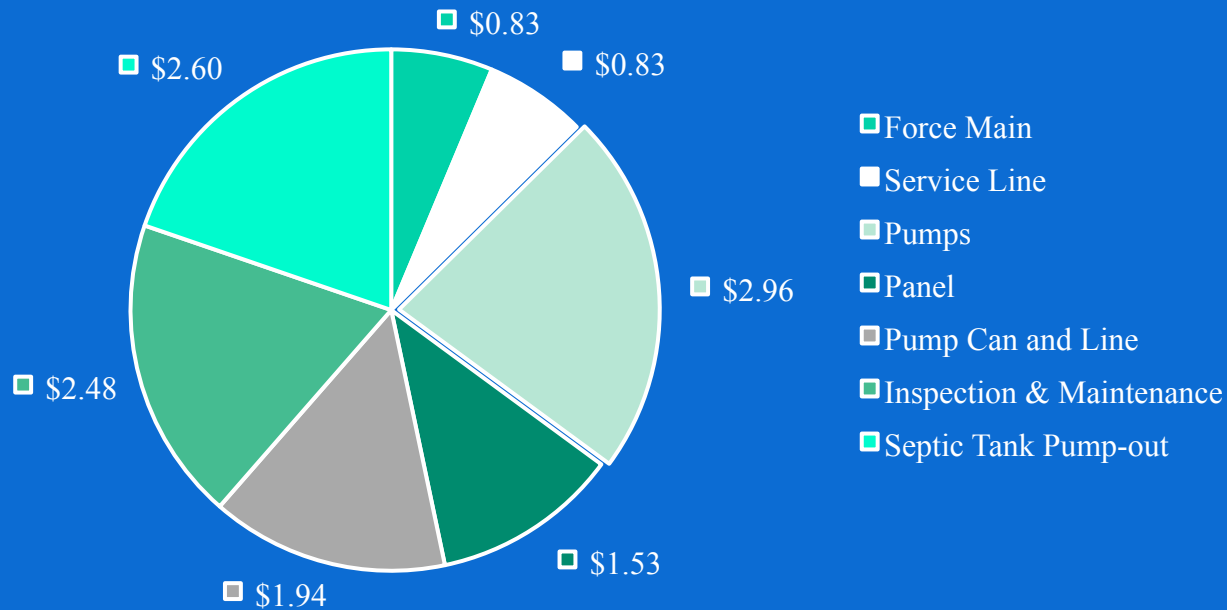
Estimated Monthly O&M Costs per EDU



# Evaluation (Continued)

## Effluent Sewer O&M Estimate

Estimated O&M Cost/Connection





# Operation & Maintenance

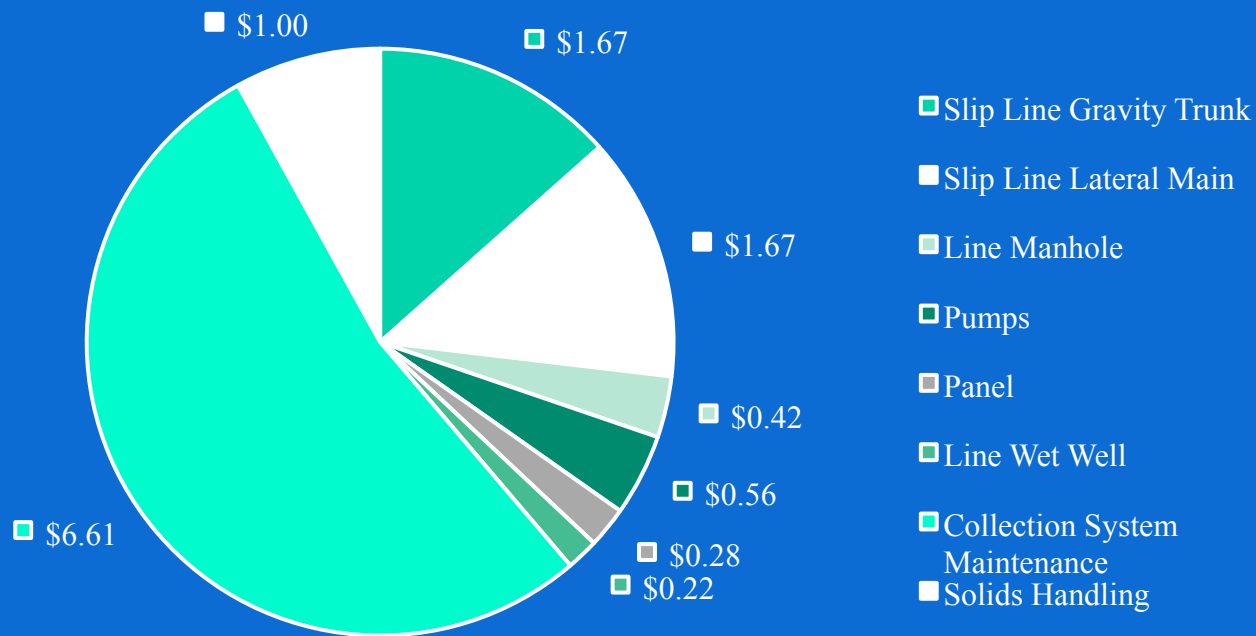
## Estimated O&M Costs

<b>Septic Tank Effluent Pump</b>	
<b>Force Main System</b>	
Force Main Replacement (75 years)	\$0.83
Service Line Replacement (75 years)	\$0.83
<b>STEP Pump System</b>	
Pumps (15 years)	\$2.96
Panel (30 years)	\$1.53
Pump Can and Line to Street (75 years)	\$1.94
Inspection & Maintenance (yearly)	\$2.48
Septic Tank Pump-out	\$2.60
<b>Monthly O&amp;M Cost</b>	<b>\$13.18</b>

# Evaluation (Continued)

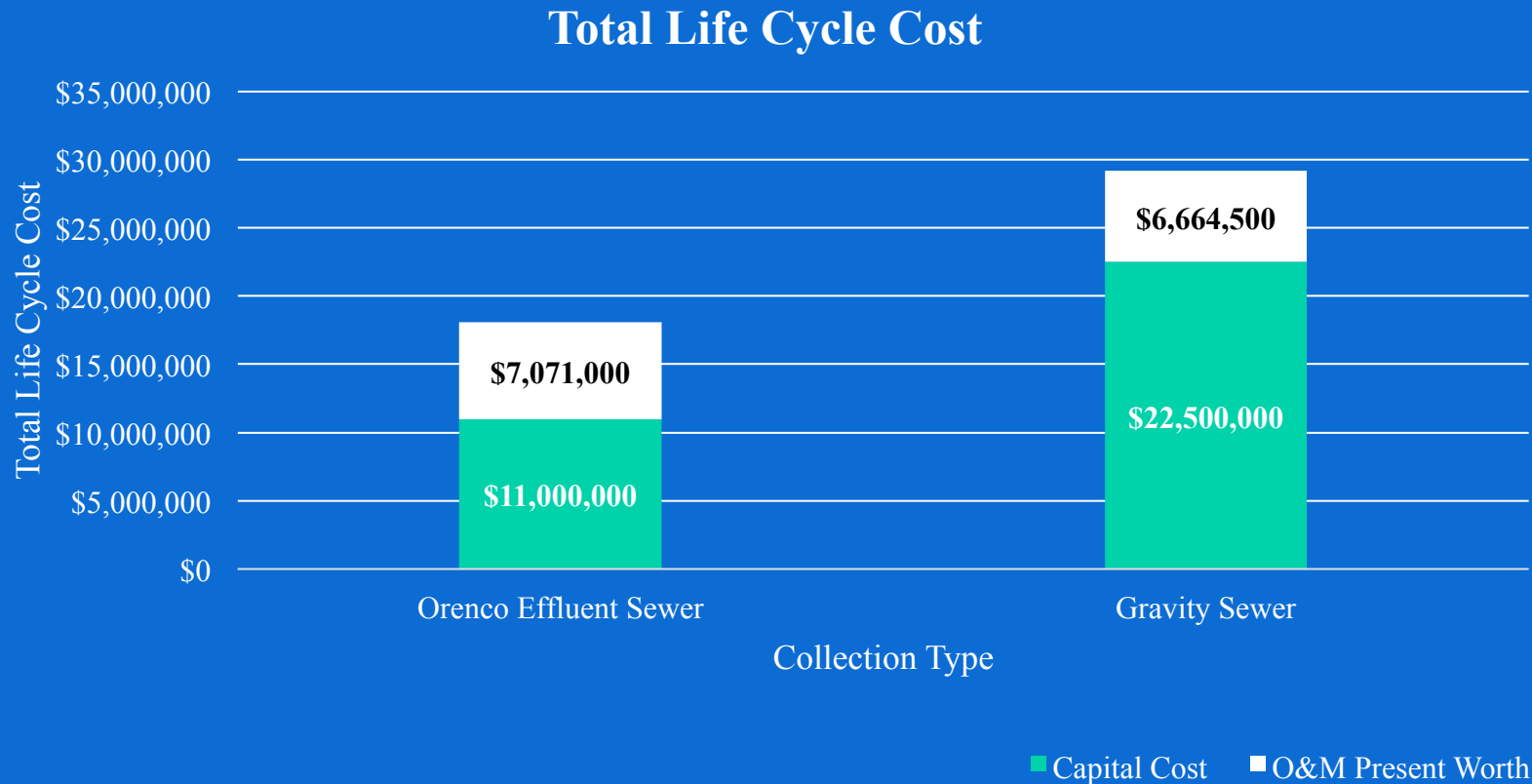
## Gravity Sewer O&M Estimate

O&M Cost/Connection



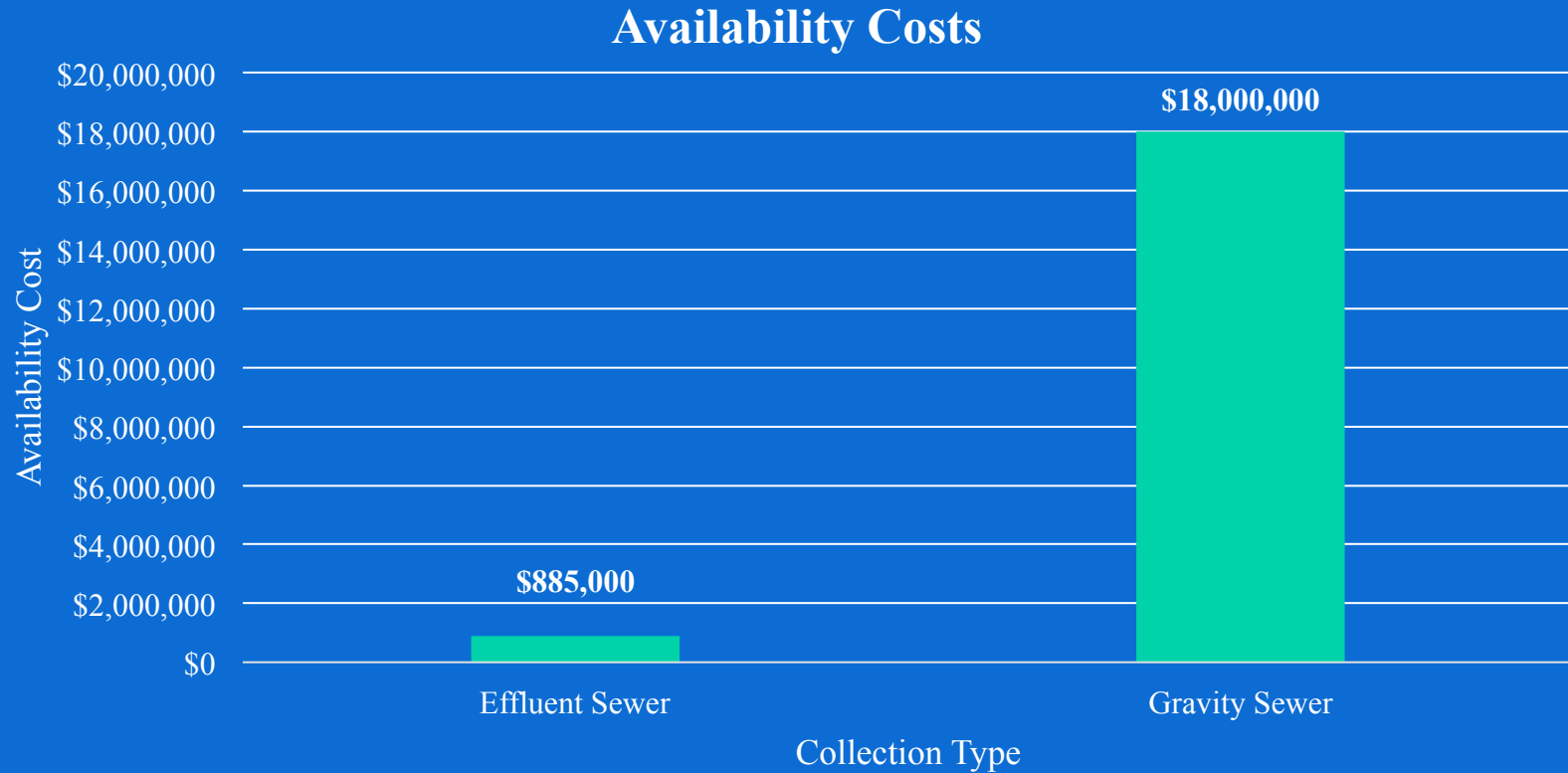
# Evaluation (Continued)

## Present Worth Estimates



# Evaluation (Continued)

## Availability Cost Estimate



# Evaluation *(Continued)*

## Social Costs

- Social Cost (aka indirect construction cost)
  - ~ Disruption to vehicular traffic
  - ~ Road and pavement damage
  - ~ Potential damage to existing utilities
  - ~ Heavy construction and air pollution
  - ~ Risk of pedestrian safety
  - ~ Tendency for citizen complaints
  - ~ Environmental impact



## Evaluation *(continued)*

### *Past Experience with Gravity Sewer*

- In 2004, 60 homes connected to gravity sewer
  - ~ Costs ranged from \$6,200 - \$19,400 per connection
  - ~ Very large construction impact
- In 2007, only 14% of residences supported gravity sewer



## Evaluation *(continued)*

### *Past Experience with Gravity Sewer (continued)*



Construction of Gravity Sewer  
Mains



Dewatering of Open Trench  
for Gravity Sewer Installation

# Evaluation (Continued)

## Social Cost (continued)



Directional Drilling of STEP  
Sewer Mains



Open Trench Excavation of  
Gravity Sewer Mains



## Evaluation *(continued)*

### *Validating Performance*

- Contacted other cities to verify the low costs of an Orenco Effluent Sewer
- Cities/Regional Examples of Orenco Effluent Sewer
  - ~ South Alabama Utilities (3,000 +)
  - ~ Consolidated Utility District of TN (4,000 +)
  - ~ Southwest Barry County (1,000+)
  - ~ Camas, WA (2,900+)
  - ~ Yelm, WA (2,000+)
  - ~ Lacey, WA (4,000+)
  - ~ Missoula, MT (2000+)
  - ~ Glide, OR (1,000+)
- Tens of thousands of connections all over the country in smaller decentralized applications

# Funding

- Florida Department of Environmental Protection
  - ~ St. Johns River Water Management District
    - \$540,000 Grant for mainlines and service laterals
- Remaining paid by homeowner, less any credits:
  - ~ STEP Up and Save Credit
    - \$2,290 offered by the city
  - ~ Wastewater Utility Extension Credit
    - \$1,100 offered by the city

# Funding (Continued)

## Estimated On-lot Cost

Component	Cost/EDU
Orenco On-Lot STEP	\$3,000
Service Lateral	\$500
Tank Installation	\$2,500
Electrical Connection	\$500
Force Main	\$600
Total Estimated Construction Cost	\$7,100



# Design Overview

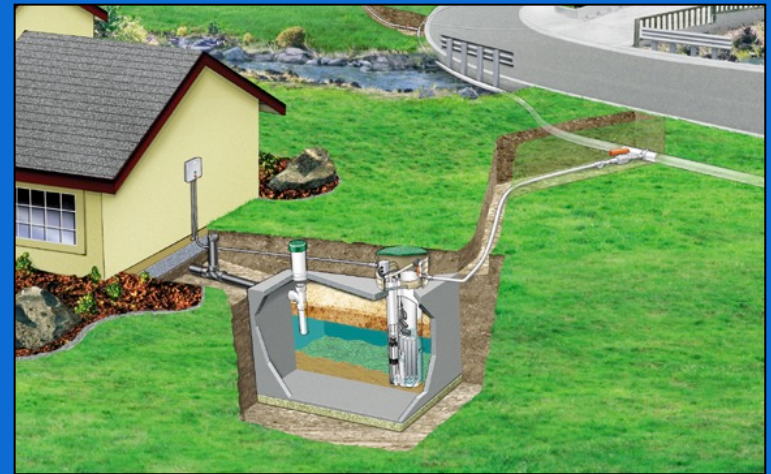
- Selected an Orenco Effluent Sewer pumped to existing centralized treatment plant
- Estimated 1,500 connections will be installed at full build-out
- 93,000 lf of 2" low-pressure, HDPE force mains by project's end



## Design (Continued)

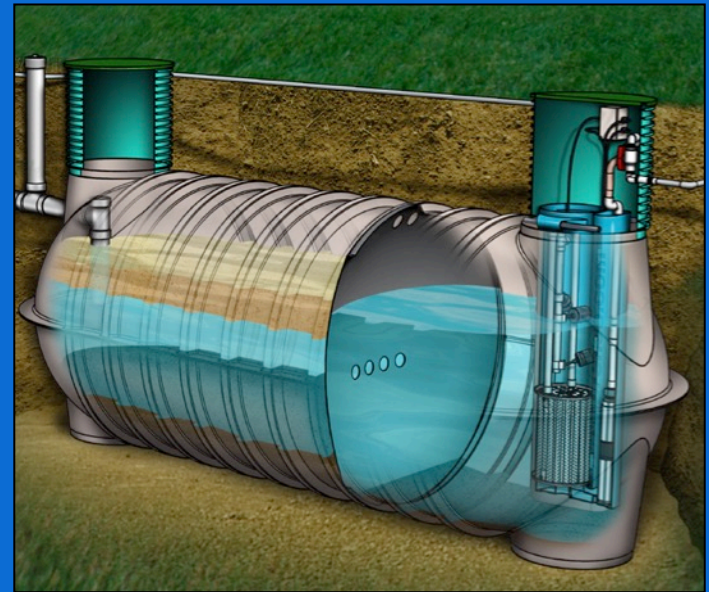
### Collection System Overview

- Septic Tank Effluent Pump (STEP) Collection
- Components
  - ~ Watertight tank
    - (1000, 1500, or 2000) gallon
  - ~ Biotube® pump vault
  - ~ Effluent screen
  - ~ High head effluent pump, 115VAC, ½ Hp, 10 gpm
  - ~ Control panel
  - ~ Splice box
  - ~ Hose and valve assembly & Floats



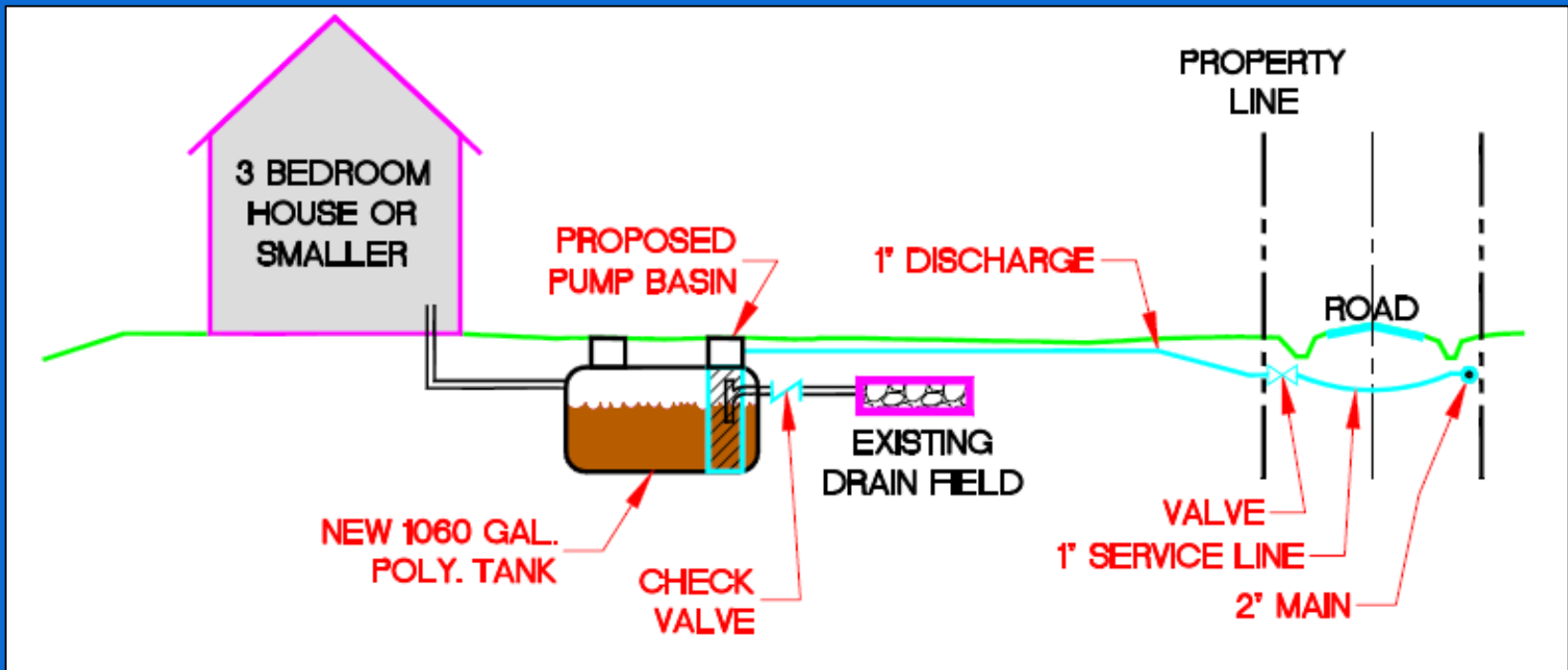
## Design (Continued) Collection System Benefits

- Primary treatment in tanks
- 85-95% removal of FOG
- 24-hour emergency storage
- 8-year pump-out interval
- Abuses stay in tank
- Chemical sources easier to identify

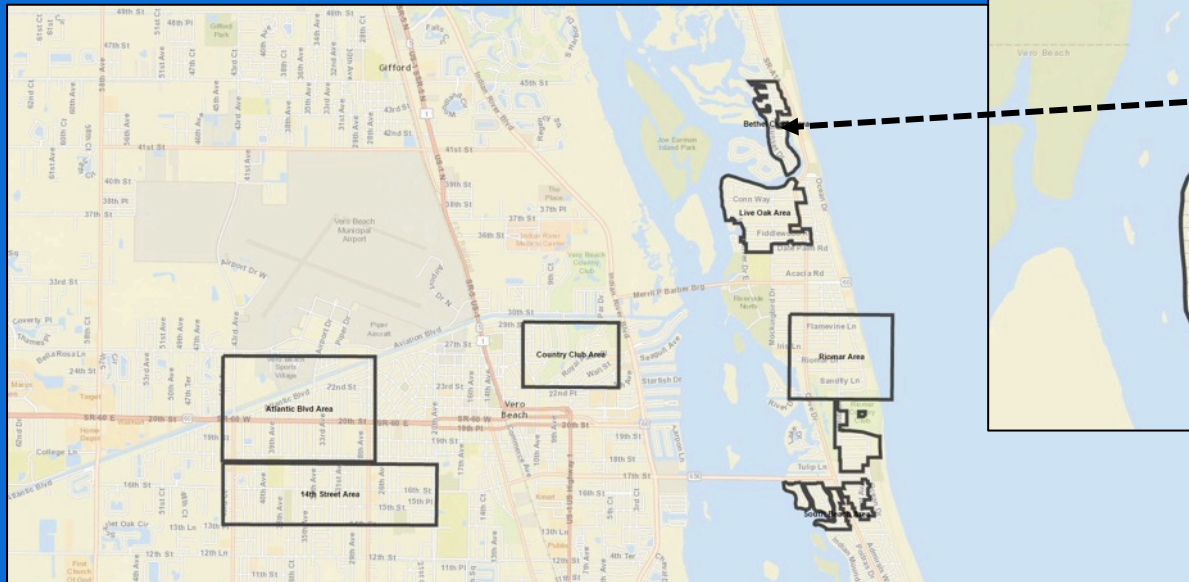


# Design

## Collection System Benefits



# Design (Continued) Collection System Service Area

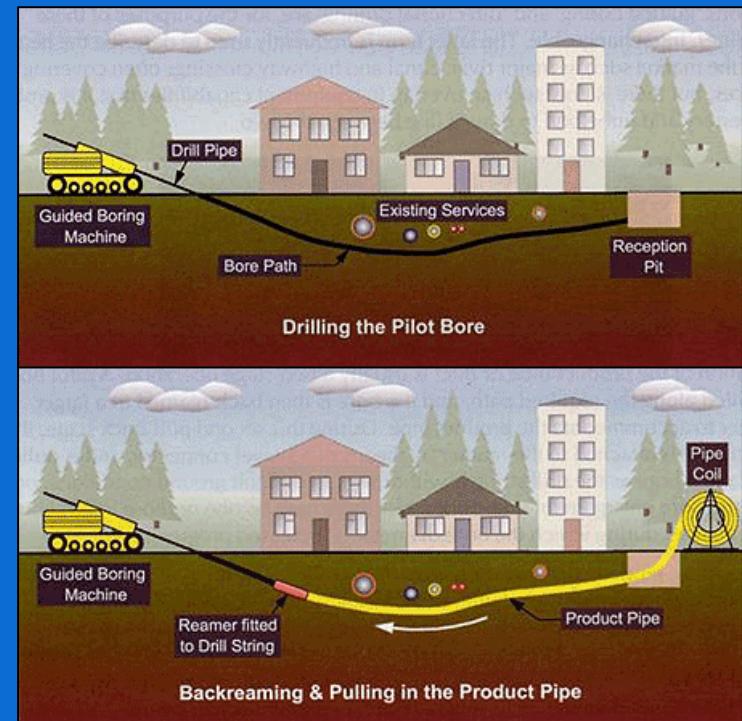




# Construction

## Right of Way Construction

- 2” Diameter HDPE mainlines
  - ~ Directionally bored
- Follow contour of land
- No lift stations
- No manholes
- Largely immune to I&I and leakage



*FHWA's "Manual for Controlling and Reducing the Frequency of Pavement Utility Cuts" report; used with permission*

## Construction (Continued)

### On-Lot Construction

- 1,500 connections
  - ~ 1,000 gallon tanks for residential
  - ~ 1,500 or 2,000 gallon tanks for commercial
- Roth polyethylene tanks
  - ~ Small excavated footprint (~108 sf)
  - ~ Two risers per tank
- Orenco S1 series panel



## Construction (Continued)

### Estimated Construction Duration

Sewer System	Mainlines	On-Lot Components
Effluent Sewer	~ 6 Weeks	1 - 2 days
Gravity	6 - 9 months	< 1 day

- Directional boring speeds up mainline installation
- 1-2 days for STEP install includes landscape restoration to make surrounding land appear undisturbed

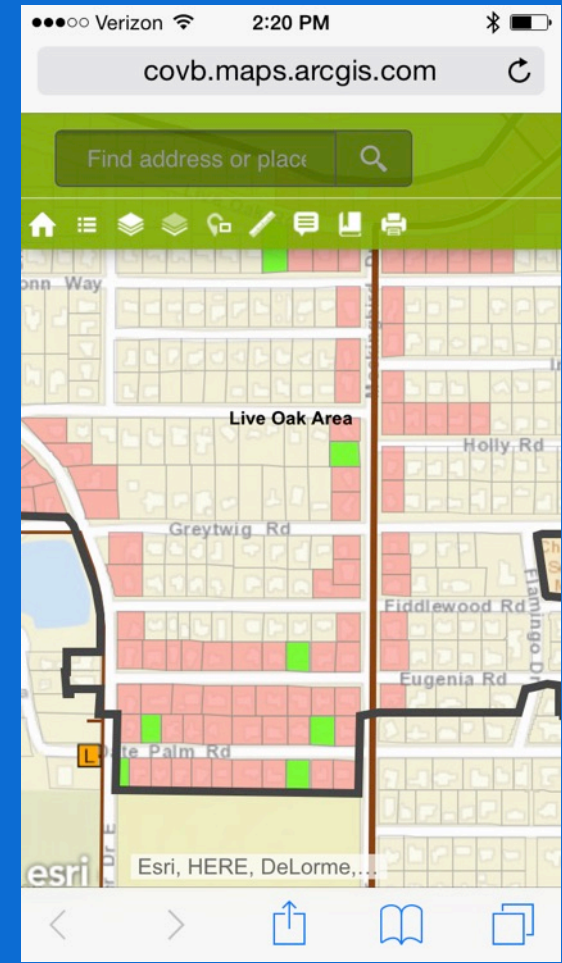
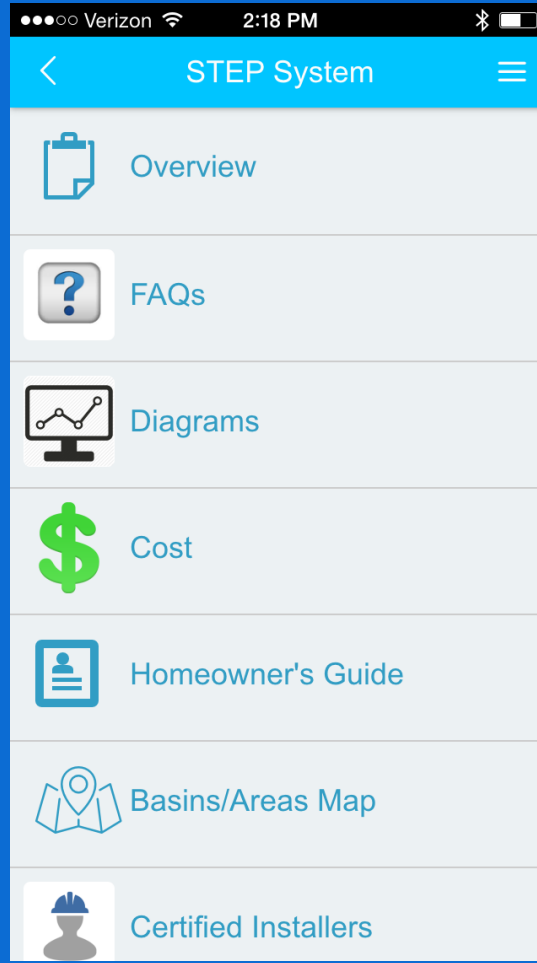
# Construction *(Continued)*

## *On-Lot Equipment Construction and Procurement*

- Certified Installers
  - ~ Eliminate incorrect installations
  - ~ Provides homeowners with list of certified contractors
- City purchases and inventories on-lot equipment



# STEP Cell Phone Application



# User Charges

- Residential base rate
  - ~ Max monthly charge of \$55.79/month/residence
    - Basic charge of \$19.89/month/residence
    - Plus \$3.59/1000 gallons up to 10,000 gallons
  - ~ Based on water usage meter data
- Initial Costs
  - ~ \$2,425 - \$9,550 depending on size of building and if new tanks are needed, typical estimated costs is \$7,100
  - ~ Less any credits mentioned previously



## Conclusion

- Cost effective
  - ~ Low capital costs
  - ~ Low O&M costs
- Minimal Construction impact
  - ~ Low social cost
    - Minimal environmental impact
- Availability Costs
  - ~ Non-mandatory connections
    - Easy to phase in connections



# Questions?

*Engineered solutions since 1981*

*Orenco Systems® , Inc.*

*[www.orenco.com](http://www.orenco.com)*

*[gespinosa@orenco.com](mailto:gespinosa@orenco.com)*