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eone SEWER SYSTEMS

# From Septic to Sewer: Pressure Sewers as the Catalyst for Improving Water Security for Communities

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# Introduction

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# Agenda

- Pressure Sewer Systems Background
  - History of Pressure Sewer
  - Applications
  - Benefits
- Septic-to-Sewer Applications
  - Case Study #1
    - Constructability
  - Case Study #2
    - Operations and Maintenance
  - Case Study #3
    - STEP vs. Pressure Sewers

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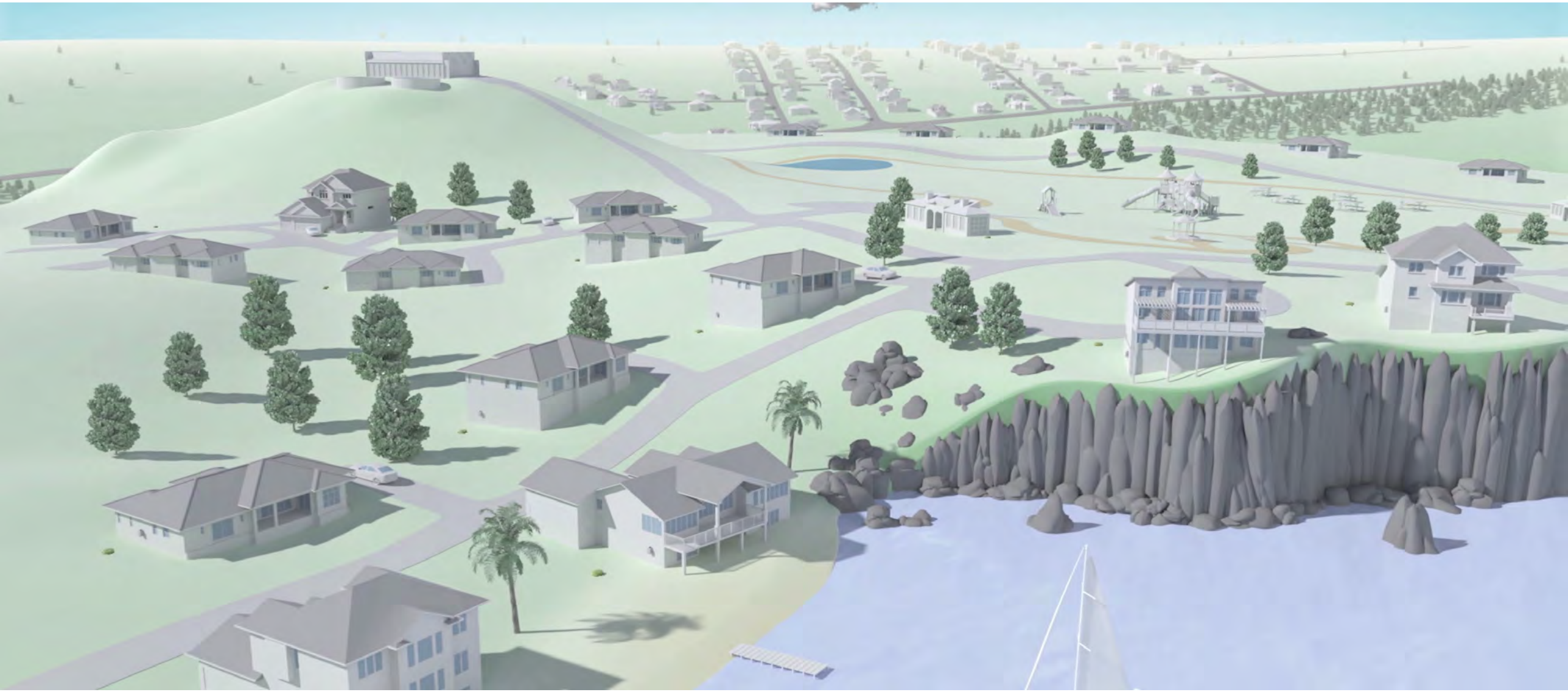

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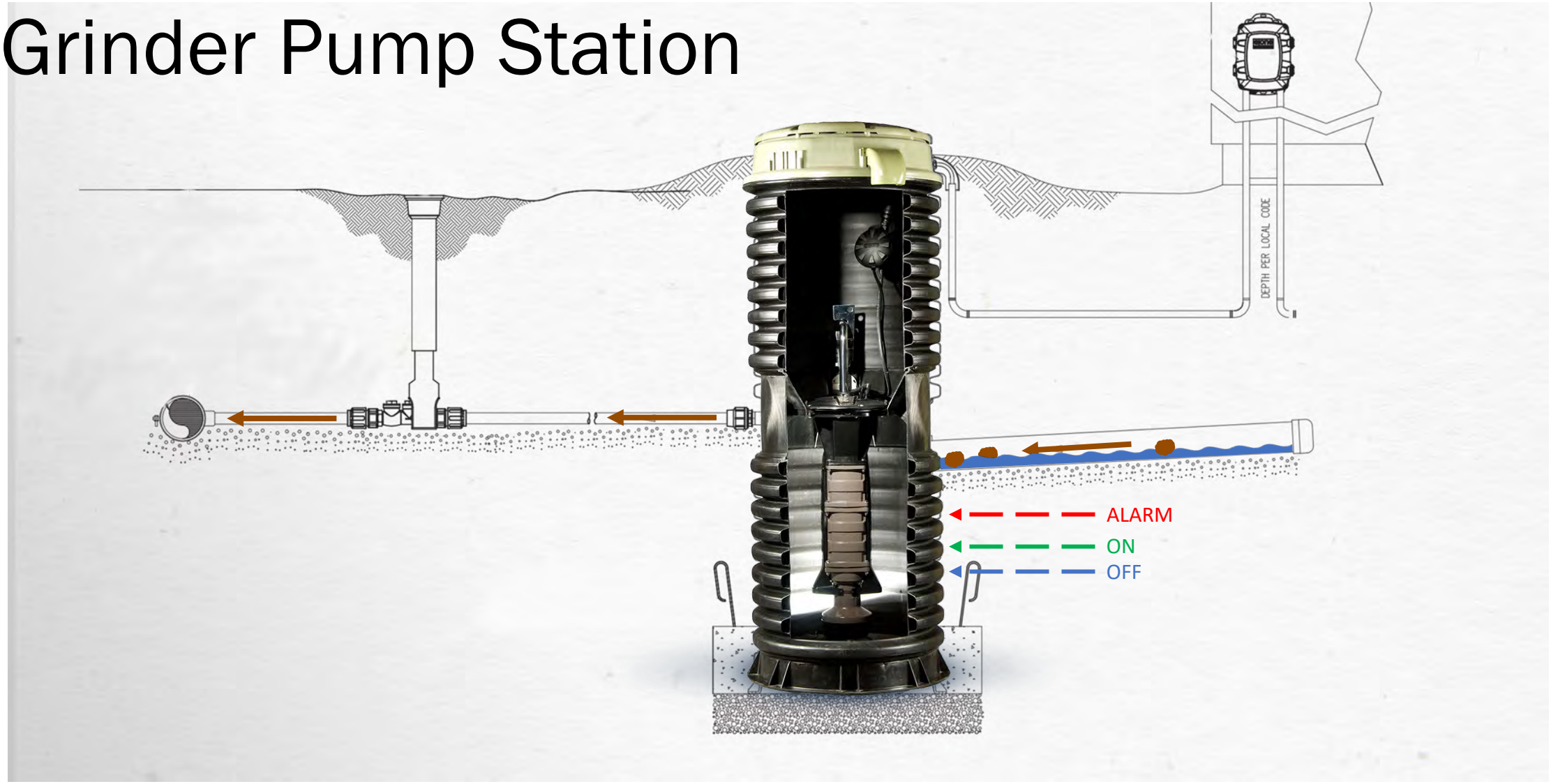
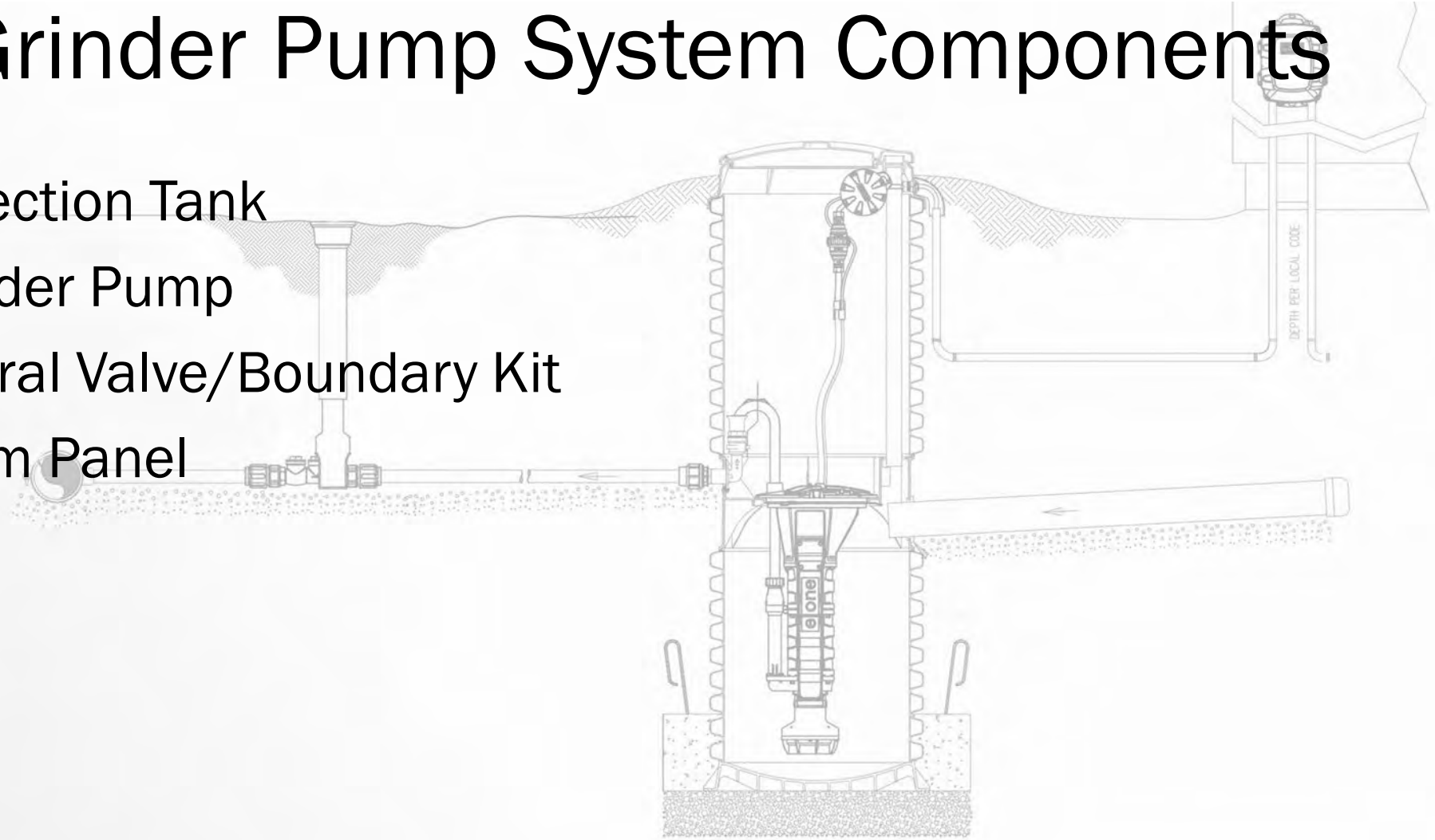
# Grinder Pump Station



# Grinder Pump System Components

- Collection Tank
- Grinder Pump
- Lateral Valve/Boundary Kit
- Alarm Panel



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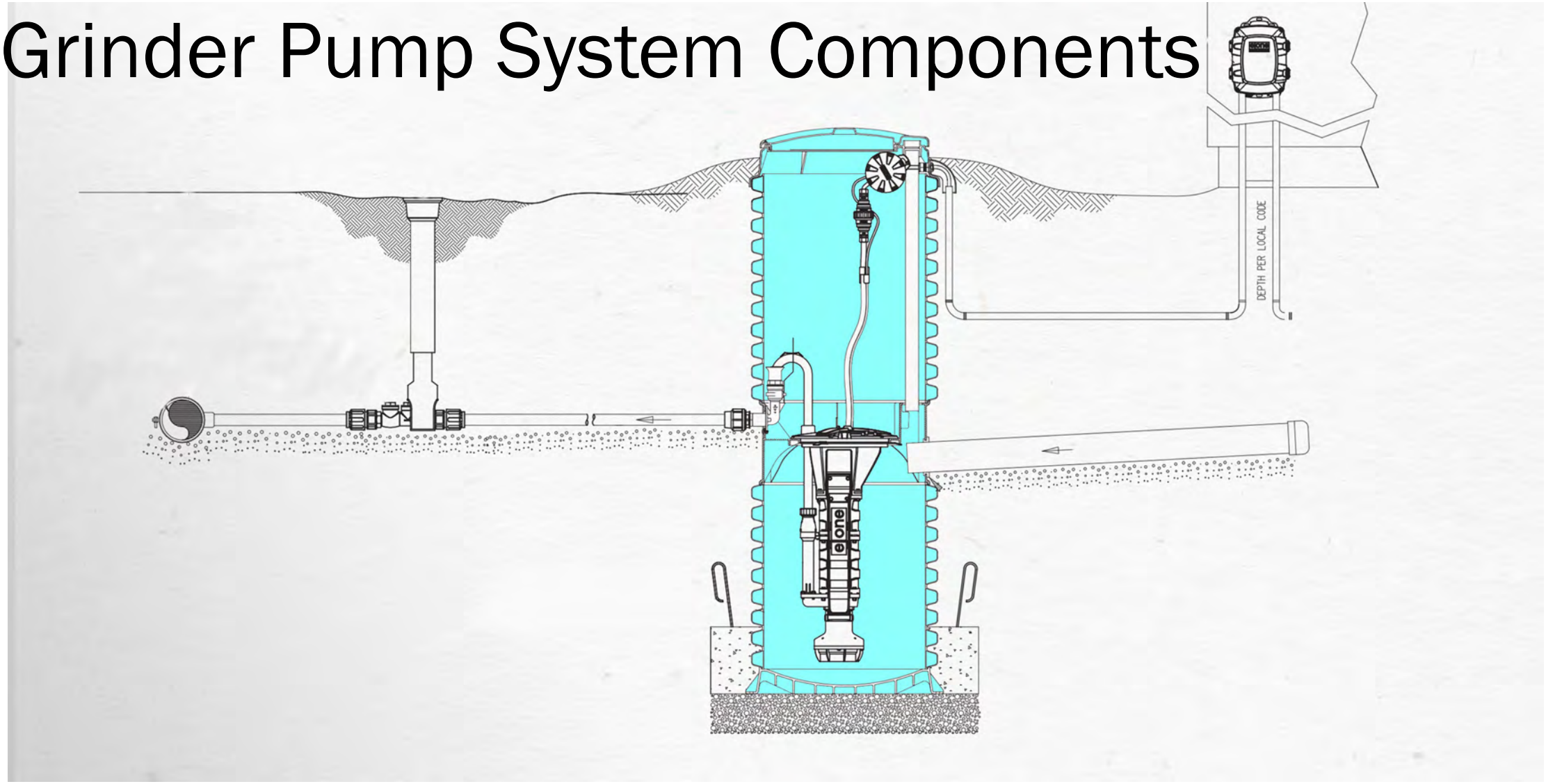

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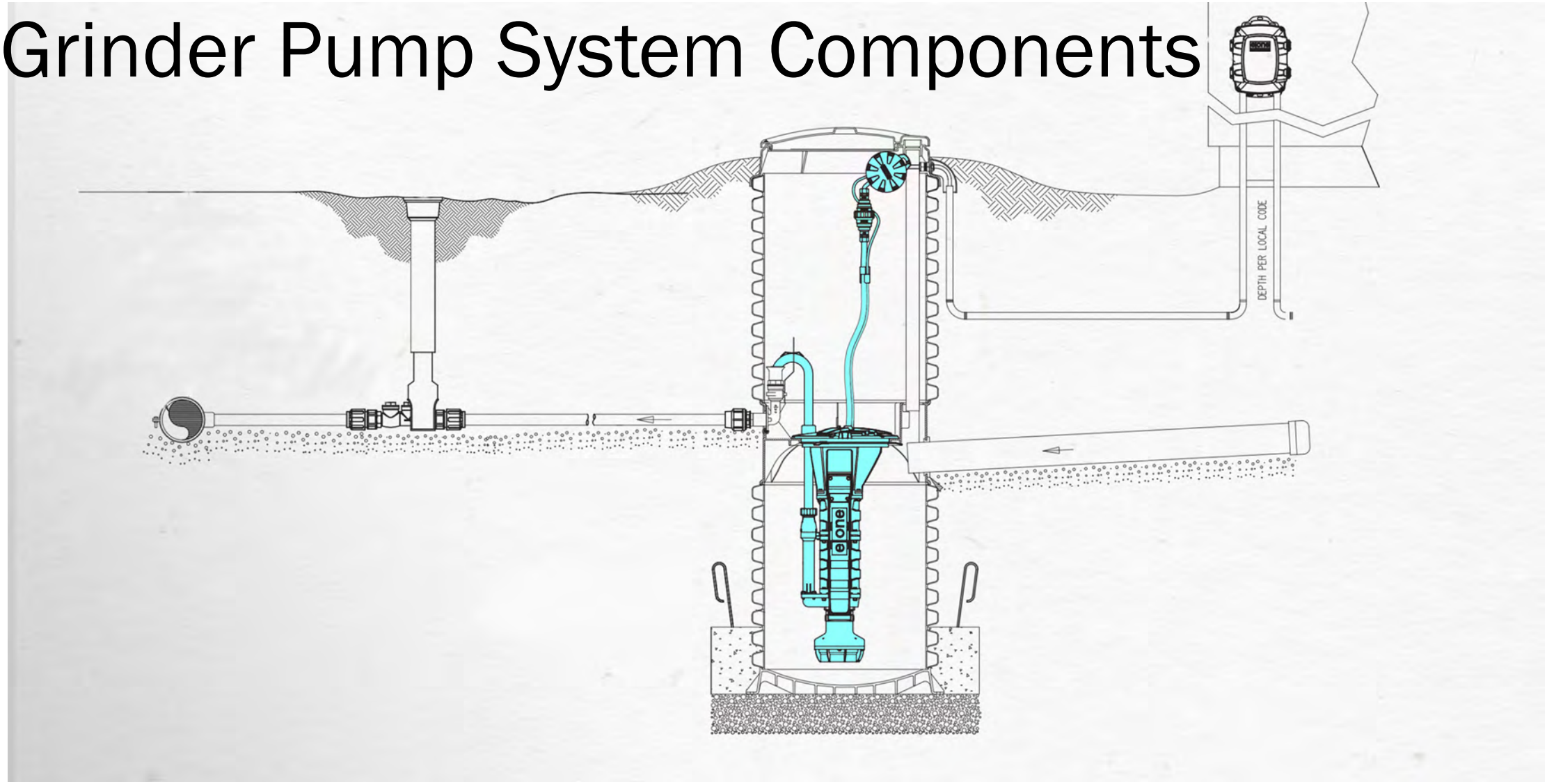

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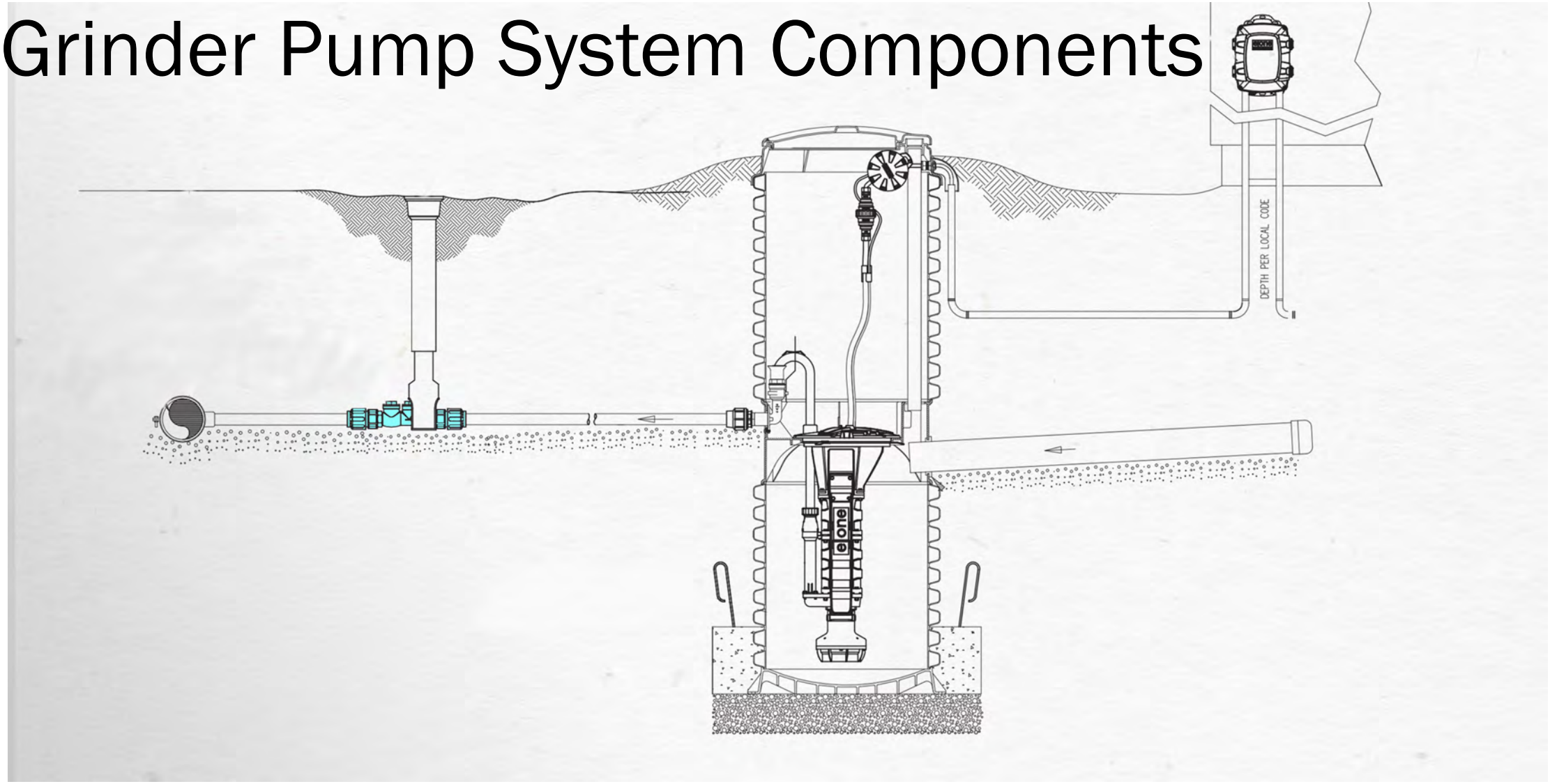

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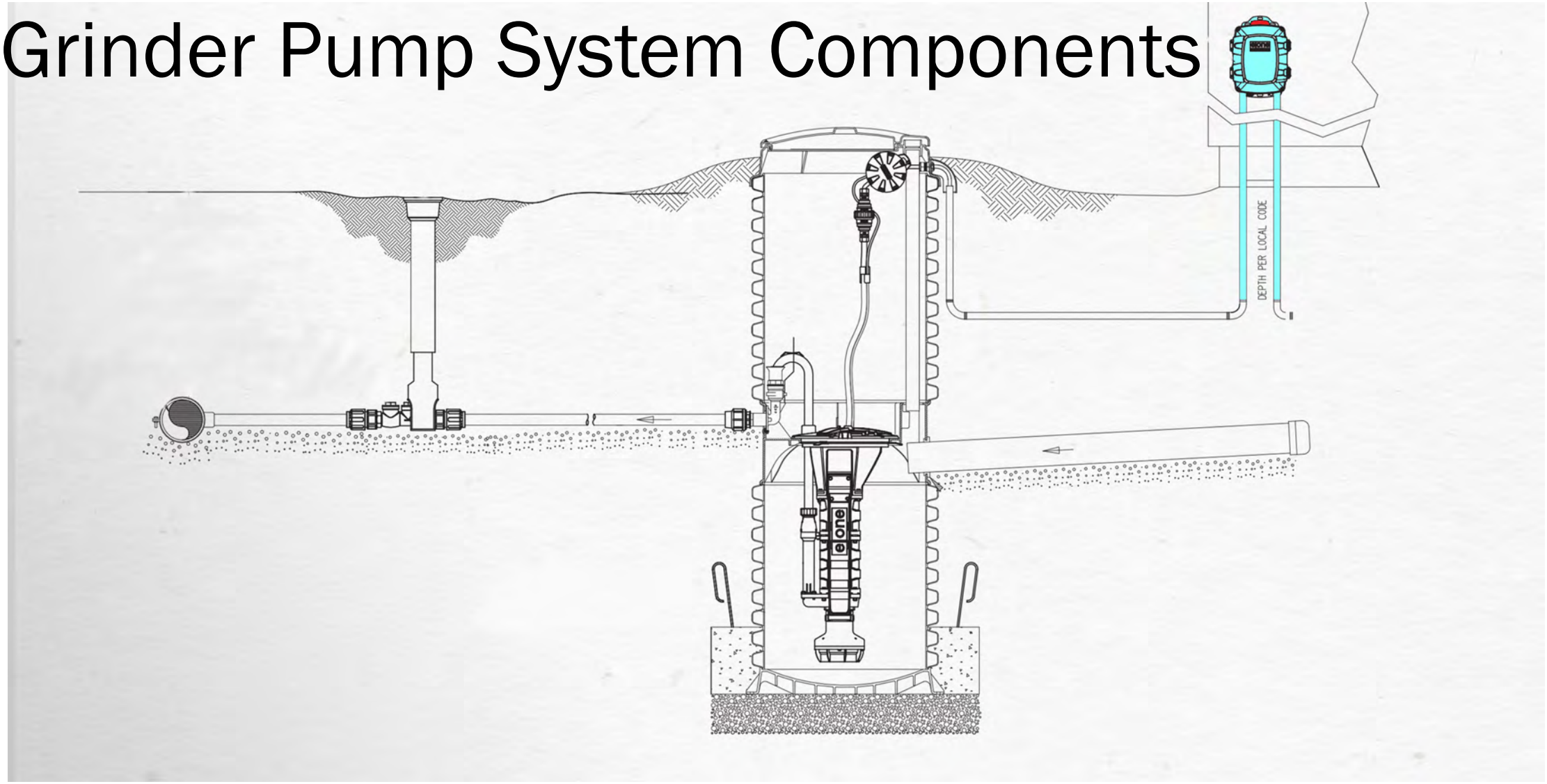

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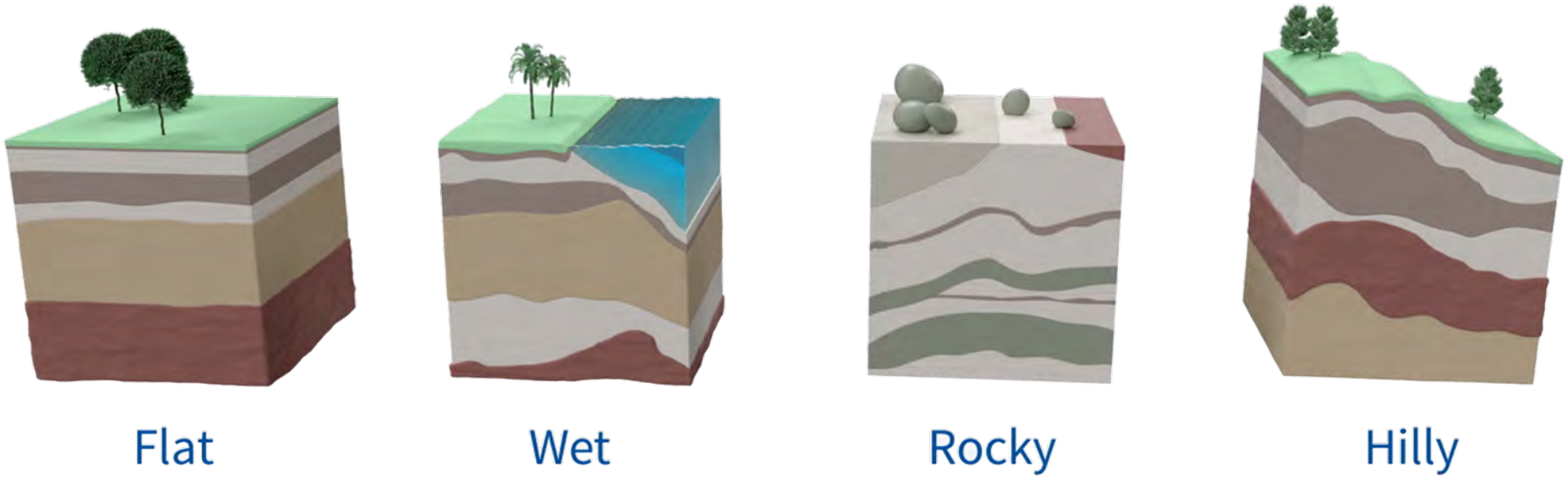
# Pressure Sewer History

- American Society of Civil Engineers / United States Environmental Protection Agency
- General Electric spinoff
- E/One formed in 1969
- Global presence in North America, Europe & ANZ

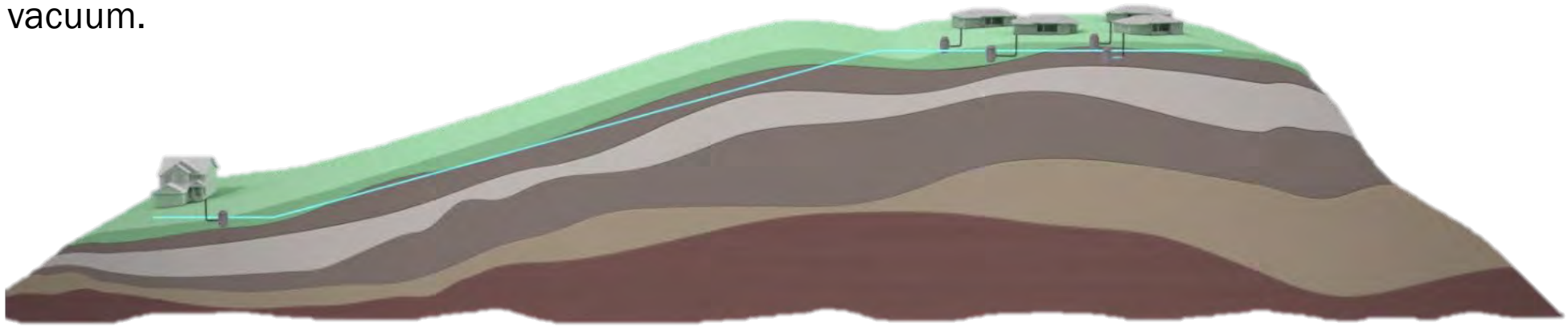
# Pressure Sewers System Applications

- Flat terrain
- Wet terrain (coastal or high-water table)
- Rocky terrain
- Hilly terrain
- Expand the service area of existing collection



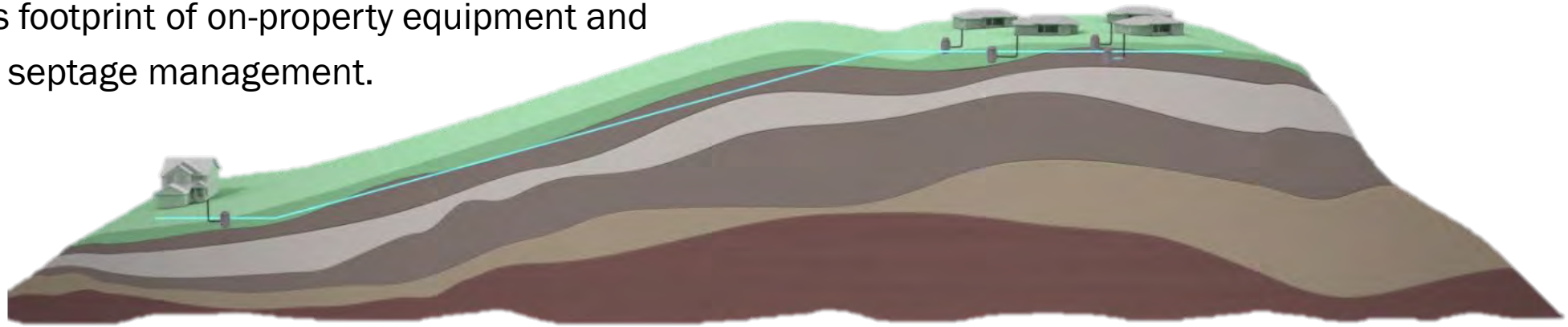
# Advantages – Pressure Sewer System *(general)*

- Pressure Sewer does not have any central critical infrastructure. A fault at one site will not affect the operation at other sites.
- Pressure Sewer sites can identify system abusers - debris or infiltration more effectively than gravity, STEP, or vacuum.
- Pressure sewer systems have zero network infiltration which significantly reduces the burden on downstream infrastructure.

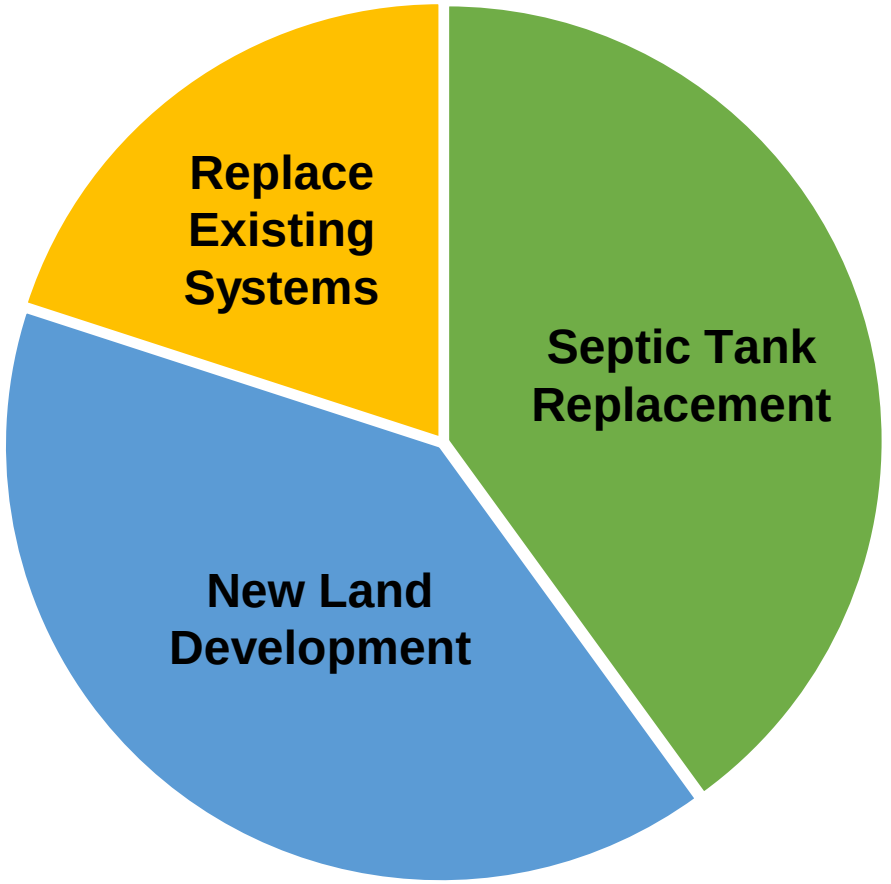


# Advantages – Pressure Sewer System *(septic-to-sewer)*

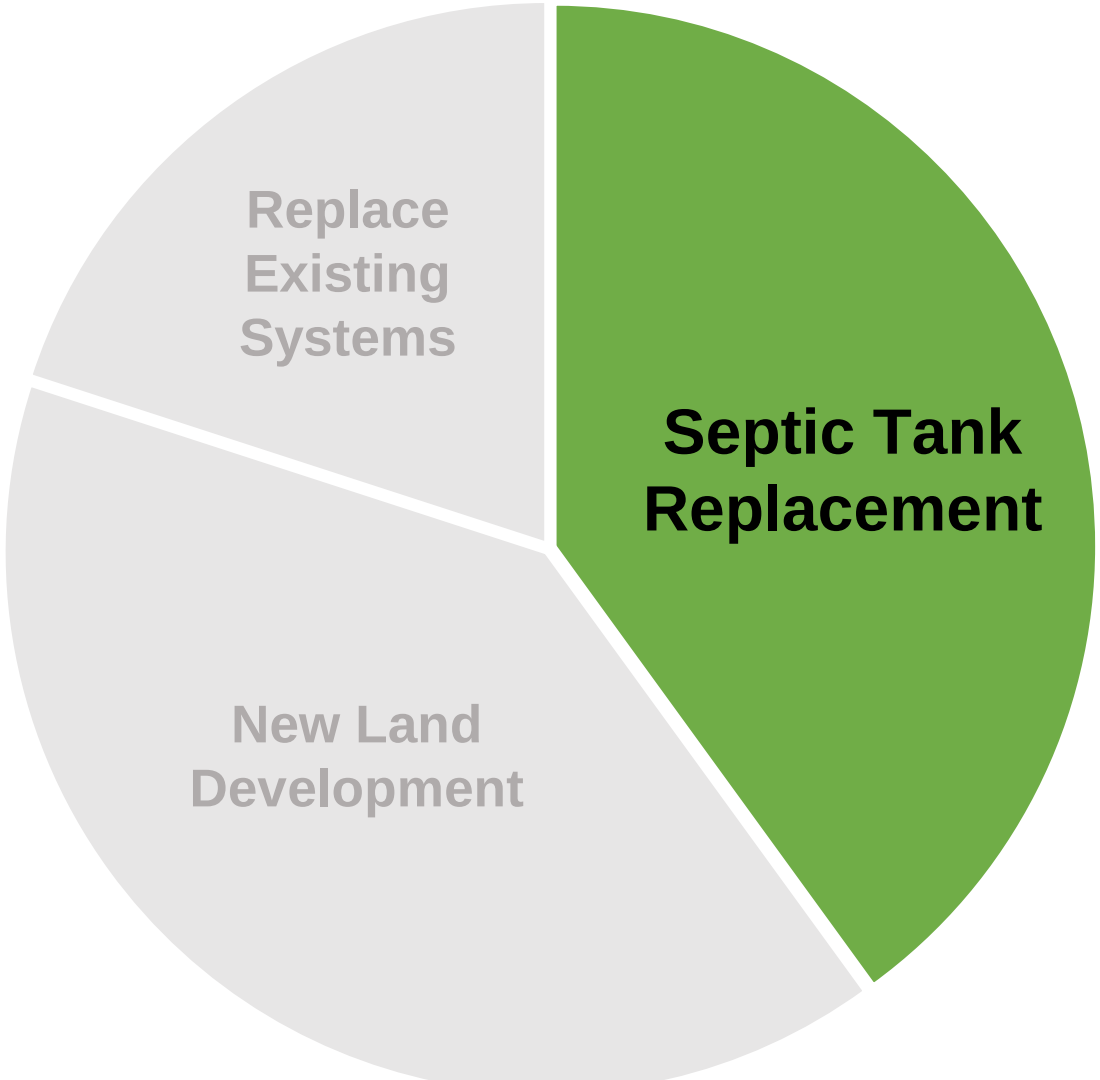
- Pressure Sewer pipe network has a light touch on the land. Installation minimizes disruption in established communities and minimizes restoration costs.
- Pressure Sewers eliminate on-site treatment. Reduces footprint of on-property equipment and periodic septage management.
- Grinder pumps actively macerate solids and are more resilient against abuse versus effluent pumps in STEP systems and system that passively manage debris like gravity.



# Pressure Sewer Applications



# Pressure Sewer Applications



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# Case Study #1 – Port Orchard, Washington

# Case Study #1 – Port Orchard, Washington

Background:

- Established community of over 200 homes on Beach Drive in Port Orchard, Kitsap County
- Failing septic tanks were creating environmental and public health concerns (21% of septic tanks had failed)
- Oyster and clam beds were threatened due to pollution
- Service area is rocky and with high ground water table

# Case Study #1 – Port Orchard, Washington

Evaluating Alternatives:

- Utility Local Improvement District (ULID) formed – permitted direct involvement of properties owners
- ULID had vested interested in selecting a system with lowest whole-of-life costs
- Solutions were considered based on topography, waterfront conditions, water quality issues, and estimated CapEx + OpEx costs

# Case Study #1 – Port Orchard, Washington

## Identifying the Solution:

- Matrix of options
- Grinder pumps selected

**Table 1: Sewer Collection System Alternatives**

| System Alternative | Estimated Construction Cost | Estimated Annual O&M Cost |
|---|---|---|
| Gravity Sewer System (including three lift stations) | $8,420,000 | $25,000 |
| STEP System | $2,336,000 | $12,600 |
| Vacuum System (with two vacuum stations) | $2,222,000 | $14,700 |
| Grinder Pump System | $1,912,000 | $10,710 |

# Case Study #1 – Port Orchard, Washington

## The Result:

- Improved water quality and health
- 75% OpEx savings, 58% CapEx savings *(vs. gravity)*
- Lessons learned:
  - Homeowner/user education
  - Proper Installation ∝ Reduced O&M

**Table 3: Pre- and Post-Construction Maintenance and Repair**

| | Pre-Project Estimate | Actual Post-Construction | Savings |
|---|---|---|---|
| MTBSC | 10 Years | 22 Years | 12 Years |
| Average Number of Service Calls/Year | 35 Calls | 16 Calls | 19 Calls |
| Average Maintenance $/Year | $13,186 | $9,009 | $4,177 |

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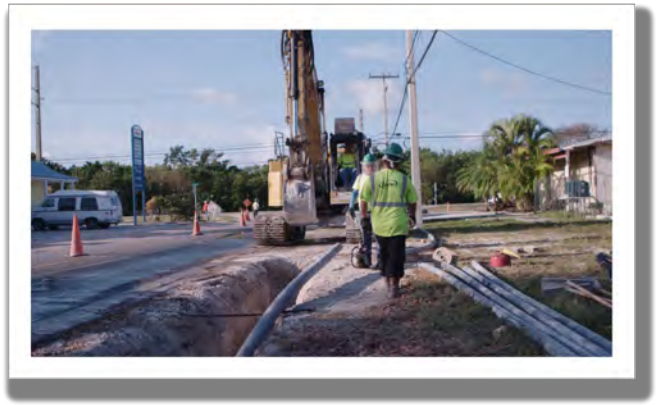
# Constructability



Gravity

- Deep excavations
- Dewatering
- Precision grade / slope / bedding
- Traffic management
- Extended construction schedule
- Greater disruption to the existing community
  - Facebook, Nextdoor, X (formerly Twitter), Instagram, TikTok, whatever…
- Increased risk

# Constructability

<u>Pressure Sewers</u>

- Horizontal Directional Drilling / Shallow Trenching
- Minimal disruption / light touch
  - Reduced excavation and restoration
- Smaller equipment, crews, impact
- Program management flexibility
  - Pipe network
  - Grinder pump station
- Community engagement is key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# Case Study #2 – Keuka Lake, New York (Town of Jerusalem)

# Case Study #2 – Keuka Lake, New York (Town of Jerusalem)

Background

- Glacier formed lakes and gorges
- Failed septic tanks were polluting the lake, impacting recreation and public health
- Building/improvement moratorium due to wastewater issues
- 265 impacted properties
- Highly seasonal occupancy (only 20% full time residents)

# Case Study #2 – Keuka Lake, New York (Town of Jerusalem)

<u>Evaluating Alternatives</u>

- Keuka Watershed Improvement Cooperative (KWIC)
- Challenges:
  - Steep, rocky, hilly terrain
  - Small lots, minimal footprint
  - Existing homes close to lake front
  - High ground water table
  - Seasonal occupancy
- Considered gravity, STEP, and grinder pump pressure sewers

# Case Study #2 – Keuka Lake, New York (Town of Jerusalem)

## Identifying the Solution

- Pressure sewers with grinder pumps advantages:
  - ~50% lower construction costs vs gravity ($3.2M vs. $6.0M)
  - Most properties were below grade of road and would require pumps
  - Eliminated the need to large equipment/excavation on lots (required for STEP)
  - Sealed grinder pump stations could be located near homes regardless of set back from lake
  - Progressive cavity grinder pumps capable of mitigating risks with seasonality – periods of low flow and low velocity

# Case Study #2 – Keuka Lake, New York (Town of Jerusalem)

## The Result

- After 10 years of operation:
  - Mean Time Between Service Calls (MTBSC): 13.3 years
  - Repeat service calls to properties identified system abusers
  - Measured flow rates are lower than anticipated
    - Average velocity of 0.71 feet/second (versus 2 feet/second)
    - Despite velocities lower than published threshold for scouring, no hydraulic issues or evidence of debris accumulation

# Operation and Maintenance

| Activity | Avg Frequency (% of system/yr) |
|---|---|
| CCTV | 7.8 |
| Cleaning | 29.9 |
| Root Removal | 2.9 |
| Manhole Inspection | 19.8 |
| Smoke Testing | 7.8 |

## Gravity

- Gravity isn't free
- Proactive maintenance is key to longevity
- Regular inspection prevents blockages and overflows
- Lift station maintenance
  - Regular PMs (daily, weekly)
  - Wet well cleaning
  - Mechanical / electrical maintenance

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# Operation and Maintenance

## Pressure Sewers

- "A frequently held misunderstanding is that pressure sewer are inherently maintenance intense. Experience has not supported that opinion. Well designed pressure sewers, made easy to maintain by design … have been relatively easy to maintain." [Alternative Wastewater Collection Systems (EPA/625/1-91/024)]
- O&M of mainline pipe for pressure sewers is typically insignificant
- O&M of Grinder Pump stations vary from manufacturer
  - MTBSC: 8-10 years, Average Annual Cost: $50/station

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# Case Study #3 – Sacheen Lake, Washington

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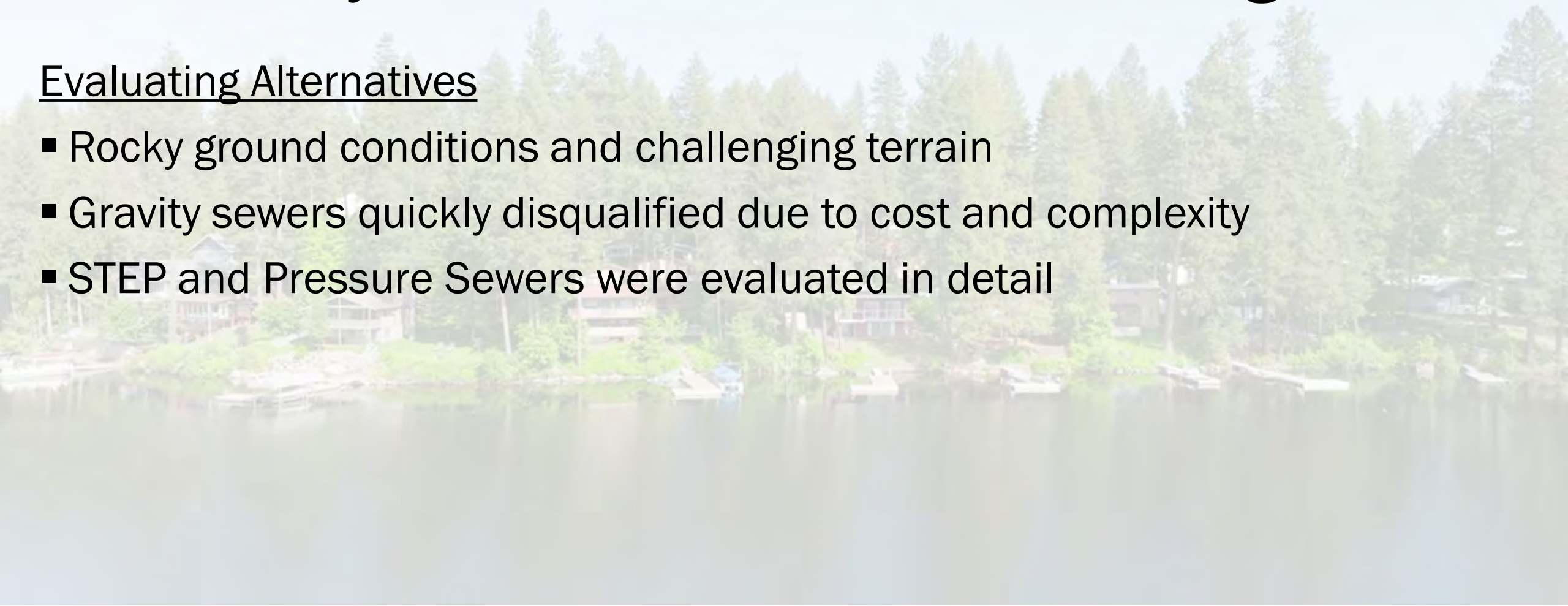
# Case Study #3 – Sacheen Lake, Washington

Background

- Pend Oreille County, Washington
- Lake formed from granite “bowl”
- Invasive milfoil and increased turbidity were present
- Failing septic tanks and cesspools were uncovered
- Homeowners struggled to mitigate symptoms and save their lake

# Case Study #3 – Sacheen Lake, Washington



## Evaluating Alternatives

- Rocky ground conditions and challenging terrain
- Gravity sewers quickly disqualified due to cost and complexity
- STEP and Pressure Sewers were evaluated in detail

# Case Study #3 – Sacheen Lake, Washington

## Identifying the Solution

- STEP and Pressure Sewers were evaluated in detail
- STEP disqualified due to constructability
  - Varying lot sizes, minimal available land for septic tank
  - Equipment access and ground conditions not suitable for larger equipment
- Pressure sewers have better constructability and flexibility
  - Adjust alignment as is rock discovered
  - Reduced cost

# Case Study #3 – Sacheen Lake, Washington

The Result

- Pressure sewers allowed for a cost effective and practical solution
- Centralized treatment prevented risk of pollution to the lake
- Hydraulic benefits of selected grinder pump results in operational simplicity – one pump model used across the network
- Water quality sampling demonstrated impact of collection system
  - Water clarify improved by at least 25% shortly after installation
- Homeowners enjoying the improved water quality

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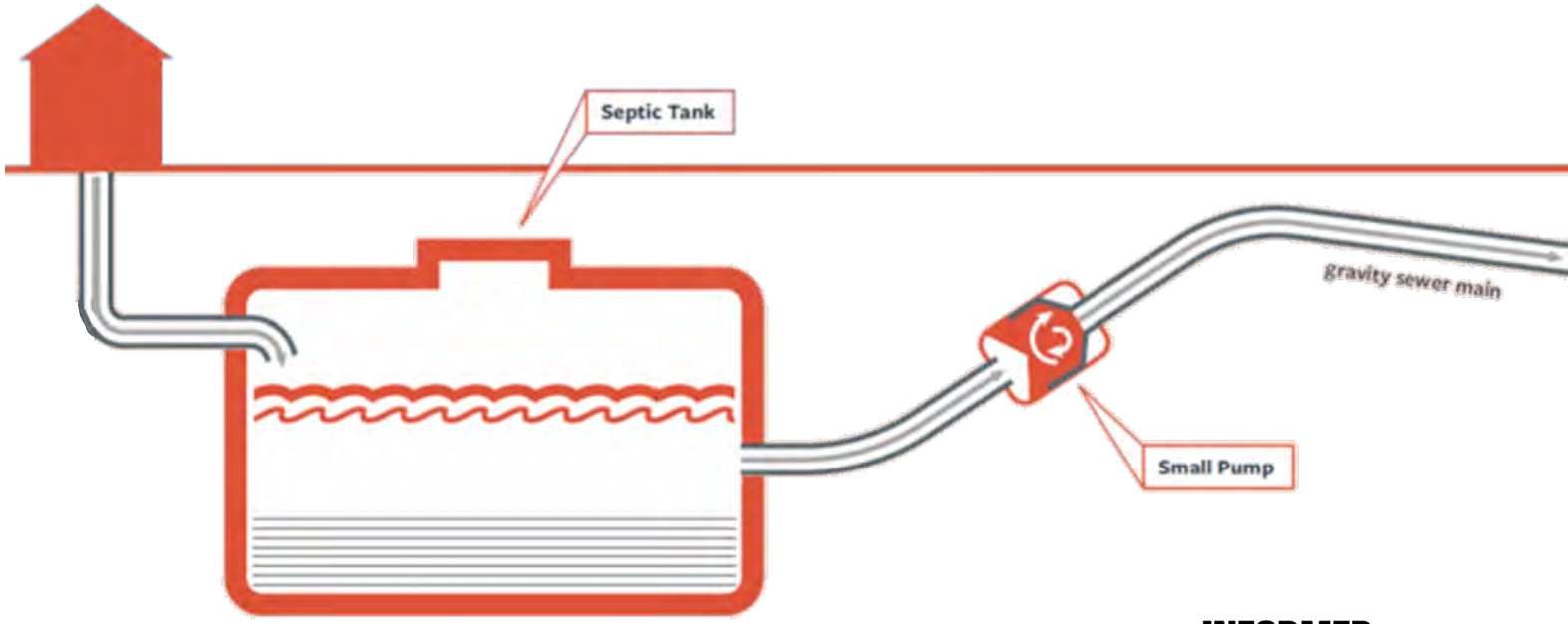
# Differentiation from Septic Tank Effluent Pumping (STEP)

## Similarities

- System components include:
  - Tank
  - Pump
  - Small-diameter pipe
  - network



# Differentiation from Septic Tank Effluent Pumping (STEP)

## Differences

- Tank IS a septic tank
  - Significantly larger (1,000+ vs. 70+ gallons)
  - Performs primary treatment
  - Must be periodically emptied
  - Minimal “storage”
- Pump does not macerate/grind
  - Filter/screen in tank
  - Regular maintenance to protect pump
  - Lower power / less hydraulic capacity

# Differentiation from Septic Tank Effluent Pumping (STEP)

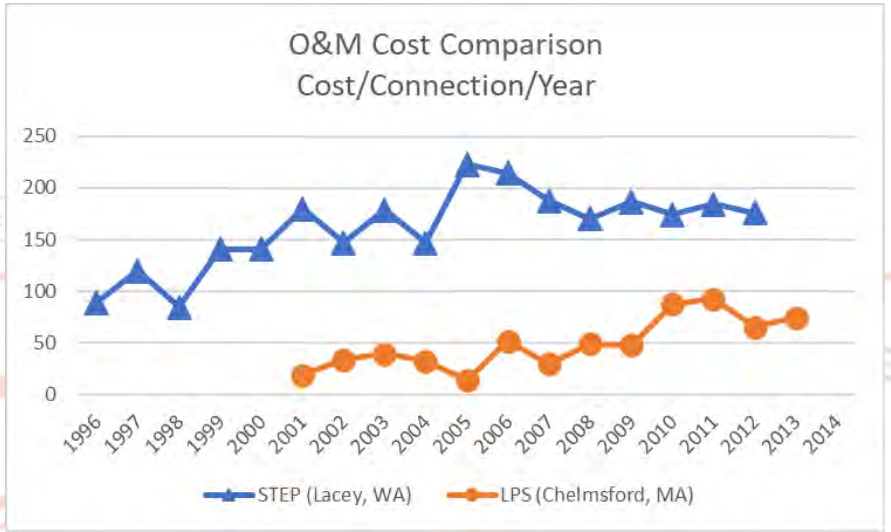
## Treatment Impacts

- STEP effluent is always septic and potentially odorous and corrosive
- STEP effluent is high in BOD, increases treatment costs
- Septage must still be managed
  - Concentrated grit, grease, and trash

# Differentiation from Septic Tank Effluent Pumping (STEP)

## Practicalities

- Reusing or modifying existing septic tanks is rarely possible or practical
- Existing or proposed treatment must be considered during the evaluation process
- Regular maintenance of STEP systems is necessary to protect pumps and pipe network from blockages
- Odors and corrosion are more prevalent
- Greater operational costs



# Differentiation from Septic Tank Effluent Pumping (STEP)

<u>The Bottom Line</u>

- STEP is different than pressure sewers
- Utility of pressure sewers is greater than a small diameter force main
- Operational experience should be specific to the technology, manufacturer, and supplier

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# Protecting Water Security with Pressure Sewers

- Failing septic tanks create risks to public and environmental health
- Wastewater collection systems protect water assets
- Technical, financial, and operational challenges are barriers
- Pressure sewers with grinder pumps have unique characteristics that address construction, operational, and financial challenges
- Pressure sewers have a demonstrated track record of protecting environmental quality of life around the world

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# Questions and Answers with:

**Derek Lachut**
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*Informed Infrastructure*

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