Demonstration Project for

Orick Community Services District

Technical Assistance for Economically Disadvantaged Water and Wastewater Providers

North Coast Resource Partnership

California Department of Water Resources

December 2014

North Coast Resource Partnership
California Department of Water Resources

Technical Assistance for Economically Disadvantaged Water and Wastewater Providers

Demonstration Project for the

Orick Community Services District

November 2014

Prepared by

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1. Introduction

Orick, California is a small rural community of 357 people spread out over about five square miles. Orick is located on the North Coast of California in Humboldt County, about 43 miles north of Eureka. The Orick Community Services District (Orick CSD) location and service boundaries are presented in Figure 1. Orick does not currently have any form of community wastewater treatment system and depends solely on individual septic systems to provide storage and treatment for the community's wastewater. Many of the individual septic systems are past their design life, malfunctioning, or have failed altogether. The existing situation poses a public health hazard, threatens water quality in Redwood Creek, represents potential regulatory violations, and limits economic investment opportunities.

The community of Orick has been involved with wastewater improvement planning for several years. A previous feasibility study (SHN, 2004) focused on a centralized treatment system, however this concept has not proven viable due to high capital and operational costs, system complexity, large land needs, and regulatory challenges. A centralized system is the presumed solution for high-density areas where costs can be distributed over a large number of rate-payers and trained staff can be hired to operate and maintain the system. Orick is an example of a less densely populated area that may fall below the thresholds for where a centralized system is practical and affordable, yet with areas where individual systems are inappropriate due to under-sized lots and/or poor soil conditions. The concept of a decentralized, or cluster, system was identified as a candidate for Orick in previous studies but was not evaluated in detail.

Orick CSD proposed this demonstration project to evaluate the feasibility of a decentralized wastewater system as a potential solution for communities like Orick that appear to be too large for individual on-site systems and too small for a centralized system. Orick is a good candidate for this project due to abundant information available on soil and groundwater conditions and other constraints. If a decentralized system proves to be a viable solution for Orick, then other small communities can potentially use the same model for disposal of wastewater.

1.1 Purpose of this report

This report provides a preliminary feasibility assessment for implementing a decentralized (cluster) wastewater system in Orick. This feasibility study is part of a larger project for the North Coast Resource Partnership (NCRP) that is intended to assist small communities explore options for improving wastewater infrastructure. The report is intended to demonstrate the use of tools from the Small Community Toolbox and to further the infrastructure improvement goals for the Orick CSD. This report will show the opinion of GHD on the costs and benefits of implementing a decentralized wastewater treatment system.

1.2 Scope and limitations

This report: has been prepared and reviewed by GHD for the NCRP. The Orick Community Services District has signed a participation agreement relating to the demonstration project that is the subject of this report. It should be emphasized that the report is to be used as an example of how tools and processes can be used to help further infrastructure improvement projects for a variety of communities throughout the North Coast region. Further planning, analysis, engineering and permitting will be required by the OCSD.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. This report has been prepared based on information provided by others, which has not been independently verified or checked.

Any cost estimates presented in this report or through related Toolbox elements are for conceptual purposes only. Actual prices, costs and other variables may be different at the time of an actual project and thus, project costs may change. Actual costs will depend on final project configuration and requirements. There is no warranty or guarantee that the project as currently conceived can or will be undertaken at a cost which is the same or less than costs that may be inferred from this report.

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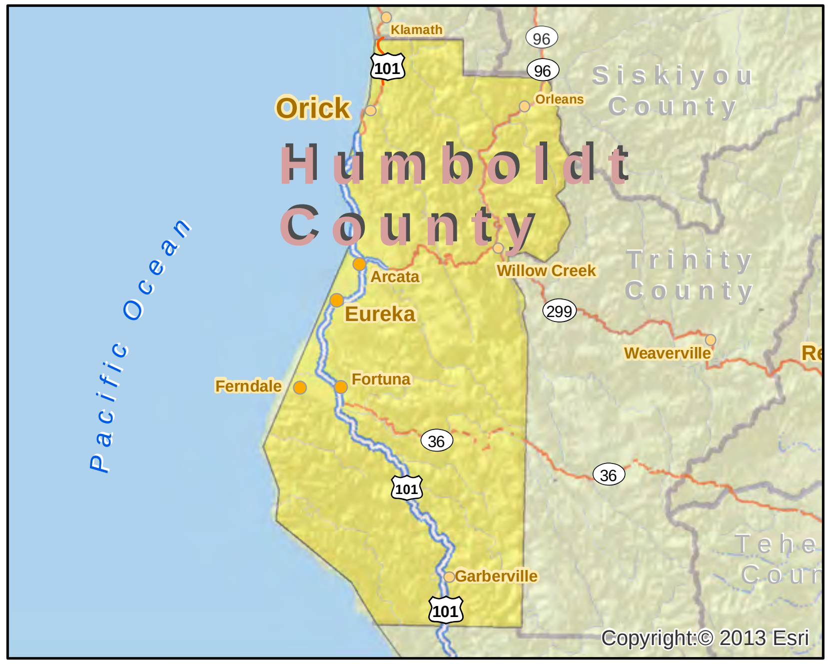

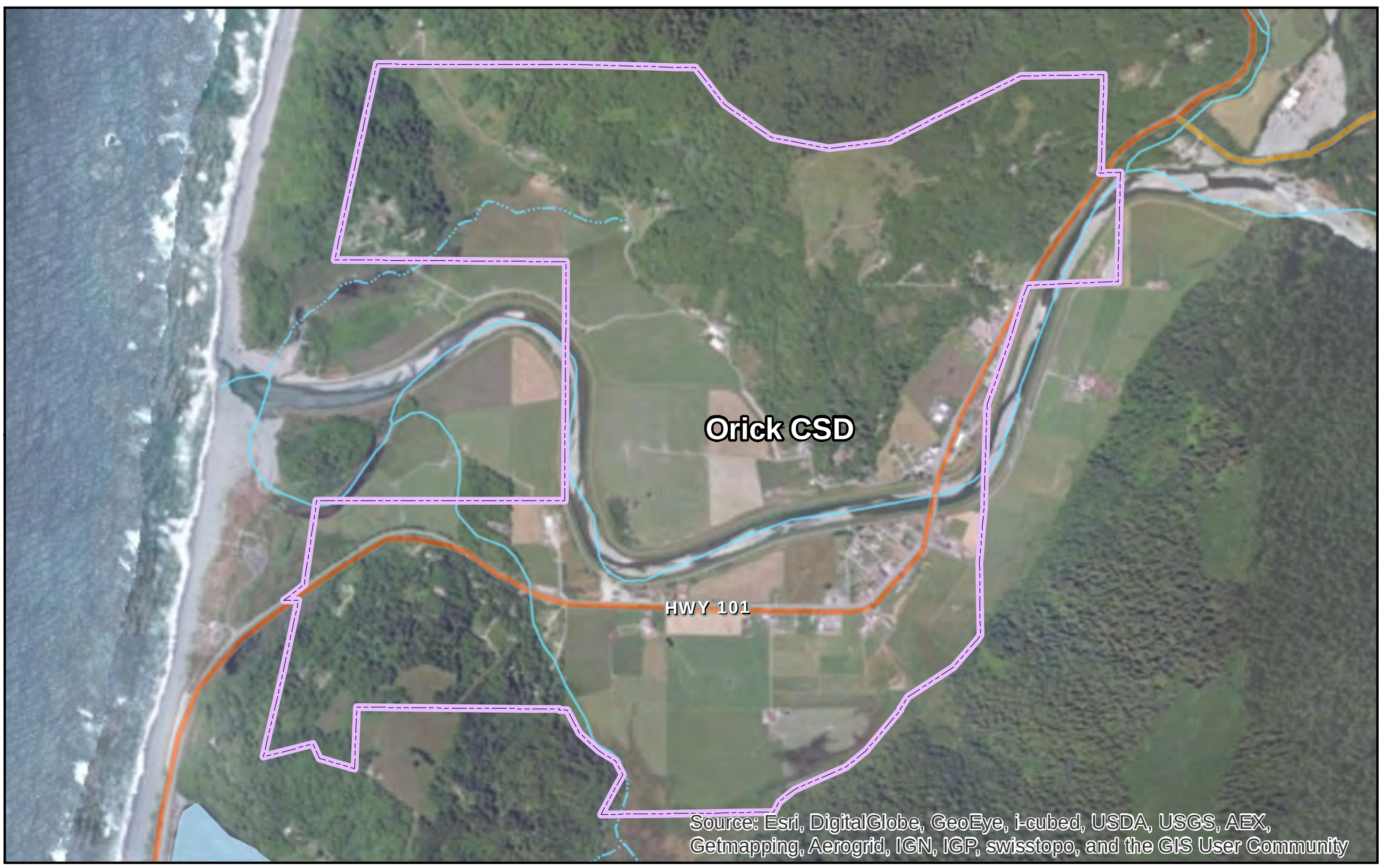

U.S. Highway
Major Road
Local Roads
Stream
River
Orick CSD

Paper Size 8.5" x 11" (ANSI A)

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Miles

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

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Orick Community Services District
NCRP Demonstration Project

Job Number	8410996
Revision	A
Date	24 Oct 2014

Vicinity Map

Figure 1

718 Third Street Eureka CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

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Data source: ESRI Street Map; NAIP aerial 1m. Created by:porogers

2. Use of the Small Community Toolbox

This Small Community Toolbox provides resources and references that allow small communities to approach the management of local water and wastewater infrastructure in a systematic fashion. The Toolbox is not a substitute for professional assistance with operations, management, engineering and legal issues. Rather it is intended to help small utilities develop a "first order" understanding of what their options are, how they should begin to budget, and how to get help.

The Small Community Toolbox is organized around the concept of the Utility Management Cycle illustrated in Figure 2.

Figure 2 Utility Management Cycle

Individual tools have been prepared for each of the elements of the Utility Management Cycle which are summarized in Table 1. The tools used for this demonstration project are highlighted throughout this report. The Small Community Toolbox summaries should be referenced for additional information regarding the tools and their use.

Table 1 Small Community Toolbox Elements

Utility Management Cycle Element	Toolbox Element	What it is and How it can be Used
Utility Management Cycle Element 1: ***Organize and Plan for Success***	**1.1:** Community Networking Directory:	A contacts list of water and wastewater providers who can be called upon.
	1.2: Governance Summaries:	An overview of options, benefits, and steps required to form various types of service entities
	1.3: GIS Maps:	Census, legislative, and other public data to help agencies access information needed for applications.
Utility Management Cycle Element 2: ***Match Needs to Economical Technologies***	**2.1:** Technology Overviews:	Overviews of common issues, technologies, and evaluation factors to help select alternatives
	2.2: General Cost Estimating Strategies:	Cost estimating charts to help develop order of magnitude estimates for various types and sizes of infrastructure to begin scoping overall funding strategies
Utility Management Cycle Element 3: ***Create Viable Financing Strategies***	**3.1:** Funding Program Summaries:	A one-stop information shop about funding programs suited to small community infrastructure projects
	3.2: Capital Recovery Tables:	Lookup tables to translate the portion of total project costs not paid by grant into annual debt service requirements met through a revenue mechanism
	3.3: Financing District Summaries:	Summary of strategy options for generating revenue to pay the annual debt service
	3.4: Cash Flow Considerations:	Assists entities in understanding the funds needed to move a project through planning, design, and construction
Utility Management Cycle Element 4: ***Prepare Preliminary Design, Studies, and Applications***	**4.1:** Consolidated Preliminary Engineering Report Template:	Consolidated report outline, with model tables that will meet the needs commonly used funding programs.
	4.2: CEQA/NEPA Exemptions and Checklists:	Summary of CEQA/NEPA exemptions and checklists to aid in meeting State and Federal environmental requirements and funding program requirements
	4.3: Common Permit Triggers:	Summary chart of typical project components that often trigger different types of permits
Utility Management Cycle Element 5: ***Complete Final Design and Construction***	**5.1:** Guidance for Hiring Professionals:	As a project moves from initial planning towards implementation, detailed, community-specific designs are required and communities will need to retain professional support
	5.2: Public Bidding Process Overview:	Understanding how the public bidding process works, how to set up a successful project bid, and how the low bid contractor is selected
Utility Management Cycle Element 6: ***Operate and Manage System***	**6.1:** Technical, Managerial, and Financial (TMF) Resources:	Tools to help agencies be organized and managed to improve overall operations and funding competitiveness
	6.2: Regulatory Resources:	Sources to provide information to the utility operator on various federal and state regulations
	6.3: Rate Setting Guidance:	Linking the costs of projects to the need to rate increases and methods to set and change rates
	6.4: Capital Improvement Planning Resources:	Part of the on-going Utility Management Cycle of planning for future system improvements

3. Project Background

3.1 Decentralized Wastewater Systems

Decentralized or onsite wastewater systems consist of a variety of approaches for collection, treatment and dispersal/reuse of wastewater for communities. Decentralized systems provide a range of treatment options from septic systems that use passive treatment techniques such as soil dispersal, to more complex approaches that involve advanced treatment units. For many communities, decentralized treatment methods can be more cost effective as they avoid large capital costs and reduce operation and maintenance costs (Orenco 2014).

Instead of each private property managing their own septic system and leach field, decentralized systems are able to treat all of the wastewater collectively generated by a community. A collective disposal area is utilized which enables greater land use efficiency (EPA 2005). A central treatment unit can be added prior to disposal to improve water quality (Orenco 2014). The responsibility of operation and maintenance of a decentralized system is shifted from individual property owners to a formal entity such as a community services district. This shift in responsibility opens up more project funding opportunities as it is likely that State funds could be used to pay for the system installation. State funding is not an option for individual systems located on private property.

3.1.1 Benefits of a Decentralized System

Decentralized wastewater treatment systems can provide a number of benefits to small communities through:

- Better wastewater treatment performance
- Greater environmental protection by improving groundwater quality
- A lower risk of system failure
- Economic efficiency
- Greater benefit to public health through mitigating contamination and health risks associated with the existing failing onsite wastewater treatment systems

3.2 Background Planning History and Literature Review

Past reports were reviewed to better understand the feasibility of installing a decentralized wastewater treatment systems for OCSD. The reports are summarized below.

3.2.1 Onsite Wastewater System Pollution Study, OLA 1999

As discussed in the introduction, Oscar Larson & Associates (OLA) performed an Onsite Wastewater System Pollution Study for Orick CSD in 1999. OLA's study found that as much as 31% of the onsite wastewater systems were malfunctioning or failing (OLA). According to Jeff Anderson & Associates, these are likely mostly caused by disconnected pipes, lack of septic system (direct discharge to the ground), undersized system, and/or failure to properly maintain/pump tanks. The OLA report suggested that the lack of proper wastewater disposal and treatment is likely polluting both the ground water and Redwood Creek, which runs through Orick. OLA found that the individually owned, on-site wastewater treatment and disposal systems were not suitable for continued use due to geological and hydrological factors.

3.2.2 Feasibility Study: Wastewater collection, treatment and disposal facilities, SHN 2004

SHN Consulting Engineers & Geologists, Inc. (SHN) conducted a feasibility study investigating wastewater discharge alternatives for the District in 2004. The purpose of the study was to evaluate the feasibility of wastewater treatment alternatives for OCSD. The alternative chosen as most advantageous was a centralized system consisting of a low-pressure grinder pump, "sewage receiving station, pre-treatment screening, a double oxidation ditch for secondary treatment, composting facilities for sludge treatment, hypochlorite disinfection and storage ponds", and land irrigation of treated effluent. SHN noted that the lack of community wastewater collection had the potential to inhibit economic development in Orick (SHN 2004).

SHN estimated a total cost for the treatment facility of $3.8 million with a projected additional $120,000 in facility equipment costs. SHN expected the cost to residents to be $75-80/month/household. SHN argued the cost to residents to be high with respect to the $30-50/month/household treatment facility cost to residents of other districts, and suggested that Orick CSD cover the majority of the facility costs via grants (SHN 2004).

3.2.3 Request for a Declaration from the Humboldt County Board of Supervisors regarding a potential problem in Orick, OCSD 2006

Orick CSD sent a request the Humboldt County Board of Supervisors to issue a Declaration to the stating that the current wastewater treatment systems in Orick might be polluting or have the potential to be polluting Redwood Creek. In January 2007, the board voted to declare Orick a pollution problem to help open up more avenues to address the sewage issues. On The request cites the OLA 1999 report, stating that 20% of the septic systems in Orick were malfunctioning and an additional 67% of the septic systems did not meet County minimum design criteria. OCSD stated that the OLA report argued that failing and malfunctioning septic systems were considered a possible source of pollution to Redwood Creek. The request established that Redwood Creek is considered impaired by the Federal Clean Water Act, a priority watershed under the State's Coho Salmon Recovery Strategy and North Coast Watershed Assessment Program, a Critical Coastal Area, and an Area of Special Biological Significance (OCSD 2006).

OCSD stated that the on-site sewage disposal systems in Orick were failing at a rate of 1 to 3 annually, and that almost all were destined to fail and require replacement. OCSD suggests that a community sewer system could remedy the problems associated with failing individually owned on-site septic systems (OCSD 2006).

3.2.4 Humboldt County Department of Environmental Health Community of Orick Report Review, JAA 2008

Jeff Anderson & Associates (JAA) compiled a preliminary draft database of 115 files available for review from the Humboldt County Department of Environmental Health (DEH) for the Orick Community Services District. Although the DEH reports are not all complete, the database is an abundant resource for soil logs, septic tank sizes, leach field size and dimensions, and failure/malfunction descriptions. The purpose of the database was to investigate if any patterns existed in the failures and malfunctions of the septic systems, and possible causes for any patterns found (JAA 2008).

The DEH database helped to identify four main causes for sewage disposal systems (SDS) problems in Orick CSD:

1. Disconnected pipe
2. No connection to a SDS
3. SDS does not meet size requirements for sewage being allocated
4. Septic tank was not pumped in 5-7 years

Some property owners regularly maintain their SDS and attain permits when necessary but other property owners do not maintain their SDS, retain illegal SDS hookups, and build without a permit. The DEH database is not a true representation of the condition of the SDS within OCSD because SDS permits are not always obtained. OCSD is a low income area and SDS permits are relatively expensive, so commonly repairs and new construction occurs without a SDS permit. The DEH began systematically assessing and reviewing SDS in OCSD in the last decade (JAA 2008).

JAA reported that most areas within OCSD have suitable soils for SDS and in areas that soils were not appropriate for SDS, appropriate soils were found in close proximity. JAA stated that at the time the database was compiled in 2008, DEH reports were generally filed by DEH staff for SDS repair permits, but sometimes other actions by the landowner can cause DEH to review and report SDS conditions. The study recommended an investigation to better understand the possible connection between SDS and contamination of Redwood Creek. The OLA study from 1999 stated that the creek was being polluted by SDS failures, but the review indicated that there was not enough evidence to prove that SDS failures were contaminating Redwood Creek (JAA 2008, Appendix A).

3.2.5 Report of Waste Discharge for the Orick Community Services District Wastewater Project, SHN 2010

SHN completed a Report of Wastewater Discharge (ROWD) for the District Wastewater Project in 2010. SHN conducted a two year study of ground and surface water elevations, soil characteristics, and alternative wastewater disposal methods. Three areas were identified as most suitable for a centralized wastewater treatment system for Orick CSD; APN 520-142-009, 520-161-006 and 520-161-010 (SHN 2010).

The general design of the system consisted of collecting wastewater from existing septic tanks using Septic Tank Effluent Pump (STEP) systems, pumping effluent to a Recirculating Gravel Filter, and discharging to a subsurface disposal field at controlled effluent release rates. SHN (2010) states, that Orick CSD anticipate that most of the existing septic tanks in the district will require retrofit or replacement in order to be compatible with the STEP system.

One of the suitable sites in the ROWD is bisected by the coastal zone. OCSD would need to acquire the inland portion of this site to undertake development. A Coastal Development Permit from California Coastal Commission would also be required. Additionally, the ROWD stated a use permit and updating OCSD’s public works plan to include the wastewater service boundary might be necessary (SHN 2010).

3.2.6 Final Environmental Impact Report Orick Community Services District Wastewater Project, SHN 2012

The project objective was to construct a centralized wastewater treatment facility that will treat the wastewater of the Orick Community Services District in an economic and environmentally efficient manner. The EIR cited the Waste Disposal Report that SHN prepared for OCSD in 2010 for the project description (SHN 2012).

The EIR details environmental impacts and mitigations to reduce and minimize environmental impacts due to the construction of the project. Alternatives are evaluated and the environmentally superior project is chosen (SHN 2012).

3.2.7 Final Report, Orick CSD 2012

This report synthesizes and presents the activities associated with the Orick CSD's from 2007 to 2012 to develop a community wastewater system. The project was funded with Proposition 50 funds through the North Coast Integrated Regional Water Management Plan.

3.3 Regulatory Framework

Toolbox Element 6.2, Regulatory Resources, includes links to the North Coast Regional Water Quality Control Board (NCRWQCB) and the California State Water Resources Control Board (SWRCB) as the regulatory agency for wastewater projects. The SWRCB issued an Onsite Water Treatment System (OWTS) Policy in 2012 that includes regulations for onsite wastewater treatment systems. This document classifies an OWTS into five categories (Tier 0-4). Tier 1 is for Low-Risk New or Replacement OWTS where there is not an approved Local Agency Management Program.

The OWTS policy is provided as Appendix B. The regulations stated for Tier 1 include but are not limited to;

- Treatment system setbacks;
    - 5 ft. from property lines and structures
    - 100 ft. from wells
    - 100 ft. from unstable land mass
    - 100 ft. from springs and waterways (as measured from top of bank)
    - 200 ft. from vernal pools, wetlands, lakes, ponds
    - 150 ft. from public water well where the depth of the effluent dispersal system does not exceed 10 ft.
- Ground slope must be less than 25%;
- Subdivision density must not exceed densities provided in Appendix B, Table 1);
- Shall not exceed 3500 gallons per day flow;
- 12 in. of soil cover;
- Depth to groundwater determined by Appendix B, Table 2);
- Application rates determined by Appendix B, Table 3);
- Dispersal systems shall not exceed depth of 10 ft. from ground surface; and

- All new dispersal systems shall have 100% replacement area that is separate and available for future use.

The SWRCB recognizes the range in geologic and climatic conditions in California and that a one size fits all approach may not work across the state, therefore they developed Tier 2 – Local Agency Management Program for New or Replacement OWTS. Local Agency Management Programs approved under Tier 2 provide an alternate method from Tier 1 programs to achieve the same policy purpose, which is to protect water quality and public health. Once the Local Agency Management Program is approved, new and replacement OWTS that are included within the Local Agency Management Program may be approved by the Local Agency. Once a Local Agency Management Program is approved, it shall supersede Tier 1 and all future OWTS decisions will be governed by the Tier 2 Local Agency Management Program until it is modified, withdrawn, or revoked. Humboldt County (the County) is currently preparing a Local Agency Management Program (LAMP) but as of the time of writing this report the LAMP had not yet been finalized. It is expected that many of the regulations for Tier 1 projects will continue within the LAMP however some regulations are expected to change.

3.4 Consultation

- David Spinosa from Humboldt County Department of Environmental Health was consulted regarding the status of Humboldt County's Local Agency Management Program (LAMP). As of October 8 2014, the Humboldt County Board of Supervisors recommended action on the development of the LAMP. The County is working from a set timeline to complete the LAMP but this process is expected to take a number of years. In January 2014 the County will host a stakeholder information session on the LAMP and receive feedback on what stakeholders would like to see in the regulations. Following the stakeholder meeting, the County will form a technical advisory committee who will meet regularly to develop the LAMP. David's opinion was that it is expected the County's authority on regulating OWTSs to be increased to 10,000 gallons per day or above but could not yet provide any detail on how much. David was also unaware on what the operational requirements for OWTS will be including whether a professional operator would be required.
- Jeff Anderson with Northern Hydrology & Engineering (formerly Jeff Anderson & Associates) was consulted regarding OCSD. Anderson assisted SHN in conducting a wastewater discharge analysis in 2010. Anderson was consulted for information regarding decentralized wastewater treatment regulations, design guidelines, data and resources, and his opinion regarding the feasibility of a decentralized wastewater treatment system for Orick CSD.
    - Anderson suggested referencing the EPA's Onsite Wastewater Treatement and Disposal Systems Manual for technical information regarding onsite wastewater treatment and disposal systems. The manual does not include regulations but is instead intended to assist as design guidelines. Anderson also recommended the textbook: Small & Decentralized Wastewater Management Systems by Ronald Crites and George Tchobanoglous as design guidelines. Lastly, Anderson suggested contacting Orenco Inc. for design guidelines.
    - In Anderson's opinion, a decentralized wastewater system for OCSD could be feasible. He recommended discussing the feasibility with Humboldt County and the RWQCB.

Anderson suggested looking at 2 to 4 households per cluster system and noted that each system will require a permit from Humboldt County.

- David Lepre from Orenco Systems Inc. (Orenco) was consulted regarding the specifics of the Orenco system. Orenco designs, manufactures, and markets quality equipment for decentralized wastewater applications. David is familiar with the OCSD system as he worked previously with SHN on their feasibility study. The Orenco system has no restrictions on the number of properties that can be connected into the decentralized system. The key constraint is the geology and soils of the disposal area. Orenco uses a conservative relationship of 1 gallon of wastewater per day per square foot of disposal area. For example, a system required to manage 10,000 gallons of wastewater per day, would need a disposal area of approximately 10,000 square feet, not including setbacks and a reserve area.
- Mike Nelson from LACO was consulted to gain information on LACOs work within the OCSD. LACO is currently designing an RV park for Redwood Park Lodge Company, which is to be located at the southern extent of Orick. The site is approximately 30 acres.

  LACO has performed a fate and transport analysis (dye study) to assess groundwater gradient. The study showed that the groundwater gradient is parallel to Redwood Creek. Other studies completed for OCSD have shown that the groundwater gradient follows the gradient of redwood creek (OLA 1999). The conceptual design for the RV park is in progress and LACO has submittals into Humboldt County for Conditional Use Permit. A decentralized system has been designed for the RV Park that would treat wastewater produced by commercial, recreational and residential activities at the site and a total estimated flow of 21,025 gallons per day (LACO 2014). The preliminary design was completed by LACO with assistance from Orenco. Construction is scheduled for 2015 with RV Park to open 2016. However as of writing this report, no wastewater permit has been applied for. It is likely, that if the wastewater system designed for the RV Park is approved, a similar system could be approved for the District.
- Roy O'Conner with the RWQCB was contacted regarding wastewater regulation for OCSD. He stated the RWQCB was supportive of projects that would help the community. He referenced the new OWTS Policy adopted in 2012 in regards to possible flow limits for RWQCB regulation. As discussed above, if Humboldt County adopts a LAMP, it would supersede the Tier 1 regulations, and the County is currently considering regulatory limits around 10,000 gallons per day. Mr. O'Conner cautioned that if OCSD builds a system that ends up being greater than the final County LAMP limit it would automatically be regulated by the RWQCB. Thus, timing of the completion of the LAMP and OCSD system is an important consideration.

4. Project Planning

4.1 Development of Wastewater Service Area Boundaries

The majority of the properties with failing septic systems are located in central Orick. It might not be necessary, nor feasible to design a system to treat this entire area. For the purpose of this feasibility assessment, central Orick has been divided into two districts; North-East and South-West (Figure 3 and Figure 4). These two districts were identified to have the greatest need of one or more combined decentralized wastewater systems based on the proximity of dwellings within each region and the lack of capacity to improve or replace the existing septic systems. The service area for the decentralized system was reduced further by removing the properties in these neighborhoods that have a land area greater than 0.5 acres. Properties larger than 0.5 acres are likely to contain sufficient space to replace/update their personal septic systems and likely do not need to be connected to a cluster system. In addition, according to Table 1 of the 2012 OWTS Policy, the allowable housing density for a community with rainfall greater than 40 inches per year is 0.5 acres/ single family dwelling unit. The average annual rainfall in Orick is 66.38 inches/ year according to the US Climate Data. Thus, the 0.5 acre parcel limit for this analysis is reasonable.

The two districts are separated by Redwood Creek, so each district would require a separate cluster system, or the regions would need to be connected across Redwood Creek. A system connection across Redwood Creek would require the construction of a bridge to convey pipe, or directionally drilled pipe under the creek. Separate cluster systems for each region are preferred because a system connection would result in excess cost and environmental and regulatory concerns.

4.1.1 Topography

Orick is located within the floodplain of upper Redwood Creek. The area has a low gradient lying between 19 to 40 feet in elevation (OLA 1999). The populated sections are located in the lowest lying area along highway 101. To the north of Orick, the foothills rise to elevations above 800 feet.

4.1.2 Soil suitability

Two soils types; Orick and Kerr series, were identified within the project area from “Soils of Western Humboldt County, California” (Humboldt County and UC Davis, 1965). These soils are generally well drained, silty to sandy loams with 15% to 75% sand and 22% to 67% silt and 5% to 30% clay (OLA 1999). The Natural Resources Conservation Service (NRCS) Web Soil Survey online tool contained no digital soil data for the populated region of Orick. The SHN (2010) report describes the soils near the South West District as loam to sandy loam soil. The soils were measured to have an average percolation rate of 8 minutes per inch and an average infiltrometer test result of 15 gallons per square foot per day (SHN 2010).

4.1.3 Population Trends

As of the 2010 census, there were 357 people residing in Orick including 166 houses. The population density is 73.6 people per square mile. At the time of the 2010 census, the median annual household income was $39,124.

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Map Projection: Lambert Conformal Conic
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District Boundary
Parcels < 0.25 Acres
Parcels 0.25 < Acres < 0.5 Acres
Potential Facility Location

Zoning
Commercial
Residential

NOTES
13 Parcels < 0.25 Acres
11 Parcels 0.25 < Acres < 0.5 Acres

Orick CSD
NCRP Demonstration Project

North East District
Project Boundary

Job Number 8410996
Revision A
Date 24 Oct 2014

Figure 3

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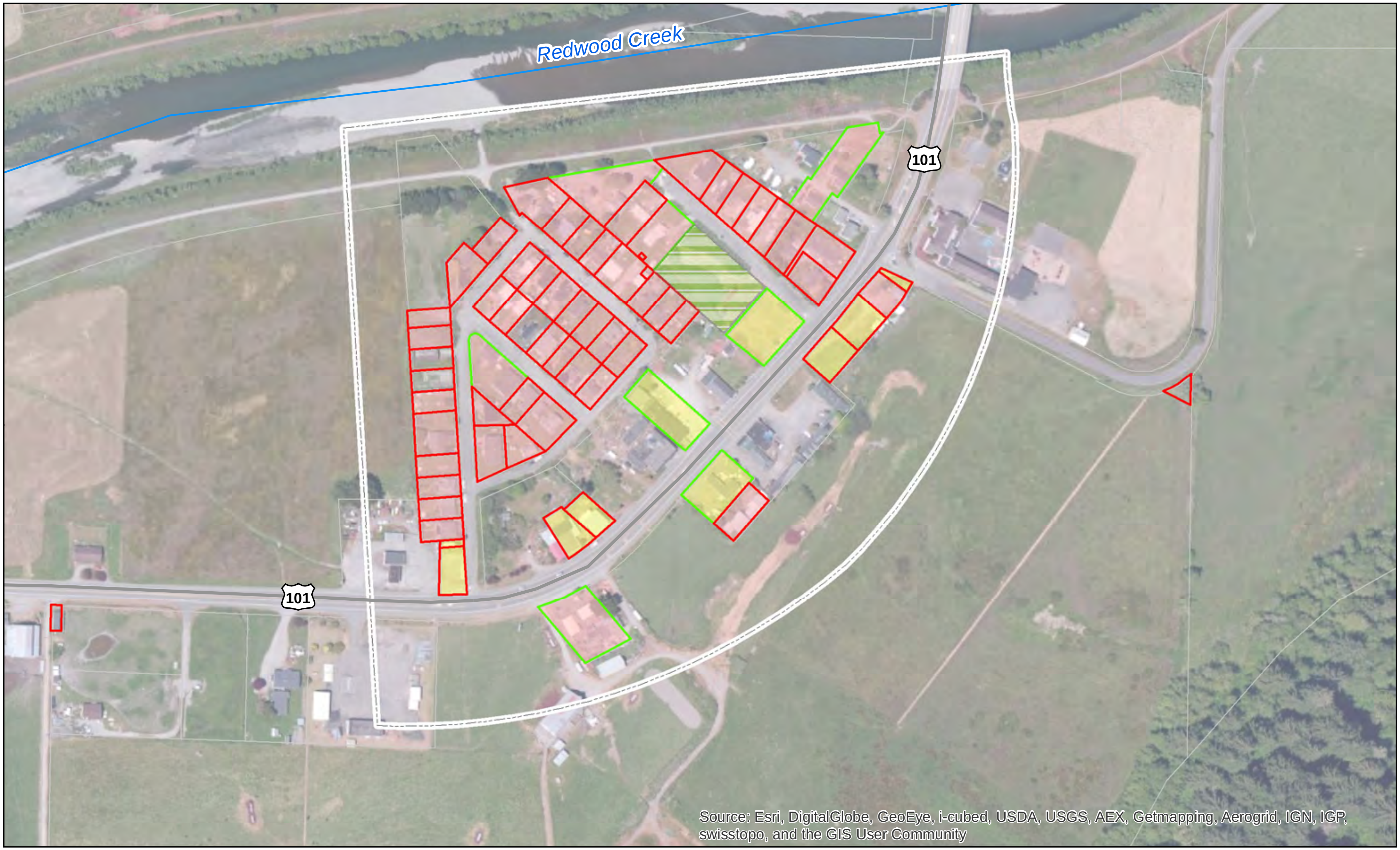

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

- District Boundary
- Parcels < 0.25 Acres
- Parcels 0.25 < Acres < 0.5 Acres
- Potential Facility Location

Zoning

- Commercial
- Residential

NOTES
60 Parcels < 0.25 Acres
8 Parcels 0.25 < Acres < 0.5 Acres

GHD

Orick CSD
NCRP Demonstration Project

South West District
Project Boundary

Job Number	8410996
Revision	A
Date	24 Oct 2014

Figure 4

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4.2 Wastewater Estimate Calculations

Orenco Systems Inc (Orenco) undertook a preliminary evaluation for an Orenco® Effluent Sewer System and AdvanTex® Treatment Facility for Orick. The full report presents the results of a feasibility study for the construction and long-term operation of a wastewater system for Orick and is provided as Appendix C. The study completed by Orenco provides information for a STEP/STEG (effluent sewer) connection system and an AdvanTex® Treatment System.

As discussed in section 4.1 the proposed service area consists of two districts. The North East District (Figure 3) includes approximately 24 Equivalent Dwelling Units (EDUs) and the South West District (Figure 4) includes approximately 67 EDUs. Each district includes domestic and commercial connections. This analysis assumes that each commercial connection is roughly equivalent to a single EDU. This is a reasonable assumption as the commercial properties included in this analysis are those located on less than 0.5 acres and include the post office and local restaurants and small businesses.

Table 2 presents the hydraulic design parameters used by Orenco. Due to limited infiltration and inflow from pressure sewer systems, per capita flow rates for Design Average flows are estimated at 50 gpd (Orenco 2014). These flows were estimated based on typical wastewater flow rates form residential dwelling units, per ranges from Metcalf and Eddy (Metcalf 2003). For the purpose of this analysis, the design average flow was assumed to be 175 gpd/EDU. This accounts for 3.5 people per EDU.

Table 2 Hydraulic Design Parameters (Orenco 2014)

Flow Component	North East District	South West District
Design Average Day Flow	4,200 gpd	11,725 gpd
Design Max Day Flow	7,200 gpd	20,100 gpd
Design Peak Hourly Flow	27 gpm	49 gpm

Typical wastewater flow rates and other design parameters including wastewater characteristics and treatment plant loading are provided in Appendix C.

Roy O'Conner from the RWQCB confirmed that the maximum effluent flows that could be regulated by a county LAMP is 10,000 gpd. The estimated flows for the South West District are 11,725 gpd. This exceeds the maximum allowable limit for regulation by the County LAMP. The design flow for the South West District is expected to be a conservative estimate that includes wastewater from all all properties less than 0.5 acres in size, whether they currently contain dwellings or not. The design flow also assumes that each commercial property is equivalent to one EDU which would also contribute to a higher design flow estimate.

It is likely that significant water quality issues in Orick could be addressed with by a decentralized system that is capped at treating 10,000 gpd. This could be done through reducing the number of properties connected to the system and also by conducting a more thorough investigation into EDU flow rates. It is also possible to divide the South West District into two smaller districts, each producing less than 10,000 per day. The RWQCB was supportive of the County overseeing Orick's wastewater treatment system, but do not want to see a solution that was obviously trying to work the system by having two 10,000 gpd systems on one parcel.

5. Wastewater Treatment

5.1 Description

Wastewater treatment processes are generally divided into three levels and five categories, depending on the level of treatment afforded by them. The following is a brief description of the types of treatment processes that fall into these categories:

- Primary treatment
- Secondary treatment
- Tertiary treatment
- Disinfection
- Solids treatment.

The wastewater treatment process produces treated water, or effluent, which must be disposed of. There are essentially two options for disposal:

- Land disposal through either a subsurface leach field or a surface spreading basin or rapid infiltration basin (also called a percolation pond). According to OCSD, the SWRCB have expressed concerns with subsurface disposal due to its potential influence on Redwood Creek.
- Reuse as irrigation to grow either a crop or at a golf course. If used on a crop it should be one that requires further processing, such as wine grapes, fruit trees, or hay for animal feed (and not one that is consumed directly, such as most vegetables).

The third alternative, which would be direct discharge to surface water, such as a creek or river, would be prohibited for Orick, Redwood Creek, or any other water body that is in close proximity to the site.

The least restrictive treatment requirements are applicable when the effluent is disposed of through either a leach field or rapid infiltration basin where the public cannot come into contact with the effluent. In this case, the controlling requirement is the need to remove nitrates such that levels in the groundwater do not exceed 10 mg/L. Treatment requirements for effluent used for irrigation require the secondary effluent from the processes described above to be filtered (tertiary treatment) and have a higher level of disinfection.

5.1.1 Proposed Collection and Storage

Based on previous experience retrofitting decentralized wastewater systems in existing towns, Orenco recommends replacing all septic tanks that would be connected into the new system. All old tanks that could be connected onto the system would need to be inspected and inspection costs can be very high in comparison to the installation of a new tank.

A Septic Tank Effluent Pump / Septic Tank Effluent Gravity (STEP/STEG) system collects wastewater from each property via an underground septic tank. The effluent undergoes primary treatment via settling and natural biological process. Solids remain in the tank and the filtered effluent is then pumped to a centralized secondary treatment facility via small diameter pipe that follows ground contours. The system is watertight, reducing infiltration costs during conveyance and at the facility. There are no manholes or lift stations required which reduces overall energy consumption.

5.1.2 Proposed Treatment Option

AdvanTex

The AdvanTex process is a proprietary technology that uses a textile membrane for the filtration process. Primary treatment is provided through individual septic tanks located on each property, and septic tank effluent then enters a two-compartment processing tank. In the first compartment, the septic tank effluent separates into three zones: a sludge layer, a scum layer, and a clear layer. Effluent from the clear layer flows into the second compartment of the tank through holes in the bank's baffle wall. A proprietary Biotube pumping package in the second compartment then pumps the filtered effluent to a distribution manifold in the AdvanTex pod. This effluent then percolates through the textile membrane media and is collected at the bottom of the filter basin by a drain pipe. The drain pipe returns the treated water to the recirculating splitter valve (RSV), where it is then split between the processing tank and the final discharge.

An AdvanTex system that would be regulated by the State Water Resources Control Board (SWRCB) requires a Class II operator that must also be certified by Orenco Systems, Inc. to operate and maintain the facility. Humboldt County Department of Environmental Health has not yet developed their LAMP and so the operational requirements for the system, if regulated by the County, have not yet been established. However it is likely that an operator will be required.

The Orenco (2014) report provides dimensions for the AvanTex treatment systems. Sample drawings were developed by Orenco for the decentralized facilities proposed for the North East and South West Districts. These drawings are provided in Appendix D and Appendix E respectively.

5.1.1 Proposed Disposal Options

For wastewater treatment disposal areas, Orenco estimates that 1 square foot land is required for each gallon of wastewater produced per day.

Land requirements for disposal were estimated based on Design Average Day Flows and are presented in Table 3. Set back distances were estimated to be 30% of the area required for disposal and reserve

Table 3 Disposal Area Land Requirements

District	Avg Flow (gpd)	Disposal Area (Sq Ft)	Disposal Area (Acrs)	Reserve Area (Acres)	Set Backs (Acrs)	Total Area (Acrs)
SW	11725	11725	0.27	0.27	0.16	0.70
NE	4200	4200	0.10	0.10	0.06	0.26

The North East District would require 0.26 acres of land for disposal and the South West District would require 0.70 acres of land. One potential site for each district was identified as feasible for use as a disposal area. These locations are highlighted on Figure 3 and Figure 4. The property identified in the North East District is approximately 1.9 acres and the property identified for the South West District is 0.7 acres. OCSD would be required to gain a utility easement to access these properties. This is discussed further in Section 5.3.

5.2 Cost Estimate

Item 2.2 in the Small Community Tool Box provides a tool for cost estimation. The Project Cost Estimating Tool is a spreadsheet that allows the user to input specifics about a project's capital costs and percentage estimates of other costs to result in a Class 5 cost estimate for a project. The spreadsheet provides typical percentages for cost estimating which can be adjusted if desired. An opinion of probable cost was developed by Orenco Systems Inc. for treatment (including materials, construction labor, shipping and commissioning), on-lot costs, service laterals, and the collection system. Orenco provided both a low and high cost estimate for both the Southwest and Northeast project areas. Additional construction costs not included in Orenco's estimate were added, including controls unit, site work, and mobilization and demobilization. Non-construction costs not included in Orenco's estimate were also added, including CEQA and permitting, engineering, construction management, OCSD costs, land and right of way acquisition, and legal services.

The low and high cost estimates for the Southwest and Northeast systems provided by Orenco were entered into the Project Cost Estimating Tool along with the other estimated costs. The full cost breakdowns are included in Table 4.1 to Table 4.4 below. Detailed cost breakdowns for the Orenco system are provided in Appendix C. Table 5summarizes the total costs for the Southwest and Northeast systems. Table 6 presents the Equivalent Annual Costs assuming a project loan at 2.5% interest over 30 years, which are typically planning numbers for funding through the SWRCB Clean Water SRF, which is discussed further under the funding section.

Operations and maintenance (O&M) costs were also developed by Orenco for the collection and treatment systems. Orenco O&M costs for the collection system included costs for; (1) preventative maintenance, (2) reactive maintenance, (3) equipment repair and replacement, and (4) pumping out the septic tanks. Additional O&M costs for insurance, billing, office assistance, and testing and sampling were added. In addition, since it is not known if an operator will be required and at what level, for this report it was assumed that a part time operator would be needed at an approximate cost to the District of $20,000 year. Table 7 shows the per EDU O&M costs for the Southwest and Northeast systems as well as the annual cost and the 20-year present worth cost over 30 years at 2.5% interest.

Table 4.1 - Total Project Costs - South West District Low Estimate

Demonstration Project for Orick Community Services District

Major Equipment and Construction Items

Unit Items	Quantity	Unit	Unit Cost		Total
South West District - Low Estimate					
Materials and Installation Costs for STEP Package with 1,000 gal tank	67	Lump Sum	$	3,974	$266,258
Service Lateral and Service Connection Costs	67	Lump Sum	$	650	$43,550
Force-main Costs with Appurtances	1	Lump Sum	$	46,802	$46,802
Advantex Materials	1	Lump Sum	$	219,518	$219,518
Flow equilization/Pre-anoxic tank materials	1	Lump Sum	$	22,362	$22,362
Ancillary materials	1	Lump Sum	$	15,500	$15,500
Shipping, commissioning and operator training	1	Lump Sum	$	15,549	$15,549
Construction	1	Lump Sum	$	84,140	$84,140
Subtotal 1					**$713,679**

Other Construction Items	Cost Estimate		Total
Electrical	5%	of subtotal 1	$35,684
Instrumentation	0%	of subtotal 1	$0
Site Work	5%	of subtotal 1	$35,684
Mobilization/ Demolition	8%	of subtotal 1	$57,094
Other	0%	of subtotal 1	$0
Subtotal 2	18%	of subtotal 1	**$128,462**

Non Construction Implementation Costs (Soft Costs)

Permitting/CEQA/NEPA	5%		of (subtotal 1 + 2)		$42,107
Engineering	10%		of (subtotal 1 + 2)		$84,214
Construction Management	10%		of (subtotal 1 + 2)		$84,214
Agency Costs	2%		of (subtotal 1 + 2)		$16,843
Land/ROW Acquisition	1	Acre	$	10,000	$10,000
Legal		Lump Sum			$35,000
Contingency	20%		of (subtotal 1 + 2)		$168,428
Subtotal 3	47%		of (subtotal 1 + 2)		**$440,806**

Cost Summary

Total Construction Estimate (w/o Contingency)	100%	of subtotal 1+2	**$842,141**
Total Estimated Project Costs	100%	of (subtotal 1 + 2 + 3)	**$1,282,948**
For Initial Funding Application	150%	of Total Estimated Project Costs	**$1,924,421**

Notes: All estimates include Orenco and non-Orenco materials; consequently, this is only a rough estimate and intended for budgetary and evaluation purposes. Construction estimates are in today's dollars. The estimates are approximate and require thorough evaluation and confirmation. Costs do not incorporate bridge crossings, railroad crossings, interstate crossings, asphalt/concrete repair, rock excavation, etc (Orenco 2014)

Table 4.2 - Total Project Costs - South West District High Estimate

Demonstration Project for Orick Community Services District

Major Equipment and Construction Items

Unit Items	Quantity	Unit	Unit Cost		Total
South West District - High Estimate					
Materials and Installation Costs for STEP Package with 1,000 gal tank	67	Lump Sum	$	4,743	$317,781
Service Lateral and Service Connection Costs	67	Lump Sum	$	1,000	$67,000
Force-main Costs with Appurtances	1	Lump Sum	$	46,802	$46,802
Advantex Materials	1	Lump Sum	$	236,908	$236,908
Flow equilization/Pre-anoxic tank materials	1	Lump Sum	$	25,829	$25,829
Ancillary materials	1	Lump Sum	$	20,500	$20,500
Shipping, commissioning and operator training	1	Lump Sum	$	14,538	$14,538
Construction	1	Lump Sum	$	123,908	$123,908
Subtotal 1					**$853,266**

Other Construction Items	Cost Estimate		Total
Electrical	5%	of subtotal 1	$42,663
Instrumentation	0%	of subtotal 1	$0
Site Work	5%	of subtotal 1	$42,663
Mobilization/ Demolition	8%	of subtotal 1	$68,261
Other	0%	of subtotal 2	$0
Subtotal 2	18%	of subtotal 1	**$153,588**

Non Construction Implementation Costs (Soft Costs)

Permitting/CEQA/NEPA	5%		of (subtotal 1 + 2)		$50,343
Engineering	10%		of (subtotal 1 + 2)		$100,685
Construction Management	10%		of (subtotal 1 + 2)		$100,685
Agency Costs	2%		of (subtotal 1 + 2)		$20,137
Land/ROW Acquisition	1	Acre	$	10,000	$10,000
Legal		Lump Sum			$35,000
Contingency	20%		of (subtotal 1 + 2)		$201,371
Subtotal 3	47%		of (subtotal 1 + 2)		**$518,221**

Cost Summary

Total Construction Estimate (w/o Contingency)	100%	of subtotal 1+2	**$1,006,854**
Total Estimated Project Costs	100%	of (subtotal 1 + 2 + 3)	**$1,525,075**
For Initial Funding Application	150%	of Total Estimated Project Costs	**$2,287,613**

Notes: All estimates include Orenco and non-Orenco materials; consequently, this is only a rough estimate and intended for budgetary and evaluation purposes. Construction estimates are in today's dollars. The estimates are approximate and require thorough evaluation and confirmation. Costs do not incorporate bridge crossings, railroad crossings, interstate crossings, asphalt/concrete repair, rock excavation, etc (Orenco 2014)

Table 4.3 - Total Project Costs - North East District Low Estimate

Demonstration Project for Orick Community Services District

Major Equipment and Construction Items

Unit Items	Quantity	Unit	Unit Cost		Total
North East District - Low Estimate					
Materials and Installation Costs for STEP Package with 1,000 gal tank	24	Lump Sum	$	3,974	$95,376
Service Lateral and Service Connection Costs	24	Lump Sum	$	650	$15,600
Force-main Costs with Appurtances	1	Lump Sum	$	19,802	$19,802
Advantex Materials	1	Lump Sum	$	81,564	$81,564
Flow equilization/Pre-anoxic tank materials	1	Lump Sum	$	8,362	$8,362
Ancillary materials	1	Lump Sum	$	10,500	$10,500
Shipping, commissioning and operator training	1	Lump Sum	$	7,001	$7,001
Construction	1	Lump Sum	$	48,432	$48,432
Subtotal 1					**$286,637**
Other Construction Items			**Cost Estimate**		**Total**
Electrical	5%	of subtotal 1			$14,332
Instrumentation	0%	of subtotal 1			$0
Site Work	5%	of subtotal 1			$14,332
Mobilization/ Demolition	8%	of subtotal 1			$22,931
Other	0%	of subtotal 2			$0
Subtotal 2	18%	of subtotal 1			**$51,595**

Non Construction Implementation Costs (Soft Costs)

Permitting/CEQA/NEPA	5%	of (subtotal 1 + 2)			$16,912
Engineering	10%	of (subtotal 1 + 2)			$33,823
Construction Management	10%	of (subtotal 1 + 2)			$33,823
Agency Costs	2%	of (subtotal 1 + 2)			$6,765
Land/ROW Acquisition	1	Acre	$	10,000	$10,000
Legal		Lump Sum			$35,000
Contingency	20%	of (subtotal 1 + 2)			$67,646
Subtotal 3	47%	of (subtotal 1 + 2)			**$203,969**

Cost Summary

Total Construction Estimate (w/o Contingency)	100%	of subtotal 1+2	**$338,231**
Total Estimated Project Costs	100%	of (subtotal 1 + 2 + 3)	**$542,200**
For Initial Funding Application	150%	of Total Estimated Project Costs	**$813,300**

Notes: All estimates include Orenco and non-Orenco materials; consequently, this is only a rough estimate and intended for budgetary and evaluation purposes. Construction estimates are in today's dollars. The estimates are approximate and require thorough evaluation and confirmation. Costs do not incorporate bridge crossings, railroad crossings, interstate crossings, asphalt/concrete repair, rock excavation, etc (Orenco 2014)

Table 4.4 - Total Project Costs - North East District High Estimate

Demonstration Project for Orick Community Services District

Major Equipment and Construction Items

Unit Items	Quantity	Unit	Unit Cost		Total
North East District - High Estimate					
Materials and Installation Costs for STEP Package with 1,000 gal tank	24	Lump Sum	$	4,743	$113,832
Service Lateral and Service Connection Costs	24	Lump Sum	$	1,000	$24,000
Force-main Costs with Apuortances	1	Lump Sum	$	19,802	$19,802
Advantex Materials	1	Lump Sum	$	87,719	$87,719
Flow equilization/Pre-anoxic tank materials	1	Lump Sum	$	10,079	$10,079
Ancillary materials	1	Lump Sum	$	12,500	$12,500
Shipping, commissioning and operator training	1	Lump Sum	$	7,579	$7,579
Construction	1	Lump Sum	$	48,432	$48,432
Subtotal 1					**$323,943**
Other Construction Items		**Cost Estimate**			**Total**
Electrical	5%	of subtotal 1			$16,197
Instrumentation	0%	of subtotal 1			$0
Site Work	5%	of subtotal 1			$16,197
Mobilization/ Demolition	8%	of subtotal 1			$25,915
Other	0%	of subtotal 2			$0
Subtotal 2	18%	of subtotal 1			**$58,310**
Non Construction Implementation Costs (Soft Costs)					
Permitting/CEQA/NEPA	5%	of (subtotal 1 + 2)			$19,113
Engineering	10%	of (subtotal 1 + 2)			$38,225
Construction Management	10%	of (subtotal 1 + 2)			$38,225
Agency Costs	2%	of (subtotal 1 + 2)			$7,645
Land/ROW Acquisition	1	Acre	$	10,000	$10,000
Legal		Lump Sum			$35,000
Contingency	20%	of (subtotal 1 + 2)			$76,451
Subtotal 3	47%	of (subtotal 1 + 2)			**$224,659**
Cost Summary					
Total Construction Estimate (w/o Contingency)	100%	of subtotal 1+2			**$382,253**
Total Estimated Project Costs	100%	of (subtotal 1 + 2 + 3)			**$606,911**
For Initial Funding Application	150%	of Total Estimated Project Costs			**$910,367**

Notes: All estimates include Orenco and non-Orenco materials; consequently, this is only a rough estimate and intended for budgetary and evaluation purposes. Construction estimates are in today’s dollars. The estimates are approximate and require thorough evaluation and confirmation. Costs do not incorporate bridge crossings, railroad crossings, interstate crossings, asphalt/concrete repair, rock excavation, etc (Orenco 2014)

Table 5 Summary of Decentralized Wastewater System Project Opinion of Probable Costs

	Low Estimate	High Estimate
Southwest System	$ 1,282,948	$ 1,525,075
Northeast System	$ 542,200	$ 606,911

Table 6 Summary of Decentralized Wastewater System Project Equivalent Annual Costs

	Low Estimate	High Estimate
Southwest System	$ 61,296	$ 72,864
Northeast System	$ 25,905	$ 28,997

**Assumes an interest rate of 2.5% and a term of 30 years.*

Table 7 Summary of Decentralized Wastewater System Operations and Maintenance Costs

	Southwest System	Northeast System	Units
EDUs	67	24	
Collection System	$ 7.06	$ 7.06	$/Month/ EDU
Treatment System	$ 7.70	$ 16.23	$/Month/ EDU
Insurance, Billing, Office	$ 5.00	$ 5.00	$/Month/ EDU
Testing and sampling	$ 9.00	$ 9.00	$/Month/ EDU
Operator	$ 19.00	$ 19.00	$/Month/ EDU
Total Monthly Cost per EDU	$ 47.76	$ 56.29	$/Month/ EDU
Annual Cost for all EDUs	$ 38,399	$ 16,212	$/Year
Present Worth	$ 803,703	$ 339,312	$/30 Years

5.3 Land Requirements

5.3.1 Acquire Property Easement

To install the decentralized system proposed by Orenco, OCSD would need to obtain a property easement for the location of the system. Methods available to OCSD for obtaining the land required for a decentralized system are described below.

Utility Easement

The decentralized wastewater system that GHD is analyzing will most likely be implemented on multiple private properties, requiring utility easements so Orick CSD can access and maintain the decentralized wastewater system. Utility easements allow a utility company, city, or services district to access utilities located on the private property, as described in a property deed or certificate of title. Utility easements do not generally affect the land owner’s ability to use the land, as long as the utilities are still accessible to the easement parties. The process of obtaining a utility easement is described below;

1. OCSD would contact property owners and expresses interest in using the land for a decentralized wastewater system via a utilities easement.
2. An appraisal of the land and the proposed easement would be conducted to evaluate any effects the easement and the wastewater system may have to the value of the parcel. If necessary, a mortgage company will be notified of the change in parcel value, which may increase due to an improved septic system.
3. A title company would coordinate with OCSD and the property owners to draw up a utility easement contract. A land surveyor would then prepare a legal description of the land specified in the easement. Compensation for loss in property value and/or inconvenience to property owners would also be negotiated at this time.
4. The easement must be recorded with the County Recorder.

Eminent Domain

If property owners do not wish to agree to a utilities easement, the CSD could pursue eminent domain if there are no other feasible locations for the wastewater system to be implemented. Eminent domain gives the CSD power to acquire the land necessary for the wastewater system as public use, as long as the property owner is paid just compensation. It is very unlikely the CSD would purse this option, however it is described below. The process of obtaining an eminent domain is described below;

1. The CSD must contact property owners and express interest in using the land for a decentralized wastewater syetem.
2. An appraisal of the land and the proposed easement would be conducted to evaluate any effects the easement and the wastewater system may have to the value of the parcel.
3. Offer of utility easement must first be made to the owner and if refused an offer to purchase the necessary land would be made to the owner based on the appraisal value of the property.
4. A relocation agent would be hired by the CSD to provide assistance to property owners to relocate their residence and/or business.
5. CSD must announce a public hearing to adopt “resolution of necessity” to acquire the property by eminent domain. At the public hearing a “resolution of necessity” to acquire the property by eminent domain would need to be adopted.
6. An eminent domain case would be filed in court and served to the property owner.
7. The CSD and the property owners must negotiate “fair market value” of the property with the assistance of appraisals conducted separately by both parties.
8. If a “fair market value” cannot be agreed upon by both parties, the case would be brought before a jury to determine the “fair market value”.
9. The CSD pays the property owner the determined “fair market value” within 30 days and the title to the property is transferred to the CSD by the court.

6. Funding Options:

Item 3.1 in the Small Community Tool Box summarizes common funding programs available to OCSD. The funding program summaries present a general overview of many of the more common funding programs that are available to small communities, such as OCSD, for financing infrastructure projects.

The summaries in provided in Appendix 3.1 of the Small Community Tool Box Report provide general characteristics of the common funding programs and requirements. A good first place to start with project funding is to complete a Common Inquiry Form through the California Financing Coordinating Committee. This form is a one stop inquiry for many state and federal funding agencies, including the SWRCB, USDA Rural Development, Community Development Block Grant, and some EPA programs. Several potential funding sources are discussed further below. Additionally, toolbox element 1.1 Community Networking Directory includes reference to local assistance agencies that may be able to provide limited technical support or small grants.

6.1 Public Funding Sources

6.1.1 State Water Resources Control Board (SWRCB) Clean Water State Revolving Fund (CWSRF)

This program is commonly used for funding wastewater projects. A preliminary inquiry was made to the SWRCB Division of Financial assistance to see if they would provide funding for a decentralized system. The preliminary response was yes if it was addressing water quality issues. The CWSRF has both planning and design/construction funding programs. Each year the SWRCB puts out an Intended Use Plan (IUP) which outlines total program funds available and grant funds available. The IUP also include maximum grant amounts, which have varied from $6 million to $4 million per project over the last several years. Grant funds are typically distributed to disadvantaged communities or those with high per capita wastewater rates.

Disadvantaged communities are defined at those with a median household income (MHI) of less than 80% of the statewide MHI. The Orick CSD has a MHI of $37,083, which is 61% of the statewide MHI. Thus it is likely that the District would qualify for some grant funds. As the allocation and limits on grant funds change annually, it is necessary to check the most current IUP to determine possible grant funding. For the past several years the IUP has included up to 100% principal forgiveness (grant funding) for planning and preliminary design costs for projects that connect previously unsewered areas. This may be a good opportunity for OCSD to further a cluster system wastewater project.

CWSRF Loans are typically 20 years but can be extended to 30 years for disadvantaged communities. Loan interest rates are ½ of the latest general obligation bond rate and have historically been around 2.5%, and can be reduce for disadvantaged communities.

Funding is initiated by completing a four part application covering general project information, technical information, financial data, and environmental information. Once an application is submitted the SWRCB will contact the applicant to review any missing data and work with the application on an eventual funding agreement. This process can take between 4 months to a year.

6.1.2 USDA Rural Development Water and Waste Disposal Loan/Grant Program

The USDA Rural Development Water and Waste Disposal loan/grant program is another commonly used funding source wastewater projects. This program provides loans with some grant. Historically grant funding has been limited to 75% of project costs or $1 million, whichever less. However exceptions are sometimes made. Loan terms are 40 years and interest rates vary based on community need and can range between 3-5%.

The application process is initiated with a request for assistance to USDA which will be directed to an area specialist. If the preliminary review looks good a pre-application meeting will be set up to go over the application process and required paperwork, which includes a preliminary engineering report (included in Toolbox element 4.1). USDA will then work with the applicant through the planning, permitting, environmental document preparation, and design steps. Once all necessary documents are complete a letter of conditions will be issued, which secures the funds and outlines the remaining items necessary to be completed before a funding agreement can be finalized.

USDa funds are made available to project once the notice to proceed for construction has been issued. Thus, interim funding for non-construction costs will need to be obtained to keep the project moving forward.

6.1.3 Community Development Block Grants

Community Development Block Grant (CDBG) funding could be used by Orick in several ways. These grants are highly competitive and based on the project benefit to disadvantaged households. CDBG funding is allocated only to incorporated Cities and Counties, and thus, Orick CSD would need to partner with the County to obtain these funds. If the County was agreeable, the District could apply for funds to assist with planning, design, and construction costs for the project. However, general benefit projects are typically not as competitive because CDBG grants favor projects with a high benefit 80-90% directed toward low income households.

Alternately, the District could form an assessment district to pay for project costs and the CDBG funds could be used to pay for the property assessment of low income residences. This would allow fund to be directed 100% to low income residences, improving the competitiveness of the grant application. However, this would require the assessment district formation, which includes multiple steps a separate engineering report, and a ballot vote.

6.2 Residential Wastewater Costs

Based on the information presented in Section 5, an estimate of the per EDU costs for a new wastewater system were developed. For the information presented below an average of the high and low capital project costs was used. Since it is not known how much grant funding the District may receive, possible costs are presented in Figure 5 and Figure 6. Costs are presented in terms of both total capital costs and monthly costs per EDU including operations and maintenance.

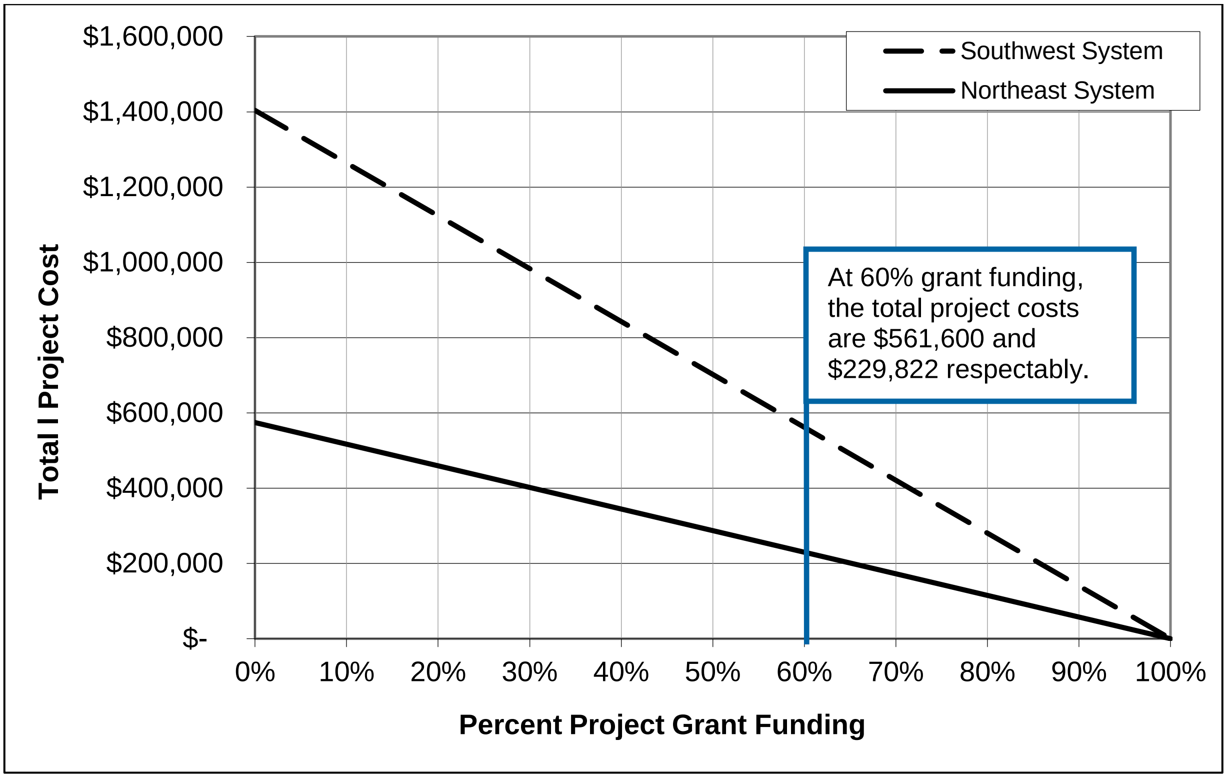

Figure 5 Total Project Costs versus Potential Grant Funding

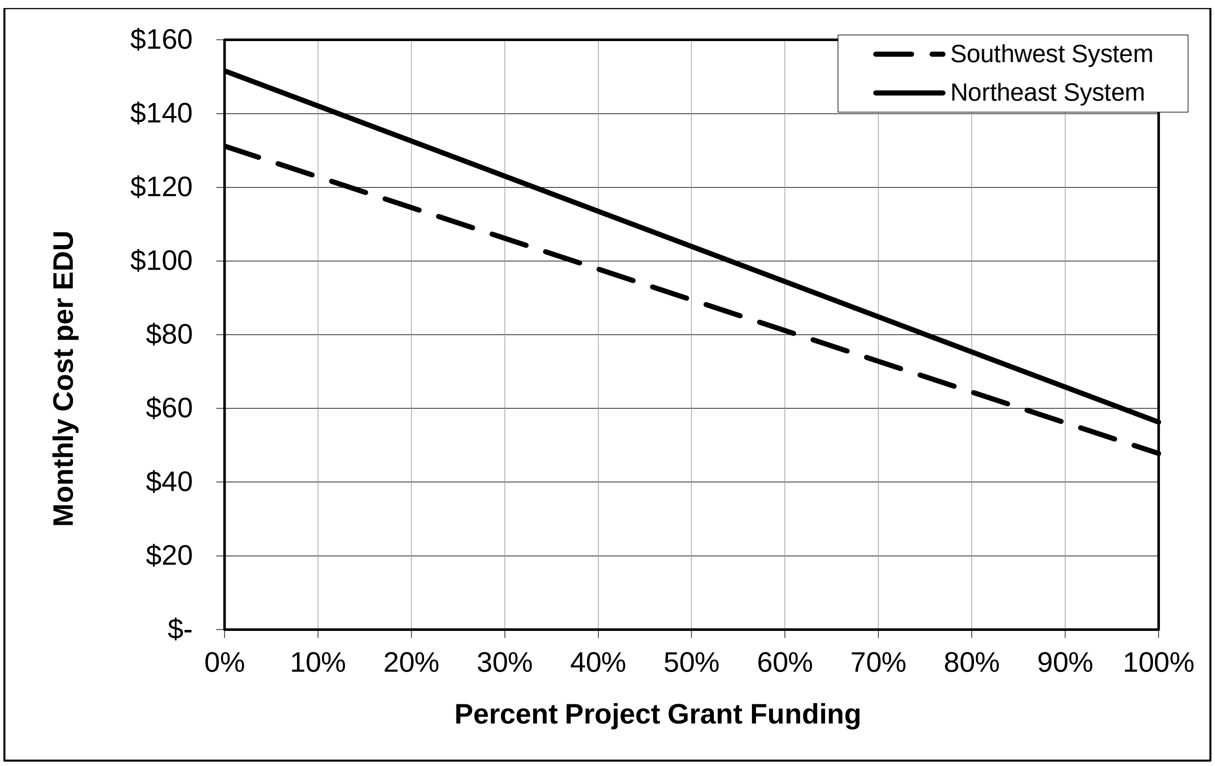

Figure 6 Total project Cost versus Potential Grant Funding

7. Conclusions and Next Steps

7.1 Conclusions

The conceptual project activities presented in this report have been developed in consultation with OCSD, Orenco Systems Ltd and other project stakeholders. The proposed decentralized system is intended to meet the needs of the Orick community and improve environmental conditions. The installation of a decentralized wastewater treatment system in Orick will require additional design and analyses. The components generally appear consistent with required regulatory approvals.

For the District to move forward, it will be important to understand the regulatory framework under which the system will permitted. As discussed, Humboldt County is currently undertaking the process to develop a Local Agency Management Plan (LAMP), which will set the effluent flow limit under which the County will permit system. However this process could take 3 or more years to complete, during which time, it is important that Orick CSD continue to move forward on a wastewater project that addresses water quality issues.

Permitting under county regulation is preferred by Orick, due to possible challenges in working with the NCRWQCB including increasing regulation over time, sampling and monitoring costs, and potential for fines. However, many small communities successfully operate system under the regulation of the NCRWQCB.

It is recommended that OCSD initiate wastewater planning in the near term and include evaluation of systems that could be regulated under either the County or NCRWQCB. It is recommended that Orick CSD apply for planning funding through the SWRCB to complete planning and a conceptual design. Much of the previous work completed can be reused in the next steps.

It is also recommended that Orick CSD engage in the LAMP process to advocate for regulatory flow limits and other features which may benefit a wastewater improvement project in Orick. Near term steps including CWSRF funding and participation in the LAMP process are described below.

7.2 Next Steps

7.2.1 Apply for CWSRF Planning Funding

The next step in moving forward with development of a decentralized wastewater system in Orick is to complete a more detailed planning analysis and concept design. This will require funding, which Orick does not have available as there is no existing wastewater revenue system in place. The CWSRF program administered by the SWRCB was identified as a funding source with a high potential to provide 100% principal forgiveness (grant funds). The first step would be to complete a planning application. The application consists of four parts as discussed under the funding section. The application is not too extensive. The most difficult parts are completing the proposed scope of work, budget and schedule. The application could be prepared by the District, through a SWRCB Technical Service Provider (currently Rural Community Assistance Corporation), or by a consultant.

Orick CSD has attempted to use the SWRCB technical service assistance in the past, which has not resulted in a complete fundable application. However, the service provider was changed in May of 2014, and with the more detailed direction in this report assistance on a funding application may be more successful.

If a consultant is used there may be opportunities for a small grant to be obtained, on the order of $4,000 to $6,000, to assist with application preparation from sources such as the Humboldt Area

Foundation. Alternately consulting companies may be willing to work with the District on a funding application on a pro bono basis if they are guaranteed the planning and design work if the application is successful. If this is the route chosen, the District may want to conduct a request for qualifications process to select a preferred consultant. Toolbox Element 5.1 includes guidance on hiring professionals.

7.2.2 Local Agency Management Planning Process

The second recommendation is for OCSD to participate in Humboldt County LAMP process. A stakeholder meeting is tentatively scheduled for January 2015 to provide information and receive input on what the County led regulation could include. It is likely that the District's best option for implementing a system not regulated by the RWQCB would be for the Humboldt County LAMP to include effluent flow limits up to the maximum of 10,000 gallons per day.

7.2.3 Additional Next Steps

In addition to the two recommended steps above, it is recommended that the District undertake public outreach and community consultation in order to continue to inform the community about the project and identify appropriate land parcels available for the disposal systems. Community outreach and education will be an important part of implementing a successful system.

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Appendices

Appendix A – Humboldt County Department of Environmental Health Report Review

Prepared by Jeff Anderson and Associates, 2008

DRAFT - Humboldt County Department of Environmental Health Report Review
Prepared by: Jeff Anderson & Associates
Date: 28 May 2008

A preliminary draft database has been compiled by Jeff Anderson & Associates (JAA) to summarize the 115 files available for review at the Humboldt County Department of Environmental Health (DEH) within the Community of Orick. The purpose of this database is to identify where sewage disposal system (SDS) failures are occurring; if the occurrences are centralized, indicating the potential for a physical cause to the failure (i.e. soil conditions, high groundwater, etc.); or if there is another explanation for system malfunction. DEH has an inconsistent, but rich record of soil logs, septic tank sizes, and leach field size and dimensions for most of their files that relate to SDS permits or failures. In the last decade, there is an increased report of these measured details during planning review. It can be concluded that although there are pockets of unfit soils and high groundwater, there is no expansive area inappropriate to install SDS based on soil conditions. A summary of findings follows.

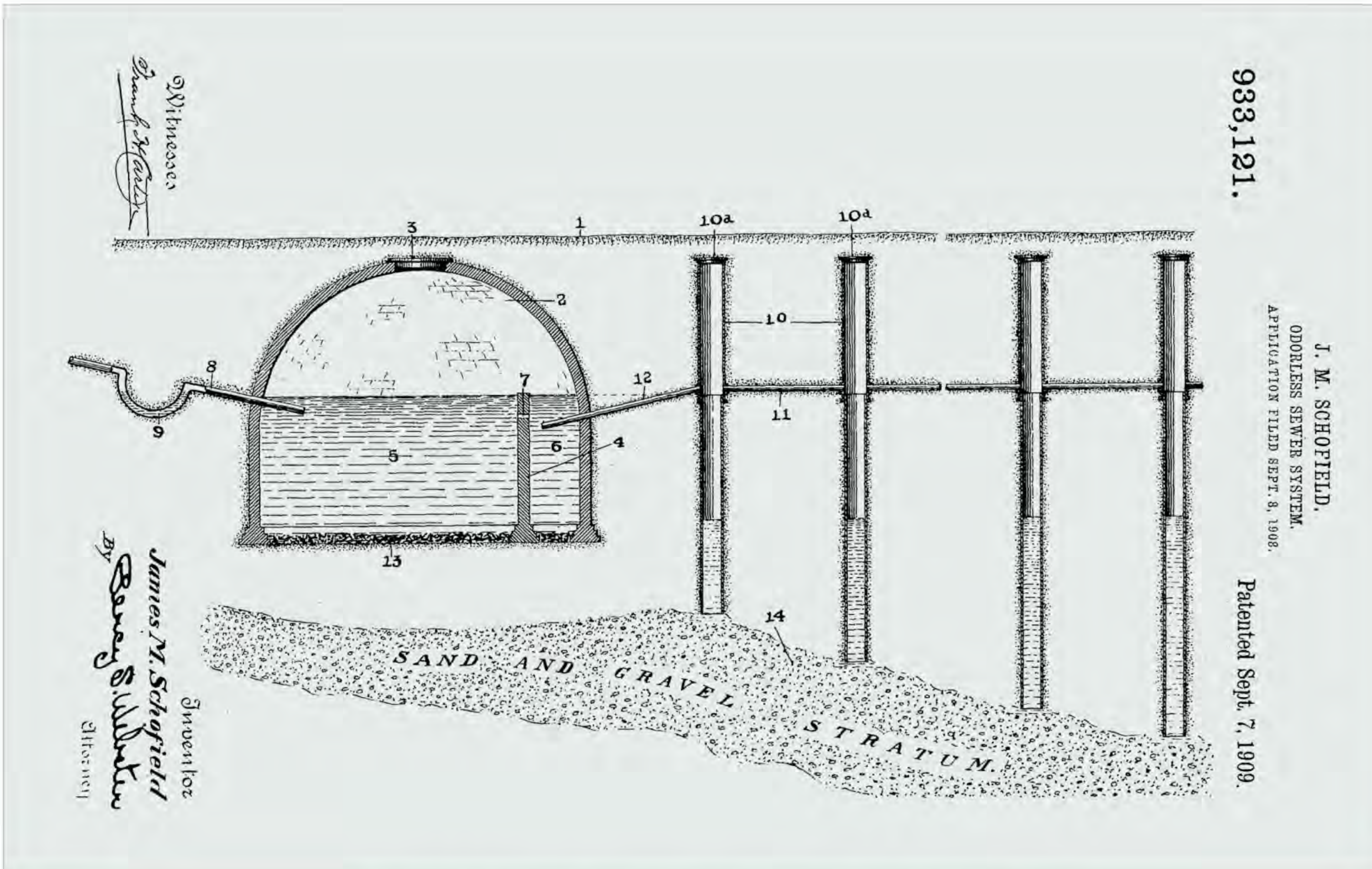
Once the community of Orick was serviced with drinking water, and the 100-feet distance from a well to a SDS was no longer applicable as a building requirement, lots began to be divided into smaller parcels; constrained by setbacks, soil conditions, groundwater, and an area for a leach field and reserve. Some parcels were approved with the SDS located on adjacent parcels. Within the past decade, these planning requirements have become more stringent and SDS permits have undergone a more thorough review, including on-site inspections.

- SDS failures are occurring; however, there are distinct patterns in the type and frequency of failures. The most common causes are (1) a disconnected pipe, (2) a lack of connection to an SDS (i.e., spilling sewage onto the ground), (3) an undersized system and therefore over-allocation of sewage into the system, and (4) a failure to pump a septic tank in 5-7 years.
- There are less property owners than there are parcels. Certain property owners systematically keep their SDS serviced (pumped) and attain permits for building. In contrast, other property owners are consistently reported for violations due to building without a permit, maintaining illegal hook ups to their SDS, and not maintaining the competency of the system.
- Orick is a low-income community and it can be deduced that the DEH reports do not comprehensively represent the number of failures, fixes and building in the community. Permits are relatively expensive and it is only within that last decade that DEH has systematically checked and reviewed new building and been an active investigative presence to detect potential system failures. Prior reports are generally blatant violations, and SDS permits.
- An overwhelming majority of soil samples and texture analyses throughout the developed area of Orick demonstrate the soils are appropriate for on-site disposal. In areas where the soils were not suitable for disposal, the geologist/engineer re-sampled within near proximity and found better soils. In areas where the depth to groundwater was too shallow, the geologist/engineer designed a mounded system.
- Nearly all of the SDS in Orick was installed by one contractor. This person is likely a wealth of knowledge for this project and harbors much of the non-reported information that will be vital for project design.

It is recommended that a decisive evaluation of the impact of groundwater quality to the surface water quality in Redwood Creek adjacent to the development in Orick be assessed. OLA began this research (OLA, 1999) and concluded there is a direct connection between on-site system failure in Orick and degraded water quality in Redwood Creek. The sampling plan that was implemented for this study does not provide the project team with clear evidence that this connection exists.

Reports are generally filed by DEH staff for sewage disposal system (SDS) repair permits, although other actions taken by the landowner (e.g. subdivision, lot line adjustment, gravel mining or various construction projects) may trigger a review from DEH staff and thus a notice in file. Notices of Violation by staff are document for both SDS failures and other uninhabitable dwelling conditions.

Appendix B – Water Quality Control Policy for Siting, Design, Operation, and Maintenance of Onsite Wastewater Treatment Systems – Proposed Policy



OWTS POLICY

Water Quality Control Policy for Siting, Design, Operation, and Maintenance of Onsite Wastewater Treatment Systems

June 19, 2012

CALIFORNIA
Water Boards

STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

State of California
Edmund G. Brown Jr., Governor

California Environmental Protection Agency
Matthew Rodriquez, Secretary

State Water Resources Control Board
http://www.waterboards.ca.gov

Adopted by the State Water Resources Control Board on June 19, 2012
Approved by the Office of Administrative Law on November 13, 2012
Effective Date of the Policy: May 13, 2013

Preamble – Purpose and Scope – Structure of the Policy

Preamble

Onsite wastewater treatment systems (OWTS) are useful and necessary structures that allow habitation at locations that are removed from centralized wastewater treatment systems. When properly sited, designed, operated, and maintained, OWTS treat domestic wastewater to reduce its polluting impact on the environment and most importantly protect public health. Estimates for the number of installations of OWTS in California at the time of this Policy are that more than 1.2 million systems are installed and operating. The vast majority of these are functioning in a satisfactory manner and meeting their intended purpose.

However there have been occasions in California where OWTS for a varied list of reasons have not satisfactorily protected either water quality or public health. Some instances of these failures are related to the OWTS not being able to adequately treat and dispose of waste as a result of poor design or improper site conditions. Others have occurred where the systems are operating as designed but their densities are such that the combined effluent resulting from multiple systems is more than can be assimilated into the environment. From these failures we must learn how to improve our usage of OWTS and prevent such failures from happening again.

As California's population continues to grow, and we see both increased rural housing densities and the building of residences and other structures in more varied terrain than we ever have before, we increase the risks of causing environmental damage and creating public health risks from the use of OWTS. What may have been effective in the past may not continue to be as conditions and circumstances surrounding particular locations change. So necessarily more scrutiny of our installation of OWTS is demanded of all those involved, while maintaining an appropriate balance of only the necessary requirements so that the use of OWTS remains viable.

Purpose and Scope of the Policy

The purpose of this Policy is to allow the continued use of OWTS, while protecting water quality and public health. This Policy recognizes that responsible local agencies can provide the most effective means to manage OWTS on a routine basis. Therefore as an important element, it is the intent of this policy to efficiently utilize and improve upon where necessary existing local programs through coordination between the State and local agencies. To accomplish this purpose, this Policy establishes a statewide, risk-based, tiered approach for the regulation and management of OWTS installations and replacements and sets the level of performance and protection expected from OWTS. In particular, the Policy requires actions for water bodies specifically identified as part this Policy where OWTS contribute to water quality degradation that adversely affect beneficial uses.

This Policy only authorizes subsurface disposal of domestic strength, and in limited instances high strength, wastewater and establishes minimum requirements for the permitting, monitoring, and operation of OWTS for protecting beneficial uses of waters of the State and preventing or correcting conditions of pollution and nuisance. And finally, this Policy also conditionally waives the requirement for owners of OWTS to apply for and receive Waste Discharge Requirements in order to operate their systems when they meet the conditions set forth in the Policy. Nothing in this Policy supersedes or requires modification of Total Maximum Daily Loads or Basin Plan prohibitions of discharges from OWTS.

This Policy also applies to OWTS on federal, state, and Tribal lands to the extent authorized by law or agreement.

Structure of the Policy

This Policy is structured into ten major parts:

Definitions
Definitions for all the major terms used in this Policy are provided within this part and wherever used in the Policy the definition given here overrides any other possible definition.
[Section 1]

Responsibilities and Duties
Implementation of this Policy involves individual OWTS owners; local agencies, be they counties, cities, or any other subdivision of state government with permitting powers over OWTS; Regional Water Quality Control Boards; and the State Water Resources Control Board.
[Sections 2, 3, 4, and 5]

Tier 0 – Existing OWTS
Existing OWTS that are properly functioning, and do not meet the conditions of failing systems or otherwise require corrective action (for example, to prevent groundwater impairment) as specifically described in Tier 4, and are not determined to be contributing to an impairment of surface water as specifically described in Tier 3, are automatically included in Tier 0.
[Section 6]

Tier 1 – Low-Risk New or Replacement OWTS
New or replacement OWTS that meet low risk siting and design requirements as specified in Tier 1, where there is not an approved Local Agency Management Program per Tier 2.
[Sections 7 and 8]

Tier 2 – Local Agency Management Program for New or Replacement OWTS
California is well known for its extreme range of geological and climatic conditions. As such, the establishment of a single set of criteria for OWTS would either be too restrictive so as to protect for the most sensitive case, or would have broad allowances that would not be protective enough under some circumstances. To accommodate this

extreme variance, local agencies may submit management programs ("Local Agency Management Programs") for approval, and upon approval then manage the installation of new and replacement OWTS under that program.

Local Agency Management Programs approved under Tier 2 provide an alternate method from Tier 1 programs to achieve the same policy purpose, which is to protect water quality and public health. In order to address local conditions, Local Agency Management Programs may include standards that differ from the Tier 1 requirements for new and replacement OWTS contained in Sections 7 and 8. As examples, a Local Agency Management Program may authorize different soil characteristics, usage of seepage pits, and different densities for new developments. Once the Local Agency Management Program is approved, new and replacement OWTS that are included within the Local Agency Management Program may be approved by the Local Agency. A Local Agency, at its discretion, may include Tier 1 standards within its Tier 2 Local Agency Management Program for some or all of its jurisdiction. However, once a Local Agency Management Program is approved, it shall supersede Tier 1 and all future OWTS decisions will be governed by the Tier 2 Local Agency Management Program until it is modified, withdrawn, or revoked.
[Section 9]

Tier 3 – Impaired Areas
Existing, new, and replacement OWTS that are near impaired water bodies may be addressed by a TMDL and its implementation program, or special provisions contained in a Local Agency Management Program. If there is no TMDL or special provisions, new or replacement OWTS within 600 feet of impaired water bodies listed in Attachment 2 must meet the specific requirements of Tier 3.
[Section 10]

Tier 4 – OWTS Requiring Corrective Action
OWTS that require corrective action or are either presently failing or fail at any time while this Policy is in effect are automatically included in Tier 4 and must follow the requirements as specified.
[Section 11]

Conditional Waiver of Waste Discharge Requirements
The requirement to submit a report of waste discharge for discharges from OWTS that are in conformance with this policy is waived.
[Section 12]

Effective Date
When this Policy becomes effective.
[Section 13]

Financial Assistance
Procedures for local agencies to apply for funds to establish low interest loan programs for the assistance of OWTS owners in meeting the requirements of this Policy.
[Section 14]

Attachment 1
AB 885 Regulatory Program Timelines.

Attachment 2

Tables 4 and 5 specifically identify those impaired water bodies that have Tier 3 requirements and must have a completed TMDL by the date specified.

Attachment 3

Table 6 shows where one Regional Water Board has been designated to review and, if appropriate, approve new Local Agency Management Plans for a local agency that is within multiple Regional Water Boards' jurisdiction.

What Tier Applies to my OWTS?

Existing OWTS that conform to the requirements for Tier 0 will remain in Tier 0 as long as they continue to meet those requirements. An existing OWTS will temporarily move from Tier 0 to Tier 4 if it is determined that corrective action is needed. The existing OWTS will return to Tier 0 once the corrective action is completed if the repair does not qualify as major repair under Tier 4. Any major repairs conducted as corrective action must comply with Tier 1 requirements or Tier 2 requirements, whichever are in effect for that local area. An existing OWTS will move from Tier 0 to Tier 3 if it is adjacent to an impaired water body listed on Attachment 2, or is covered by a TMDL implementation plan.

In areas with no approved Local Agency Management Plan, new and replacement OWTS that conform to the requirements of Tier 1 will remain in Tier 1 as long as they continue to meet those requirements. A new or replacement OWTS will temporarily move from Tier 1 to Tier 4 if it is determined that corrective action is needed. The new or replacement OWTS will return to Tier 1 once the corrective action is completed. A new or replacement OWTS will move from Tier 1 to Tier 3 if it is adjacent to an impaired water body, or is covered by a TMDL implementation plan.

In areas with an approved Local Agency Management Plan, new and replacement OWTS that conform to the requirements of the Tier 2 Local Agency Management Plan will remain in Tier 2 as long as they continue to meet those requirements. A new or replacement OWTS will temporarily move from Tier 2 to Tier 4 if it is determined that corrective action is needed. The new or replacement OWTS will return to Tier 2 once the corrective action is completed. A new or replacement OWTS will move from Tier 2 to Tier 3 if it is adjacent to an impaired water body, or is covered by a TMDL implementation plan, or is covered by special provisions for impaired water bodies contained in a Local Agency Management Program.

Existing, new, and replacement OWTS in specified areas adjacent to water bodies that are identified by the State Water Board as impaired for pathogens or nitrogen and listed in Attachment 2 are in Tier 3. Existing, new, and replacement OWTS covered by a TMDL implementation plan, or covered by special provisions for impaired water bodies contained in a Local Agency Management Program are also in Tier 3. These OWTS will temporarily move from Tier 3 to Tier 4 if it is determined that corrective action is needed. The new or replacement OWTS will return to Tier 3 once the corrective action is completed.

Existing, new, and replacement OWTS that do not conform with the requirements to receive coverage under any of the Tiers (e.g., existing OWTS with a projected flow of more than 10,000 gpd) do not qualify for this Policy's conditional waiver of waste discharge requirements, and will be regulated separately by the applicable Regional Water Board.

Definitions

1.0 Definitions. The following definitions apply to this Policy:

"303 (d) list" means the same as "**Impaired Water Bodies.**"

"At-grade system" means an OWTS dispersal system with a discharge point located at the preconstruction grade (ground surface elevation). The discharge from an at-grade system is always subsurface.

"Average annual rainfall" means the average of the annual amount of precipitation for a location over a year as measured by the nearest National Weather Service station for the preceding three decades. For example the data set used to make a determination in 2012 would be the data from 1981 to 2010.

"Basin Plan" means the same as "water quality control plan" as defined in Division 7 (commencing with Section 13000) of the Water Code. Basin Plans are adopted by each Regional Water Board, approved by the State Water Board and the Office of Administrative Law, and identify surface water and groundwater bodies within each Region's boundaries and establish, for each, its respective beneficial uses and water quality objectives. Copies are available from the Regional Water Boards, electronically at each Regional Water Boards website, or at the State Water Board's *Plans and Policies* web page (http://www.waterboards.ca.gov/plans_policies/).

"Bedrock" means the rock, usually solid, that underlies soil or other unconsolidated, surficial material.

"CEDEN" means California Environmental Data Exchange Network and information about it is available at the State Water Boards website or http://www.ceden.org/index.shtml.

"Cesspool" means an excavation in the ground receiving domestic wastewater, designed to retain the organic matter and solids, while allowing the liquids to seep into the soil. Cesspools differ from seepage pits because cesspool systems do not have septic tanks and are not authorized under this Policy. The term cesspool does not include pit-privies and out-houses which are not regulated under this Policy.

"Clay" means a soil particle; the term also refers to a type of soil texture. As a soil particle, clay consists of individual rock or mineral particles in soils having diameters <0.002 mm. As a soil texture, clay is the soil material that is comprised of 40 percent or more clay particles, not more than 45 percent sand and not more than 40 percent silt particles using the USDA soil classification system.

"Cobbles" means rock fragments 76 mm or larger using the USDA soil classification systems.

"Dispersal system" means a leachfield, seepage pit, mound, at-grade, subsurface drip field, evapotranspiration and infiltration bed, or other type of system for final wastewater treatment and subsurface discharge.

Definitions

"Domestic wastewater" means wastewater with a measured strength less then high-strength wastewater and is the type of wastewater normally discharged from, or similar to, that discharged from plumbing fixtures, appliances and other household devices including, but not limited to toilets, bathtubs, showers, laundry facilities, dishwashing facilities, and garbage disposals. Domestic wastewater may include wastewater from commercial buildings such as office buildings, retail stores, and some restaurants, or from industrial facilities where the domestic wastewater is segregated from the industrial wastewater. Domestic wastewater may include incidental RV holding tank dumping but does not include wastewater consisting of a significant portion of RV holding tank wastewater such as at RV dump stations. Domestic wastewater does not include wastewater from industrial processes.

"Dump Station" means a facility intended to receive the discharge of wastewater from a holding tank installed on a recreational vehicle. A dump station does not include a full hook-up sewer connection similar to those used at a recreational vehicle park.

"Domestic well" means a groundwater well that provides water for human consumption and is not regulated by the California Department of Public Health.

"Earthen material" means a substance composed of the earth's crust (i.e. soil and rock).

"EDF" see "electronic deliverable format."

"Effluent" means sewage, water, or other liquid, partially or completely treated or in its natural state, flowing out of a septic tank, aerobic treatment unit, dispersal system, or other OWTS component.

"Electronic deliverable format" or **"EDF"** means the data standard adopted by the State Water Board for submittal of groundwater quality monitoring data to the State Water Board's internet-accessible database system Geotracker (http://geotracker.waterboards.ca.gov/).

"Escherichia coli" means a group of bacteria predominantly inhabiting the intestines of humans or other warm-blooded animals, but also occasionally found elsewhere. Used as an indicator of human fecal contamination.

"Existing OWTS" means an OWTS that was constructed and operating prior to the effective date of this Policy, and OWTS for which a construction permit has been issued prior to the effective date of the Policy.

"Flowing water body" means a body of running water flowing over the earth in a natural water course, where the movement of the water is readily discernible or if water is not present it is apparent from review of the geology that when present it does flow, such as in an ephemeral drainage, creek, stream, or river.

"Groundwater" means water below the land surface that is at or above atmospheric pressure.

Definitions

“High-strength wastewater” means wastewater having a 30-day average concentration of biochemical oxygen demand (BOD) greater than 300 milligrams-per-liter (mg/L) or of total suspended solids (TSS) greater than 330 mg/L or a fats, oil, and grease (FOG) concentration greater than 100 mg/L prior to the septic tank or other OWTS treatment component.

“IAPMO” means the International Association of Plumbing and Mechanical Officials.

“Impaired Water Bodies” means those surface water bodies or segments thereof that are identified on a list approved first by the State Water Board and then approved by US EPA pursuant to Section 303(d) of the federal Clean Water Act.

“Local agency” means any subdivision of state government that has responsibility for permitting the installation of and regulating OWTS within its jurisdictional boundaries; typically a county, city, or special district.

“Major repair” means either: (1) for a dispersal system, repairs required for an OWTS dispersal system due to surfacing wastewater effluent from the dispersal field and/or wastewater backed up into plumbing fixtures because the dispersal system is not able to percolate the design flow of wastewater associated with the structure served, or (2) for a septic tank, repairs required to the tank for a compartment baffle failure or tank structural integrity failure such that either wastewater is exfiltrating or groundwater is infiltrating.

“Mottling” means a soil condition that results from oxidizing or reducing minerals due to soil moisture changes from saturated to unsaturated over time. Mottling is characterized by spots or blotches of different colors or shades of color (grays and reds) interspersed within the dominant color as described by the USDA soil classification system. This soil condition can be indicative of historic seasonal high groundwater level, but the lack of this condition may not demonstrate the absence of groundwater.

“Mound system” means an aboveground dispersal system (covered sand bed with effluent leachfield elevated above original ground surface inside) used to enhance soil treatment, dispersal, and absorption of effluent discharged from an OWTS treatment unit such as a septic tank. Mound systems have a subsurface discharge.

“New OWTS” means an OWTS permitted after the effective date of this Policy.

“NSF” means NSF International (a.k.a. National Sanitation Foundation), a not for profit, non-governmental organization that develops health and safety standards and performs product certification.

“Oil/grease interceptor” means a passive interceptor that has a rate of flow exceeding 50 gallons-per-minute and that is located outside a building. Oil/grease interceptors are used for separating and collecting oil and grease from wastewater.

Definitions

“Onsite wastewater treatment system(s)” (**OWTS**) means individual disposal systems, community collection and disposal systems, and alternative collection and disposal systems that use subsurface disposal. The short form of the term may be singular or plural. OWTS do not include “graywater” systems pursuant to Health and Safety Code Section 17922.12.

“Percolation test” means a method of testing water absorption of the soil. The test is conducted with clean water and test results can be used to establish the dispersal system design.

“Permit” means a document issued by a local agency that allows the installation and use of an OWTS, or waste discharge requirements or a waiver of waste discharge requirements that authorizes discharges from an OWTS.

“Person” means any individual, firm, association, organization, partnership, business trust, corporation, company, State agency or department, or unit of local government who is, or that is, subject to this Policy.

“Pit-privy” (a.k.a. outhouse, pit-toilet) means self-contained waterless toilet used for disposal of non-water carried human waste; consists of a shelter built above a pit in the ground into which human waste falls.

“Policy” means this Policy for Siting, Design, Operation and Management of OWTS.

“Pollutant” means any substance that alters water quality of the waters of the State to a degree that it may potentially affect the beneficial uses of water, as listed in a Basin Plan.

“Projected flows” means wastewater flows into the OWTS determined in accordance with any of the applicable methods for determining average daily flow in the *USEPA Onsite Wastewater Treatment System Manual, 2002,* or for Tier 2 in accordance with an approved Local Agency Management Program.

“Public Water System” is a water system regulated by the California Department of Public Health or a Local Primacy Agency pursuant to Chapter 12, Part 4, California Safe Drinking Water Act, Section 116275 (h) of the California Health and Safety Code.

“Public Water Well” is a ground water well serving a public water system. A spring which is not subject to the California Surface Water Treatment Rule (SWTR), CCR, Title 22, sections 64650 through 64666 is a public well.

“Qualified professional” means an individual licensed or certified by a State of California agency to design OWTS and practice as professionals for other associated reports, as allowed under their license or registration. Depending on the work to be performed and various licensing and registration requirements, this may include an individual who possesses a registered environmental health specialist certificate or is currently licensed as a professional engineer or professional geologist. For the purposes of performing site evaluations, Soil Scientists certified by the Soil Science Society of America are considered qualified professionals. A local agency may modify this definition as part of its Local Agency Management Program.

Definitions

"Regional Water Board" is any of the Regional Water Quality Control Boards designated by Water Code Section 13200. Any reference to an action of the Regional Water Board in this Policy also refers to an action of its Executive Officer, including the conducting of public hearings, pursuant to any general or specific delegation under Water Code Section 13223.

"Replacement OWTS" means an OWTS that has its treatment capacity expanded, or its dispersal system replaced or added onto, after the effective date of this Policy.

"Sand" means a soil particle; this term also refers to a type of soil texture. As a soil particle, sand consists of individual rock or mineral particles in soils having diameters ranging from 0.05 to 2.0 millimeters. As a soil texture, sand is soil that is comprised of 85 percent or more sand particles, with the percentage of silt plus 1.5 times the percentage of clay particles comprising less than 15 percent.

"Seepage pit" means a drilled or dug excavation, three to six feet in diameter, either lined or gravel filled, that receives the effluent discharge from a septic tank or other OWTS treatment unit for dispersal.

"Septic tank" means a watertight, covered receptacle designed for primary treatment of wastewater and constructed to:

1. Receive wastewater discharged from a building;
2. Separate settleable and floating solids from the liquid;
3. Digest organic matter by anaerobic bacterial action;
4. Store digested solids; and
5. Clarify wastewater for further treatment with final subsurface discharge.

"Service provider" means a person capable of operating, monitoring, and maintaining an OWTS in accordance to this Policy.

"Silt" means a soil particle; this term also refers to a type of soil texture. As a soil particle, silt consists of individual rock or mineral particles in soils having diameters ranging from between 0.05 and 0.002 mm. As a soil texture, silt is soil that is comprised as approximately 80 percent or more silt particles and not more than 12 percent clay particles using the USDA soil classification system.

"Single-family dwelling unit" means a structure that is usually occupied by just one household or family and for the purposes of this Policy is expected to generate an average of 250 gallons per day of wastewater.

"Site" means the location of the OWTS and, where applicable, a reserve dispersal area capable of disposing 100 percent of the design flow from all sources the OWTS is intended to serve.

"Site Evaluation" means an assessment of the characteristics of the site sufficient to determine its suitability for an OWTS to meet the requirements of this Policy.

Definitions

"Soil" means the naturally occurring body of porous mineral and organic materials on the land surface, which is composed of unconsolidated materials, including sand-sized, silt-sized, and clay-sized particles mixed with varying amounts of larger fragments and organic material. The various combinations of particles differentiate specific soil textures identified in the soil textural triangle developed by the United States Department of Agriculture (USDA) as found in Soil Survey Staff, USDA; *Soil Survey Manual, Handbook 18,* U.S. Government Printing Office, Washington, DC, 1993, p. 138. For the purposes of this Policy, soil shall contain earthen material of particles smaller than 0.08 inches (2 mm) in size.

"Soil Structure" means the arrangement of primary soil particles into compound particles, peds, or clusters that are separated by natural planes of weakness from adjoining aggregates.

"Soil texture" means the soil class that describes the relative amount of sand, clay, silt and combinations thereof as defined by the classes of the soil textural triangle developed by the USDA (referenced above).

"State Water Board" is the State Water Resources Control Board

"Supplemental treatment" means any OWTS or component of an OWTS, except a septic tank or dosing tank, that performs additional wastewater treatment so that the effluent meets a predetermined performance requirement prior to discharge of effluent into the dispersal field.

"SWAMP" means Surface Water Ambient Monitoring Program and more information is available at: http://www.waterboards.ca.gov/water_issues/programs/swamp/

"Telemetric" means the ability to automatically measure and transmit OWTS data by wire, radio, or other means.

"TMDL" is the acronym for "total maximum daily load." Section 303(d)(1) of the Clean Water Act requires each State to establish a TMDL for each impaired water body to address the pollutant(s) causing the impairment. In California, TMDLs are usually adopted as Basin Plan amendments and contain implementation plans detailing how water quality standards will be attained.

"Total coliform" means a group of bacteria consisting of several *genera* belonging to the family *Enterobacteriaceae*, which includes Escherichia coli bacteria.

"USDA" means the U.S. Department of Agriculture.

"Waste discharge requirement" or **"WDR"** means an operation and discharge permit issued for the discharge of waste pursuant to Section 13260 of the California Water Code.

Responsibilities and Duties

Responsibilities and Duties

2.0 OWTS Owners Responsibilities and Duties

2.1 All new, replacement, or existing OWTS within an area that is subject to a Basin Plan prohibition of discharges from OWTS, must comply with the prohibition. If the prohibition authorizes discharges under specified conditions, the discharge must comply with those conditions and the applicable provisions of this Policy.

2.2 Owners of OWTS shall adhere to the requirements prescribed in local codes and ordinances. Owners of new and replacement OWTS covered by this Policy shall also meet the minimum standards contained in Tier 1, or an alternate standard provided by a Local Agency Management Program per Tier 2, or shall comply with the requirements of Tier 3 if near an impaired water body and subject to Tier 3, or shall provide corrective action for their OWTS if their system meets conditions that place it in Tier 4.

2.3 Owners of OWTS shall comply with any and all permitting conditions imposed by a local agency that do not directly conflict with this Policy, including any conditions that are more stringent than required by this Policy.

2.4 To receive coverage under this Policy and the included waiver of waste discharges, OWTS shall only accept and treat flows of domestic wastewater. In addition, OWTS that accept high-strength wastewater from commercial food service buildings are covered under this Policy and the waiver of waste discharge requirements if the wastewater does not exceed 900 mg/L BOD and there is a properly sized and functioning oil/grease interceptor (a.k.a grease trap).

2.5 Owners of OWTS shall maintain their OWTS in good working condition including inspections and pumping of solids as necessary, or as required by local ordinances, to maintain proper function and assure adequate treatment.

2.6 The following owners of OWTS shall notify the Regional Water Board by submitting a Report of Waste Discharge for the following:

2.6.1 a new or replacement OWTS that does not meet the conditions and requirements set forth in either a Local Agency Management Program if one is approved, an existing local program if it is less than 60 months from the effective date of the Policy and a Local Agency Management Program is not yet approved, or Tier 1 if no Local Agency Management Program has been approved and it is more than 60 months after the effective date of this Policy;

2.6.2 any OWTS, not under individual waste discharge requirements or a waiver of individual waste discharge requirements issued by a Regional Water Board, with the projected flow of over 10,000 gallons-per-day;

2.6.3 any OWTS that receives high-strength wastewater, unless the waste stream is from a commercial food service building;

2.6.4 any OWTS that receives high-strength wastewater from a commercial food service building: (1) with a BOD higher than 900 mg/L, or (2) that does not have a properly sized and functioning oil/grease interceptor.

2.7 All Reports of Waste Discharge shall be accompanied by the required application fee pursuant to California Code of Regulations, title 23, section 2200.

3.0 Local Agency Requirements and Responsibilities

3.1 Local agencies, in addition to implementing their own local codes and ordinances, shall determine whether the requirements within their local jurisdiction will be limited to the water quality protection afforded by the statewide minimum standards in Tier 0, Tier 1, Tier 3, and Tier 4, or whether the local agency will implement a Local Agency Management Program in accordance with Tier 2. Except for Tier 3, local agencies may continue to implement their existing OWTS permitting programs in compliance with the Basin Plan in place at the effective date of the Policy until 60 months after the effective date of this Policy, or approval of a Local Agency Management Program, whichever comes first, and may make minor adjustments as necessary that are in compliance with the applicable Basin Plan and this Policy. Tier 3 requirements take effect on the effective date of this Policy. In the absence of a Tier 2 Local Agency Management Program, to the extent that there is a direct conflict between the applicable minimum standards and the local codes or ordinances (such that it is impossible to comply with both the applicable minimum standards and the local ordinances or codes), the more restrictive standards shall govern.

3.2 If preferred, the local agency may at any time provide the State Water Board and all affected Regional Water Board(s) written notice of its intent to regulate OWTS using a Local Agency Management Program with alternative standards as authorized in Tier 2 of this Policy. A proposed Local Agency Management Program that conforms to the requirements of that Section shall be included with the notice. A local agency shall not implement a program different than the minimum standards contained in Tier 1 and 3 of this Policy after 60 months from the effective date of this Policy until approval of the proposed Local Agency Management Program is granted by either the Regional Water Board or State Water Board. All initial program submittals desiring approval prior to the 60 month limit shall be received no later than 36 months from the effective date of this Policy. Once approved, the local agency shall adhere to the Local Agency Management Program, including all requirements, monitoring, and reporting. If at any time a local agency wishes to modify its Local Agency Management Program, it shall provide the State Water Board and all affected Regional Water Board(s) written notice of its intended modifications and will continue to implement its existing Local Agency Management Program until the modifications are approved.

3.3 All local agencies permitting OWTS shall report annually to the Regional Water Board(s). If a local agency's jurisdictional area is within the boundary of multiple Regional Water Boards, the local agency shall send a copy of the annual report to each Regional Water Board. The annual report shall include the following information (organized in a tabular spreadsheet format) and summarize whether any further actions are warranted to protect water quality or public health:

3.3.1 number and location of complaints pertaining to OWTS operation and maintenance, and identification of those which were investigated and how they were resolved;

3.3.2 shall provide the applications and registrations issued as part of the local septic tank cleaning registration program pursuant to Section 117400 et seq. of the California Health and Safety Code;

3.3.3 number, location, and description of permits issued for new and replacement OWTS and which Tier the permit is issued.

3.4 All local agencies permitting OWTS shall retain permanent records of their permitting actions and will make those records available within 10 working days upon written request for review by a Regional Water Board. The records for each permit shall reference the Tier under which the permit was issued.

3.5 A local agency shall notify the owner of a public well or water intake and the California Department of Public Health as soon as practicable, but not later than 72 hours, upon its discovery of a failing OWTS as described in sections 11.1 and 11.2 within the setbacks described in sections 7.5.6 through 7.5.10.

3.6 A local agency may implement this Policy, or a portion thereof, using its local authority to enforce the policy, as authorized by an approval from the State Water Board or by the appropriate Regional Water Board.

3.7 Nothing in the Policy shall preclude a local agency from adopting or retaining standards for OWTS in an approved Local Agency Management Program that are more protective of the public health or the environment than are contained in this Policy.

3.8 If at any time a local agency wishes to withdraw its previously submitted and approved Tier 2 Local Agency Management Program, it may do so upon 60 days written notice. The notice of withdrawal shall specify the reason for withdrawing its Tier 2 program, the effective date for cessation of the program and resumption of permitting of OWTS only under Tiers 1, 3, and 4.

4.0 Regional Water Board Functions and Duties

4.1 The Regional Water Boards have the principal responsibility for overseeing the implementation of this Policy.

4.2 Regional Water Boards shall incorporate the requirements established in this Policy by amending their Basin Plans within 12 months of the effective date of this Policy, pursuant to Water Code Section 13291(e). The Regional Water

Boards may also consider whether it is necessary and appropriate to retain or adopt any more protective standards. To the extent that a Regional Water Board determines that it is necessary and appropriate to retain or adopt any more protective standards, it shall reconcile those region-specific standards with this Policy to the extent feasible, and shall provide a detailed basis for its determination that each of the more protective standards is necessary and appropriate.

4.2.1 Notwithstanding 4.2 above, the North Coast Regional Water Board will continue to implement its existing Basin Plan requirements pertaining to OWTS within the Russian River watershed until it adopts the Russian River TMDL, at which time it will comply with section 4.2 for the Russian River watershed.

4.3 The Regional Water Board designated in Attachment 3 shall review, and if appropriate, approve a Local Agency Management Program submitted by the local agency pursuant to Tier 2 in this Policy. Upon receipt of a proposed Local Agency Management Program, the Regional Water Board designated in Attachment 3 shall have 90 days to notify the local agency whether the submittal contains all the elements of a Tier 2 program, but may request additional information based on review of the proposed program. Approval must follow a noticed hearing with opportunity for public comment. If a Local Agency Management Program is disapproved, the Regional Water Board designated in Attachment 3 shall provide a written explanation of the reasons for the disapproval. A Regional Water Board may approve a Local Agency Management Program while disapproving any proposed special provisions for impaired water bodies contained in the Local Agency Management Program. If no action is taken by the respective Regional Water Board within 12 months of the submission date of a complete Local Agency Management Program, the program shall be forwarded to the State Water Board for review and approval pursuant to Section 5 of this Policy.

4.3.1 Where the local agency's jurisdiction lies within more than one Regional Water Board, staff from the affected Regional Water Boards shall work cooperatively to assure that water quality protection in each region is adequately protected. If the Regional Water Board designated in Attachment 3 approves the Local Agency Management Program over the written objection of an affected Regional Water Board, that Regional Water Board may submit the dispute to the State Water Board under Section 5.3.

4.3.2 Within 30 days of receipt of a proposed Local Agency Management Program, a Regional Water Board will forward a copy to and solicit comments from the California Department of Public Health regarding a Local Agency Management Program's proposed policies and procedures, including notification to local water purveyors prior to OWTS permitting.

4.4 Once a Local Agency Management Program has been approved, any affected Regional Water Board may require modifications or revoke authorization of a local agency to implement a Tier 2 program, in accordance with the following:

4.4.1 The Regional Water Board shall consult with any other Regional Water Board(s) having jurisdiction over the local agency before providing the notice described in section 4.4.2.

4.4.2 Written notice shall be provided to the local agency detailing the Regional Water Board's action, the cause for such action, remedies to prevent the action from continuing to completion, and appeal process and rights. The local agency shall have 90 days from the date of the written notice to respond with a corrective action plan to address the areas of non-compliance, or to request the Regional Water Board to reconsider its findings.

4.4.3 The Regional Water Board shall approve, approve conditionally, or deny a corrective action plan within 90 days of receipt. The local agency will have 90 days to begin implementation of a corrective action plan from the date of approval or 60 days to request reconsideration from the date of denial. If the local agency fails to submit an acceptable corrective action plan, fails to implement an approved corrective action plan, or request reconsideration, the Regional Water Board may require modifications to the Local Agency Management Program, or may revoke the local agency's authorization to implement a Tier 2 program.

4.4.4 Requests for reconsideration by the local agency shall be decided by the Regional Water Board within 90 days and the previously approved Local Agency Management Program shall remain in effect while the reconsideration is pending.

4.4.5 If the request for reconsideration is denied, the local agency may appeal to the State Water Board and the previously approved Local Agency Management Program shall remain in effect while the appeal is under consideration. The State Water Board shall decide the appeal within 90 days. All decisions of the State Water Board are final.

4.5 The appropriate Regional Water Board shall accept and consider any requests for modification or revocation of a Local Agency Management Program submitted by any person. The Regional Water Board will notify the person making the request and the local agency implementing the Local Agency Management Program at issue by letter within 90 days whether it intends to proceed with the modification or revocation process per Section 4.4 above, or is dismissing the request. The Regional Water Board will post the request and its response letter on its website.

4.6 A Regional Water Board may issue or deny waste discharge requirements or waivers of waste discharge requirements for any new or replacement OWTS within a jurisdiction of a local agency without an approved Local Agency Management Program if that OWTS does not meet the minimum standards contained in Tier 1.

4.7 The Regional Water Boards will implement any notifications and enforcement requirements for OWTS determined to be in Tier 3 of this Policy.

4.8 Regional Water Boards may adopt waste discharge requirements, or conditional waivers of waste discharge requirements, that exempt individual OWTS from requirements contained in this Policy.

5.0 State Water Board Functions and Duties

5.1 As the state agency charged with the development and adoption of this Policy, the State Water Board shall periodically review, amend and/or update this Policy as required.

5.2 The State Water Board may take any action assigned to the Regional Water Boards in this Policy.

5.3 The State Water Board shall resolve disputes between Regional Water Boards and local agencies as needed within 12 months of receiving such a request by a Regional Water Board or local agency, and may take action on its own motion in furtherance of this Policy. As part of this function, the State Water Board shall review and, if appropriate, approve Local Agency Management Programs in cases where the respective Regional Water Board has failed to consider for approval a Local Agency Management Program. The State Water Board shall approve Local Agency Management Programs at a regularly noticed board hearing and shall provide for public participation, including notice and opportunity for public comment. Once taken up by the State Water Board, Local Agency Management Programs shall be approved or denied within 180 days.

5.4 A member of the public may request the State Water Board to resolve any dispute regarding the Regional Water Board's approval of a Local Agency Management Program if the member of the public timely raised the disputed issue before the Regional Water Board. Such requests shall be submitted within 30 days after the Regional Water Board's approval of the Local Agency Management Program. The State Water Board shall notify the member of the public, the local agency, and the Regional Water Board within 90 days whether it intends to proceed with dispute resolution.

5.5 The State Water Board shall accept and consider any requests for modification or revocation of a Local Agency Management Program submitted by any person, where that person has previously submitted said request to the Regional Water Board and has received notice from the Regional Water Board of its dismissal of the request. The State Water Board will notify the person making the request and the local agency implementing the Local Agency Management Program at issue by letter within 90 days whether it intends to proceed with the modification or revocation process per Section 4.4 above, or is dismissing the request. The State Water Board will post the request and its response letter on its website.

5.6 The State Water Board or its Executive Director, after approving any Impaired Water Bodies [303 (d)] List, and for the purpose of implementing Tier 3 of this Policy, shall update Attachment 2 to identify those water bodies where: (1) it is likely that operating OWTS will subsequently be determined to be a contributing source of pathogens or nitrogen and therefore it is anticipated that OWTS would receive a loading reduction, and (2) it is likely that new OWTS installations discharging within 600 feet of the water body would contribute to the impairment. This identification shall be based on information available at the time of 303 (d) listing and may be further updated based on new information. Updates to Attachment 2 will be processed as amendments to this Policy.

5.7 The State Water Board will make available to local agencies funds from its Clean Water State Revolving Fund loan program for mini-loan programs to be operated by the local agencies for the making of low interest loans to assist private property owners with complying with this Policy.

Tier 0 – Existing OWTS

Tier 0 – Existing OWTS

Existing OWTS that are properly functioning and do not meet the conditions of failing systems or otherwise require corrective action (for example, to prevent groundwater impairment) as specifically described in Tier 4, and are not determined to be contributing to an impairment of surface water as specifically described in Tier 3, are automatically included in Tier 0.

6.0 Coverage for Properly Operating Existing OWTS

6.1 Existing OWTS are automatically covered by Tier 0 and the herein included waiver of waste discharge requirements if they meet the following requirements:

6.1.1 have a projected flow of 10,000 gallons-per-day or less;

6.1.2 receive only domestic wastewater from residential or commercial buildings, or high-strength wastewater from commercial food service buildings that does not exceed 900 mg/L BOD and has a properly sized and functioning oil/grease interceptor (a.k.a. grease trap);

6.1.3 continue to comply with any previously imposed permitting conditions;

6.1.4 do not require supplemental treatment under Tier 3;

6.1.5 do not require corrective action under Tier 4; and

6.1.6 do not consist of a cesspool as a means of wastewater disposal.

6.2 A Regional Water Board or local agency may deny coverage under this Policy to any OWTS that is:

6.2.1 Not in compliance with Section 6.1;

6.2.2 Not able to adequately protect the water quality of the waters of the State, as determined by the Regional Water Board after considering any input from the local agency. A Regional Water Board may require the submission of a report of waste discharge to receive Region specific waste discharge requirements or waiver of waste discharge requirements so as to be protective.

6.3 Existing OWTS currently under waste discharge requirements or individual waiver of waste discharge requirements will remain under those orders until notified in writing by the appropriate Regional Water Board that they are covered under this Policy.

Tier 1 – Low Risk New or Replacement OWTS

Tier 1 – Low Risk New or Replacement OWTS

New or replacement OWTS meet low risk siting and design requirements as specified in Tier 1, where there is not an approved Local Agency Management Program per Tier 2.

7.0 Minimum Site Evaluation and Siting Standards

7.1 A qualified professional shall perform all necessary soil and site evaluations for all new OWTS and for existing OWTS where the treatment or dispersal system will be replaced or expanded.

7.2 A site evaluation shall determine that adequate soil depth is present in the dispersal area. Soil depth is measured vertically to the point where bedrock, hardpan, impermeable soils, or saturated soils are encountered or an adequate depth has been determined. Soil depth shall be determined through the use of soil profile(s) in the dispersal area and the designated dispersal system replacement area, as viewed in excavations exposing the soil profiles in representative areas, unless the local agency has determined through historical or regional information that a specific site soil profile evaluation is unwarranted.

7.3 A site evaluation shall determine whether the anticipated highest level of groundwater within the dispersal field and its required minimum dispersal zone is not less than prescribed in Table 2 by estimation using one or a combination of the following methods:

7.3.1 Direct observation of the highest extent of soil mottling observed in the examination of soil profiles, recognizing that soil mottling is not always an indicator of the uppermost extent of high groundwater; or

7.3.2 Direct observation of groundwater levels during the anticipated period of high groundwater. Methods for groundwater monitoring and determinations shall be decided by the local agency; or

7.3.3 Other methods, such as historical records, acceptable to the local agency.

7.3.4 Where a conflict in the above methods of examination exists, the direct observation method indicating the highest level shall govern.

7.4 Percolation test results in the effluent disposal area shall not be faster than one minute per inch (1 MPI) or slower than one hundred twenty minutes per inch (120 MPI). All percolation test rates shall be performed by presoaking of percolation test holes and continuing the test until a stabilized rate is achieved.

7.5 Minimum horizontal setbacks from any OWTS treatment component and dispersal systems shall be as follows:

7.5.1 5 feet from parcel property lines and structures;

7.5.2 100 feet from water wells and monitoring wells, unless regulatory or legitimate data requirements necessitate that monitoring wells be located closer;

7.5.3 100 feet from any unstable land mass or any areas subject to earth slides identified by a registered engineer or registered geologist; other setback distance are allowed, if recommended by a geotechnical report prepared by a qualified professional.

7.5.4 100 feet from springs and flowing surface water bodies where the edge of that water body is the natural or levied bank for creeks and rivers, or may be less where site conditions prevent migration of wastewater to the water body;

7.5.5 200 feet from vernal pools, wetlands, lakes, ponds, or other surface water bodies where the edge of that water body is the high water mark for lakes and reservoirs, and the mean high tide line for tidally influenced water bodies;

7.5.6 150 feet from a public water well where the depth of the effluent dispersal system does not exceed 10 feet;

7.5.7 Where the effluent dispersal system is within 1,200 feet from a public water systems' surface water intake point, within the catchment of the drainage, and located such that it may impact water quality at the intake point such as upstream of the intake point for flowing water bodies, the dispersal system shall be no less than 400 feet from the high water mark of the reservoir, lake or flowing water body.

7.5.8 Where the effluent dispersal system is located more than 1,200 feet but less than 2,500 feet from a public water systems' surface water intake point, within the catchment of the drainage, and located such that it may impact water quality at the intake point such as upstream of the intake point for flowing water bodies, the dispersal system shall be no less than 200 feet from the high water mark of the reservoir, lake or flowing water body.

7.6 Prior to issuing a permit to install an OWTS the permitting agency shall determine if the OWTS is within 1,200 feet of an intake point for a surface water treatment plant for drinking water, is in the drainage catchment in which the intake point is located, and located such that it may impact water quality at the intake point such as being upstream of the intake point for a flowing water body. If the OWTS is within 1,200 feet of an intake point for a surface water treatment plant for drinking water, is in the drainage catchment in which the intake point is located, and is located such that it may impact water quality at the intake point:

7.6.1 The permitting agency shall provide a copy of the permit application to the owner of the water system of their proposal to install an OWTS within 1,200 feet of an intake point for a surface water treatment. If the owner of the water system cannot be identified, then the permitting agency will notify California Department of Public Health Drinking Water Program.

7.6.2 The permit application shall include a topographical plot plan for the parcel showing the OWTS components, the property boundaries, proposed structures, physical address, and name of property owner.

7.6.3 The permit application shall provide the estimated wastewater flows, intended use of proposed structure generating the wastewater, soil data, and estimated depth to seasonally saturated soils.

7.6.4 The public water system owner shall have 15 days from receipt of the permit application to provide recommendations and comments to the permitting agency.

7.7 Natural ground slope in all areas used for effluent disposal shall not be greater than 25 percent.

7.8 The average density for any subdivision of property made by Tentative Approval pursuant to the Subdivision Map Act occurring after the effective date of this Policy and implemented under Tier 1 shall not exceed the allowable density values in Table 1 for a single-family dwelling unit, or its equivalent, for those units that rely on OWTS.

Table 1: Allowable Average Densities per Subdivision under Tier 1.

Average Annual Rainfall (in/yr)	Allowable Density (acres/single family dwelling unit)
0 - 15	2.5
>15 - 20	2
>20 - 25	1.5
>25 - 35	1
>35 - 40	0.75
>40	0.5

8.0 Minimum OWTS Design and Construction Standards

8.1 OWTS Design Requirements

8.1.1 A qualified professional shall design all new OWTS and modifications to existing OWTS where the treatment or dispersal system will be replaced or expanded. A qualified professional employed by a local agency, while acting in that capacity, may design, review, and approve a design for a proposed OWTS, if authorized by the local agency.

8.1.2 OWTS shall be located, designed, and constructed in a manner to ensure that effluent does not surface at any time, and that percolation of effluent will not adversely affect beneficial uses of waters of the State.

8.1.3 The design of new and replacement OWTS shall be based on the expected influent wastewater quality with a projected flow not to exceed 3,500 gallons per day, the peak wastewater flow rates for purposes of sizing hydraulic components, the projected average daily flow for purposes of sizing the dispersal system, the characteristics of the site, and the required level of treatment for protection of water quality and public health.

8.1.4 All dispersal systems shall have at least twelve (12) inches of soil cover, except for pressure distribution systems, which must have at least six (6) inches of soil cover.

8.1.5 The minimum depth to the anticipated highest level of groundwater below the bottom of the leaching trench, and the native soil depth immediately below the leaching trench, shall not be less than prescribed in Table 2.

Table 2: Tier 1 Minimum Depths to Groundwater and Minimum Soil Depth from the Bottom of the Dispersal System

Percolation Rate	Minimum Depth
Percolation Rate ≤1 MPI	Only as authorized in a Tier 2 Local Agency Management Program
1 MPI< Percolation Rate ≤ 5 MPI	Twenty (20) feet
5 MPI< Percolation Rate ≤ 30 MPI	Eight (8) feet
30 MPI< Percolation Rate ≤ 120 MPI	Five (5) feet
Percolation Rate > 120 MPI	Only as authorized in a Tier 2 Local Agency Management Program

MPI = minutes per inch

8.1.6 Dispersal systems shall be a leachfield, designed using not more than 4 square-feet of infiltrative area per linear foot of trench as the infiltrative surface, and with trench width no wider than 3 feet. Seepage pits and other dispersal systems may only be authorized for repairs where siting limitations require a variance. Maximum application rates shall be determined from stabilized percolation rate as provided in Table 3, or from soil texture and structure determination as provided in Table 4.

8.1.7 Dispersal systems shall not exceed a maximum depth of 10 feet as measured from the ground surface to the bottom of the trench.

Tier 1 – Low Risk New or Replacement OWTS

Table 3: Application Rates as Determined from Stabilized Percolation Rate							
Percolation Rate (minutes per Inch)	**Application Rate (gallons per day per square foot)**		**Percolation Rate (minutes per Inch)**	**Application Rate (gallons per day per square foot)**		**Percolation Rate (minutes per Inch)**	**Application Rate (gallons per day per square foot)**
<1	Requires Local Management Program		31	0.522		61	0.197
1	1.2		32	0.511		62	0.194
2	1.2		33	0.5		63	0.19
3	1.2		34	0.489		64	0.187
4	1.2		35	0.478		65	0.184
5	1.2		36	0.467		66	0.18
6	0.8		37	0.456		67	0.177
7	0.8		38	0.445		68	0.174
8	0.8		39	0.434		69	0.17
9	0.8		40	0.422		70	0.167
10	0.8		41	0.411		71	0.164
11	0.786		42	0.4		72	0.16
12	0.771		43	0.389		73	0.157
13	0.757		44	0.378		74	0.154
14	0.743		45	0.367		75	0.15
15	0.729		46	0.356		76	0.147
16	0.714		47	0.345		77	0.144
17	0.7		48	0.334		78	0.14
18	0.686		49	0.323		79	0.137
19	0.671		50	0.311		80	0.133
20	0.657		51	0.3		81	0.13
21	0.643		52	0.289		82	0.127
22	0.629		53	0.278		83	0.123
23	0.614		54	0.267		84	0.12
24	0.6		55	0.256		85	0.117
25	0.589		56	0.245		86	0.113
26	0.578		57	0.234		87	0.11
27	0.567		58	0.223		88	0.107
28	0.556		59	0.212		89	0.103
29	0.545		60	0.2		90	0.1
30	0.533					>90 - 120	0.1

Table 4: Design Soil Application Rates

(Source: USEPA Onsite Wastewater Treatment Systems Manual, February 2002)

Soil Texture (per the USDA soil classification system)	**Soil Structure Shape**	**Grade**	**Maximum Soil Application Rate(gallons per day per square foot)** [1]
Coarse Sand, Sand, Loamy Coarse Sand, Loamy Sand	Single grain	Structureless	0.8
Fine Sand, Very Fine Sand, Loamy Fine Sand, Loamy Very Fine Sand	Single grain	Structureless	0.4
Coarse Sandy Loam, Sandy Loam	Massive	Structureless	0.2
	Platy	Weak	0.2
		Moderate, Strong	Prohibited
	Prismatic, Blocky, Granular	Weak	0.4
		Moderate, Strong	0.6
Fine Sandy Loam, very fine Sandy Loam	Massive	Structureless	0.2
	Platy	Weak, Moderate, Strong	Prohibited
	Prismatic, Blocky, Granular	Weak	0.2
		Moderate, Strong	0.4
Loam	Massive	Structureless	0.2
	Platy	Weak, Moderate, Strong	Prohibited
	Prismatic, Blocky, Granular	Weak	0.4
		Moderate, Strong	0.6
Silt Loam	Massive	Structureless	Prohibited
	Platy	Weak, Moderate, Strong	Prohibited
	Prismatic, Blocky, Granular	Weak	0.4
		Moderate, Strong	0.6
Sandy Clay Loam, Clay Loam, Silty Clay Loam	Massive	Structureless	Prohibited
	Platy	Weak, Moderate, Strong	Prohibited
	Prismatic, Blocky, Granular	Weak	0.2
		Moderate, Strong	0.4
Sandy Clay, Clay, or Silty Clay	Massive	Structureless	Prohibited
	Platy	Weak, Moderate, Strong	Prohibited
	Prismatic, Blocky, Granular	Weak	Prohibited
		Moderate, Strong	0.2

[1] Soils listed as prohibited may be allowed under the authority of the Regional Water Board, or as allowed under an approved Local Agency Management Program per Tier 2.

8.1.8 All new dispersal systems shall have 100 percent replacement area that is equivalent and separate, and available for future use.

8.1.9 No dispersal systems or replacement areas shall be covered by an impermeable surface, such as paving, building foundation slabs, plastic sheeting, or any other material that prevents oxygen transfer to the soil.

8.1.10 Rock fragment content of native soil surrounding the dispersal system shall not exceed 50 percent by volume for rock fragments sized as cobbles or larger and shall be estimated using either the point-count or line-intercept methods.

8.1.11 Increased allowance for IAPMO certified dispersal systems is not allowed under Tier 1.

8.2 OWTS Construction and Installation

8.2.1 All new or replacement septic tanks and new or replacement oil/grease interceptor tanks shall comply with the standards contained in Sections K5(b), K5(c), K5(d), K5(e), K5(k), K5(m)(1), and K5(m)(3)(ii) of Appendix K, of Part 5, Title 24 of the 2007 California Code of Regulations.

8.2.2 All new septic tanks shall comply with the following requirements:

8.2.2.1 Access openings shall have watertight risers, the tops of which shall be set at most 6 inches below finished grade; and

8.2.2.2 Access openings at grade or above shall be locked or secured to prevent unauthorized access.

8.2.3 New and replacement OWTS septic tanks shall be limited to those approved by the International Association of Plumbing and Mechanical Officials (IAPMO) or stamped and certified by a California registered civil engineer as meeting the industry standards, and their installation shall be according to the manufacturer's instructions.

8.2.4 New and replacement OWTS septic tanks shall be designed to prevent solids in excess of three-sixteenths (3/16) of an inch in diameter from passing to the dispersal system. Septic tanks that use a National Sanitation Foundation/American National Standard Institute (NSF/ANSI) Standard 46 certified septic tank filter at the final point of effluent discharge from the OWTS and prior to the dispersal system shall be deemed in compliance with this requirement.

Tier 1 – Low Risk New or Replacement OWTS

8.2.5 A Licensed General Engineering Contractor (Class A), General Building Contractor (Class B), Sanitation System Contractor (Specialty Class C-42), or Plumbing Contractor (Specialty Class C-36) shall install all new OWTS and replacement OWTS in accordance with California Business and Professions Code Sections 7056, 7057, and 7058 and Article 3, Division 8, Title 16 of the California Code of Regulations. A property owner may also install his/her own OWTS if the as-built diagram and the installation are inspected and approved by the Regional Water Board or local agency at a time when the OWTS is in an open condition (not covered by soil and exposed for inspection).

Tier 2 – Local Agency OWTS Management Program

Tier 2 – Local Agency OWTS Management Program

Local agencies may submit management programs for approval, and upon approval then manage the installation of new and replacement OWTS under that program. Local Agency Management Programs approved under Tier 2 provide an alternate method from Tier 1 programs to achieve the same policy purpose, which is to protect water quality and public health. In order to address local conditions, Local Agency Management Programs may include standards that differ from the Tier 1 requirements for new and replacement OWTS contained in Sections 7 and 8. As examples, a Local Agency Management Program may authorize different soil characteristics, usage of seepage pits, and different densities for new developments. Once the Local Agency Management Program is approved, new and replacement OWTS that are included within the Local Agency Management Program may be approved by the Local Agency. A Local Agency, at its discretion, may include Tier 1 standards within its Tier 2 Local Agency Management Program for some or all of its jurisdiction. However, once a Local Agency Management Program is approved, it shall supersede Tier 1 and all future OWTS decisions will be governed by the Tier 2 Local Agency Management Program until it is modified, withdrawn, or revoked.

9.0 Local Agency Management Program for Minimum OWTS Standards

The Local Agency Management Program for minimum OWTS Standards is a management program where local agencies can establish minimum standards that are differing requirements from those specified in Tier 1 (Section 7 and Section 8), including the areas that do not meet those minimum standards and still achieve this Policy's purpose. Local Agency Management Programs may include any one or combination of the following to achieve this purpose:

- Differing system design requirements;
- Differing siting controls such as system density and setback requirements;
- Requirements for owners to enter monitoring and maintenance agreements; and/or
- Creation of an onsite management district or zone.

9.1 Where different and/or additional requirements are needed to protect water quality the local agency shall consider the following, as well as any other conditions deemed appropriate, when developing Local Agency Management Program requirements:

9.1.1 Degree of vulnerability to pollution from OWTS due to hydrogeological conditions.

9.1.2 High Quality waters or other environmental conditions requiring enhanced protection from the effects of OWTS.

9.1.3 Shallow soils requiring a dispersal system installation that is closer to ground surface than is standard.

9.1.4 OWTS is located in area with high domestic well usage.

9.1.5 Dispersal system is located in an area with fractured bedrock.

9.1.6 Dispersal system is located in an area with poorly drained soils.

9.1.7 Surface water is vulnerable to pollution from OWTS.

9.1.8 Surface water within the watershed is listed as impaired for nitrogen or pathogens.

9.1.9 OWTS is located within an area of high OWTS density.

9.1.10 A parcel's size and its susceptibility to hydraulic mounding, organic or nitrogen loading, and whether there is sufficient area for OWTS expansion in case of failure.

9.1.11 Geographic areas that are known to have multiple, existing OWTS predating any adopted standards of design and construction including cesspools.

9.1.12 Geographic areas that are known to have multiple, existing OWTS located within either the pertinent setbacks listed in Section 7.5 of this Policy, or a setback that the local agencies finds is appropriate for that area.

9.2 The Local Agency Management Program shall detail the scope of its coverage, such as the maximum authorized projected flows for OWTS, as well as a clear delineation of those types of OWTS included within and to be permitted by the program, and provide the local site evaluation, siting, design, and construction requirements, and in addition each of the following:

9.2.1 Any local agency requirements for onsite wastewater system inspection, monitoring, maintenance, and repairs, including procedures to ensure that replacements or repairs to failing systems are done under permit from the local governing jurisdiction.

9.2.2 Any special provisions applicable to OWTS within specified geographic areas near specific impaired water bodies listed for pathogens or nitrogen. The special provisions may be substantive and/or procedural, and may include, as examples: consultation with the Regional Water Board prior to issuing permits, supplemental treatment, development of a management district or zone, special siting requirements, additional inspection and monitoring.

9.2.3 Local Agency Management Program variances, for new installations and repairs in substantial conformance, to the greatest extent practicable. Variances are not allowed for the requirements stated in sections 9.4.1 through 9.4.9.

9.2.4 Any educational, training, certification, and/or licensing requirements that will be required of OWTS service providers, site evaluators, designers, installers, pumpers, maintenance contractors, and any other person relating to OWTS activities.

9.2.5 Education and/or outreach program including informational materials to inform OWTS owners about how to locate, operate, and maintain their

OWTS as well as any Water Board order (e.g., Basin Plan prohibitions) regarding OWTS restrictions within its jurisdiction. The education and/or outreach program shall also include procedures to ensure that alternative onsite system owners are provided an informational maintenance or replacement document by the system designer or installer. This document shall cite homeowner procedures to ensure maintenance, repair, or replacement of critical items within 48 hours following failure. If volunteer well monitoring programs are available within the local agency's jurisdiction, the outreach program shall include information on how well owners may participate.

9.2.6 An assessment of existing and proposed disposal locations for septage, the volume of septage anticipated, and whether adequate capacity is available.

9.2.7 Any consideration given to onsite maintenance districts or zones.

9.2.8 Any consideration given to the development and implementation of, or coordination with, Regional Salt and Nutrient Management Plans.

9.2.9 Any consideration given to coordination with watershed management groups.

9.2.10 Procedures for evaluating the proximity of sewer systems to new or replacement OWTS installations.

9.2.11 Procedures for notifying the owner of a public water system prior to issuing an installation or repair permit for an OWTS, if the OWTS is within 1,200 feet of an intake point for a surface water treatment plant for drinking water, is in the drainage area catchment in which the intake point is located, and is located such that it may impact water quality at the intake point such as upstream of the intake point for a flowing water body, or if the OWTS is within a horizontal sanitary setback from a public well.

9.2.12 Policies and procedures that will be followed when a proposed OWTS dispersal area is within the horizontal sanitary setback of a public well or a surface water intake point. These policies and procedures shall either indicate that supplemental treatment as specified in 10.9 and 10.10 of this policy are required for OWTS that are within a horizontal sanitary setback of a public well or surface water intake point, or will establish alternate siting and operational criteria for the proposed OWTS that would similarly mitigate the potential adverse impact to the public water source.

9.2.13 Any plans for the phase-out or discontinuance of cesspool usage.

9.3 The minimum responsibilities of the local agency for management of the Local Agency Management Program include:

9.3.1 Maintain records of the number, location, and description of permits issued for OWTS where a variance is granted.

9.3.2 Maintain a water quality assessment program to determine the general operation status of OWTS and to evaluate the impact of OWTS discharges, and assess the extent to which groundwater and local surface water quality may be adversely impacted. The focus of the assessment should be areas with characteristics listed under section 9.1. The assessment program will include monitoring and analysis of water quality data, review of complaints, variances, failures, and any information resulting from inspections. The assessment may use existing water quality data from other monitoring programs and/or establish the terms, conditions, and timing for monitoring done by the local agency. At a minimum this assessment will include monitoring data for nitrates and pathogens, and may include data for other constituents which are needed to adequately characterize the impacts of OWTS on water quality. Other monitoring programs for which data may be used include but are not limited to any of the following:

9.3.2.1. Random well samples from a domestic well sampling program.

9.3.2.2. Routine real estate transfer samples if those are performed and reported.

9.3.2.3. Review of public system sampling reports done by the local agency or another municipality responsible for the public system.

9.3.2.4. Water quality testing reports done at the time of new well development if those are reported.

9.3.2.5. Beach water quality testing data performed as part of Health and Safety Code Section 115885.

9.3.2.6. Receiving water sampling performed as a part of a NPDES permit.

9.3.2.7. Data contained in the California Water Quality Assessment Database.

9.3.2.8. Groundwater sampling performed as part of Waste Discharge Requirements.

9.3.2.9. Groundwater data collected as part of the Groundwater Ambient Monitoring and Assessment Program and available in the Geotracker Database.

9.3.3 Submit an annual report by February 1 to the applicable Regional Water Board summarizing the status of items 9.3.1 through 9.3.2 above. Every fifth year, submit an evaluation of the monitoring program and an assessment of whether water quality is being impacted by OWTS, identifying any changes in the Local Agency Management Program that will be undertaken to address impacts from OWTS. The first report will commence one year after approval of the local agency's Local Agency Management Program. In addition to summarizing monitoring data collected per 9.3.2 above, all groundwater monitoring data generated by the local agency shall be submitted in EDF format for inclusion into

Geotracker, and surface water monitoring shall be submitted to CEDEN in a SWAMP comparable format.

9.4 The following are not allowed to be authorized in a Local Agency Management Program:

9.4.1 Cesspools of any kind or size.

9.4.2 OWTS receiving a projected flow over 10,000 gallons per day.

9.4.3 OWTS that utilize any form of effluent disposal that discharges on or above the post installation ground surface such as sprinklers, exposed drip lines, free-surface wetlands, or a pond.

9.4.4 Slopes greater than 30 percent without a slope stability report approved by a registered professional.

9.4.5 Decreased leaching area for IAPMO certified dispersal systems using a multiplier less than 0.70.

9.4.6 OWTS utilizing supplemental treatment without requirements for periodic monitoring or inspections.

9.4.7 OWTS dedicated to receiving significant amounts of wastes dumped from RV holding tanks.

9.4.8 Separation of the bottom of dispersal system to groundwater less than two (2) feet, except for seepage pits, which shall not be less than 10 feet.

9.4.9 Installation of new or replacement OWTS where public sewer is available. The public sewer may be considered as not available when such public sewer or any building or exterior drainage facility connected thereto is located more than 200 feet from any proposed building or exterior drainage facility on any lot or premises that abuts and is served by such public sewer. This provision does not apply to replacement OWTS where the connection fees and construction cost are greater than twice the total cost of the replacement OWTS and the local agency determines that the discharge from the OWTS will not affect groundwater or surface water to a degree that makes it unfit for drinking or other uses.

9.4.10 Except as provided for in sections 9.4.11 and 9.4.12, new or replacement OWTS with minimum horizontal setbacks less than any of the following:

9.4.10.1 150 feet from a public water well where the depth of the effluent dispersal system does not exceed 10 feet in depth.

9.4.10.2 200 feet from a public water well where the depth of the effluent dispersal system exceeds 10 feet in depth.

9.4.10.3 Where the effluent dispersal system is within 600 feet of a public water well and exceeds 20 feet in depth the horizontal setback required to achieve a two-year travel time for microbiological contaminants shall be evaluated. A qualified professional shall conduct this evaluation. However in no case shall the setback be less than 200 feet.

9.4.10.4 Where the effluent dispersal system is within 1,200 feet from a public water systems' surface water intake point, within the catchment of the drainage, and located such that it may impact water quality at the intake point such as upstream of the intake point for flowing water bodies, the dispersal system shall be no less than 400 feet from the high water mark of the reservoir, lake or flowing water body.

9.4.10.5 Where the effluent dispersal system is located more than 1,200 feet but less than 2,500 feet from a public water systems' surface water intake point, within the catchment area of the drainage, and located such that it may impact water quality at the intake point such as upstream of the intake point for flowing water bodies, the dispersal system shall be no less than 200 feet from the high water mark of the reservoir, lake or flowing water body.

9.4.11 For replacement OWTS that do not meet the above horizontal separation requirements, the replacement OWTS shall meet the horizontal separation to the greatest extent practicable. In such case, the replacement OWTS shall utilize supplemental treatment and other mitigation measures, unless the permitting authority finds that there is no indication that the previous system is adversely affecting the public water source, and there is limited potential that the replacement system could impact the water source based on topography, soil depth, soil texture, and groundwater separation.

9.4.12 For new OWTS, installed on parcels of record existing at the time of the effective date of this Policy, that cannot meet the above horizontal separation requirements, the OWTS shall meet the horizontal separation to the greatest extent practicable and shall utilize supplemental treatment for pathogens as specified in section 10.8 and any other mitigation measures prescribed by the permitting authority.

9.5 A Local Agency Management Program for OWTS must include adequate detail, including technical information to support how all the criteria in their program work together to protect water quality and public health.

9.6 A Regional Water Board reviewing a Local Agency Management Program shall consider, among other things, the past performance of the local program to adequately protect water quality, and where this has been achieved with criteria differing from Tier 1, shall not unnecessarily require modifications to the program for purposes of uniformity, as long as the Local Agency Management Program meets the requirements of Tier 2.

Tier 3 – Impaired Areas

Tier 3 – Advanced Protection Management Programs for Impaired Areas

Existing, new, and replacement OWTS that are near impaired water bodies may be addressed by a TMDL and its implementation program, or special provisions contained in a Local Agency Management Program. If there is no TMDL or special provisions, new or replacement OWTS within 600 feet of impaired water bodies listed in Attachment 2 must meet the applicable specific requirements of Tier 3.

10.0 Advanced Protection Management Program

An Advanced Protection Management Program is the minimum required management program for all OWTS located near a water body that has been listed as impaired due to nitrogen or pathogen indicators pursuant to Section 303(d) of the Clean Water Act. Local agencies are authorized to implement Advanced Protection Management Programs in conjunction with an approved Local Agency Management Program or, if there is no approved Local Agency Management Program, Tier 1. Local agencies are encouraged to collaborate with the Regional Water Boards by sharing any information pertaining to the impairment, provide advice on potential remedies, and regulate OWTS to the extent that their authority allows for the improvement of the impairment.

10.1 The geographic area for each water body's Advanced Protection Management Program is defined by the applicable TMDL, if one has been approved. If there is not an approved TMDL, it is defined by an approved Local Agency Management Program, if it contains special provisions for that water body. If it is not defined in an approved TMDL or Local Agency Management Program, it shall be 600 linear feet [in the horizontal (map) direction] of a water body listed in Attachment 2 where the edge of that water body is the natural or levied bank for creeks and rivers, the high water mark for lakes and reservoirs, and the mean high tide line for tidally influenced water bodies, as appropriate. OWTS near impaired water bodies that are not listed on Attachment 2, and do not have a TMDL and are not covered by a Local Agency Management Program with special provisions, are not addressed by Tier 3.

10.2 The requirements of an Advanced Protection Management Program will be in accordance with a TMDL implementation plan, if one has been adopted to address the impairment. An adopted TMDL implementation plan supersedes all other requirements in Tier 3. All TMDL implementation plans adopted after the effective date of this Policy that contain load allocations for OWTS shall include a schedule that requires compliance with the load allocations as soon as practicable, given the watershed-specific circumstances. The schedule shall require that OWTS implementation actions for OWTS installed prior to the TMDL implementation plan's effective date shall commence within 3 years after the TMDL implementation plan's effective date, and that OWTS implementation actions for OWTS installed after the TMDL implementation plan's effective date shall commence immediately. The TMDL implementation plan may use some or all of the Tier 3 requirements and shall establish the applicable area of implementation for OWTS requirements within the watershed. For those impaired water bodies that do have an adopted TMDL addressing the impairment, but the TMDL does not assign a load allocation to OWTS, no further action is required unless the TMDL is modified at some point in the future to include actions for OWTS. Existing, new, and replacement OWTS that are near impaired water bodies and are covered by a Basin Plan prohibition must also comply with the terms of the prohibition, as provided in Section 2.1.

10.3 In the absence of an adopted TMDL implementation plan, the requirements of an Advanced Protection Management Program will consist of any special provisions for the water body if any such provisions have been approved as part of a Local Agency Management Program.

10.4 The Regional Water Boards shall adopt TMDLs for impaired water bodies identified in Attachment 2, in accordance with the specified dates.

10.4.1 If a Regional Water Board does not complete a TMDL within two years of the time period specified in Attachment 2, coverage under this Policy's waiver of waste discharge requirements shall expire for any OWTS that has any part of its dispersal system discharging within the geographic area of an Advanced Protection Management Program. The Regional Water Board shall issue waste discharge requirements, general waste discharge requirements, waivers of waste discharge requirements, or require corrective action for such OWTS. The Regional Water Board will consider the following when establishing the waste discharge requirements, general waste discharge requirements, waivers of waste discharge requirements, or requirement for corrective action:

10.4.1.1 Whether supplemental treatment should be required.

10.4.1.2 Whether routine inspection of the OWTS should be required.

10.4.1.3 Whether monitoring of surface and groundwater should be performed.

10.4.1.4 The collection of a fee for those OWTS covered by the order.

10.4.1.5 Whether owners of previously-constructed OWTS should file a report by a qualified professional in accordance with section 10.5.

10.4.1.6 Whether owners of new or replacement OWTS should file a report of waste discharge with additional supporting technical information as required by the Regional Water Board.

10.5 If the Regional Water Board requires owners of OWTS to submit a qualified professional's report pursuant to Section 10.4.1.5, the report shall include a determination of whether the OWTS is functioning properly and as designed or requires corrective actions per Tier 4, and regardless of its state of function, whether it is contributing to impairment of the water body.

10.5.1 The qualified professional's report may also include, but is not limited to:

10.5.1.1 A general description of system components, their physical layout, and horizontal setback distances from property lines, buildings, wells, and surface waters.

10.5.1.2 A description of the type of wastewater discharged to the OWTS such as domestic, commercial, or industrial and classification of it as domestic wastewater or high-strength waste.

10.5.1.3 A determination of the systems design flow and the volume of wastewater discharged daily derived from water use, either estimated or actual if metered.

10.5.1.4 A description of the septic tank, including age, size, material of construction, internal and external condition, water level, scum layer thickness, depth of solids, and the results of a one-hour hydrostatic test.

10.5.1.5 A description of the distribution box, dosing siphon, or distribution pump, and if flow is being equally distributed throughout the dispersal system, as well as any evidence of solids carryover, clear water infiltration, or evidence of system backup.

10.5.1.6 A description of the dispersal system including signs of hydraulic failure, condition of surface vegetation over the dispersal system, level of ponding above the infiltrative surface within the dispersal system, other possible sources of hydraulic loading to the dispersal area, and depth of the seasonally high groundwater level.

10.5.1.7 A determination of whether the OWTS is discharging to the ground's surface.

10.5.1.8 For a water body listed as an impaired water body for pathogens, a determination of the OWTS dispersal system's separation from its deepest most infiltrative surface to the highest seasonal groundwater level or fractured bedrock.

10.5.1.9 For a water body listed as an impaired water body for nitrogen, a determination of whether the groundwater under the dispersal field is reaching the water body, and a description of the method used to make the determination.

10.6 For new, replacement, and existing OWTS in an Advanced Protection Management Program, the following are not covered by this Policy's waiver but may be authorized by a separate Regional Water Board order:

10.6.1 Cesspools of any kind or size.

10.6.2 OWTS receiving a projected flow over 10,000 gallons per day.

10.6.3 OWTS that utilize any form of effluent disposal on or above the ground surface.

10.6.4 Slopes greater than 30 percent without a slope stability report approved by a registered professional.

10.6.5 Decreased leaching area for IAPMO certified dispersal systems using a multiplier less than 0.70.

10.6.6 OWTS utilizing supplemental treatment without requirements for periodic monitoring or inspections.

10.6.7 OWTS dedicated to receiving significant amounts of wastes dumped from RV holding tanks.

10.6.8 Separation of the bottom of dispersal system to groundwater less than two (2) feet, except for seepage pits, which shall not be less than 10 feet.

10.6.9 Minimum horizontal setbacks less than any of the following:

10.6.9.1 150 feet from a public water well where the depth of the effluent dispersal system does not exceed 10 feet in depth;

10.6.9.2 200 feet from a public water well where the depth of the effluent dispersal system exceeds 10 feet in depth:

10.6.9.3 Where the effluent dispersal system is within 600 feet of a public water well and exceeds 20 feet in depth the horizontal setback required to achieve a two-year travel time for microbiological contaminants shall be evaluated. A qualified professional shall conduct this evaluation. However in no case shall the setback be less than 200 feet.

10.6.9.4 Where the effluent dispersal system is within 1,200 feet from a public water systems' surface water intake point, within the catchment of the drainage, and located such that it may impact water quality at the intake point such as upstream of the intake point for flowing water bodies, the dispersal system shall be no less than 400 feet from the high water mark of the reservoir, lake or flowing water body.

10.6.9.5 Where the effluent dispersal system is located more than 1,200 feet but less than 2,500 feet from a public water systems' surface water intake point, within the catchment of the drainage, and located such that it may impact water quality at the intake point such as upstream of the intake point for flowing water bodies, the dispersal system shall be no less than 200 feet from the high water mark of the reservoir, lake or flowing water body.

10.6.9.6 For replacement OWTS that do not meet the above horizontal separation requirements, the replacement OWTS shall meet the horizontal separation to the greatest extent practicable. In such case, the replacement OWTS shall utilize supplemental treatment and other mitigation measures.

10.6.9.7 For new OWTS, installed on parcels of record existing at the time of the effective date of this Policy, that cannot meet the above horizontal separation requirements, the OWTS shall meet the horizontal separation to the greatest extent practicable and shall utilize supplemental treatment for pathogens as specified in section 10.10 and any other mitigation measures as prescribed by the permitting authority.

10.7 The requirements contained in Section 10 shall not apply to owners of OWTS that are constructed and operating, or permitted, on or prior to the date that the nearby water body is added to Attachment 2 who commit by way of a legally binding document to connect to a centralized wastewater collection and treatment system regulated through WDRs as specified within the following timeframes:

10.7.1 The owner must sign the document within forty-eight months of the date that the nearby water body is initially listed on Attachment 2.

10.7.2 The specified date for the connection to the centralized community wastewater collection and treatment system shall not extend beyond nine years following the date that the nearby water body is added to Attachment 2.

10.8 In the absence of an adopted TMDL implementation plan or Local Agency Management Program containing special provisions for the water body, all new or replacement OWTS permitted after the date that the water body is initially listed in Attachment 2 that have any discharge within the geographic area of an Advanced Protection Management Program shall meet the following requirements:

10.8.1 Utilize supplemental treatment and meet performance requirements in 10.9 if impaired for nitrogen and 10.10 if impaired for pathogens,

10.8.2 Comply with the setback requirements of Section 7.5.1 to 7.5.5, and

10.8.3 Comply with any applicable Local Agency Management Program requirements.

10.9 Supplemental treatment requirements for nitrogen

10.9.1 Effluent from the supplemental treatment components designed to reduce nitrogen shall be certified by NSF, or other approved third party tester, to meet a 50 percent reduction in total nitrogen when comparing the 30-day average influent to the 30-day average effluent.

10.9.2 Where a drip-line dispersal system is used to enhance vegetative nitrogen uptake, the dispersal system shall have at least six (6) inches of soil cover.

10.10 Supplemental treatment requirements for pathogens

10.10.1 Supplemental treatment components designed to perform disinfection shall provide sufficient pretreatment of the wastewater so that effluent from the supplemental treatment components does not exceed a 30-day average TSS of 30 mg/L and shall further achieve an effluent fecal coliform bacteria concentration less than or equal to 200 Most Probable Number (MPN) per 100 milliliters.

10.10.2 The minimum soil depth and the minimum depth to the anticipated highest level of groundwater below the bottom of the dispersal system shall not be less than three (3) feet. All dispersal systems shall have at least twelve (12) inches of soil cover.

10.11 OWTS in an Advanced Protection Management Program with supplemental treatment shall be designed to meet the applicable performance requirements above and shall be stamped or approved by a Qualified Professional.

10.12 Prior to the installation of any proprietary treatment OWTS in an Advanced Protection Management Program, all such treatment components shall be tested by an independent third party testing laboratory.

10.13 The ongoing monitoring of OWTS in an Advanced Protection Management Program with supplemental treatment components designed to meet the performance requirements in Sections 10.9 and 10.10 shall be monitored in accordance with the operation and maintenance manual for the OWTS or more frequently as required by the local agency or Regional Water Board.

10.14 OWTS in an Advanced Protection Management Program with supplemental treatment components shall be equipped with a visual or audible alarm as well as a telemetric alarm that alerts the owner and service provider in the event of system malfunction. Where telemetry is not possible, the owner or owner's agent shall inspect the system at least monthly while the system is in use as directed and instructed by a service provider and notify the service provider not less than quarterly of the observed operating parameters of the OWTS.

10.15 OWTS in an Advanced Protection Management Program designed to meet the disinfection requirements in Section 10.10 shall be inspected for proper operation quarterly while the system is in use by a service provider unless a telemetric monitoring system is capable of continuously assessing the operation of the disinfection system. Testing of the wastewater flowing from supplemental treatment components that perform disinfection shall be sampled at a point in the system after the treatment components and prior to the dispersal system and shall be conducted quarterly based on analysis of total coliform with a minimum detection limit of 2.2 MPN. All effluent samples must include the geographic coordinates of the sample's location. Effluent samples shall be taken by a service provider and analyzed by a California Department of Public Health certified laboratory.

Tier 3 – Impaired Areas

10.16 The minimum responsibilities of a local agency administering an Advanced Protection Management Program include those prescribed for the Local Agency Management Programs in Section 9.3 of this policy, as well as monitoring owner compliance with Sections 10.13, 10.14,and 10.15.

Tier 4 – OWTS Requiring Corrective Action

Tier 4 – OWTS Requiring Corrective Action

OWTS that require corrective action or are either presently failing or fail at any time while this Policy is in effect are automatically included in Tier 4 and must follow the requirements as specified. OWTS included in Tier 4 must continue to meet applicable requirements of Tier 0, 1, 2 or 3 pending completion of corrective action.

11.0 Corrective Action for OWTS

11.1 Any OWTS that has pooling effluent, discharges wastewater to the surface, or has wastewater backed up into plumbing fixtures, because its dispersal system is no longer adequately percolating the wastewater is deemed to be failing, no longer meeting its primary purpose to protect public health, and requires major repair, and as such the dispersal system must be replaced, repaired, or modified so as to return to proper function and comply with Tier 1, 2, or 3 as appropriate.

11.2 Any OWTS septic tank failure, such as a baffle failure or tank structural integrity failure such that either wastewater is exfiltrating or groundwater is infiltrating is deemed to be failing, no longer meeting its primary purpose to protect public health, and requires major repair, and as such shall require the septic tank to be brought into compliance with the requirements of Section 8 in Tier 1 or a Local Agency Management Program per Tier 2.

11.3 Any OWTS that has a failure of one of its components other than those covered by 11.1 and 11.2 above, such as a distribution box or broken piping connection, shall have that component repaired so as to return the OWTS to a proper functioning condition and return to Tier 0, 1, 2, or 3.

11.4 Any OWTS that has affected, or will affect, groundwater or surface water to a degree that makes it unfit for drinking or other uses, or is causing a human health or other public nuisance condition shall be modified or upgraded so as to abate its impact.

11.5 If the owner of the OWTS is not able to comply with corrective action requirements of this section, the Regional Water Board may authorize repairs that are in substantial conformance, to the greatest extent practicable, with Tiers 1 or 3, or may require the owner of the OWTS to submit a report of waste discharge for evaluation on a case-by-case basis. Regional Water Board response to such reports of waste discharge may include, but is not limited to, enrollment in general waste discharge requirements, issuance of individual waste discharge requirements, or issuance of waiver of waste discharge requirements. A local agency may authorize repairs that are in substantial conformance, to the greatest extent practicable, with Tier 2 in accordance with section 9.2.3 if there is an approved Local Agency Management Program, or with an existing program if a Local Agency Management Program has not been approved and it is less than 5 years from the effective date of the Policy.

Tier 4 – OWTS Requiring Corrective Action

11.6 Owners of OWTS will address any corrective action requirement of Tier 4 as soon as is reasonably possible, and must comply with the time schedule of any corrective action notice received from a local agency or Regional Water Board, to retain coverage under this Policy.

11.7 Failure to meet the requirements of Tier 4 constitute a failure to meet the conditions of the waiver of waste discharge requirements contained in this Policy, and is subject to further enforcement action.

Waiver – Effective Date – Financial Assistance

Conditional Waiver of Waste Discharge Requirements

12.0 In accordance with Water Code section 13269, the State Water Board hereby waives the requirements to submit a report of waste discharge, obtain waste discharge requirements, and pay fees for discharges from OWTS covered by this Policy. Owners of OWTS covered by this Policy shall comply with the following conditions:

12.0.1 The OWTS shall function as designed with no surfacing effluent.

12.0.2 The OWTS shall not utilize a dispersal system that is in soil saturated with groundwater.

12.0.3 The OWTS shall not be operated while inundated by a storm or flood event.

12.0.4 The OWTS shall not cause or contribute to a condition of nuisance or pollution.

12.0.5 The OWTS shall comply with all applicable local agency codes, ordinances, and requirements.

12.0.6 The OWTS shall comply with and meet any applicable TMDL implementation requirements, special provisions for impaired water bodies, or supplemental treatment requirements imposed by Tier 3.

12.0.7 The OWTS shall comply with any corrective action requirements of Tier 4.

12.1 This waiver may be revoked by the State Water Board or the applicable Regional Water Board for any discharge from an OWTS, or from a category of OWTS.

Effective Date

13.0 This Policy becomes effective six months after its approval by the Office of Administrative Law, and all deadlines and compliance dates stated herein start at such time.

Financial Assistance

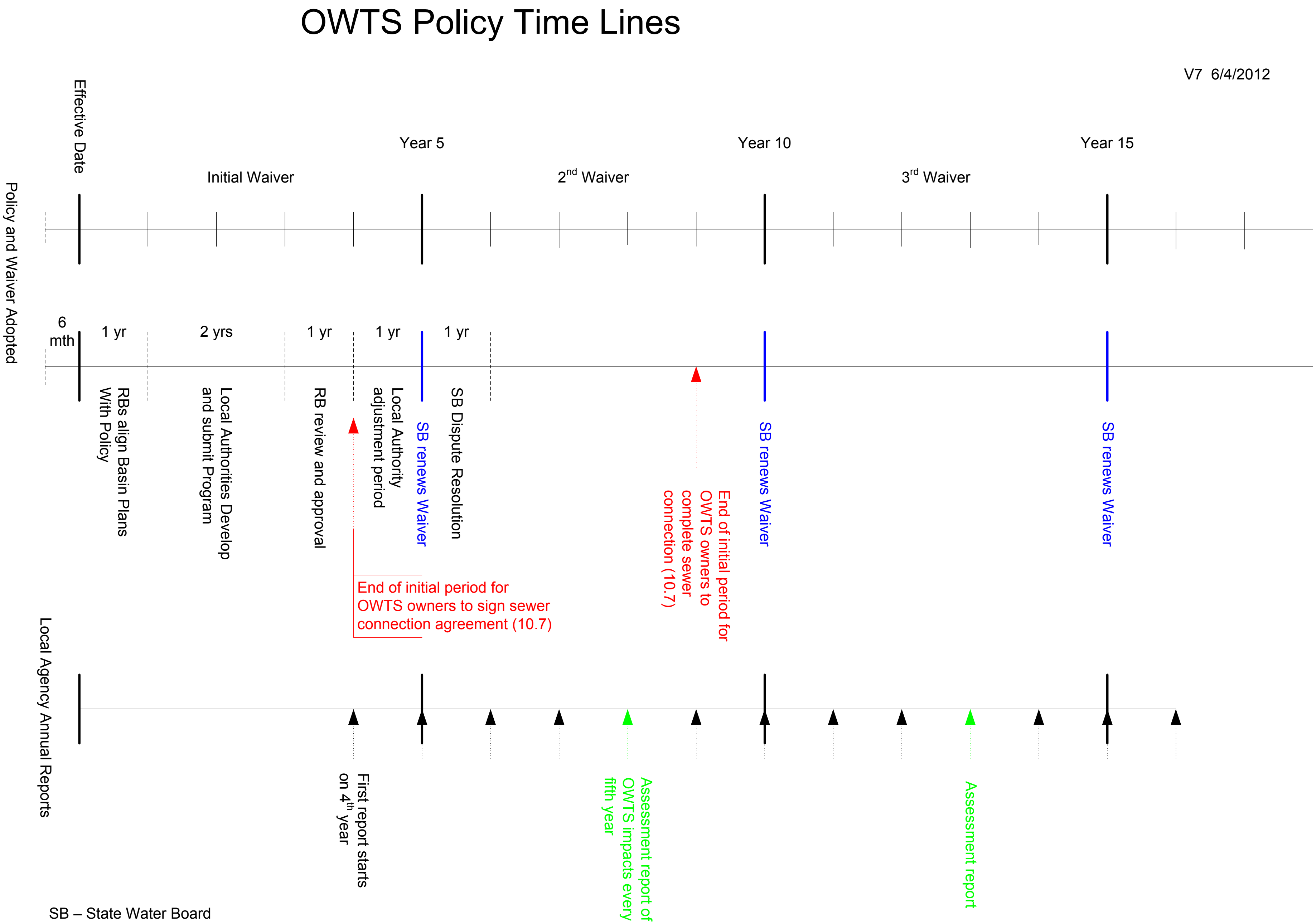
14.0 Local Agencies may apply to the State Water Board for funds from the Clean Water State Revolving Fund for use in mini-loan programs that provide low interest loan assistance to private property owners with costs associated with complying with this Policy.

14.1 Loan interest rates for loans to local agencies will be set by the State Water Board using its policies, procedures, and strategies for implementing the Clean Water State Revolving Fund program, but will typically be one-half of the States most recent General Obligation bond sale. Historically interest rates have ranged between 2.0 and 3.0 percent.

14.2 Local agencies may add additional interest points to their loans made to private entities to cover their costs of administering the mini-loan program.

14.3 Local agencies may submit their suggested loan eligibility criteria for the min-loan program they wish to establish to the State Water Board for approval, but should consider the legislative intent stated in Water Code Section 13291.5 is that assistance is encouraged for private property owners whose cost of complying with the requirements of this policy exceeds one-half of one percent of the current assessed value of the property on which the OWTS is located.

Attachment 1



SB – State Water Board
RB – Regional Water Board

Attachment 2

The tables below specifically identify those impaired water bodies where: (1) it is likely that operating OWTS will subsequently be determined to be a contributing source of pathogens or nitrogen and therefore it is anticipated that OWTS would receive a loading reduction, and (2) it is likely that new OWTS installations discharging within 600 feet of the water body would contribute to the impairment. Per this Policy (Tier 3, Section 10) the Regional Water Boards must adopt a TMDL by the date specified in the table. The State Water Board, at the time of approving future 303 (d) Lists, will specifically identify those impaired water bodies that are to be added or removed from the tables below.

Table 5. Water Bodies impaired for pathogens that are subject to Tier 3 as of 2012.

REGION NO.	REGION NAME	WATERBODY NAME	COUNTIES	TMDL Completion Date
1	North Coast	Clam Beach	Humboldt	2020
1	North Coast	Luffenholtz Beach	Humboldt	2020
1	North Coast	Moonstone County Park	Humboldt	2020
1	North Coast	Russian River HU, Lower Russian River HA, Guerneville HSA, mainstem Russian River from Fife Creek to Dutch Bill Creek	Sonoma	2016
1	North Coast	Russian River HU, Lower Russian River HA, Guerneville HSA, Green Valley Creek watershed	Sonoma	2016
1	North Coast	Russian River HU, Middle Russian River HA, Geyserville HSA, mainstem Russian River at Healdsburg Memorial Beach and unnamed tributary at Fitch Mountain	Sonoma	2016
1	North Coast	Russian River HU, Middle Russian River HA, mainstem Laguna de Santa Rosa	Sonoma	2016
1	North Coast	Russian River HU, Middle Russian River HA, mainstem Santa Rosa Creek	Sonoma	2016
1	North Coast	Trinidad State Beach	Humboldt	2020
2	San Francisco Bay	China Camp Beach	Marin	2014
2	San Francisco Bay	Lawsons Landing	Marin	2015
2	San Francisco Bay	Pacific Ocean at Bolinas Beach	Marin	2014

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REGION NO.	REGION NAME	WATERBODY NAME	COUNTIES	TMDL Completion Date
2	San Francisco Bay	Pacific Ocean at Fitzgerald Marine Reserve	San Mateo	2016
2	San Francisco Bay	Pacific Ocean at Muir Beach	Marin	2015
2	San Francisco Bay	Pacific Ocean at Pillar Point Beach	San Mateo	2016
2	San Francisco Bay	Petaluma River	Marin, Sonoma	2017
2	San Francisco Bay	Petaluma River (tidal portion)	Marin, Sonoma	2017
2	San Francisco Bay	San Gregorio Creek	San Mateo	2019
3	Central Coast	Pacific Ocean at Point Rincon (mouth of Rincon Cr, Santa Barbara County)	Santa Barbara	2015
3	Central Coast	Rincon Creek	Santa Barbara, Ventura	2015
4	Los Angeles	Canada Larga (Ventura River Watershed)	Ventura	2017
4	Los Angeles	Coyote Creek	Los Angeles, Orange	2015
4	Los Angeles	Rincon Beach	Ventura	2017
4	Los Angeles	San Antonio Creek (Tributary to Ventura River Reach 4)	Ventura	2017
4	Los Angeles	San Gabriel River Reach 1 (Estuary to Firestone)	Los Angeles	2015
4	Los Angeles	San Gabriel River Reach 2 (Firestone to Whittier Narrows Dam	Los Angeles	2015
4	Los Angeles	San Gabriel River Reach 3 (Whittier Narrows to Ramona)	Los Angeles	2015
4	Los Angeles	San Jose Creek Reach 1 (SG Confluence to Temple St.)	Los Angeles	2015
4	Los Angeles	San Jose Creek Reach 2 (Temple to I-10 at White Ave.)	Los Angeles	2015
4	Los Angeles	Sawpit Creek	Los Angeles	2015
4	Los Angeles	Ventura River Reach 3 (Weldon Canyon to Confl. w/ Coyote Cr)	Ventura	2017
4	Los Angeles	Walnut Creek Wash (Drains from Puddingstone Res)	Los Angeles	2015
5	Central Valley	Wolf Creek (Nevada County)	Nevada, Placer	2020
5	Central Valley	Woods Creek (Tuolumne County)	Tuolumne	2020
7	Colorado River	Alamo River	Imperial	2017

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REGION NO.	REGION NAME	WATERBODY NAME	COUNTIES	TMDL Completion Date
7	Colorado River	Palo Verde Outfall Drain and Lagoon	Imperial, Riverside	2017
8	Santa Ana	Canyon Lake (Railroad Canyon Reservoir)	Riverside	2019
8	Santa Ana	Fulmor, Lake	Riverside	2019
8	Santa Ana	Goldenstar Creek	Riverside	2019
8	Santa Ana	Los Trancos Creek (Crystal Cove Creek)	Orange	2017
8	Santa Ana	Lytle Creek	San Bernardino	2019
8	Santa Ana	Mill Creek Reach 1	San Bernardino	2015
8	Santa Ana	Mill Creek Reach 2	San Bernardino	2015
8	Santa Ana	Morning Canyon Creek	Orange	2017
8	Santa Ana	Mountain Home Creek	San Bernardino	2019
8	Santa Ana	Mountain Home Creek, East Fork	San Bernardino	2019
8	Santa Ana	Silverado Creek	Orange	2017
8	Santa Ana	Peters Canyon Channel	Orange	2017
8	Santa Ana	Santa Ana River, Reach 2	Orange, Riverside	2019
8	Santa Ana	Temescal Creek, Reach 6 (Elsinore Groundwater sub basin boundary to Lake Elsinore Outlet)	Riverside	2019
8	Santa Ana	Seal Beach	Orange	2017
8	Santa Ana	Serrano Creek	Orange	2017
8	Santa Ana	Huntington Harbour	Orange	2017

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Table 6. Water Bodies impaired for nitrogen that are subject to Tier 3.

REGION NO.	REGION NAME	WATERBODY NAME	COUNTIES	TMDL Completion Date
1	North Coast	Russian River HU, Middle Russian River HA, mainstem Laguna de Santa Rosa	Sonoma	2015
2	San Francisco Bay	Lagunitas Creek	Marin	2016
2	San Francisco Bay	Napa River	Napa, Solano	2014
2	San Francisco Bay	Petaluma River	Marin, Sonoma	2017
2	San Francisco Bay	Petaluma River (tidal portion)	Marin, Sonoma	2017
2	San Francisco Bay	Sonoma Creek	Sonoma	2014
2	San Francisco Bay	Tomales Bay	Marin	2019
2	San Francisco Bay	Walker Creek	Marin	2016
4	Los Angeles	Malibu Creek	Los Angeles	2016
4	Los Angeles	San Antonio Creek (Tributary to Ventura River Reach 4)	Ventura	2013
8	Santa Ana	East Garden Grove Wintersburg Channel	Orange	2017
8	Santa Ana	Grout Creek	San Bernardino	2015
8	Santa Ana	Rathbone (Rathbun) Creek	San Bernardino	2015
8	Santa Ana	Summit Creek	San Bernardino	2015
8	Santa Ana	Serrano Creek	Orange	2017

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Regional Water Boards, upon mutual agreement, may designate one Regional Water Board to regulate a person or entity that is under the jurisdiction of both (Water Code Section 13228). The following table identifies the designated Regional Water Board for all counties within the State for purposes of reviewing and, if appropriate, approving new Local Agency Management Plans.

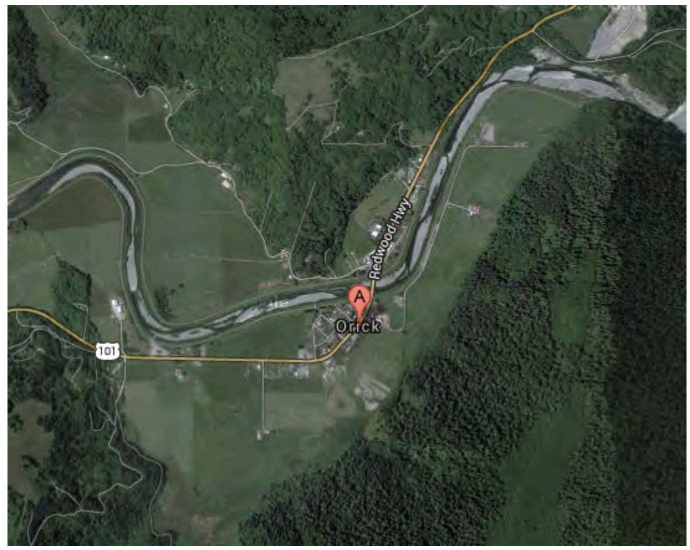
Table 7. Regional Water Board designations by County.

County	Regions with Jurisdiction	Designated Region
Alameda	2,5	2
Alpine	5,6	6
Amador	5	5
Butte	5	5
Calaveras	5	5
Colusa	5	5
Contra Costa	2,5	2
Del Norte	1	1
El Dorado	5,6	5
Fresno	5	5
Glenn	5,1	5
Humboldt	1	1
Imperial	7	7
Inyo	6	6
Kern	3,4,5,6	5
Kings	5	5
Lake	5,1	5
Lassen	5,6	6
Los Angeles	4,6	4
Madera	5	5
Marin	2,1	2
Mariposa	5	5
Mendocino	1	1
Merced	5	5
Modoc	1,5,6	5
Mono	6	6
Monterey	3	3
Napa	2,5	2
Nevada	5,6	5
Orange	8,9	8

County	Regions with Jurisdiction	Designated Region
Placer	5,6	5
Plumas	5	5
Riverside	7,8,9	7
Sacramento	5	5
San Benito	3,5	3
San Bernardino	6,7,8	6
San Diego	9,7	9
San Francisco	2	2
San Joaquin	5	5
San Luis Obispo	3,5	3
San Mateo	2,3	2
Santa Barbara	3	3
Santa Clara	2,3	2
Santa Cruz	3	3
Shasta	5	5
Sierra	5,6	5
Siskiyou	1,5	1
Solano	2,5	5
Sonoma	1,2	1
Stanislaus	5	5
Sutter	5	5
Tehama	5	5
Trinity	1	1
Tulare	5	5
Tuolumne	5	5
Ventura	4,3	4
Yolo	5	5
Yuba	5	5

Appendix C – Preliminary Evaluation of an Orenco® Effluent Sewer System and AdvanTex® Treatment Facility

Preliminary Evaluation of an
Orenco® Effluent Sewer System
And AdvanTex® Treatment Facility



Project Name
Orick, CA

Prepared for
Penny Rogers

Prepared by
Tyler J. Molatore, PE
Orenco Systems, Inc.

Date
October 21, 2014

Orenco Systems® Inc.
Changing the Way the World Does Wastewater®

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SECTION 1: EXECUTIVE SUMMARY

This report presents the results of a feasibility study for the construction and long-term operation of wastewater system for Orick, CA. Approximate construction costs, operation and maintenance costs, and life-cycle cost for a STEP (effluent sewer) collection system used in conjunction with an AdvanTex recirculating packed bed treatment system are included in this report.

The proposed service area consists of two decentralized districts. The Northeast District has approximately 24 Equivalent Dwelling Units (EDUs). The Southwest District has approximately 67 Equivalent Dwelling Units (EDUs). This proposal assumes 175 gpd/EDU for design average flows. Each district includes some small commercial connections. We have assumed that each commercial connection is roughly equivalent to a single family home (i.e. EDU). Expected organic loads and permit requirements are further described in this report.

Table 1. Hydraulic Design Parameters.

Hydraulic Design Parameters	
Design Average Day Flow	4,200 gpd (NE), 11,725 gpd (SW)
Design Max Day Flow	7,200 gal/day (NE), 20,100 gpd (SW)
Design Peak Hourly Flow	27 gal/min (NE), 49 gpm (SW)

A preliminary scope of supply if provided in the following table. Orenco and non-Orenco materials are included.

Table 2. Scope of supply.

NE District ---

Residential STEP Packages: 1,000 gal (Orenco and Non-Orenco Equipment)	Per Unit Pricing
Service Connections (Orenco and Non-Orenco Equipment)	Per Unit Pricing
2" Dia Forcemain, LF	1,500 lf
Air Release Valves	2
Cleanouts	3
Pigging Ports	1
WWTP Control Panel (TCOM, Telemetry)	1 Custom Unit
AX MAX Units	1 Unit
Discharge Tank and Access Equipment (Orenco and Non-Orenco Equipment)	4,000 gal
Flow EQ / Pre-Anoxic Tank and Access Equipment (Orenco and Non-Orenco Equipment)	4,000 gal
UV Disinfection System (Orenco and Non-Orenco Equipment)	Not Included
Flow Meter (Orenco and Non-Orenco Equipment)	1 Mag-meter

SW District ---

Residential STEP Packages: 1,000 gal (Orenco and Non-Orenco Equipment)	Per Unit Pricing
Service Connections (Orenco and Non-Orenco Equipment)	Per Unit Pricing
2" Dia Forcemain, LF	3,750 lf
Air Release Valves	2
Cleanouts	8
Pigging Ports	4
WWTP Control Panel (TCOM, Telemetry)	1 Custom Unit
AX MAX Units	3 Units
Discharge Tank and Access Equipment (Orenco and Non-Orenco Equipment)	11,000 gal

Flow EQ / Pre-Anoxic Tank and Access Equipment (Orenco and Non-Orenco Equipment)	11,000 gal
UV Disinfection System (Orenco and Non-Orenco Equipment)	Not Included
Flow Meter (Orenco and Non-Orenco Equipment)	1 Mag-meter

[x]Costs are approximate and several exclusions are associated with each item. Refer to detailed scope of supply sections for more information.

Based on bid tabulations from recently constructed, publicly bid small community projects, estimated construction costs are provided in the following tables. Costs are provided for a STEP/STEG system with AdvanTex Treatment. Detailed cost estimates are provided in the Appendices.

Typical unit costs for material and installation estimates for a 1,000 gal septic tank equipped with a STEP package are listed below.

Table 3. Typical STEP package costs for 1,000 gal package.

1,000 gal STEP System Estimate (Per Unit)	Unit Low ($)	Unit High ($)
Interceptor Tank, 1000 gal	$1,000	$1,200
Interceptor Tank Access Equipment (2 ft & 4ft Burial Depth)	$201	$449
STEP Pumping Equipment	$1,038	$1,296
Control Panel (Telemetry & Non-Telemetry)	$325	$443
Installation Estimate (% of Materials)	$1,282	$1,186
Shipping Estimate (% of Materials)	$128	$169
Total (Per Unit)	$3,974	$4,743

[x]Costs include Orenco and non-Orenco equipment. Tank is often pre-cast concrete. Installation costs are estimated and are subject to escalation based on presence of rock, installation depth, and other factors. Costs are approximate and should be verified.

Table 4. Typical service lateral and service connection costs.

Residential & Commercial Service Lateral Estimate (Per Unit)	Unit Low ($)	Unit High ($)
1.25" Dia Service Lateral and Connection (Ball Valve & Check Valve)	$650	$1,000
Total (Per Unit)	$650	$1,000

[x]Costs for service laterals and connections vary depending upon burial depth, presence of rock, lot size, tank location, and force-main location. Unit costs are approximate and should be verified.

Table 5. Approximate force-main costs with appurtenances.

Force-Main Estimate – SW District	Total ($)
2" Dia Forcemain	$45,000
Air Release Valves	$906
Cleanouts	$603
Pigging Ports	$293
Total	$46,802

Force-Main Estimate – NE District		Total ($)
2" Dia Forcemain		$18000
Air Release Valves		$906
Cleanouts		$603
Pigging Ports		$293
	Total	$19,802

[x]Costs are approximate and based on recently constructed projects. All costs should be evaluated and verified.

For treatment, stage one (1) treatment system costs are provided in the following tables.

Table 6. AdvanTex materials estimate.

SW District ---

Stage One Materials	Unit Low	Unit High	Total Low	Total High
AX-MAX Pumping Equipment	$1,940	$2,020	$5,819	$6,059
RNE Pump	$549	$549	$549	$549
Piping, fittings, glue	$75	$150	$150	$300
42 ft AX-MAX	$79,000	$85,000	$158,000	$170,000
28 ft AX-MAX	$55,000	$60,000	$55,000	$60,000
		Subtotal	$219,518	$236,908

NE District ---

Stage One Materials	Unit Low	Unit High	Total Low	Total High
AX-MAX Pumping Equipment	$1,940	$2,020	$1,940	$2,020
RNE Pump	$549	$549	$549	$549
Piping, fittings, glue	$75	$150	$75	$150
42 ft AX-MAX	$79,000	$85,000	$79,000	$85,000
		Subtotal	$81,564	$87,719

[x]Estimate includes Orenco and non-Orenco equipment, both of which are estimates.

The flow equalization / pre-anoxic tanks are sized at 50% the maximum day flow. An estimate is provided in the following table.

Table 7. Flow equalization / Pre-anoxic tank and Discharge Tank material estimate.

SW District ---

Flow EQ / Anoxic System Materials	Unit Low	Unit High	Total Low	Total High
Pre-Anoxic Tank	$2.00	$2.25	$22,000	$24,750
Pre-Anoxic Tank Access Equipment	$362	$1,079	$362	$1,079
		Subtotal	$22,362	$25,829

Discharge System Materials	Unit Low	Unit High	Total Low	Total High
Discharge Tank	$2.00	$2.25	$22,000	$24,750

Discharge Tank Access Equipment	$362	$1,079	$362	$1,079
Discharge Tank Pumping Equipment	$1,224	$1,202	$1,224	$1,202
		Subtotal	$23,586	$27,031

NE District ---

Flow EQ / Anoxic System Materials	Unit Low	Unit High	Total Low	Total High
Pre-Anoxic Tank	$2.00	$2.25	$8,000	$9,000
Pre-Anoxic Tank Access Equipment	$362	$1,079	$362	$1,079
		Subtotal	$8,362	$10,079

Discharge System Materials	Unit Low	Unit High	Total Low	Total High
Discharge Tank	$2.00	$2.25	$8,000	$9,000
Discharge Tank Access Equipment	$362	$1,079	$362	$1,079
Discharge Tank Pumping Equipment	$1,224	$1,202	$1,224	$1,202
		Subtotal	$9,586	$11,281

[x]Estimate includes Orenco and non-Orenco equipment, both of which are estimates.

Ancillary materials (if required) are estimated in the following table.

Table 8. Ancillary material estimate.

SW District ---

Ancillary Materials	Unit Low	Unit High	Total Low	Total High
Telemetry Control Panel	$2,200	$3,700	$15,000	$20,000
Operation & Maintenance Manual	$500	$500	$500	$500
		Subtotal	$15,500	$20,500

NE District ---

Ancillary Materials	Unit Low	Unit High	Total Low	Total High
Telemetry Control Panel	$2,200	$3,700	$10,000	$12,000
Operation & Maintenance Manual	$500	$500	$500	$500
		Subtotal	$10,500	$12,500

[x]Estimate includes Orenco and non-Orenco equipment, both of which are estimates.

Shipping, commissioning, construction, operator training, and installation estimates are provided in the following tables.

Table 9. Shipping, commissioning, construction, and operator training estimates.

SW District ---

Shipping, Commissioning, and Operator Training	Total Low	Total High
Commissioning and Operator Training	$1,500	$1,500
Shipping (% of Materials)	$11,848.33	$13,038.45
Subtotal	$13,348.33	$14,538.45

Construction Estimate

Labor and Misc. Equipment (% of Materials)	30%	40%	$84,140	$123,908
		Subtotal	$84,140	$123,908

NE District ---

Shipping, Commissioning, and Operator Training	Total Low	Total High
Commissioning and Operator Training	$1,500	$1,500
Shipping (% of Materials)	$4,700.61	$5,178.98
Subtotal	$6,200.61	$6,678.98

Construction Estimate

Labor and Misc. Equipment (% of Materials)	30%	40%	$32,854	$48,432
		Subtotal	$32,854	$48,432

Total material and installation estimates for the WWTP are listed below.

Table 10. Total materials and installation estimate for WWTP.

SW District ---

Materials Total	$280,967	$310,269
Construction Total	$84,140	$123,908
Shipping and Commissioning	$13,348	$14,538
Total	$378,455	$448,715

NE District ---

Materials Total	$110,012	$121,580
Construction Total	$32,854	$48,432
Shipping and Commissioning	$6,201	$6,679
Total	$149,066	$176,690

Cost estimates do not include material and labor costs for a controls building, site work, utilities, state or local taxes, permitting, inspections, administration, engineering, etc.

Total costs for the on-lot equipment, service laterals, mainlines, and treatment system are listed in the following Table.

Table 11. Approximate total system costs for collection and treatment.

SW District ---

Total Capital Cost Summary (1,000 gal)	STEP System (On-Lot)	Service Laterals	Mainlines	Treatment	Total	$/EDU
Low	$266,224.67	$43,550.00	$46,802.00	$378,454.78	$735,031.44	$10,970.62

High	$317,799.09	$67,000.00	$46,802.00	$448,714.91	$880,316.00	$13,139.04

NE District ---

Total Capital Cost Summary (1,000 gal)	STEP System (On-Lot)	Service Laterals	Mainlines	Treatment	Total	$/EDU
Low	$95,364.06	$15,600.00	$19,802.00	$149,066.34	$279,832.40	$11,659.68
High	$113,838.48	$24,000.00	$19,802.00	$176,690.28	$334,330.76	$13,930.45

This report is based on information supplied by Penny Rogers, GHD.

SECTION 2: INTRODUCTION

Because small communities tend to be economically disadvantaged, under-served and resource-poor, they face significant barriers to building and maintaining effective wastewater treatment services. Common challenges to achieving and maintaining sustainable wastewater treatment systems faced by small communities include (but are not limited to): Economic / financial limitations; Inability to sustain community-wide systems (lack of economies of scale); Inability to attract and maintain system operators; Lack of managerial competency and consistency; Extreme topography and climate; Geographic isolation / remoteness (US EPA, 2012). For these reasons, many small communities remain unsewered today, possibly posing significant environmental problems.

Small communities have historically had difficulty owning and operating small activated sludge package plants and gravity sewers. They typically can't afford the long-term necessary O&M costs associated with properly maintaining an activated sludge package plant. Case in point, there are hundreds of small communities with gravity sewers throughout the US that were installed in the 70's and 80's that, due in part to O&M neglect with the collection system, are spending millions of dollars upgrading their WWTPs - often due to excessive I/I.

As an example of the inability of small communities to operate gravity sewers and package plants, small rural community water and wastewater systems currently account for approximately 90% of environmental regulation violations (Burton, 1996). According to *Recommended Standards for Wastewater Facilities* (2004 Ed.), the activated sludge process requires close attention and competent operating supervision, including routine laboratory control (i.e. full time oversight/operation) and requires major energy usage to meet aeration demands (i.e. high power costs). Salvato et al (2009) notes, "Extended aeration systems require daily operational control because air blowers must be operated continuously and sludge must be returned." Small communities typically lack the budget and operator knowledge to operate small activated sludge package plants.

The technologies used for small communities must be able to operate for extended periods of time with low maintenance needs, and be fundamentally easy to operate (Asano et all, 2007). Operational costs, including electrical usage, are an increasingly important design parameter. With increasing energy costs, uncertainties about future fossil fuel supplies, and increasing awareness of the impacts of greenhouse gas emissions, the efficient management of energy is now of greater concern with both private and public entities. Energy consumption is a significant operating cost at a treatment plant, consuming 15 to 30% of the operation and maintenance (O&M) budgets at a large WWTP and 30 to 40% at a small WWTP. Energy costs of operating these facilities continue to rise because of the trend in the cost of fuels, inflation, and increasing wastewater discharge requirements that result in the application of energy intensive treatment processes (WEF MOP No. 32, 2009).

This report contains information related to a STEP/STEG (effluent sewer) collection system and an AdvanTex® Treatment System. STEP/STEG systems use small diameter pipe that follows the contour of the land, to significantly reduce construction costs. Compared to conventional activated sludge processes, AdvanTex treatment systems allow reduced operation and maintenance (comparatively), are well suited for part time operations, and produce less sludge and biosolids. The sludge production from a conventional activated sludge treatment facility with primary sedimentation is higher by a factor of 4.6 than a septic tank system (i.e. STEP collection system) operated in conjunction with geotextile treatment process (Asano et all, 2007). In addition, most sand filtration and other packed bed filtration processes (i.e. AdvanTex) operate reliably for more than 20 yr with effluent TSS concentrations below 5 mg/L and never require solids removal, suggesting much higher SRT values (Asano et all, 2007).

SECTION 3: ABOUT ORENCO

Orenco Systems®, Inc. has been in the business of researching/developing, manufacturing, and selling leading-edge wastewater collection and treatment systems for more than 30 years. Markets include residential, commercial, mobile, municipal, and utilities. Hundreds of communities across North America and internationally are using Orenco's sewer solutions, and Orenco is recognized worldwide as an industry leader. Orenco holds multiple patents, its products and technologies appear in numerous technical publications, and its owners and managers are asked to speak at conferences throughout the world.

Orenco is headquartered in Douglas County, Oregon, where it has nearly 300,000 sq ft of facilities under roof. Employees work at either the company's 26-acre Sutherlin headquarters site – including state-of-the-art composites manufacturing facility, an electrical controls division, and a full lab – or a 45-acre site in Winchester for large-scale manufacturing. Because Orenco is dedicated to science-based solutions, more than 10 percent of the company's approximately 250 employees are scientists or engineers. Orenco has engineers liscensed in Civil, Environmental, Manufacturing, and Mechanical Engineering.

Orenco manufactures standard products, custom products, and OEM products and has numerous third-party listings, including IAPMO, NSF, UL, and CE. Products and systems are sold through a network of more than 150 distributors and have been installed in more than 60 countries.

Additional Services

Orenco does more than supply equipment. The company offers customers extensive "value-added" services. Orenco works with engineers and consultants to assist with the following:

- master planning
- hydraulic modeling
- plan reviews
- drawings/specifications
- budgetary estimates
- stakeholder presentations
- contractor pre-qual assistance
- installer/operator training
- construction oversight
- system start-up/commissioning
- post-install tech support
- O & M protocols
- asset managemnt guidelines
- lab services
- homeowner education

With respect to this project, we can perform the hydraulic grade line (i.e. mainline sizing) if desired, as well as provide custom specifications and drawings, to supplement your design.

Orenco Literature

Orenco product and system literature can be obtained from Appendix A or from the Orenco website; www.orenco.com.

SECTION 4: DESIGN PARAMETERS

The area addressed in this feasibility study contains two districts. Projected wastewater flow rates and organic loading are provided for the STEP/STEG sewer option only.

Wastewater Flow Rates

Wastewater design flows for the study area are projected at the values outlined in the following table. Due to limited infiltration and inflow ("I/I") from pressure sewer systems, per capita flow rates for Design Average Flows are estimated at 50 gal/day. Design Average Flows are defined as 30-day average flows, whereas Design Maximum Day Flow is defined as the maximum day flow to occur over a 7-day period. All flows are provided and intended for preliminary purposes.

Table 12. Hydraulic Design Parameters.

Hydraulic Design Parameters	
Design Average Day Flow	4,200 gpd (NE), 11,725 gpd (SW)
Design Max Day Flow	7,200 gal/day (NE), 20,100 gpd (SW)
Design Peak Hourly Flow	27 gal/min (NE), 49 gpm (SW)

The derivation of wastewater flow rates is founded on typical wastewater flow rates from residential dwelling units, per ranges provided in Metcalf and Eddy. Furthermore, EPA's "Alternative Wastewater Collection Systems" manual states, "At this time, thousands of flow measurements have been made on pressure sewer systems with wide demographic spread. The result of these measurements has corroborated findings of the earlier studies: that flows are typically 40-60 gallons/capita/day, with little weekly or seasonal variation."

Table 13. Typical Wastewater Flow Rates from Residential Dwellings

	Range	Typical
Type of dwelling	gallon/capita/day	
Single family		
Summer	35-50	42
Low income	40-55	45
Median income	40-80	55
Luxury homes	50-100	65
Apartments	35-50	40

Source: Metcalf and Eddy, Wastewater Engineering: Treatment, Disposal, and Reuse, McGraw Hill, 3rd Edition, 1991, p. 1019.

Wastewater Characteristics

Wastewater characteristics for STEP/STEG systems are provided in the following table. Constituent concentrations are provided for septic tank effluent wastewater.

Table 14. Recirculation Tank Influent Characteristics

Recirculation Tank Influent Characteristics (Design Average)	Average	Maximum
BOD_5	244 mg/L	250 mg/L
TSS	60 mg/L	75 mg/L
TKN	65 mg/L	65 mg/L
NH_3-N	45 mg/L	45 mg/L
pH	8.0 SU	8.0 SU
FOG	20 mg/L	20 mg/L
Alkalinity as $CaCO_3$	300 mg/L	300 mg/L
Phosphorus	8 mg/L	8 mg/L

For proper WWTP performance, the influent wastewater temperature must be above 15 deg C.

The following table shows expected constituent concentrations – which have been widely-published and are generally accepted by the wastewater industry – from individual residences for flows of 50 gpcd and 120 gpcd. The design values presented in this report are based on 50 gpcd.

Table 15. Expected Wastewater Constituent Concentrations from Residences

Constituent	Typical Dry Weight of Constituent (grams/capita/day)	Concentration (mg/L) Volume per capita per day (gallons)	
		50	120
BOD_5	85	450	187
COD	198	1050	436
TSS	95	503	209
NH_3 as N	7.8	41.2	17.2
Org. N as N	5.5	29.1	12.1
TKN as N	13.3	70.4	29.3
Org. P as P	1.23	6.5	2.7
Inorg. P as P	2.05	10.8	4.5
Total P as P	3.28	17.3	7.2
Oil and Grease	31	164	68

[x]Table 4-12, "Typical data on the unit loading factors and expected wastewater constituent concentrations from individual residences," Small and Decentralized Wastewater Management Systems, Crites and Tchobanoglous, 1998, p. 180.

Wastewater Treatment Plant Loading

Table 16. Wastewater treatment plant loading.

NE District ---

Design Parameters	
Design Average Flow	4,200 gal/day
Max Day Flow	7,200 gal/day
Design Peak Hourly Flow	27 gal/min
Design Average BOD_5 (Septic Tank Effluent, "STE")	5.3 lbs/day
Design Average TSS (STE)	1.4 lbs/day
Design Average TN or TKN (STE)	2.3 lbs/day
Design Average NH_3-N (STE)	1.6 lbs/day
Design Average $CaCO_3$ (STE)	10.5 lbs/day
Design Average FOG (STE)	0.7 lbs/day

SW District ---

Design Parameters	
Design Average Flow	11,725 gal/day
Max Day Flow	20,100 gal/day
Design Peak Hourly Flow	49 gal/min
Design Average BOD_5 (Septic Tank Effluent, "STE")	14.7 lbs/day
Design Average TSS (STE)	3.9 lbs/day
Design Average TN or TKN (STE)	6.4 lbs/day
Design Average NH_3-N (STE)	4.4 lbs/day
Design Average $CaCO_3$ (STE)	29.3 lbs/day

Design Average FOG (STE)	2.0 lbs/day

Permit Limits

The following table provides the discharge limitations for the constituents specified. The scope of this proposal is pertinent only to BOD_5, and TSS.

Table 17. Permit Limits.

Permit Limits	Average	Maximum
BOD_5	20.0 mg/L	20.0 mg/L
TSS	20.0 mg/L	20.0 mg/L
pH	6.0 SU	9.0 SU

SECTION 5: TECHNOLOGY DESCRIPTION

To reduce overall costs, an increasing number of small communities are choosing wastewater management solutions that use alternative technologies, such as *effluent sewers* (i.e., STEP/STEG systems, which collect wastewater from each property in an underground septic tank and then pump the filtered effluent to a centralized treatment facility or neighboring sewer, leaving solids in the tank to decompose naturally).

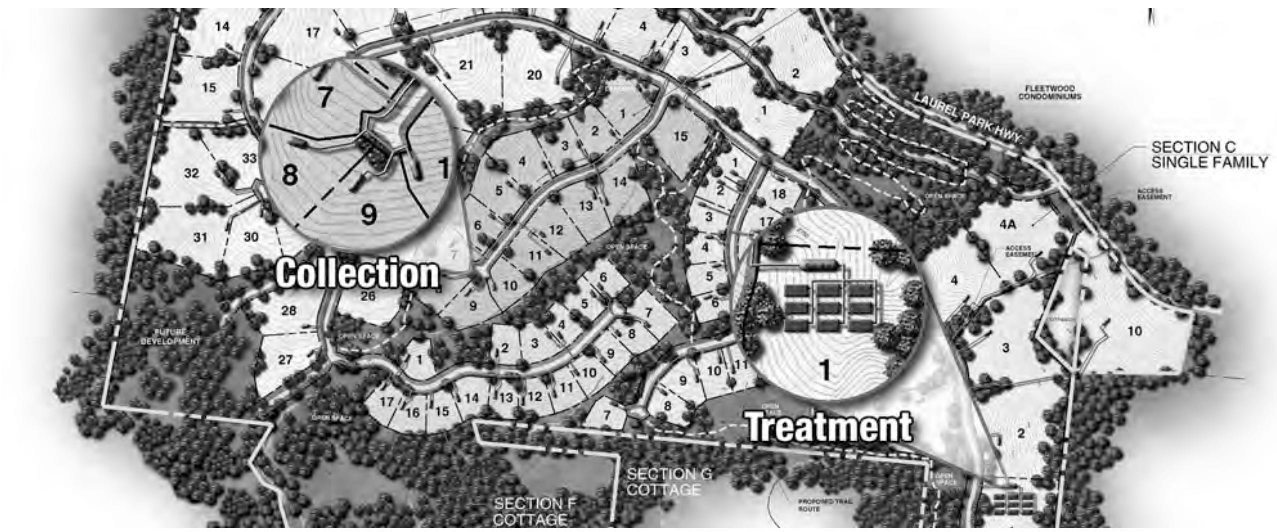


Figure 1. Orenco STEP System and AdvanTex Treatment Facility

Alternative wastewater collection and treatment systems offer several benefits for small communities, including reduced up-front capital costs, lower life-cycle costs, improved system performance at low flows, reduced maintenance (compared to traditional gravity sewers), and increased reliability (allowing part-time operation). Moreover, systems can be installed in half the time. No deep (and costly) excavations are necessary ... just a shallow trench that follows the contour of the land, small-diameter (typically 2"-6") mainlines, and cleanouts instead of manholes. These and many other features of alternative collection systems can save utilities thousands of dollars in up-front costs compared to conventional solutions.

Effluent sewer systems were created in Florida in the early 70's to address some of the difficulties noted with Florida's conventional gravity sewers. Douglas County, Oregon, adopted and modified the concept in the early 70's to address the needs of its difficult to sewer low income communities. In the early 80's, Orenco was founded and the company pioneered advancements in effluent sewer technology. Orenco Effluent Sewer systems minimize initial capital investment, reduce biosolids production, reduce energy consumption, provide for efficient conveyance, and minimize long-term costs for renewal and replacement. Additionally, Orenco Effluent Sewer systems are the only collection system technology that provides primary wastewater treatment.

Several wastewater treatment technologies (Lagoons, SBRs, MBBRs, Conventional Activated Sludge, Extended Aeration, MBRs, etc) can easily be paired with Orenco Effluent Sewers. Due to the reduced organic load and hydraulic load (limited I/I), most treatment facilities can be downsized compared to a treatment facility receiving wastewater from a conventional gravity sewer. Consult with your local regulations for details. Orenco Effluent Sewers can also be connected to existing gravity sewer infrastructure or connected to existing grinder sewers.

AdvanTex Treatment Systems, as highlighted in this report, are designed to affordably and reliably process effluent sewer wastewater to very high standards. AdvanTex Treatment Systems are modular, do not require a large footprint, and are factory built. AdvanTex Treatment Systems provide low cost, high-level treatment without high energy-consumption or the need for chemicals (typically). Their modular construction allows addition of treatment capacity as demand for service warrants. Additionally, the treatment can be distributed throughout the service area so that it is in close proximity for irrigation or re-use.

Orenco Effluent Sewer

The collection system that is the basis of this feasibility study is an Orenco Effluent Sewer, a collection technology that has been optimized for more than 30 years. With an Orenco Effluent Sewer, raw sewage flows from the building to a watertight underground tank, where primary treatment occurs via settling and natural biological processes. Solids remain in the tank, decreasing in volume, which reduces biosolids treatment costs at secondary treatment facilities. Filtered liquid effluent is then discharged (by high-head pump or gravity) through small-diameter service laterals to small-diameter collection lines. These service and collection lines are shallowly buried and follow the contour of the land. The entire system is watertight, reducing infiltration costs in conveyance and at the treatment facility. No manholes or lift stations are required and energy consumption is minimal.

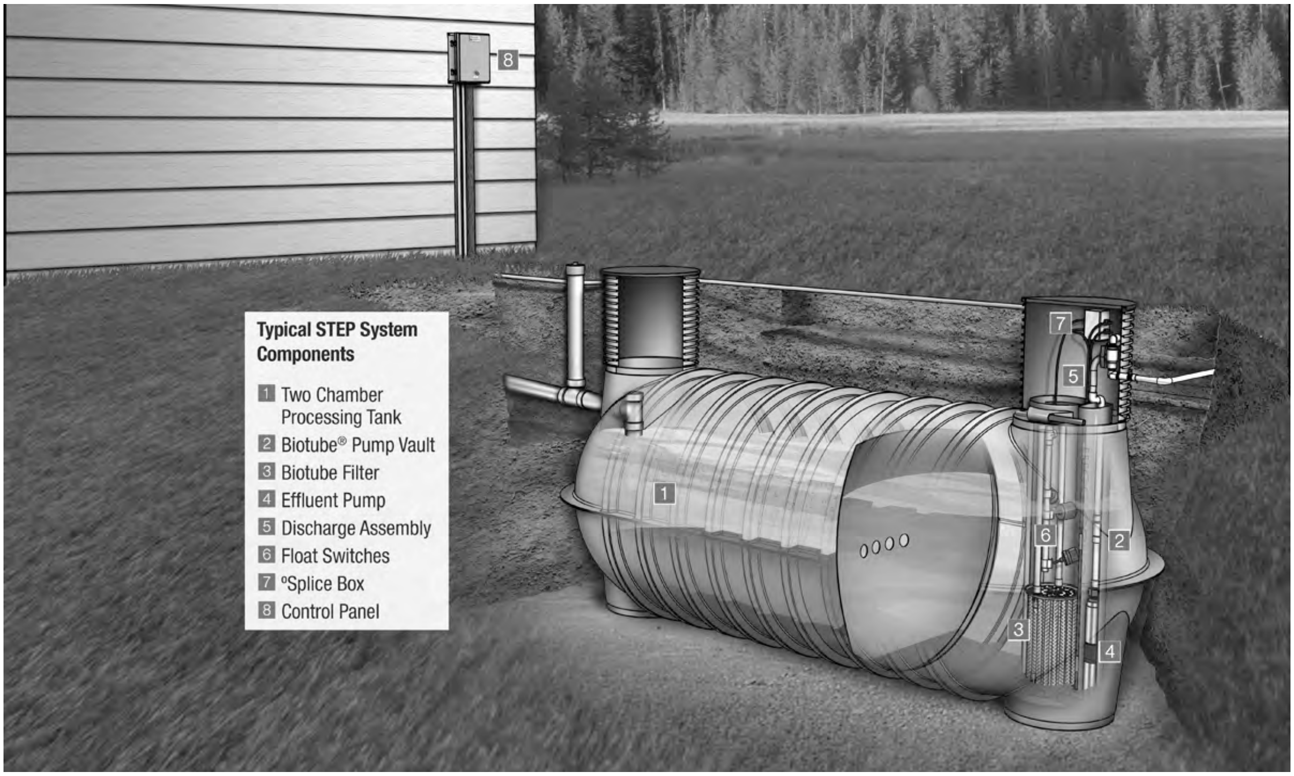


Figure 2. Typical STEP System Components

Relatively small diameter PVC pipe, usually Class 200 but increasingly HDPE, is laid with the contour of the terrain in the same manner as a water line. Heat-fused high density polyethylene is the preferred material in some communities with existing utilities, installed via directional boring.

Figure 3. Typical small diameter forcemain installation.

An effluent sewer main line will be smaller than its corresponding water main because the peak demands are much lower. Effluent sewers generally receive only 80 percent of the daily water usage and are not required to satisfy fire and peak domestic flows. The storage reserve in the septic tanks provides sufficient holding capacity, eliminating any concern for large hydraulic doses or flow rates. Small diameter lines are also feasible because the effluent is substantially free of solids, eliminating concerns for a minimum velocity, and the lines are free of infiltration and inflow.

There are great cost savings in the excavation and installation of effluent sewer main lines. In normal installations, effluent sewer main lines are installed at shallow depth, usually 30 inches below original grade. In colder climates, main lines are buried below frost depth or insulated to prevent freeze damage. Strict vertical and horizontal alignment is unnecessary; mains are laid quickly, without tedious surveying, and 90º bends are no problem. In septic tank effluent pump (STEP) systems, manholes are not necessary. Pigging ports and pigging equipment facilitate line cleaning in the same manner as water lines. To date only one STEP system on the West Coast has ever required cleaning and that was the result of improper tankage design.

As the following chart shows, in many cases six inch diameter class 200 PVC pipe can convey wastewater from over 1,000 homes. Actual pipe diameters are a function of static lift, peak wastewater flows, and line lengths, but remain a fraction of the size of conventional gravity sewer lines.

Table 18. Head loss calculations for various STEP mains

EDUs	Qp	Pipe Size, Inches	Head Loss, ft/1000 ft
10	20	1 1/4	35 ±
100	65	2	54 ±
500	265	4	32 ±
1000	515	6	16 ±

1. Assumed D of 15 per EPA Manual of Practice, and nominal diameters.

Residential Connections

Residential sewage is conveyed to a 1,000-gallon (or, occasionally, 1,500-gallon) single-compartment septic tank by way of a standard building sewer. In effluent sewer systems, the septic tanks are often referred to as interceptor tanks.

The interceptor tank serves several physical functions critical to every system:

- It provides sufficient hydraulic retention time for capturing grease, grit, and other substances that settle or float. Minimum retention times from 6 to 24 hours are considered adequate.
- It allows sufficient storage capacity for sludge and scum so that septage pumping intervals are infrequent.
- It provides reserve space adequate for 24 to 48 hours of normal operation before a system malfunction must be corrected, thus eliminating the need for emergency maintenance. (The reserve space must also allow for adequate tank ventilation back through the inlet plumbing.)
- It provides an operating zone sufficient to modulate peak inflows without causing nuisance alarms or excessive hydraulic gradients.

In addition to its physical functions, the tank provides conditions conducive to biological treatment of the captured organic matter. The organic (volatile solids) reduction is a result of facultative and anaerobic digestion that converts organic matter to gases. Facultative microbes solubilize the complex organic material to volatile organic acids, while strict anaerobes ferment the volatile organic acids to gases (methane, carbon dioxide, etc.). Volatile solids reduction may vary from 30 to 70 percent. The mineral or inorganic (fixed) solids content may range between 40 and 60 percent of the total solids. The organic solids content of tanks that are well managed generally exceeds 80 percent. On average, therefore, about 55 percent of the organic matter is reduced biologically, extending the septage pumping frequency by a factor of 2.2 ±.

These tanks provide highly efficient treatment, yielding an effluent that is relatively free of fats, oils, greases, solids and other constituents that can clog and foul collection and disposal equipment. More than 45 percent of the ultimate treatment of the wastewater is accomplished in the septic tank. And anoxic digestion can reduce the solids handling requirements of the treatment facility by as much as 80 percent. These issues should not be overlooked when comparing alternatives.

An interceptor tank maintains a lower liquid level than does a typical septic tank followed by a drainfield. If a pumping system malfunctions, a resident can continue to use water for about two days before using up the reserve space. The need for emergency maintenance, then, is minimized. During a power outage, the safe period of use is probably even longer since washing machines and water heaters do not function, lessening water use.

To avoid abuse of a system's interceptor tanks, cooperation of users is essential and best accomplished through community education. To explain a district's policies and property owners' responsibilities, a list of "Do's and Don'ts" should be provided to patrons and updated regularly. Among other guidelines, these "Do's and Don'ts" include lists of substances that should be disposed into trash containers, not into the wastewater system. The best practice is to not discharge anything into an interceptor tank that is poisonous or that may inhibit the digestive abilities of its working microbes (such as tampons, prophylactics, cigarette butts, "disposable" wipes, diapers, excessive grease, coffee grounds, egg shells, water softener backwash, etc.). One excellent and memorable guideline is to not dispose anything into the tank that hasn't first been ingested, with the exception of toilet tissue and mild detergents. A simple educational program tailored to encourage homeowners' compliance can cure most tank problems and reduce the need for premature septage pumping. If that does not suffice, charging homeowners for excessive pumping can incentivize cooperation.

Commercial Connections

Multiple user sites include small clusters of homes that can be economically connected together, as well as schools, offices, industries, institutions and commercial businesses. Commercial sites generally have one or more primary tanks followed by a pump tank. Tanks for commercial sites range from a single 1,500-gallon size, to several tanks in series, to very large poured-in-place tanks. The tank just preceding the pump tank is usually equipped with one or more effluent filters.

Schools, restaurants, meat plants, or other food processors must pay special attention to the handling of fats, oils, and greases. Grease tanks are essential, and the effluent from them must be routed through the primary tank(s) rather than directly to the pump tank. Daily flow, peak flow duration, and wastewater strength may necessitate additional tankage. Adequate grease tank design requires a detailed knowledge of water temperatures, ambient temperatures, waste strength (BOD), types of solvents, detergents, and chemical cleaners in use. Grease tanks may vary in size from one to three times the daily flow and may require solids or grease removal as frequently as every three-to-six months.

Use of Existing On-Lot Equipment

Existing septic tanks require thorough evaluation to confirm watertightness and structural integrity before they can be used as interceptor tanks in a new STEP/STEG sewer system. That's because most U.S. septic tanks that are already in the ground are structurally unsound and almost never watertight. While recently installed tanks are sometimes acceptable, when working with older communities (e.g., Glide, Oregon) we've seen tank failure rates as high as 95%.

Where groundwater levels are high, leaky tanks allow infiltration that can overburden a system's pumps and treatment facilities. Where high groundwater is not a problem, leaky tanks exfiltrate and the scum layer lowers to the discharge ports, causing solids and grease carryover and subsequent maintenance and pollution problems.
The extra cost of a high quality tank is insignificant when compared to the cost of maintaining and rectifying a system with inadequate tanks. Explicit design details and specifications are necessary to ensure quality tank construction, and quality control must be uniformly enforced. Otherwise, manufacturers of quality tanks will find it hard to compete.

Performance During Extended Power Outages

The reserve storage in the on-lot tanks is normally about 150 gallons. This allows for 24 hours of normal water usage during a power outage, although, during an outage, most residents reduce their water usage dramatically because they are not washing dishes or clothes or taking hot showers. Moreover, most power disruptions last no longer than a couple of hours; power outages of 9-12 hours are infrequent and generally considered the worst condition to allow for. In regions of the country with extended power outages, 1,500-gallon tanks can be substituted for the standard 1,000-gallon tanks and portable generators of at least 4,000 watts can be used to power a residential panel.

Following a power outage the hydraulics of the system will balance so that even the most remote pumps will still discharge 1 or 2 gpm into the collection system. Turbine effluent pumps are constructed with a 1/8" diameter by-pass orifice in the discharge head that allows 3 gpm to circulate when the pump is operating near its shut-off head. These pumps are capable of operating at shut-off, continuously for several days, without damage to the motor or liquid end.

Septic Tank Area Requirements

Septic tanks are often installed in high-density areas, encompassing small and large commercial areas. The following figure illustrates the viability of installing 1,000 gal septic tanks the highly dense small community of Coburg, Oregon. Other examples include; Montesano, WA, Yelm, WA, and Lacey, WA.

Figure 4. Map of community (Coburg, OR) that installed STEP collection system

Dimensioned (sample) septic tank drawings can be downloaded in PDF format at; http://sfdocs.orenco.com/2013/2/1000_gal_Tank.PDF. A 1,000 gal tank typically has a height of 64 inches, a width of 63 inches, and a length of 99 inches. Approximate excavation requirements for a 1,000 gal tank are often; 87 inches wide, 123 inches in length. Consult with your local tank manufacturer and installer for local requirements. STEP installation instructions can also be downloaded at http://www.orenco.com/doclib/documents/nim-eps-1.pdf. The following figure shows new septic tank locations and existing utilities and other structures on 60’ by 150’ lots.

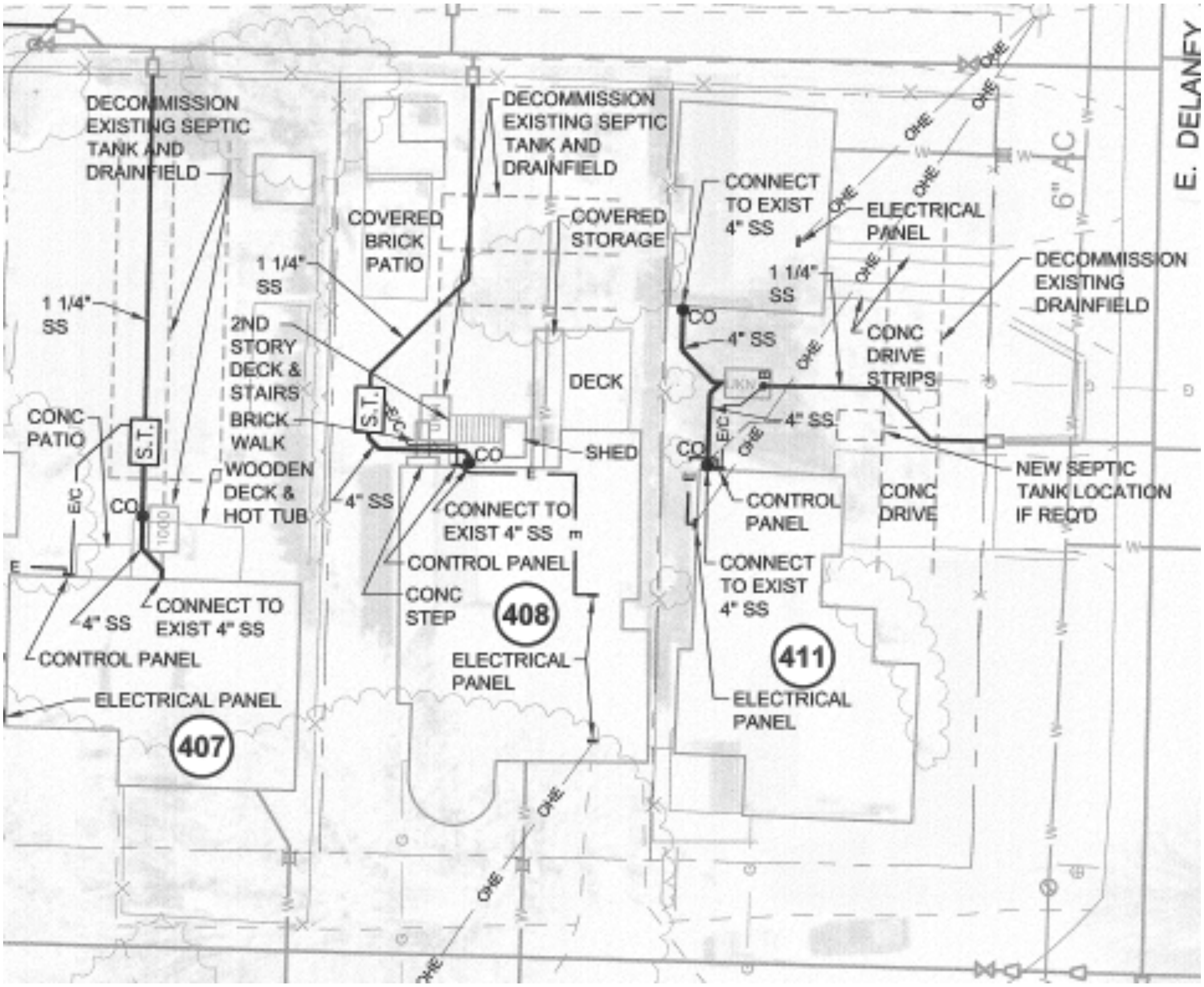


Figure 5. Dense community with new septic tank locations.

STEP Bid Tabulation Summary

The following table summarizes several recently bid STEP projects throughout the US. Detailed bid tabulations are available upon request. Bids are available from STEP, grinder, and gravity bids.

Table 19. STEP system bid summary.

Project Name	Bid Yr	Scope	Unit Bid	Qty	Award Unit Bid	Awarded Total Bid	Approximate Tank Depth
El Dorado, AR	2011	1000 gal Tank	EA	402	$4,795.00	$1,927,590.00	2-3 ft
Lexington, IN	2010	1500 gal Tank	EA	117	$4,532.43	$530,294.31	2-3 ft
Rathbun Lake, IA	2011	1250 gal Tank	EA	24	$4,289.00	$102,936.00	4-5 ft
City of Superior, IA	2011	1000 gal Tank	EA	69	$4,485.00	$309,465.00	4-6 ft
Fulton, AL	2012	1,000 gal Tank	EA	125	$3,400.00	$425,000.00	1.5-2 ft
Fulton, AL	2012	1,500 gal Tank	EA	5	$4,000.00	$20,000.00	1.5-2 ft
Atoka, TN	2009	1,000 gal Tank	EA	226	$4,700.00	$1,062,200.00	2-3 ft

Bayou La Batre, AL	2010	1,000 gal Tank	EA	26	$4,400.00	$114,400.00	1.5-2 ft

Summary: Key Design Features of STEP/STEG Effluent Sewers (Residential Connections)

- 24-hour emergency storage (>150 gallons), eliminates the need for immediate operator response.
- Average pump-out frequency of 17 years for 1,000 gal tank serving 4 occupants.
- Average pump-out frequency of 23 years for 1,500 gal tank serving 5 occupants.
- Caustic chemicals and other system abuses are limited to interceptor tanks and easily identified.
- Ability to use directional boring reduces conflicts with other utilities during installation.
- Low pump repair and replacement costs of less than $1.50/month/EDU. Long pump life of 20 to 30 years.
- Pumps come with a standard 5-year warranty.
- Pumps are lightweight, typically 30 lbs.
- Energy costs to operate residential pumps are <$1.50/month/EDU.
- If terrain/hydraulics permit, gravity (STEG) connections are allowed.
- 1" diameter service laterals and small diameter conveyance system, typically 2"-4", are used.
- Force mains follow the contour of the land and are installed at shallow burial depths.
- Minimum velocities are not required.
- Watertight collection system is largely immune to I/I.
- Inexpensive cleanouts replace expensive manholes, but only where cleanouts are needed (terminal end of mainlines).
- Lift stations are typically not required.
- Downstream WWTP influent screening and grit removal are not required.
- Solids management at the treatment facility is reduced due to low influent TSS.
- Sludge thickening (gravity thickening) in primary settling tanks.

Magnetic Flow Meter

Magnetic flow meters are often incorporated into the WWTP. Magnetic flow meters are normally integrated into our panels via a 4-20mA relay, allowing flows to be logged and programming to facilitate easier and more stable operations.

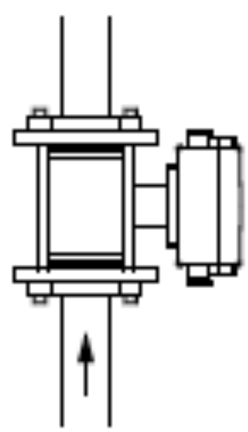


Figure 6. Siemens magnetic flow meter and vertical installation.

Packed Bed Filters

Packed bed filters (PBFs) – incorporating treatment media such as sand, gravel, and textile – have been used successfully for treating small-to-medium volume wastewater flows for decades. These filters reliably produce high quality effluent that is superior to that discharged by the majority of our nation's municipal treatment facilities.

Process Description

A typical packed bed media filter system, illustrated below, is comprised of three major components: the septic tank(s) or primary treatment, the recirculation/dilution (R/D) tank, and an open media filter bed. The treatment of wastewater begins in the septic tank. There, residential waste strength, as measured by five-day biochemical oxygen demand (BOD_5), is reduced by more than 45 - 60%. Treated effluent flows from the septic tank into the R/D tank, mixing with its contents. A timer-controlled pump in the R/D tank periodically doses effluent to a distribution system on top of the filter bed. Each time the filter is dosed, effluent percolates through the filter media and is treated by naturally-occurring microorganisms that populate the filter. Effluent is then collected in an underdrain pipe at the bottom of the filter and conveyed back to the R/D tank. Depending on the liquid level in the R/D tank, a flow-splitting device either returns all of the flow to the R/D tank or splits the flow so that a portion of the effluent is shunted to final disposal and the remainder is returned to the R/D tank. Effluent typically recirculates four times before final disposal.

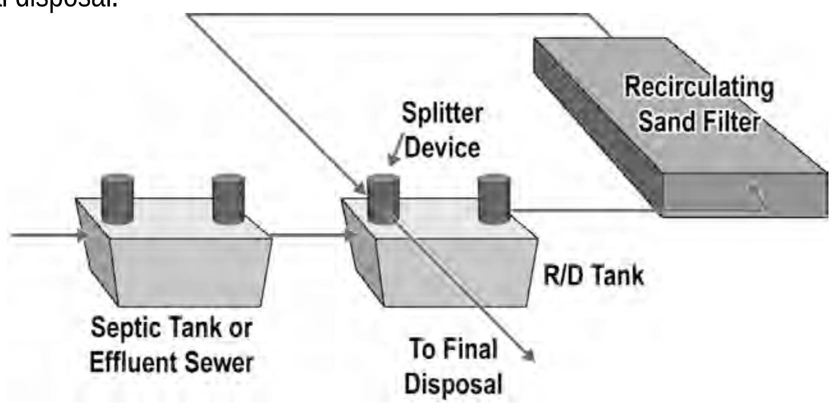


Figure 7. Typical Media Filter Process Flow Diagram

As wastewater percolates slowly through the filter medium, physical, biological, and chemical processes remove contaminants. A naturally occurring, microscopically thin zoogleal film composed of large populations of bacteria and other microorganisms grows on the surface of the media. As blended effluent flows over the surface of the zoogleal film, organic material contained in the wastewater is absorbed onto the film where it becomes food for the bacteria. For maximum treatment, then, it is essential that all the wastewater have sustained contact (hydraulic residence time, HRT) with the film attached to the medium. And because the aerobic organisms in the zoogleal film need oxygen to live, it is also essential to maintain unsaturated flow conditions through the filter medium.

Unsaturated flow and sustained contact are achieved by distributing the wastewater evenly over the surface of the filter medium and by keeping doses small and frequent over the course of the day. Even distribution also ensures that all of the filter medium is used, thus preventing clogging that can result when parts of a filter go unused and others are hydraulically and organically overloaded. Even distribution is best accomplished by applying septic tank effluent to the surface of the media by means of uniformly spaced distribution nozzles or other method. Even distribution is also dependent on the infiltrative capacity of the treatment media, the rate of flow through the orifices, and the total volume of the dose.

AdvanTex PBF Treatment Systems

Launched in 2000, AdvanTex Treatment Systems are Orenco's 21st century packed bed media filter. Like other PBFs, AdvanTex Treatment Systems provide low-cost, high-level treatment without high energy consumption or the need for chemicals. Unlike other PBFs, however, AdvanTex Treatment Systems are modular and factory-built, use an engineered textile for the treatment media, and require a much smaller footprint than sand or gravel media filters. The filter's modular construction allows addition of treatment capacity as demand for service warrants. Additionally, the treatment units can be distributed throughout the service area so that they are in close proximity for irrigation or re-use.

AdvanTex Treatment Systems are a non-submerged, attached-growth biological treatment facility, similar to but different than a conventional trickling filter. Typical trickling filters have specific surface (ft^2/ft^3) of between 50 and 100 ft^2/ft^3, with hydraulic loading rates between 28 gpd/ft^2 (low rate) and 230 gpd/ft^2 (intermediate rate) or higher. AdvanTex systems, on the other hand, have a specific surface (ft^2/ft^3) greater than 2,400 ft^2/ft^3, with hydraulic loading rates between 10 gal/day/ft^2 and 50 gal/day/ft^2, depending upon permit requirements.

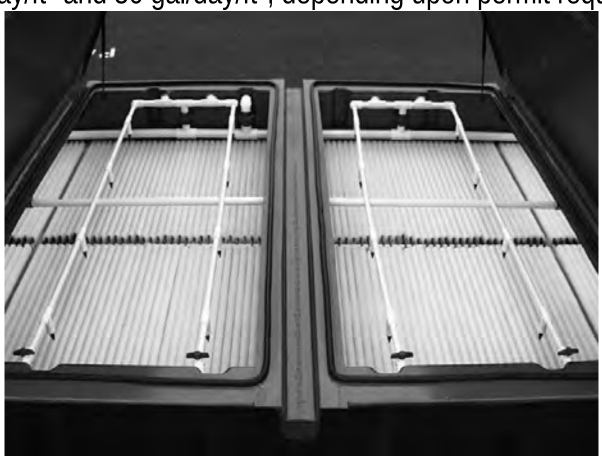


Figure 8. AdvanTex Packed Bed Filter

AdvanTex systems are dosed intermittently with doses that are approximately 1/4 to 1/3 the moisture-holding capacity of the media to avoid hydraulic channeling and achieve "thin film" flow of wastewater over the filtering medium. Operationally, conventional trickling filters are dosed intermittently (often continuously) but with significantly larger dose volumes, thus hydraulic channeling is a feature of the design, resulting in sloughing (periodic or continuous). When influent characteristics are of typical residential strength, effluent output from media filters (AdvanTex) typically averages <10 mg/L 5-day Biochemical Oxygen Demand (BOD_5), <10 mg/L Total Suspended Solids (TSS), and <1 mg/L Ammonia-Nitrogen (NH_3-N), depending on configuration and design. AdvanTex systems are sized based upon an actual hydraulic load of 25 gal/day/ft^2, a peak hydraulic load of 50 gal/day/ft^2, and an organic load of 0.04 lbs BOD/day/ft^2. Sloughing is extremely minimized, and AdvanTex treatment processes can be used in concert with many other pre- and post- treatment processes for advanced polishing and nutrient removal.

AdvanTex Performance

Effluent quality is dependent on a number of factors, including influent wastewater characteristics, hydraulic loading rates, organic loading rates, ammonia-nitrogen loading rates, temperature, and process configuration. Performance data from applications similar to those proposed is available upon request.

Figure 9. AdvanTex AX MAX Treatment Facility.

Orenco's AdvanTex Treatment System and its components are designed for highly cost-effective operation over the life of the system. Unlike other treatment systems, AdvanTex uses comparatively little electricity, thanks to the use of high-head turbine pumps that only run on an intermittent basis and the use of a small vent fan, both of which have very low power requirements. Partly as a consequence of their low power use, AdvanTex systems won the Water Environment Federation's "2011 Innovative Technology Award" and earn LEED credits. Moreover, because of their energy efficiency, residential AdvanTex systems installed in certain Oregon utility districts qualify for a cash incentive through the Energy Trust of Oregon.

Figure 10. AX MAX Installation.

In addition to low power consumption, the maintenance requirements for AdvanTex are minimal (compared to other technologies), which further enhances the system's cost-effective operation, especially when compared to other treatment systems. As with any engineered system, however, the AdvanTex Treatment System will work better and last longer if a qualified service provider regularly maintains it.

Typically, the location of package plants requires careful consideration and must take into account factors such as water quality of the receiving stream, odor control, availability of usable sites, and proximity to existing residences and businesses. However, AdvanTex Treatment Systems (and packed bed media filters in general) are easier to locate than other package plants due to minimized odors and a lower visual impact when installed in-ground. A number of references and examples are available to demonstrate location options for installed and operational AdvanTex facilities.

Summary: Key Design Features of AdvanTex Treatment Systems

- Consistent performance with highly variable wastewater strengths and flows, including overloads, due to attached growth process and micro-dosing for microbe management.
- No release of untreated sewage.
- Low maintenance requirements compared to other more conventional treatment processes.
- Simple operational procedures; no complex operational adjustments or controls.
- Simpler operation with no issues of mixed liquor inventory control and sludge wasting
- Better recovery from shock loads
- No problems of bulking sludge in secondary clarifiers
- Secondary clarification not required (generally, dependent upon permit requirements).
- Adequate surge storage for managing peak flows (depending upon anticipated design flows).

Treatment Facility Area Requirement

AX100 pods are approximately 7'-8" wide, 15'-10" long, 42" tall, and installed in parallel for additional capacity. Dimensioned drawings of an AX100 can be downloaded in PDF format at http://sfdocs.orenco.com/2012/3/AX100_pod_with_dims.pdf. Spacing between AX100 pods varies, but is often 2 ft. Recirculation tanks for AX100 systems are typically cast-in-place concrete, fiberglass, or precast. Fiberglass recirculation tanks are often either Containment Solutions (http://www.containmentsolutions.com/) or Xerxes Corporation (http://www.xerxes.com/). Both websites offer dimensioned drawings for a variety of tank volumes. An example AX100 pod layout is provided in the following link; http://sfdocs.orenco.com/2012/3/8_pod_-_Fiberglass_TNKAGM-opt2.pdf.

AX MAX units are 14' to 42' in length, 7' in width, and 8' in height and installed in series for additional capacity. An example layout is provided in the following link for reference; http://sfdocs.orenco.com/2013/2/AL_Fulton_AX-Max_system_planset.pdf.

Alkalinity Feed

An alkalinity feed system (dry feeder with mixing tank) is not included but if incorporated into the design can provide a relatively inexpensive assurance that the system will have sufficient alkalinity to support the biological nitrification. A sample alkalinity feed system is illustrated in the following figure. Approximate costs are between $10,000 and $15,000 (excluding installation).

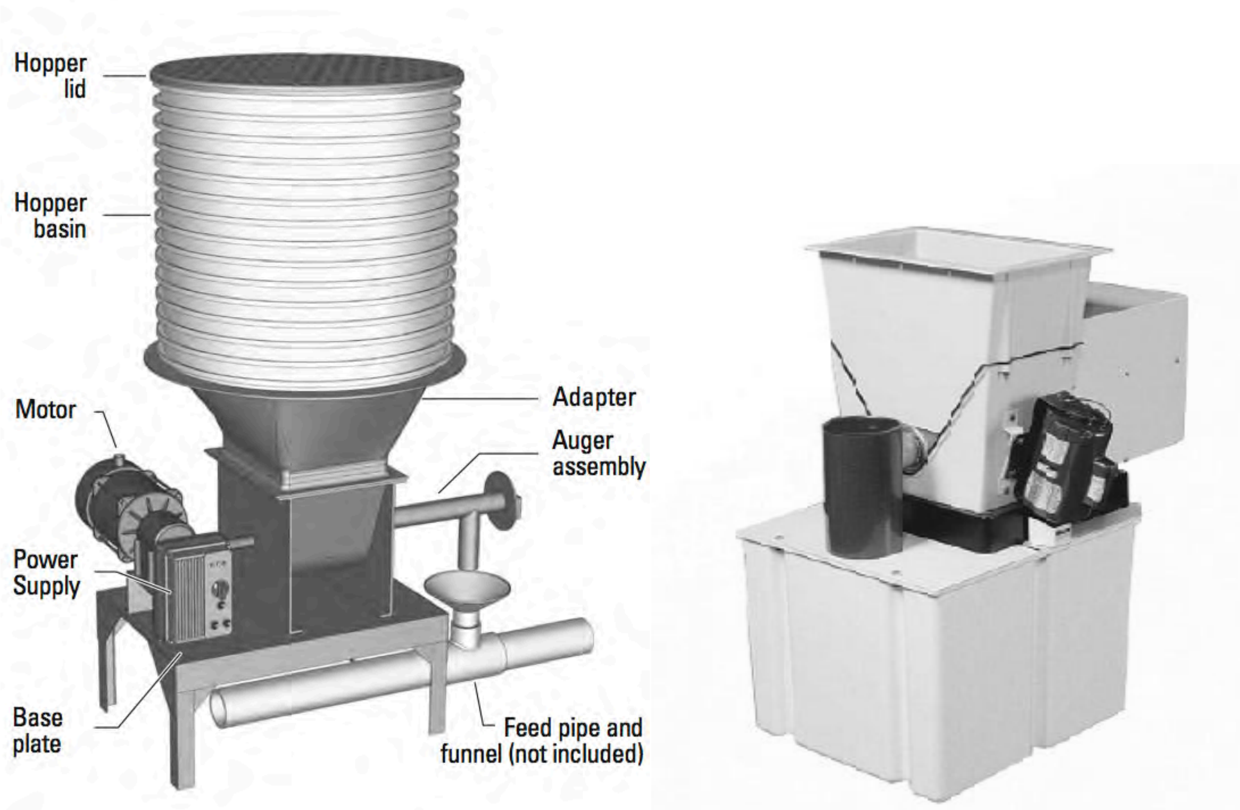


Figure 11. Typical dry chemical feed systems with and without mixing tank (generally necessary).

Telemetry Controls

Controls and alarms are listed per UL 508 for the AdvanTex AX MAX system. TCOM control panels provide real-time connection and parameter manipulation via a dedicated phone line. The system will be monitored via remote telemetry with real time efficiency. The panel will have the following functions; 1) Data Collection and Utilization: Logs data for system conditions and events such as daily flows, pump run time, pump cycles, and alarm conditions. Logs shall store data for at least a year. 2) Downloadable Logs: Download logs into a *.dif or ASCII format for simple conversion to common spreadsheet or word processor programs. 3) Multi-Level Password Security: Only qualified personnel can remotely access site. 4) Program Logic Rules: Simple "If … then" declarations. 5) Touch screen display (typically). 6) Manual transfer switch. 7) Current sensors, and several other features.

Infrastructure Phasing and Non-Mandatory Connections

Orenco Effluent Sewers provide the most cost-effective collection system option for phased approaches. The cost to upsize/oversize the small-diameter pipe in the conveyance system is minimal … typically a small percentage of total project costs. In addition, up to 85% of the cost of Orenco Effluent Sewers is associated with on-lot equipment packages (the STEP system), not the conveyance system (the mainlines). And these on-lot packages are not required until a connection is made to the system. Plus, O&M costs for STEP/STEG systems are almost fully attributed to the on-site pump and tank and the treatment.

Conventional gravity sewer collection systems, on the other hand, require expensive, large diameter gravity mains that are costly to oversize and maintain and constitute the majority of the cost of traditional sewer systems.

Similarly, grinder sewers pose design challenges when oversizing force-mains for future connections because they require 2 ft/sec scouring velocity.

Because of their high up-front costs, traditional gravity sewer collection and centralized wastewater treatment systems require a large and immediate customer base to equitably distribute these costs. This, in large part, is why mandatory connections are necessary when a conventional sewer approach is utilized.

With STEP/STEG systems, both the on-site system and the treatment capacity can easily be deferred to the time of connection. Consequently, the issue of mandatory connections can be revisited. We recommend that the performance of existing septic systems be evaluated and recommended for mandatory connection based on that evaluation, while newer systems be allowed to remain in service provided they are regularly inspected.

Nutrient Removal Considerations

Low ammonia and total nitrogen limits are acheivable with AdvanTex assuming proper process design, alkalinity, temperature, and operations. Nitrification occurs in the lower region of the textile media where conditions (highly aerobic, low organic concentration) favor this process. Nitrification is a two-step biochemical process where ammonia (NH_4) is converted to nitrate. The ammonia is converted to nitrite (NO_2) by autotrophic bacteria. Nitrite demands oxygen and where oxygen is available, it will rapidly convert (oxidize) to nitrate (NO_3).

$$2NH_4^+ + 3O_2 \longrightarrow NO_3^- + 2H^+ + H_2O$$

During the process about 9 parts oxygen are consumed in converting 2 parts ammonia to nitrate. Therefore, depending on the concentration of ammonia, a considerable amount of air may be needed. Sufficient air is provided either through passive or active (ventilation fan) venting. Depending on the discharge limits, to accomplish additional aeration, a two-stage configuration may be used.

Factors Affecting Nitrification

Alkalinity is a characteristic that, more often than suspected, limits nitrification, and ultimately total nitrogen removal rates. Alkalinity is not a specific polluting substance, but a combination of factors. It is the ability of water to neutralize an acid, and is due primarily to the presence of carbonate.

Alkalinity is essential for nitrification; for each part ammonia that is nitrified, 7.14 parts alkalinity are consumed (*buffering the acidity*). Therefore, about 428 mg/L of alkalinity would be consumed in nitrifying a concentration of 60 mg/L of ammonia. It is also important to note that during the denitrification process 3.5 parts of alkalinity are formed for every part of nitrate that is converted. In a properly functioning nitrifying/denitrifying system, approximately 214 mg/L of alkalinity would be consumed.

Many wastewater streams may not have sufficient alkalinity to support complete nitrification. And, if the alkalinity drops too much (<50 mg/L±), the pH can correspondingly drop to levels that will cause the microbial activity to degrade (<6). Optimum pH is between 7 and 7.5. This is typical in all wastewater processes. In applications where the alkalinity may be limited, a chemical feed system can be incorporated into the design to increase and/or control the concentration.

Temperature is also a critical factor that can limit the process. Wastewater temperatures that fall below 40° F will inhibit the process. Toxic chemicals introduced into the wastewater stream in can kill the bacteria that are carrying out this process thus reducing the treatment systems performance.

SECTION 6: PROCESS FLOW DIAGRAM

A basic process flow diagram is provided in the following figure. Detailed design drawings and specifications are available upon request.

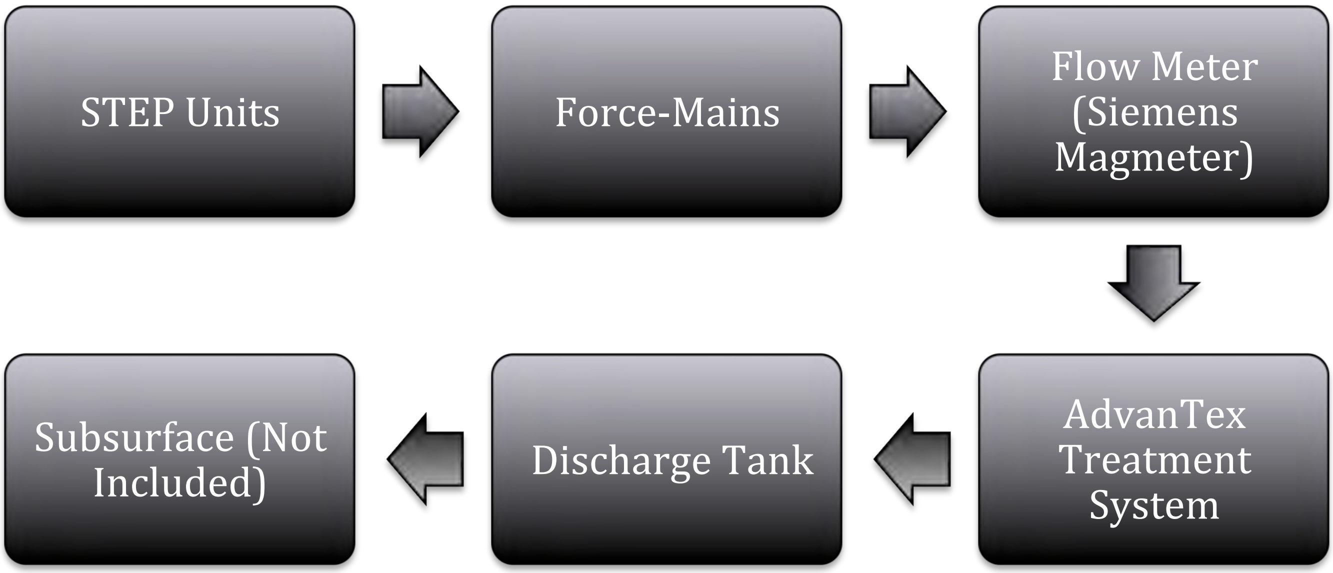


Figure 12. Process flow diagram.

SECTION 7: SCOPE OF SUPPLY

STEP/STEG System scope of supply includes an interceptor tank (1,000 gal), access equipment, pumping equipment, control panel, service lateral (1.25" dia), service connection, force main, and force main appurtenances (cleanouts, pigging ports, air release valves, etc). Material lists include Orenco and non-Orenco materials, and only include major items. Refer to the Appendices for detailed scope of supply information. The AdvanTex Treatment Facility materials include recirculation tank, access equipment, pumping systems, control panel, and AdvanTex filters.

Table 20. Collection and treatment system scope of supply.

NE District ---

Residential STEP Packages: 1,000 gal (Orenco and Non-Orenco Equipment)	Per Unit Pricing
Service Connections (Orenco and Non-Orenco Equipment)	Per Unit Pricing
2" Dia Forcemain, LF	1,500 lf
Air Release Valves	2
Cleanouts	3
Pigging Ports	1
WWTP Control Panel (TCOM, Telemetry)	1 Custom Unit
AX MAX Units	1 Unit
Discharge Tank and Access Equipment (Orenco and Non-Orenco Equipment)	4,000 gal
Flow EQ / Pre-Anoxic Tank and Access Equipment (Orenco and Non-Orenco Equipment)	4,000 gal
UV Disinfection System (Orenco and Non-Orenco Equipment)	Not Included
Flow Meter (Orenco and Non-Orenco Equipment)	1 Mag-meter

SW District ---

Residential STEP Packages: 1,000 gal (Orenco and Non-Orenco Equipment)	Per Unit Pricing
Service Connections (Orenco and Non-Orenco Equipment)	Per Unit Pricing
2" Dia Forcemain, LF	3,750 lf
Air Release Valves	2
Cleanouts	8
Pigging Ports	4
WWTP Control Panel (TCOM, Telemetry)	1 Custom Unit
AX MAX Units	3 Units
Discharge Tank and Access Equipment (Orenco and Non-Orenco Equipment)	11,000 gal
Flow EQ / Pre-Anoxic Tank and Access Equipment (Orenco and Non-Orenco Equipment)	11,000 gal
UV Disinfection System (Orenco and Non-Orenco Equipment)	Not Included
Flow Meter (Orenco and Non-Orenco Equipment)	1 Mag-meter

SECTION 8: CAPITAL COST ESTIMATES

Capital Cost Estimates

The following cost estimates are derived from recent bid tabulations from similarly sized STEP projects. Detailed cost estimates and scope of supplies are provided in the Appendix. Several bid tabulations from small communities with Orenco collection and treatment systems are available upon request.

As addressed in the previous section, the timing of capital expenditures can make a significant difference when comparing effluent sewer versus sewer systems that require complete up-front installation.

With effluent sewer:

- 70-80% of the collection system capital costs are associated with the on-lot components. On-lot components are not installed until the connection is made
- 20-30% of the collection system capital costs are associated with the main lines. Mainlines have low up-front capital cost and low maintenance costs
- Upwards of 50-70% of the total (collection + treatment + dispersal) project costs are associated with the on-lot components (STEP units).
- Cluster AdvanTex Treatment Systems are modular in construction and facilitate capacity on demand.

Typical unit costs for material and installation estimates for a 1,000 gal septic tank equipped with a STEP package are listed below. All estimates include Orenco and non-Orenco materials; consequently, this is only a rough estimate and intended for budgetary and evaluation purposes. Construction estimates are in today's dollars. The estimates are approximate and require thorough evaluation and confirmation. Costs do not incorporate bridge crossings, railroad crossings, interstate crossings, asphalt/concrete repair, rock excavation, etc.

Table 21. Typical material and installation costs for STEP package with 1,000 gal tank.

1,000 gal STEP System Estimate (Per Unit)	Unit Low ($)	Unit High ($)
Interceptor Tank, 1000 gal	$1,000	$1,200
Interceptor Tank Access Equipment (2 ft & 4ft Burial Depth)	$201	$449

STEP Pumping Equipment	$1,038	$1,296
Control Panel (Telemetry & Non-Telemetry)	$325	$443
Installation Estimate (% of Materials)	$1,282	$1,186
Shipping Estimate (% of Materials)	$128	$169
Total (Per Unit)	$3,974	$4,743

[x]Costs include Orenco and non-Orenco equipment. Tank is often pre-cast concrete. Installation costs are estimated and are subject to escalation based on presence of rock, installation depth, and other factors. Costs are approximate and should be verified.

Table 22. Typical service lateral and service connection costs.

Residential & Commercial Service Lateral Estimate (Per Unit)	Unit Low ($)	Unit High ($)
1.25" Dia Service Lateral and Connection (Ball Valve & Check Valve)	$650	$1,000
Total (Per Unit)	$650	$1,000

[x]Costs for service laterals and connections vary depending upon burial depth, presence of rock, lot size, tank location, and force-main location. Unit costs are approximate and should be verified.

Table 23. Approximate force-main costs with appurtenances.

Force-Main Estimate – SW District	Total ($)
2" Dia Forcemain	$45,000
Air Release Valves	$906
Cleanouts	$603
Pigging Ports	$293
Total	$46,802

Force-Main Estimate – NE District	Total ($)
2" Dia Forcemain	$18000
Air Release Valves	$906
Cleanouts	$603
Pigging Ports	$293
Total	$19,802

[x]Costs are approximate and based on recently constructed projects. All costs should be evaluated and verified.

The AdvanTex Treatment Facility cost estimates include recirculation tank, access equipment, pumping systems, control panel, and AdvanTex filters. Estimates for both Orenco equipment and non-Orenco equipment are provided, in addition to an approximate construction cost.

Table 24. Stage one (1) AdvanTex material estimate.

SW District ---

Stage One Materials	Unit Low	Unit High	Total Low	Total High
AX-MAX Pumping Equipment	$1,940	$2,020	$5,819	$6,059

RNE Pump	$549	$549	$549	$549
Piping, fittings, glue	$75	$150	$150	$300
42 ft AX-MAX	$79,000	$85,000	$158,000	$170,000
28 ft AX-MAX	$55,000	$60,000	$55,000	$60,000
		Subtotal	$219,518	$236,908

NE District ---

Stage One Materials	Unit Low	Unit High	Total Low	Total High
AX-MAX Pumping Equipment	$1,940	$2,020	$1,940	$2,020
RNE Pump	$549	$549	$549	$549
Piping, fittings, glue	$75	$150	$75	$150
42 ft AX-MAX	$79,000	$85,000	$79,000	$85,000
		Subtotal	$81,564	$87,719

[x]Estimate includes Orenco and non-Orenco equipment, both of which are estimates.

The flow equalization / pre-anoxic tank sized at 50% the maximum day flow. An estimate is provided in the following table.

Table 25. Flow equalization / Pre-anoxic tank and Dose tank material estimate.

SW District ---

Flow EQ / Anoxic System Materials	Unit Low	Unit High	Total Low	Total High
Pre-Anoxic Tank	$2.00	$2.25	$22,000	$24,750
Pre-Anoxic Tank Access Equipment	$362	$1,079	$362	$1,079
		Subtotal	$22,362	$25,829

Discharge System Materials	Unit Low	Unit High	Total Low	Total High
Discharge Tank	$2.00	$2.25	$22,000	$24,750
Discharge Tank Access Equipment	$362	$1,079	$362	$1,079
Discharge Tank Pumping Equipment	$1,224	$1,202	$1,224	$1,202
		Subtotal	$23,586	$27,031

NE District ---

Flow EQ / Anoxic System Materials	Unit Low	Unit High	Total Low	Total High
Pre-Anoxic Tank	$2.00	$2.25	$8,000	$9,000
Pre-Anoxic Tank Access Equipment	$362	$1,079	$362	$1,079
		Subtotal	$8,362	$10,079

Discharge System Materials	Unit Low	Unit High	Total Low	Total High
Discharge Tank	$2.00	$2.25	$8,000	$9,000
Discharge Tank Access Equipment	$362	$1,079	$362	$1,079
Discharge Tank Pumping Equipment	$1,224	$1,202	$1,224	$1,202
		Subtotal	$9,586	$11,281

[x]Estimate includes Orenco and non-Orenco equipment, both of which are estimates.

Ancillary equipment estimates are provided in the following table.

Table 26. Ancillary material estimate.

SW District ---

Ancillary Materials	Unit Low	Unit High	Total Low	Total High
Telemetry Control Panel	$2,200	$3,700	$15,000	$20,000
Operation & Maintenance Manual	$500	$500	$500	$500
		Subtotal	$15,500	$20,500

NE District ---

Ancillary Materials	Unit Low	Unit High	Total Low	Total High
Telemetry Control Panel	$2,200	$3,700	$10,000	$12,000
Operation & Maintenance Manual	$500	$500	$500	$500
		Subtotal	$10,500	$12,500

[x]Estimate includes Orenco and non-Orenco equipment, both of which are estimates.

Shipping, commissioning, operator training, and installation estimates are provided in the following tables.

Table 27. Shipping, commissioning, operator training, and installation estimates.

SW District ---

Shipping, Commissioning, and Operator Training	Total Low	Total High
Commissioning and Operator Training	$1,500	$1,500
Shipping (% of Materials)	$11,848.33	$13,038.45
Subtotal	$13,348.33	$14,538.45

Construction Estimate				
Labor and Misc. Equipment (% of Materials)	30%	40%	$84,140	$123,908
		Subtotal	$84,140	$123,908

NE District ---

Shipping, Commissioning, and Operator Training	Total Low	Total High
Commissioning and Operator Training	$1,500	$1,500
Shipping (% of Materials)	$4,700.61	$5,178.98
Subtotal	$6,200.61	$6,678.98

Construction Estimate				
Labor and Misc. Equipment (% of Materials)	30%	40%	$32,854	$48,432
		Subtotal	$32,854	$48,432

Total material and installation estimates are listed below.

Table 28. Total materials and installation estimate.

SW District ---

Materials Total	$280,967	$310,269
Construction Total	$84,140	$123,908
Shipping and Commissioning	$13,348	$14,538
Total	$378,455	$448,715

NE District ---

Materials Total	$110,012	$121,580
Construction Total	$32,854	$48,432
Shipping and Commissioning	$6,201	$6,679
Total	$149,066	$176,690

Cost estimates do not include material and labor costs for a controls building, site work, utilities, state or local taxes, permitting, inspections, administration, engineering, etc.

STEP/STEG O&M

Estimated operation and maintenance costs for the recommended STEP/STEG system (assuming 1,000 gal STEP/STEG tanks) are provided in the table below. Complete economics for the 1,500 gal STEP/STEG system and AdvanTex Treatment System option are provided in Appendix B.

Table 29. O&M Cost Estimate: Collection.

SW District ---

O&M Cost Summary ($/Month/EDU)	
System Option	Collection
1,000 gal Tank(s)	$7.06

NE District ---

O&M Cost Summary ($/Month/EDU)	
System Option	Collection
1,000 gal Tank(s)	$7.06

STEP/STEG system O&M costs include primary tank pumpout costs, pro-active maintenance procedures, re-active maintenance requirements, and equipment repair and replacement. Mainline O&M requirements and costs are unaccounted for, but are generally minor compared to on-lot maintenance costs and requirements.

AdvanTex O&M and Energy Consumption

Estimated operation and maintenance costs for the recommended AdvanTex Treatment System are provided in the table below:

Table 30. O&M Cost Estimate: Treatment Facility.

SW District ---

O&M Cost Summary ($/Month/EDU)	
System Option	Treatment[1]
1,000 gal Tank(s)	$7.70

NE District ---

O&M Cost Summary ($/Month/EDU)	
System Option	Treatment
1,000 gal Tank(s)	$16.23

Treatment System O&M costs include regular component maintenance (specific activities listed in detailed AdvanTex O&M estimate provided in the Appendix), telephone line costs (for TCOM™ Panel), solids removal costs for the recirculation tank, and energy costs. The treatment system O&M cost excludes equipment repair and replacement.

It bears repeating that, while power usage can be a significant part of O&M costs for treatment systems, power costs are very low with AdvanTex Treatment Systems. Energy calculations are based on the Design Average Daily Flow, the $/kWh specified, the target recirculation ratio, and the energy consumption of the pumps and ventilation fan. Primary tank, flow EQ, and/or discharge tank energy costs are not included.

Table 31. Treatment Facility Energy Consumption.

SW District ---

Energy Consumption (Treatment Facility)	
kWh/day	48.54
kWh/1,000 gal	4.14

NE District ---

Energy Consumption (Treatment Facility)	
kWh/day	17.32
kWh/1,000 gal	4.12

One final note: due to variations in system design, labor rates, and power usage costs, this O&M Cost Estimate should be used as a guideline only. In addition, it does not include estimates for insurance, billing, accounting, audits, office labor, equipment, permitting, bonding, training, consultant services, disinfection, sampling, travel time to site, or laboratory testing.

SECTION 10: LIFE-CYCLE COSTS, PRESENT WORTH, AND PROJECTED RATES

Total life-cycle costs (design, construction, O&M and R&R) for the various collection and treatment technologies differ significantly. Consequently, it's important to conduct a long term (40 + year) present worth analysis for each technology being evaluated. Virtually all wastewater treatment system will spend more for operation and maintenance than they will to construct the facility. As illustrated in the following figure, nearly half of the life-cycle cost of a wastewater treatment plant is O&M and R&R.

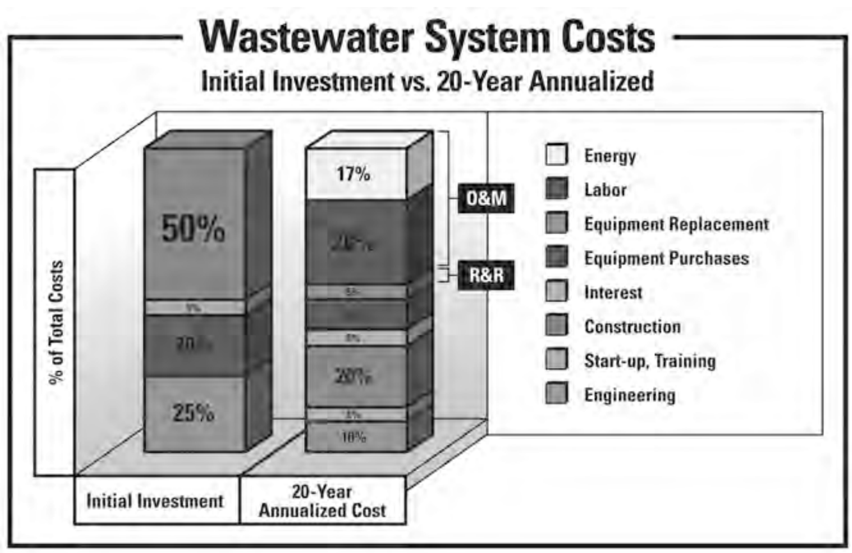


Figure 13. 20 yr annualized cost for ww treatment facility.

Source: Energenecs, Inc., from bid tabulations, originally published in "Choosing Your Community Wastewater System: A Life-Cycle Cost Analysis Can Prevent Financial Woes," T. Molatore, Orenco Systems®, Inc., The Water Street Journal, Fall, 2008, pp. 26-27.

Present Worth Analysis

This Present Worth analysis is based on a 40 yr term and 3% interest rate, for a STEP/STEG System using a 1,000 gal tank, followed by AdvanTex for treatment. Exclusions are listed in the detailed cost estimates (capital and O&M) provided in the Appendix.

Table 32. Total Present Worth Summary for Collection and Treatment.

SW District ---

Cost Summary	Capital Cost	Collection Present Worth	Treatment Present Worth	Total Present Worth
Low	$735,031.44	$117,024.26	$148,571.80	$1,000,627.50
High	$880,316.00	$117,024.26	$148,571.80	$1,145,912.05

NE District ---

Cost Summary	Capital Cost	Collection Present Worth	Treatment Present Worth	Total Present Worth
Low	$279,832.40	$41,919.14	$110,094.63	$431,846.16
High	$334,330.76	$41,919.14	$110,094.63	$486,344.52

Projected Rate Structure

Based on the above Present Worth analysis and the number of EDUs specified, the projected rate structure, as a function of the grant percentage or connection fee, is provided in the following table.

Table 33. Projected Rate Structure for 1,000 gal STEP/STEG System and AdvanTex WWTP.

SW District ---

% Grant or Connection Fee	Debt Retirement ($/Month/EDU)	Total Debt & O&M ($/Month/EDU)
0%	$39.55	$54.32
25%	$29.66	$44.43
50%	$19.78	$34.54
75%	$9.89	$24.65

NE District ---

% Grant or Connection Fee	Debt Retirement ($/Month/EDU)	Total Debt & O&M ($/Month/EDU)
0%	$42.04	$65.33
25%	$31.53	$54.82

50%	$21.02	$44.31
75%	$10.51	$33.80

To accurately compare collection and treatment system technologies and avoid future financial problems for the community, decision-makers must evaluate these life-cycle and present worth costs during the selection process and plan for them in the management and rate-setting process.

SECTION 11: TECHNOLOGY COMPARISONS

Collection System Comparisons

Alternative wastewater collection systems, such as Orenco Effluent Sewers, can save small communities millions of dollars in capital costs, when compared to conventional gravity sewers. Pressure sewers can affordably serve small, spread-out communities because they use small-diameter, shallowly buried PVC or HDPE mainlines to convey wastewater to a treatment facility rather than large-diameter, deeply excavated conveyance mains.

Alternative wastewater collection systems are not new technologies. Over the past several decades, hundreds of communities have installed pressure sewers (effluent sewers and grinder sewers), a number of which are approaching 30 years since start-up. This section provides comparisons for the three main collection system technologies: Gravity, Grinder, and STEP/STEG.

The following table provides a sample capital cost and operational cost summary of effluent, grinder, gravity, and vacuum sewers, according to "WERF's Wastewater Planning Model, Version 1.0." Model output is based on a 200 unit example.

Table 34. WERF Wastewater Planning Model: Low Pressure Sewer (Grinder) and Effluent Sewer

Cost Description	Low Pressure (Grinder) Sewer			Effluent Sewer		
Cost of Collection Network[1]	$525,950	to	$788,925	$516,179	to	$774,268
Installation Cost of On-Lot	$4,291	to	$6,436	$2,625	to	$3,938
Total Installation Cost	$1,384,090	to	$2,076,135	$1,041,232	to	$1,561,848
Total System Cost / Conn.	$6,920	to	$10,381	$5,206	to	$7,809
Annual On-Lot O&M	$224	to	$336	$63	to	$78

Table 35. WERF Wastewater Planning Model: Vacuum Collection and Gravity Sewer

Cost Description	Vacuum Collection			Gravity Sewer		
Cost of Collection Network	$2,120,188	to	$3,180,283	$3,092,330	to	$4,638,494
Installation Cost of On-Lot	$3,761	to	$5,641	$726	to	$1,088
Total Installation Cost	$2,120,188	to	$3,180,283	$4,638,494	to	$5,001,322
Total Collection System Cost / Conn.	$10,601	to	$15,901	$23,192	to	$25,007
Annual On-Lot O&M	Maintained by Utility			$16	to	$24

Source:
http://www.werf.org/i/c/DecentralizedCost/Decentralized_Cost.aspx

Gravity Sewers

Gravity sewers use 4” diameter service laterals and 8” (or larger depending on peak flows) mainlines, installed at a constant slope. Mainlines are regularly installed 10 - 40 ft deep depending upon terrain and other factors. Manholes are required at changes in diameter, slope or direction, and at regular intervals for cleaning and inspection purposes. Primary treatment is not included in the collection system.

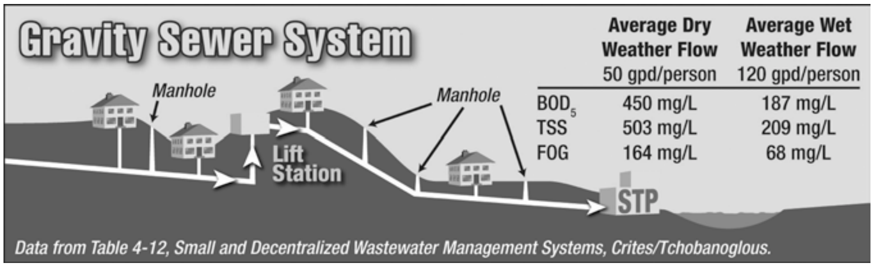


Figure 14. Gravity Sewer System Profile (typ.)

Costs for gravity sewers vary widely depending on density and topography. Approximate costs for materials/installation to install building sewer and connect to sewer main are typically $1,800-$2,700 per home. Cost for mainline materials/installation, again vary widely, but for 50,000 gpd or 200 homes range from $2,182,000 - $3,273,000. (Source: WERF Fact Sheet C1: “Performance & Cost of Decentralized Unit Processes: Gravity Sewer Systems,” Water Environment Research Foundation, April 2010.)

Figure 15. Typical gravity sewer main installation.

Immediate operator response is required when gravity sewers back-up into homes/businesses. Caustic chemicals, system abuses, and on-lot I/I are very difficult to identify and control. Installation of gravity sewers often results in conflicts with existing utility services, requiring costly change orders and redesigns.

Deep mainline trench excavations (10'-40') go in slowly with significant disruption to the community. Manholes are required at intersections, changes in slope or direction, and at regular intervals along the lines. Non-watertight collection system is plagued by I/I, significantly increasing treatment costs downstream, especially in the long-term. Gravity systems require larger, energy-intensive, high-cost (capital and O&M) treatment facilities to handle I/I and solids.

Grinder Sewers

Grinder sewers typically use 50 to 150 gallon on-lot basins equipped with 1 to 2.5 hp grinder pumps that grind and convey raw sewage to the treatment facility. Small diameter lines that are installed following the contour of the land are used to convey the wastewater to the discharge point, without manholes. Minimum velocities (> 2 ft/s) are, like gravity sewers, required to avoid solid deposition. Primary treatment is not included in the collection system.

Figure 16. Grinder sewer system profile (typ.)

On-lot equipment costs are typically $4,000-$7,200 per home in materials/installation to install the pump, pump basin, controls, excavation, and network connection. Example package construction costs are listed in the following table. Annual on-lot O&M costs are $10-$24 per month per EDU. For materials/installation of the mainline for 50,000 gpd or 200 homes, costs range $344,000-$516,000. (Source: WERF Fact Sheet C2: "Performance & Cost of Decentralized Unit Processes: Pressure Sewer Systems.) Solids management is also required downstream.

Table 36. Grinder bid tabulation summary.

Project Name	Bid Yr	Scope	Unit Bid	Qty	Award Unit Bid	Awarded Total Bid	Approximate Basin Height
Carlisle, IA	2008	Simplex	EA	152	$4,035.00	$1,409,456.60	-
Leisure Lake, IA	2012	Simplex	EA	339	$5,207.00	$3,294,798.65	-

Due to lack of emergency storage provided by on-lot pump basin, any emergency call-outs generally requires immediate operator response. And, grinders typically have high on-lot electricity costs, greater than $2.50/month/EDU to operate the pump. Many homes require costly upgrades for 230 VAC power. Grinder systems often require intermediate lift stations costing >$250,000 that require immediate alarm response and back-up power.

Consideration should be taken to select appropriate styles of grinder pumps. Many of the newer grinder pumps are progressive cavity style. Per Metcalf and Eddy, "The pumps [progressive cavity] are expensive to maintain because of wear on the rotors and the stators…"

The following paper provides operational costs for both STEP and grinders sewers; http://sfdocs.orenco.com/2012/10/ntp-stp-tjm-2.pdf.

Effluent (STEP/STEG) Sewers

Effluent sewers use 1,000 gal. - 1,500 gal. on-lot interceptor tanks to provide primary treatment to wastewater prior to conveying filtered effluent to the discharge point. This reduced-strength, filtered effluent is conveyed through small diameter pressure mains, without manholes. Since the majority of solids are contained and passively digested in the primary tank, scouring velocities are not required. High head effluent pumps (250 ft of head capability) accommodate systems with hilly terrain or distant treatment sites. Twenty-four hour extra storage provided by the on-lot tank means there is no need for immediate operator response in emergency situations.

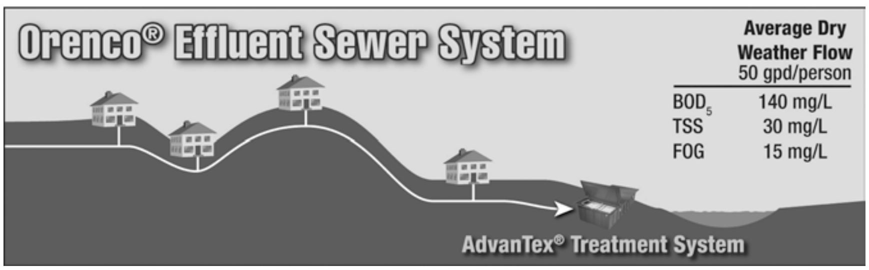


Figure 17. Effluent sewer system profile (typ.)

Costs for materials/installation for pump, septic tank, controls, excavation, and connection to network are $3,000-$5,000 per home. Approximate mainline materials/installation costs for 50,000 gpd or 200 homes ranges $340,000 to $510,000. (Source: Fact Sheet C3: "Performance & Cost of Decentralized Unit Processes: Effluent Sewer Systems," Water Environment Research Foundation, April 2010.)

The following paper provides operational costs for both STEP and grinders sewers; http://sfdocs.orenco.com/2012/10/ntp-stp-tjm-2.pdf.

Both grinder and effluent sewer share the advantage of using small diameter force mains that can be installed with just a trencher or directional borer, avoiding conflicts with existing utility services easily, at little or no cost. This watertight collection system is largely immune to I/I (inflow & infiltration). Inexpensive clean-outs replace the expensive manholes found on gravity sewer systems.

A list of several recently bid STEP systems is summarized below.

Table 37. STEP bid summary.

Project Name	Bid Yr	Scope	Unit Bid	Qty	Award Unit Bid	Awarded Total Bid	Approximate Tank Depth
El Dorado, AR	2011	1000 gal Tank	EA	402	$4,795.00	$1,927,590.00	2-3 ft
Lexington, IN	2010	1500 gal Tank	EA	117	$4,532.43	$530,294.31	2-3 ft
Rathbun Lake, IA	2011	1250 gal Tank	EA	24	$4,289.00	$102,936.00	4-5 ft
City of Superior, IA	2011	1000 gal Tank	EA	69	$4,485.00	$309,465.00	4-6 ft

Fulton, AL	2012	1,000 gal Tank	EA	125	$3,400.00	$425,000.00	1.5-2 ft
Fulton, AL	2012	1,500 gal Tank	EA	5	$4,000.00	$20,000.00	1.5-2 ft
Atoka, TN	2009	1,000 gal Tank	EA	226	$4,700.00	$1,062,200.00	2-3 ft
Bayou La Batre, AL	2010	1,000 gal Tank	EA	26	$4,400.00	$114,400.00	1.5-2 ft

Treatment System Comparisons

Pre-engineered wastewater treatment systems may use any of several technologies and processes. Extended aeration activated sludge is common for larger flows and municipalities. Attached-growth media filter systems are often used for small communities. The attached growth media filters may rely upon either natural media materials or synthetic materials. Integrated fixed activated sludge (IFAS) units have become popular systems for package plants. The media in the IFAS systems may be suspended as in a moving bed bioreactor (MBBR), or the media may be static with the wastewater moving around the media. MBBRs are being used for facilities ranging in size from individual home applications to thousands. Sequencing batch reactors, SBRs, utilize all of the unit processes of suspended growth activated sludge while minimizing the volume of the reactors by using a single tank and performing each process in sequence. Two parallel treatment trains must be provided if continuous flow is required.

The selection of a treatment plant process must take into account several factors, including but not limited to ...

- Regulatory requirements: permit limitations, operational stipulations
- Compatibility with existing facilities: new process additions
- Cost considerations: capital cost, operational costs, energy consumption, life-cycle analysis
- Environmental considerations: social, technical, ecological, economic, political, legal, and institutional
- Other important considerations: equipment availability, personnel requirements, energy and resource requirements.

The following paragraphs provide a basic description of the common types of technologies and some considerations for small flow applications.

Conventional Activated Sludge (CAS)

Conventional activated sludge (CAS) is the most common type of treatment system for larger communities. CAS is an aerobic process that uses suspended microorganism biomass to convert biodegradable organic compounds and nutrients into easily removable byproducts. Wastewater typically enters the plant through a screen and/or grit removal system, for the removal of grit and large particles. Following screening, the wastewater is conveyed to a primary clarifier, which is followed by an aeration basin where air is introduced to a mixed liquor. The microorganisms absorb dissolved and suspended constituents in the wastewater and multiply, creating more mixed liquor solids. The mixed liquor is then sent to the secondary clarifier where the solids are settled. A portion of the sludge is recycled back to the aeration basin (RAS) and a portion is processed for disposal (WAS).

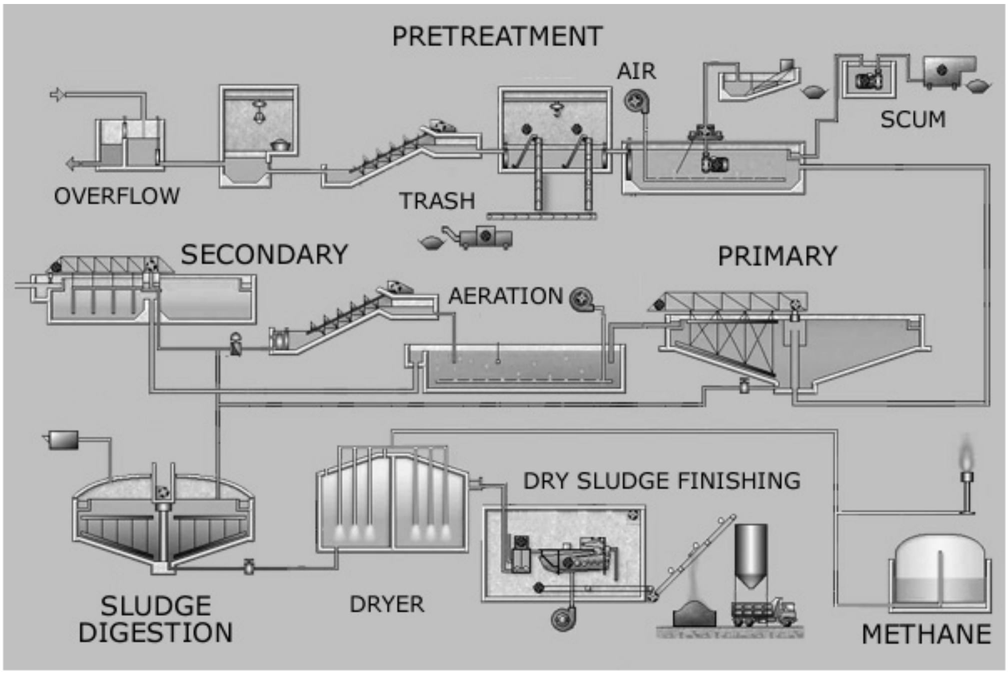


Figure 18. Conventional Activated Sludge Facility

The activated sludge process may be operated as a high-rate process with the mixed liquor volatile suspended solids (MLVSS) concentration kept high and the mean cell residence time kept low to ensure rapid assimilation of the organic substrate. This particular configuration and operation results in a large waste sludge production. Commonly, however, the activated sludge process is modified for extended aeration with a lower MLVSS and a much longer sludge age and detention time in the aeration basin. This particular modification results in a lower volume of waste activated sludge and therefore reduced costs for biosolids removal, treatment, handling and disposal.

Some disadvantages of CAS systems when they are applied to small communities:

- Large treatment plants require significant upfront capital costs. Sewer districts must incorporate as many users as possible to cover debt retirement. The public is often unsupportive since such expensive solutions are not financially practical.
- Conventional treatment plants must be located outside municipalities, increasing infrastructure and energy costs to transport wastewater.
- Sizing treatment plants for future growth creates an unbalanced rate structure for initial users.
- Conventional treatment plants typically require design flows for stable performance.
- As noted in “Recommended Standards for Wastewater Facilities,” CAS processes require “close attention and competent operating supervision, including routine laboratory control … The process requires major energy usage to meet aeration demands.” As a result of their operational requirements, a number of small communities with small flow applications have experienced poor performance with CAS systems.

Small Activated sludge extended aeration basins generally target an effluent BOD_5 concentration of approximately 30 mg/L and a TSS concentration of approximately 25 to 30 mg/L. Extended aeration activated sludge operational parameters include a sludge age (mean cell residence time, or solids retention time) of approximately 40 to 60 days and a mixed liquor volatile suspended solids (MLVSS) concentration ranging from 2500 mg/L to 3500 mg/L.

Normal annual operation and maintenance includes checking the pressure on the downstream side of the blower or compressor to determine if the aeration piping or distribution requires cleaning, cleaning the air filter, ensuring that adequate mixing and aeration is occurring by checking the dissolved oxygen concentration in the aeration basin, and performing a field settleability test of the mixed liquor. Other common field evaluations include dissolved oxygen, pH, and turbidity in the effluent. The most common repair and replacement consideration is replacing the blower. Desludging the final clarifier is recommended every year as needed to prevent sludge compaction and anaerobic conditions that could result in gas bubbles that can cause sludge to carry over into the discharge. Also, the top of the sludge blanket should be kept below the outlet tee.

Integrated Fixed Film Activated Sludge (IFAS)

The IFAS system is a combination of the activated sludge process and fixed film or attached growth process. The fixed film portion of the system is submerged in the activated sludge mixed liquor. The media for the attached growth may be stationary and relatively rigid, such as blocks of corrugated plastic, or it may be movable and partially suspended in the highly aerated mixed liquor. The suspended media IFAS is sometimes referred to as a moving bed bioreactor (MBBR). The suspended media is typically small plastic shapes that are open with high specific surface area. The mixed liquor volatile suspended solids (MLVSS) concentration is kept lower than conventional activated sludge or extended aeration activated sludge.

Figure 19. IFAS System with Media

The IFAS systems were developed to take advantage of the properties of completely mixed activated sludge systems as well as attached growth systems. The MLVSS for operating an IFAS system is typically maintained in the range of 1500 mg/L. The IFAS systems can achieve effluent concentrations similar to attached growth media filter systems, but the IFAS systems incorporate a smaller footprint. The tradeoff between IFAS and media filter systems is that the media filters require a larger footprint area, but the IFAS systems require much more energy to function.

Typical O&M for the IFAS system includes checking the blower operation, cleaning the screens and filters for the blowers, and checking the air distribution system for proper air delivery, clogged air diffusers, and pressure/flow through the air system. Excess biomass may need to be removed by pumping. Any upstream primary treatment device may need to be desludged. Typical effluent operational parameters that are checked include turbidity, pH, dissolved oxygen, and solids settleability in the final clarifier, if there is one. The media portion of the system is examined to ensure that excess growth and sloughing is not occurring that would cause the media in a moving bed bioreactor to stick together or not properly circulate as designed.

Some disadvantages of IFAS systems applied to small communities, include:

- IFAS treatment plants generally must be located outside municipalities, increasing infrastructure and energy costs to transport wastewater.

- Like CAS, IFAS systems processes require close attention and competent operating supervision, including routine laboratory control … The process requires major energy usage to meet aeration demands.

Attached Growth Media Filters

Attached growth media filters may utilize natural or synthetic media. Natural media has included clean, washed sand of a particular gradation and uniformity, as well as peat. Synthetic media includes textile fiber, open cell foam, polystyrene beads, and bottom ash from coal-fired power plants. Experimentation with crushed glass, crushed plastic (automobile tail lights), basic oxygen furnace slag, and expanded clay minerals has been conducted with varying success. Some of the media filters are single-pass or intermittent filters receiving clarified wastewater as a single pass through the media prior to discharge. Other media filters are multiple pass or recirculating systems where the clarified wastewater passes over the media and a portion of the treated wastewater is recirculated to a recirculation and processing tank to pass through the media filter repeatedly prior to discharge. Some of the attached growth systems are operated to maintain microbial populations in the endogenous phase, essentially steady-state processes, so there is no excess biomass and therefore limited sloughing from the media. Other attached growth systems have larger media and are designed as trickling filters. Those systems slough biomass and the treatment media is followed by a final clarifier. Biomass from the clarifier is typically returned to an equalization tank or to a primary tank upstream of the media filter. The recirculated effluent serves to dilute the primary wastewater and the recirculating systems are loaded at a higher hydraulic loading rate than the single-pass or intermittent systems.

Textile and other synthetic media attached growth systems are an outgrowth of research into a lightweight synthetic media that can be a replacement for sand, but light enough to be installed in the filter container and hauled to the site. The media properties can be closely controlled using the synthetic media, unlike some of the natural media such as sand, where the sand is often not clean or the transportation cost can be high to obtain good-quality media. The container containing the lightweight synthetic media is set into the excavation using normal construction equipment on site for the system installation. The synthetic media has a high water holding capacity to retard the water movement, allowing time for the wastewater to be in contact with the microorganisms. The media also has a large specific surface area for microbial attachment. However, the media needs adequate hydraulic conductivity and porosity for water and air movement. Textile and other synthetic media recirculating systems are expected to produce effluent BOD_5 of less than 10 mg/L and TSS of less than 10 mg/L and achieve a total nitrogen reduction of over 60% (or higher if necessary with process additions).

For small flows, O&M is not as complicated or time-consuming as with conventional activated sludge systems. In most cases, part-time operation is satisfactory. Operation of the recirculating media filter systems includes annually cleaning the distribution network, examining the media to ensure excess growth is not present, checking for proper air flow, either passive or induced, to the media system, checking the residual head in the distribution network, cleaning any effluent screens or filters, and making the normal measurements of turbidity, dissolved oxygen and pH in the effluent. Floats are checked for proper functioning and the control panel is cycled to ensure proper operation. In most systems, since the service provider is on site, checking the septic tank sludge and scum levels is also a routine task.

Membrane BioReactor (MBR)

A membrane bioreactor (MBR) system employs a combination of activated sludge with physical filtration. Several types of membranes have been developed: microfiltration (MF), ultrafiltration (UF), nanofiltration (NF), and reverse osmosis (RO). The membranes may be flat plate (plate and frame) or pleated membranes or hollow fiber membranes, depending upon the geometry of the membrane itself. The membrane can be pressure-driven as a side stream configuration or it may be vacuum-driven and immersed in the activated sluge aeration basin itself.

MBRs provide a suspended microorganism biomass to convert biodegradable organic compounds and nutrients in wastewater to more biomass, typically with a mixed liquor of around 12,000 mg/L. The biomass is separated from the wastewater using a membrane filter, rather than using a secondary clarifier for gravity settling. MBRs generally produce effluent $cBOD_5 < 3$ mg/L, TSS < 3 mg/L, and Ammonia-Nitrogen < 1 mg/L.

Some disadvantages of MBRs applied to small communities are:

- Operational costs (energy, chemical requirements, etc.) due to aeration demands, however, are considerably higher than for other alternatives. Membranes are widely recognized as consuming large amounts of energy compared to other treatment technologies.
- Membrane fouling may be a) reversible by physical cleaning, b) irreversible, c) only removable by chemical cleaning, or d) irrecoverable, in which case the membranes must be replaced.

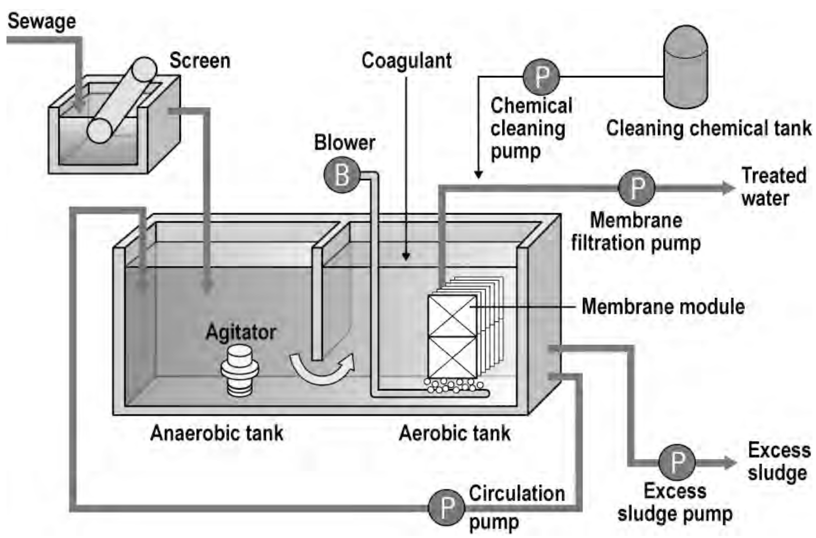


Figure 20. Typical MBR treatment facility.

To illustrate real-world MBR costs, a small commercial (office/retail) project in Ohio recently installed an MBR. The system included a 5.5 Hp, 480 VAC, 3 phase, 15 amps blower. Energy associated with air delivery required 9,980 W, resulting in the following costs; $1.10/hr, $792/month, or $9,636/yr. The present worth of $9,636/yr at 5% interest with a 20 yrs term is ~$120,000. These calculations do not include other pumps, chemicals, equipment repair/replacement, etc. The power consumption is 79 kW-hr/1,000 gal/day. Flows are about 3,000 gpd.

Lagoons

Small communities have used lagoons for wastewater treatment in areas where land is relatively inexpensive. Lagoons, however, generally do not consistently produce a high-quality effluent. They are sometimes used in a hydrograph-controlled design so that the lagoons have adequate storage to hold the sewage until the release can occur when the receiving stream is at high flow, essentially diluting the effluent concentration, but not reducing the total mass load to the receiving stream.

Lagoons for low-operational small community applications may be facultative or partial-mix lagoons, although anaerobic and complete-mix lagoons exist. Facultative lagoons are aerated by the atmosphere and oxygen diffusion and mixing at the liquid surface. Facultative lagoons have an aerobic layer near the liquid surface, but also have an anaerobic layer closer to the bottom. Facultative lagoons are typically designed using a liquid loading and a mass loading that depends upon the temperature expected. A minimum of three cells is generally required.

In cold climates, open water surface lagoons ice over in winter and may not discharge until the water thaws. The sludge is retained in the facultative lagoon until it becomes necessary to drain the lagoon and remove the sludge. This is a large undertaking and fortunately is not required frequently. In warm and sunny climates, one of the major difficulties with facultative lagoons is algae production during the day, resulting in the release of a large suspended solids concentration and possibly a high concentration of suspended Biochemical Oxygen Demand (BOD). Moreover, the algae produces oxygen by photosynthesis during the daylight hours but utilizes dissolved oxygen at night, resulting in low dissolved oxygen (D.O.) concentrations with the associated poor microbial metabolism and wastewater treatment.

Figure 21. Typical Lagoon Wastewater Treatment Facility

Partial-mix lagoons have aerators sized to provide adequate aeration to supply the oxygen requirements for the process, but not so much aerator horsepower to completely mix the lagoon contents. This results in the microbial mass mostly remaining in the lagoon. Partial-mix lagoons are designed using microbial kinetic coefficients with the aeration requirements sized for summer temperatures when the microbial metabolism would be most rapid, and the detention time (lagoon volume) sized for winter temperatures when the microbial reactions would be slowest and therefore require longer detention time for treatment. Commonly, at least 3 cells are constructed for lagoon systems and the final cell is not aerated, allowing for settlement and clarification prior to discharging the treated effluent.

Some disadvantages of lagoons for small communities include:

- Lagoon treatment plants generally must be located outside municipalities, increasing infrastructure and energy costs to transport wastewater.
- Odors are common in lagoons.
- Lagoons are aesthetically unpleasing.
- Lagoons generally require a large footprint.
- Lagoons generally do not produce high quality effluent that meets today’s environmental standards.

Sequencing Batch Reactors (SBRs)

Sequencing Batch Reactors, or SBRs, are used on a limited basis for individual home systems, but more often for installations where regular professional operation and maintenance are provided. All of the processes of an activated sludge system are provided in a single vessel. The goal is to reduce the tankage (i.e. volume) while providing unit processes. The same tank is used for sedimentation, aeration, final clarification, and decanting the clarified supernatant.

The disadvantages associated with SBRs is similar to those of an CAS.

- SBRs typically require significant upfront capital costs. Sewer districts must incorporate as many users as possible to cover debt retirement. The public is often unsupportive since such expensive solutions are not financially practical.
- SBRs must be located outside municipalities, increasing infrastructure and energy costs to transport wastewater.
- Sizing treatment plants for future growth creates an unbalanced rate structure for initial users.
- SBRs typically require design flows for stable performance.
- SBRs typically require close attention and competent operating supervision, including routine laboratory control … The process requires major energy usage to meet aeration demands.

SECTION 12: OPERATION & MAINTENANCE

Orenco has been involved in thousands of commercial and community wastewater systems, providing education and training, design assistance, equipment, installation oversight, and operational support. We've learned that a long-term relationship between the technology provider and the entity responsible for the operation and management of the wastewater infrastructure is crucially important in order to help keep the infrastructure working efficiently and cost-effectively.

To address this need, Orenco's Engineered Systems Department includes an Asset Management Division with Post-Sales Account Managers who are dedicated to this kind of asset management and support. The only responsibility of our Post-Sales Account Managers is to work with collection and treatment system operators and owners. These Account Managers provide helpful operational advice, as well as information – via direct contact, newsletters, and an on-line discussion forum – on new products and product improvements that can improve system O&M.

STEP/STEG O&M

The O&M costs for a STEP system can be broken into two major components. The first component is the onsite system (also known as an "on-lot" system). The onsite or on-lot system includes the tank, effluent filter, pumps and controls, building sewer, and service lateral that are located on each individual property. The second component is the conveyance system. The conveyance system includes the collection mains, air release valves, odor control filters, and shutoff valves, all of which are typically located in the community's right-of-way. Manholes and lift stations are not normally required for STEP systems.

In the context of the overall system, the O&M cost of the conveyance component is normally insignificant. An O&M program for STEP collection mains typically includes inspection and exercising of air release shutoff valves in accordance with the manufacturer's recommendations, as well as replacement of media in any odor control filters (if they exist). While most STEP systems are constructed with a few cleanouts that facilitate the ability to pig or flush the mains, pigging or line-flushing is rarely, if ever, necessary. Breaks in or leaks from collection mains are rare and cost little to repair, especially compared to conventional sewers.

O&M costs for STEP systems are almost entirely attributable to the onsite components. Accordingly, the decisions made by system owners and operators relative to onsite equipment (tanks, filters, pumps), installation practices, and O&M protocols can have a profound impact on the overall cost of the STEP System. Understanding this is the key to understanding the characteristics of a properly constructed and maintained STEP system.

Onsite Equipment

All STEP packages should be carefully evaluated to establish the best value for the utility owner. In its most basic form, a STEP system could consist of a standard septic tank that includes a pump sitting on a concrete block. In its most advanced form, a STEP system could consist of a pre-engineered package that integrates a watertight septic tank with a specialized pump, protective filter, and controls into a single package. In reality, many of the existing STEP systems fall somewhere in-between. Historically, the former has a poorer performance record.

Each item of material should be evaluated relative to longevity, cost and reliability. For example, tanks can range from structurally unsound tanks that crack or collapse during installation and/or leak immediately to watertight tanks with watertight connections that can provide up to 50 years of anticipated life with proper installation. STEP pumps can range from a $150 cast iron effluent pump that will provide 5 years of service up to a $500 multi-stage high head effluent pump that should last 20 years or more. Effluent filters can range from less than 0.5 square feet of flow-through area using 1/4" mesh to filters with more than 20 square feet of flow-through area using 1/8" mesh.

When substandard materials are utilized, either in new construction or for replacement parts, an increase in O&M costs is a certainty. O&M costs can also increase if the existing building sewer is not inspected and/or replaced, since the building sewer is the source of most of the inflow that can plague system performance.

Onsite O&M Protocols

The O&M of onsite pump systems is best served when the onsite components are managed by the owner of the overall system, not the property owner. Access to onsite infrastructure that is owned by the management entity is normally facilitated by a system easement. Alternatively, some STEP operators have successfully employed a combination of Service Tariffs and/or Service Agreements that are intended to grant O&M access while preserving the rights of both the operator and the property owner. While property owners and home owner associations (HOAs) can sometimes succeed at providing O&M for the on-site system, these approaches have a poor track record, owing to the inability of these parties to legally require needed O&M. Moreover, property owners are generally unqualified to perform required O&M tasks. In practicality, most property owners are willing to grant a management entity the necessary access to a STEP system on their properties for the purpose of providing O&M, rather than face the burden of maintaining wastewater infrastructure themselves.

The O&M of onsite STEP systems is typically divided into two activities: proactive maintenance (PM) and reactive maintenance (RM). Protocols for onsite system maintenance vary greatly, even when comparing similar systems. Most systems have been operated with varying degrees of emphasis placed on PM activities, the frequency of which is dictated by the most sensitive components. Extremely aggressive PM programs have been able to reduce RM service calls to a point that they become relatively insignificant in overall O&M costs. Unfortunately, an overly aggressive PM program can also result in higher overall O&M costs when PM activities unnecessarily target components that have a significant level of reliability with less PM.

A less well-known O&M protocol – one that emphasizes RM – is a "run-to-fail" approach, whereby maintenance is only performed when equipment fails. Essentially, the operator waits for an alarm. This approach is fairly uncommon, but, when used, it has some important implications. While daily O&M costs (at least in the early years) may be extremely low, the increasing frequency of major repairs and replacement activities will escalate as the system suffers from neglect. Additionally, public perception of a run-to-fail approach is generally poor because this approach may place the customer in a more responsible position of identifying system alarms and reporting them to the management entity. Most studies show that customers want as little responsibility as possible for their systems.

Practically speaking, the most cost-efficient STEP management approaches balance PM and RM to achieve the lowest overall cost for O&M. The STEP systems that typically achieve the best overall O&M cost tend to base them on the required PM cycles for each different component. For example, tank effluent screens typically need inspection and, if necessary, cleaning every three to four years. The minimum frequency for pump and controls inspection is also about one year. Thus, a program can be designed to do these annually required tasks, and, during those visits, do the other less frequently required tasks at their required frequency, such as measuring sludge/scum accumulations every three years to determine tank pump-out intervals. As the records of high-quality STEP components are verified by experience, these minimum frequencies may be extended.

One of the most costly components of STEP O&M is tank pump-outs. Extended tank pump-out intervals can be achieved through the use of larger tanks and through the measurement of sludge and scum accumulation. In a managed STEP system, where tank inspections are executed as part of a PM program, pump-out intervals can be extended until they are functionally required. When a management program is in place, as is the case with centrally managed STEP systems, operators can arrange for earlier pump-out intervals for systems that have higher accumulation rates while extending pump-outs for systems with lower accumulation rates, providing cost efficiencies. Some studies have found that managed STEP tank pump-out programs can achieve pump-out intervals in excess of 10 years.

Table 38. Pump out frequencies; average and 95% confidence level

Glide Effluent Sewer 1987 (Average Pump-outs)				

1,000 Gal Tank				
Number of Occupants	2	3	4	5
Pump-Out Interval, yrs	55	28	17	10

1,500 Gal Tank				
Number of Occupants	5	6	7	8
Pump-Out Interval, yrs	23	17	12	8

Glide Effluent Sewer 1987 (95% Confidence Level)				

1,000 Gal Tank				
Number of Occupants	2	3	4	5
Pump-Out Interval, yrs	22	11	7	4

1,500 Gal Tank				
Number of Occupants	5	6	7	8

Pump-Out Interval, yrs	9	7	5	4

It is our experience that cost efficiencies can also be achieved in the areas of maintenance equipment and employee scheduling. Many STEP systems are serviced using equipment that is unnecessary for the tasks being performed. STEP systems can be maintained with a small pick-up truck and mounted suction pump, along with a minimal inventory of products, components, and tools that wear out most frequently. In addition, most tasks can be performed by a single service technician during regular – not overtime – hours. It is not atypical for a single technician with a pick-up truck to maintain more than 2000 STEP connections.

Public education is also an important tool for managing O&M costs. New customers should be given information about their wastewater collection system, along with the do's and don'ts for using their wastewater facilities. Annual mailers to existing customers should be used to provide ongoing reminders of these guidelines. When system alarms are attributable to misuse of or lack of knowledge regarding their systems, customers should receive additional training from service employees through direct contact, door hangers or follow-up calls.

Equipment Repair & Replacement

Over time, all components of a wastewater collection system will require renewal or replacement (R&R). R&R is an important element to consider when determining the life cycle cost or the best value of a wastewater collection system. The largest repair and replacement cost for any wastewater collection system that uses onsite pumps is typically related to the pump and its controls. A high quality STEP multi-stage effluent pump will include warranties of up to 5 years. These pumps may feature a run-dry capability, a UL listing, a continuous operation listing, and may also be manufactured from corrosion-resistant materials. The actual pump/control life is highly variable, but some studies have suggested they can provide 20 years of service. (Such a long service life may actually be encountered at a specific location, but USEPA cost rules suggest using a service life interval of no more than 10 years during project planning.) Additionally, pumps should be rebuildable when they need to be replaced, either by replacement of individual components or more generally by replacement of either the liquid end or the motor end.

While pumps are the main component of R&R, high quality tanks, filters, controls and discharge assemblies should not be compromised to shave capital costs. When lower quality components are being considered, designers should be required to evaluate any changes in R&R or O&M costs in order to assure the owner that the R&R demands are acceptable and that the lowest life cycle cost is being considered.
A <u>properly constructed and maintained</u> STEP system will provide a sustainable and economical solution for wastewater collection.

AdvanTex O&M and Energy Consumption

Orenco's AdvanTex Treatment System and its components are designed for highly cost-effective operation over the life of the system. Unlike other treatment systems, AdvanTex uses comparatively little energy requirements due to intermittent use of small Hp pumps.

Based on the design basis information specified in previous sections, the anticipated energy consumption for the proposed AdvanTex Treatment System is less than 4.2 kWh per 1000 gal. Compare this energy requirement to energy requirements for other treatment technologies:

Table 39. Energy Consumption for Various Treatment Technologies[1]

	Energy Requirement (kWh/1000 gal/day)		
Treatment Process	Average	Low	High

Activated Sludge[2]	3.954 kWh[2]	2.288 kWh[2]	5.44 kWh[2]
Aerated Lagoon	7.288 kWh	NA	NA
Oxidation Ditch	6.895 kWh	NA	NA

[1] Derived from "Water & Wastewater Industry Energy Best Practice Guidebook," Wisconsin Division of Energy, Dec. 2006

[2] "The 'low' and 'high' for activated sludge are based on different flow ranges. The high is for flows between 0-1 MGD while the low is for systems with flows greater than 5 MGD. The average is from 51 facilities operating from 0 to 5+ MGD." Ibid.

The following figure illustrates electricity use by average plant flow and type of treatment process. AdvanTex systems are an attached growth process, with electrical use at or below values reported for that of a trickling filter.

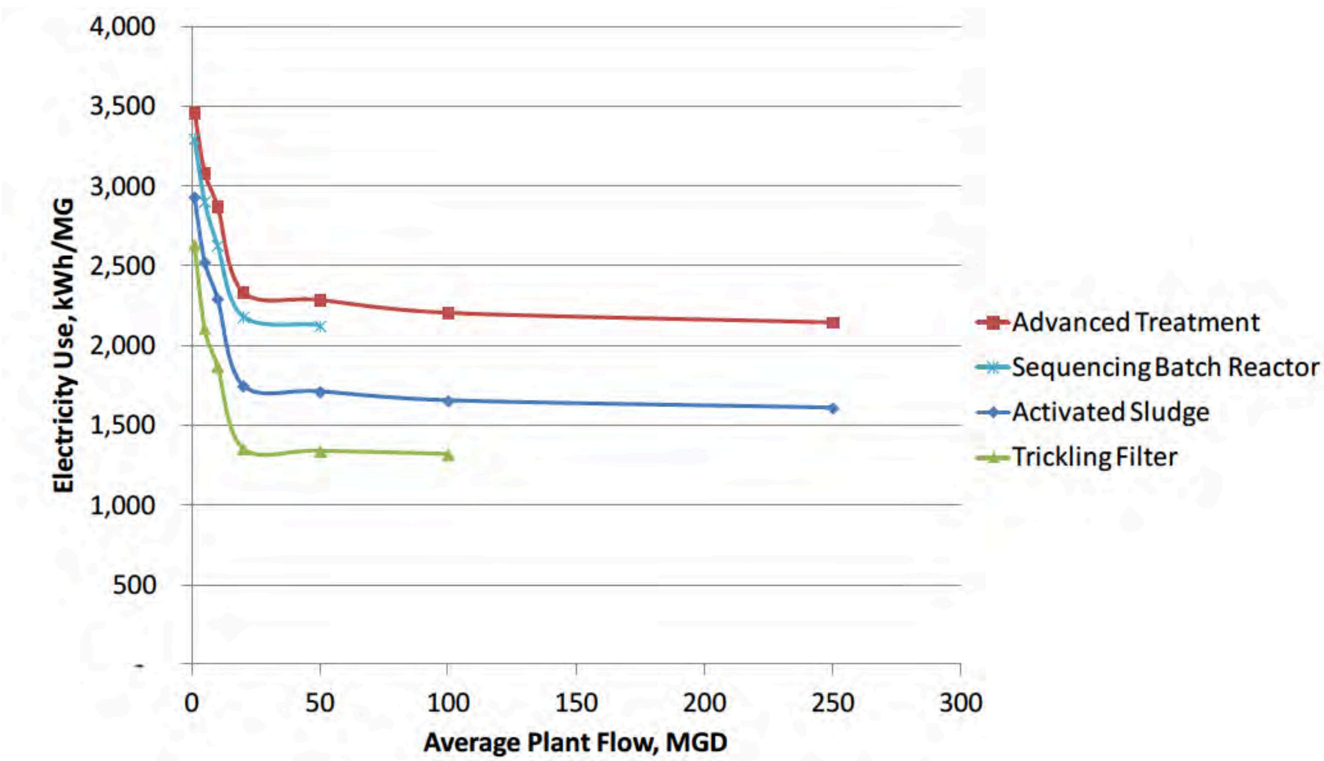


Figure 22. Daily electricity use by average plant flow and type of treatment processes employed at U.S. wastewater treatment facilities (EPRI, 2013).

In addition to low-power consumption, the maintenance requirements for Orenco's AdvanTex Treatment System are lower than for other technologies, which further enhance the system's cost-effective operation. As with any engineered system, however, the AdvanTex Treatment System will perform better and last longer if a qualified service provider regularly maintains it. Some basic O&M procedures are available upon request. Upon comissioning of the system, a custom O&M manual will be prepared and furnished with the equipment.

SECTION 13: SUMMARY OF PROJECTS AND SOLUTIONS

Orenco has provided equipment and technical support to countless projects of all types. For more than 30 years, Orenco has helped hundreds of communities find affordable decentralized solutions to wastewater problems ... solutions like the ones for the communities described below, which range in size from 40 to 3,000 connections. Operations staff are often the best resource to confirm operational requirements, performance, and costs. We encourage everyone to visit our installations to better understand real-world performance of our systems and solutions.

Glenwood, AL

An Orenco® effluent sewer collection system was installed in Glenwood, Alabama, that pumps filtered effluent nearly seven miles, without a single lift station, to the city of Luverne's gravity sewer infrastructure. Small diameter pipe was installed following the contour of the land, instead of the traditional gravity sewer with 4", 6", and 8" diameter pipe at a constant slope, which would have required deep excavations and shoring. Cleanouts replaced manholes and the ease of installation caused less disruption to the community. Total project costs were substantially reduced because a treatment system was not necessary.

Lake City, MI

Lake City, Michigan, wanted to take advantage of the regulatory and operational benefits of a treatment lagoon. An effluent sewer system was installed to pump primary treated filtered effluent to a nearby lagoon. Upfront loans and grants were minimized considerably due to the cost savings from using effluent sewer collection and small diameter force-mains. Additionally, operational requirements do not include periodic pigging (cleaning). In addition, the mainlines do not require minimum velocities, can use low-cost air release valves as used in water delivery systems, and can be oversized for growth.

Bethel Heights, AR

The rapidly growing community of Bethel Heights, Arkansas, needed a modular, "pay as you build" solution, with deferred costs. An effluent sewer system with media filtration (AdvanTex®) was installed in phases, allowing for capacity on demand and, more importantly, the ability to defer costs as developments were constructed. Since developments are spread out, effluent is pumped up to four miles through small diameter force mains to the cluster systems. A conventional gravity sewer system would require several lift stations, as well as a large up-front loan to cover the cost to install the collection system infrastructure. Gravity collection systems make up approximately 70-80% of total project costs and generally require rapid connections to fund infrastructure quickly.

Mobile, AL

South Alabama Utilities in Mobile, Alabama, needed to provide wastewater services to new subdivisions or risk losing customer share. Since the early 2000s, SAU has installed 60 miles of interconnected effluent sewer collection systems and 141 media filters (AdvanTex treatment) to serve numerous developments. Unlike traditional sewer, approximately 80% of the collection system costs are deferred until the homes are constructed. Moreover, because the area is susceptible to large storm events and consequently extended power outages, STEP systems have a minimum 24 hours emergency storage.

Lacey, WA

Located in Thurston County, Washington, approximately 50 miles south of Seattle, the relatively young city of Lacey lacked the infrastructure necessary to sustain population growth that started to occur in the mid-to-late 1980's. Lacey's population was just 13,940 in 1980, but by 2000 it had swelled to 31,226, an average annual growth rate of 4.9%. The cost of providing adequate wastewater infrastructure would have been extremely costly if a traditional sewering approach was utilized. While STEP (Septic Tank Effluent Pump) wastewater collections systems were relatively new, the City of Lacey looked at the use of STEP as a solution to their problems. In 1986, the first STEP system was introduced within the Lacey UGA. Today, the City of Lacey has a 33 square mile wastewater service area that includes approximately 100 miles of gravity sewer mains and 46 miles of STEP mains. The existing wastewater customer base includes approximately 11,500 gravity sewer connections and 3000 STEP connections that discharge directly into the gravity sewer infrastructure. From a performance standpoint, the on-site interceptor tanks perform 45-55% of sewage treatment.

Elkton, OR

In the late eighties, individual onsite septic systems in Elkton, Oregon — along the beautiful Umpqua River — were failing, threatening the river's water quality. In addition the septic systems were limited in capacity, and merchants realized they couldn't expand their businesses without making improvements. In 1989, a watertight effluent sewer system was installed that conveys effluent from about 100 onsite septic systems, of which 1/3 are STEG (gravity flow) and 2/3 are STEP (pump flow), to a 60x120 Recirculating Sand Filter (RSF) designed to treat 30,000 gpd. Final disposal of the treated effluent is to a drainfield consisting of 11,000 lineal feet, divided into twelve (12) zones. With a total system cost of $897,800, the average installation was less than $7,000 per connection, a fraction of the cost of a conventional/traditional approach/solution. Long term operational costs are reduced because septage pumping is typically no more frequent than once every 10-15+ years, depending upon occupancy loading.

Diamond Lake, WA

In the early 1970's, residents of Diamond Lake, Washington, knew that something had to be done about their wastewater. According to Bob McGowan, a long-time member of the Diamond Lake Water & Sewer Commission, "Our lake was being destroyed by leaking septic tanks and failing drainfields." The community needed federal funding assistance. Even so, "A gravity system was way out of reason," recalled Larry Garwood, former system operator, now retired. After nearly 15 years of research and planning, the Commission decided on an effluent sewer that uses lightweight pumps, typically 25-30 lbs, ½ hp, 115V. The system was installed in 1987, and its pumps are typically lasting 20 years. Plus they are relatively inexpensive to replace (~$400). Consequently, life-cycle costs are minimized.

SECTION 14: REFERENCES

References of system owners, engineers, and operators are available from Orenco. In addition, project tours are often available through the local regulatory jurisdiction or an Orenco equipment distributor. Call Orenco for more information about references or tours.

Table 40. STEP, STEG, and AdvanTex Reference Contact Information

Contact Name	Project Name	St.	Phone	E-Mail	# Conn.	Date	Notes
Dick Price	Steven's County PUD	WA	509-233-2534	dprice@stevenspud.org	1410	1997	STEP to Lagoon
Kevin Hegel	City of Montesano	WA	360-589-1141		1210	1991	STEP to conventional treatment plant
Scott Monroe	SW Barry County	MI	269-207-5324		1500+	1993	180 Grinder too - Hates Grinder
Floyd Wildman	City of Starbuck	WA	509-399-2373		93	2000	STEG. Using RX40/Upflow/Drip
Tim White	Swinomish	WA	360-466-7223	twhite@swinomish.nancysamnancy.us	120	1992	STEP. 14 years/ 5 tanks pumped
Zack Williams	Bethel Heights	AR	479-601-5932	zwilliams@bethelhightsark.org	450	2003	STEP w/ 45 AX100 w/ Drip Dispersal
Linda Higgins	City fo Elkton	OR	541-584-2547	cityofelkton@cascadeaccess.net	98	1989	STEP/STEG to RSF
Roger Dickenson	City of Lacey	WA	360-491-5644	rdickinson@ci.lacey.wa.us	2800	1986	STEP to conventional gravity
Braxton Platt	Southern Alabama Utilities	AL	251-649-4316	bplatt@southalabamautilities.net	3500	2001	STEP to AX - Mostly w/ Drip Dispersal
Pat Brook	City of Missoula	MT	406-523-4881	pbrook@ci.missoula.mt.us	1300	1995	STEP to conventional treatment plant
Mary Ann Westendorf	Amesville	OH	740-448-2411	mwestendorf@frontier.com	1500	2007	STEG to AX
Eric Arbut	Northport Point	MI	231-946-5874	earbut@gourdiefraser.com	200+	2003	STEP to AX

SECTION 15: UNIQUE ADVANTAGES

If selected, Orenco Systems offers a number of unique advantages. A number of unique advantages are listed below.

1. Orenco Systems has an Asset Management department that provides continuous operations and maintenance training for collection and treatment systems, therefore Geraldine will only have to work with a single company for collections and operations training/troubleshooting.

2. Orenco Systems has nine (9) licensed professional engineers (civil, environmental, mechanical) and over 250 employees that are available for project support.

3. Orenco Systems has been in business for over 30 years, and has installed thousands of ww treatment and collection systems.

4. Orenco Systems regularly conducts engineering training seminars in the State.

5. AdvanTex Treatment Systems are compact, odor free, and more aesthetically pleasing than other technologies (lagoons, CMAS process, etc).

6. Orenco Systems manufacture's and can supply pre-packaged controls buildings, per the following figure.

Figure 23. Sample control building (pre-packaged).

7. Orenco Systems furnishes a five year warranty for pumps, and three year warranty for treatment system equipment.

8. Small communities have highly variable flows that require unique wastewater treatment plants that are easy to operate and provide high levels of treatment with variable flows. AdvanTex systems (non-submerged, attached growth) are arguably the best available technology for small communities, and provide high quality effluent consistently. Attached growth processes are inherently more stable, with respect to the process, and less susceptible to shock loads.

9. Typically, the location of package plants requires careful consideration and must take into account factors such as water quality of the receiving stream, odor control, availability of usable sites, and proximity to existing residences and businesses. However, AdvanTex Treatment Systems (and packed bed media filters in general) are easier to locate than other package plants due to minimized odors. A number of references and examples are available to demonstrate location options for installed and operational AdvanTex facilities.

10. Consistent performance with highly variable wastewater strengths and flows, including overloads, due to attached growth process and micro-dosing for microbe management.

11. No release of untreated sewage.

12. Simple operational procedures compared to other treatment processes; no complex operational adjustments or controls.

13. Limited sludge management compared to more conventional processes.

14. Adequate surge storage for managing peak flows (depending upon anticipated design flows). Ideal for subsurface dispersal systems.

15. With multiple AX MAX Units, the system is inherently more redundant than providing a single unit or two units in parallel.

SECTION 16: QUALITY OF CONSTRUCTION MATERIALS

Orenco is headquartered in Douglas County, Oregon, where it has nearly 300,000 sq ft of facilities under roof. Employees work at either the company's 26-acre Sutherlin headquarters site – including a state-of-the-art composites manufacturing facility, an electrical controls division, and a full lab – or a 45-acre site in Winchester for large-scale manufacturing. Because Orenco is dedicated to science-based solutions, more than 10 percent of the company's approximately 250 employees are scientists or engineers. Orenco has engineers liscensed in Civil, Environmental, Manufacturing, and Mechanical Engineering.

Orenco manufactures standard products, custom products, and OEM products and has numerous third-party listings, including IAPMO, NSF, UL, and CE. Products and systems are sold through a network of more than 150 distributors and have been installed in more than 60 countries.

All vessels furnished in this proposal are manufactured of with either re-enforced concrete or fiberglass. Concrete structures are widely recognized of providing long-term solutions for wastewater treatment plants.

Pumps are manufactured by Franklin Corporation, with life-cycles approaching 15 to 20 years/pump. Orenco pumps utilize a floating impeller design, greatly reducing problems with abrasives & run-dry instances. Pumps are also manufactured with extra heavy-duty cords (SOOW, 600V), 24-hour run dry capability, and stainless steel construction. All of Orenco's PF pumps come with a 5-year extended warranty against defects in materials and workmanship.

Orenco's TCOM panels incorporate quality industry-standard components from known companies such as ABB, Allen-Bradley, Idec, Rittal, Phoenix Contact, and Schneider Electric to provide a reliable product used to maximize the lifespan of our systems. We build our control panels to the environmental spec as needed to ensure longevity against the elements, and each panel is thoroughly tested and certified per Underwriter Labratories (UL) stringent requirements.

AX MAX structures are manufactured of fiberglass. Orenco Systems Inc. has been in the business of manufacturing fiberglass products for over 30 years. Orenco utilizes three main processes in the manufacturing of its' fiberglass products:

1. Resin Transfer Molding - automated fiberglass injection molding utilizing robotic pre-forming.
2. Filament Winding - process in which a resin-saturated strand of glass is wound around a rotating mandrel.
3. Vacuum bagging - closed-molded injection process used for very large components.

The AdvanTex AX MAX product is manufactured using the vacuum bagging/closed molded injection process. The closed molding process allows the production of a high quality, cost effective part that is very strong. Part weight, thickness, and glass percent ratio are very repeatable and accurate compared to other manual methods. This provides assurance that all units shipped are of nearly identical weight, quality and strength.

The AdvanTex AX MAX units are manufactured from fiberglass reinforced polyester resin and high strength fiberglass fabrics. The grades of resin and fiberglass are considered acceptable for use in water and wastewater environments. AX MAX units have a seamless, one-piece construction that utilizes a foam core construction with fiberglass laminate on all sides. The foam core is a minimum 2 lb/cu. ft. polyurethane or polyisocyanurate foam. The fiberglass laminate on either side of the foam core is a minimum of 0.17 inches thick. Inside and outside laminate surfaces are protected with a polyester gelcoat designed for continuous outdoor exposure.

To ensure high quality product standards the AdvanTex AX MAX units are manufactured to conform to the following ASTM standards:

ASTM C 581: Standard Practice for Determining Chemical Resistance of Thermosetting Resins Used In Glass-Fiber-Reinforced Structures Intended for Liquid Service

ASTM D 2584: Standard Test Method for Ignition Loss of Cured Reinforced Resins

ASTM D 790: Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

ASTM D 2583: Standard Test Method for Indentation Hardness of Rigid Plastics by Means of Barcol Impressor

ASTM D 2563: Standard Practice for Classifying Visual Defects in Glass-Reinforced Plastic Laminate Parts

SECTION 17: STATEMENT OF QUALIFICATIONS

Wes Anderson, P.E., joined Orenco's Community Systems group in February 2013 as a Community Systems Engineer. He has a bachelor's degree in civil engineering from the University of Wyoming and then spent nine years working with consulting engineering firms in Washington and Oregon. Wes has been involved with dozens of small municipal water, wastewater, and utility projects throughout the United States.

Jerry Van Auker is an Area Sales Manager in Orenco's Engineered Systems group. He focuses on community systems customers throughout the Midwest. He joined Orenco in January 2013 after working in the wastewater products industry for more than 30 years. Jerry has a broad understanding of both municipal and industrial wastewater systems — and their equipment — as well as degrees in mechanical engineering and marketing.

Ben White, P.E. is a Community Systems Engineer for the Southeast Region at Orenco. He supports municipal entities by providing customer training, helping engineers to specify and design decentralized systems, and establishing new business relationships. Ben has a bachelor's degree in civil engineering and 14 years of experience in water and wastewater engineering for developments and municipalities. He has consulted on a variety of projects including onsite systems, subdivisions, and commercial developments.

Garry-Lee Espinosa has been with Orenco Systems since 1998. He currently works as a Community Systems Engineer in Orenco's Community Systems Department, providing support for our sales engineers, reviewing plans and specifications, managing bids and quotes, and providing logistical sales support. Prior to joining Orenco, Garry-Lee worked as an AutoCAD draftsman for the Department of Veterans Affairs. He has an A.S. degree in Manufacturing Engineering from Umpqua Community College.

Tyler Molatore, P.E. is Orenco's Community Systems Program Manager. He assists Orenco's engineers and private consulting engineers with evaluating various wastewater collection and treatment system options for communities. Over the past few years, Tyler has compiled, published, and presented information about the life cycle costs of various decentralized wastewater technologies. Tyler earned a Bachelor of Science degree in mechanical engineering from Oregon State University and has been with Orenco since 2002.

Darren Paschke has been with Orenco Systems since 1991. Currently, he serves as Asset Manager of Orenco's Engineered Systems Department. In this role, he works with owners, operators, and managers of the company's larger systems (for municipal applications and fringe development, as well as commercial applications). He travels around the country, talking to operators of Orenco's Effluent Sewer Systems and AdvanTex® Treatment Systems, gathering performance and cost data and analyzing this data to help system operators optimize O&M processes and reduce long-term costs. Darren holds a bachelor's degree in business from Oregon State University.

Steve Miles is a Systems Asset Manager in Orenco's Community Systems Group. He has been in the wastewater industry for almost 20 years, primarily as a system operator. In his current position, Steve works with operators of STEP/STEG systems in the western United States to collect data, install upgrades, and troubleshoot difficulties. Formerly the Oregon Regional Director of PNCWA, Steve now serves on the Oregon Department of Environmental Quality's operator certification advisory group and is certified as a grade IV wastewater treatment operator. He earned a bachelor's degree in Economics from U.C. Santa Barbara.

SECTION 18: EXAMPLE BID TABULATIONS

A number of bid tabulations are available from over 50 recently constructed wastewater projects. Tabulations are available that use STEP sewers, gravity sewers, grinder sewers, AdvanTex systems, lagoons, and other wastewater treatment processes. Some relevant examples are provided in the Appendix.

SECTION 19: FREQUENTLY ASKED QUESTIONS

- Does every residence in an Orenco Effluent Sewer require a Septic Tank Effluent Pumping (STEP) system?

No. Depending upon the elevation of the interceptor tank and the pressure in the collection main, certain connections, referred to as Septic Tank Effluent Gravity (STEG) systems, can gravity flow into main lines. Relatively simple hydraulic analyses are required to determine which connections require STEP systems and which permit STEG systems. Orenco Effluent Sewers can be entirely STEP or STEG, or any combination thereof, depending upon the results of the hydraulic analyses.

- Gravity sewer systems, and at times grinder sewer systems, frequently require lift/pump stations to convey wastewater to the point of discharge. Do Orenco Effluent Sewer systems require lift stations?

Lift stations are generally not required with Orenco Effluent Sewers, even when the point of discharge is located miles away from the point of wastewater generation. Main lines are normally sized to allow communities to standardize on a single high-head effluent pump, typically 10 gal/min, ½ hp, throughout.

- In existing neighborhoods, conventional gravity sewers are normally installed under existing roads, often-requiring road removal, replacement, and closures. Where are Orenco Effluent Sewers typically installed and are road closures common?

Orenco Effluent Sewer mains are generally installed in the right-of-way next to the road, thus avoiding road removal, replacement, and closures. Main lines are typically small diameter, often just 2". Main lines follow the contour of the land and are installed at shallow burial depths, below frost depth, much like water lines. As a result, small open trench installation is common, as well as directional boring, a trenchless method for installing small diameter pressure pipe. Directional boring significantly reduces the construction trauma and elevated costs associated with avoiding utilities and driveways in existing communities.

- Do I need to replace my septic tank if an Orenco Effluent Sewer system is installed?

Probably. Some communities have used existing tanks in an Orenco Effluent Sewer, but that is rare. Existing tanks require a thorough evaluation to confirm watertightness and structural integrity. Older tanks are often leaky and structurally inadequate, leading to increased infiltration, less efficient solids digestion, compromised secondary treatment processes, and higher maintenance costs. However, recently installed tanks built to sound specifications are definitely worth evaluating.

- Do Orenco Effluent Sewer systems require an AdvanTex treatment process following them?

No. Although AdvanTex Treatment Systems are manufactured and designed specifically to process effluent sewer wastewater affordably and reliably, several other secondary treatment processes can be paired with Orenco Effluent Sewers. Plus, nearly all types of secondary treatment processes can be downsized with effluent sewers, as effluent sewers are the only technology that provides primary treatment.

- Septic tanks are normally pumped out at intervals of three years or less. How often do the on-lot tanks used in Orenco Effluent Sewers require solids removal?

Typically 7-12 years. Septic tank pump-out intervals are generally mandated by local health departments, and they are based upon short-term solids accumulation studies that fail to take into account long-term solids-decomposition in interceptor tanks. The microbial activity that optimizes decomposition takes up to three years to develop fully. When a management program is in place, pump-outs are scheduled based on sludge/scum inspections and monitoring records so that costs are controlled. Onsite regulations and manuals may encourage frequent pump-outs as a precautionary measure when an inspection program is not in effect; however, longer intervals are usually justified, particularly if an effluent screening device is in place. At a 95% level of confidence and assuming the national average of 2.5 people per home using a 1,000-gallon interceptor tank, pump-out intervals between 10 and 12 years are not uncommon.

- Are Orenco Effluent Sewers odorous?

No. Odors are not common in well-designed and operated Orenco Effluent Sewer systems because interceptor tanks vent naturally through building stacks and mainlines are completely enclosed and watertight. However, when discharging a grinder sewer line or effluent sewer line into an existing gravity sewer, hydrogen sulfide can be generated and control measures are generally necessary to combat odor and corrosion. These control measures include aeration, chemical addition, etc.

- Do Orenco Effluent Sewers have higher operation and maintenance costs compared to traditional gravity sewer systems?

No. Fact Sheets developed by the Water Environment Research Foundation show that O&M for effluent sewers is slightly less than O&M for gravity sewers.[1] In our experience, it is considerably less. Although gravity sewers have a low initial O&M cost, as they age, I&I (inflow & infiltration of extraneous water), expensive R&R (renewal and replacement), expensive system failures, SSO's (sanitary sewer overflows) and replacement of on-site laterals have substantial cost implications. Growing communities often offset these O&M costs with new, low-maintenance connections. However, small communities with aging systems generally lack the new connections that help to fund capital improvements to repair aging infrastructure. Orenco Effluent Sewers and AdvanTex Treatment Systems offer an affordable, low- cost alternative with reduced O&M requirements and lower life cycle cost requirements. Substantial savings are achieved through reduced infiltration and inflow, reduced biosolids production, reduced energy consumption, and less costly collection and treatment system infrastructure.

[1] *Fact Sheet C1, "Collection Series, Gravity Sewer Systems" and Fact Sheet C3, "Collection Series, Effluent Sewer Systems,"*
April 2010

- What is your experience with access and easements for the effluent sewer equipment that's on private property?

Property that has been platted with Orenco Effluent Sewers typically includes easements for operation and maintenance access. Recording easements for existing communities can be challenging, although service tariff's, often used by power and phone companies, have been employed successfully. Customers who insist on an easement can be accommodated by being charged for the cost of the survey and the recording of the easement.

- Can Orenco Effluent Sewers be upsized affordably to serve future connections/developments?

Yes. Orenco Effluent Sewers are easily oversized to accommodate future connections, at relatively low up-front and ongoing costs, due to the lack of solids in the main lines,. Because up to 85% of the cost of Orenco Effluent Sewers is associated with on-lot equipment packages (STEP system), the cost to upsize/oversize conveyance system infrastructure, a network of small diameter PVC or polyethylene pipe, is minimal … typically a small percentage of total project costs. Conventional gravity sewer collection systems, on the other hand, require expensive, large diameter gravity mains that are costly to oversize and maintain and comprise the majority of the cost of traditional sewer programs.

- Do AdvanTex Treatment Systems require full-time operation and maintenance oversight?

No. AdvanTex Treatment Systems, unlike systems that use conventional activated sludge processes, are renown for their low operation and maintenance requirements. Consequently, full-time oversight and operation are not required. AdvanTex treatment systems incorporate small, low Hp pumps that operate a fraction of the day. Control systems are straightforward with no need for continuous oversight and process manipulation.

- Can AdvanTex Treatment Systems be manipulated, in the future, to address more stringent discharge limits?

Yes. While AdvanTex Treatment Systems consistently and reliably produce effluent low in BOD_5, TSS, and nitrogen, they are easily paired with or followed by tertiary processes for further constituent removal, including disinfection, nutrient removal, etc.

- Can AdvanTex Treatment Systems be easily expanded to serve future connections/development?

Yes. AdvanTex Treatment Systems, unlike other technologies, are modular in nature, allowing communities to 'phase-in' treatment systems and resulting in capacity on demand. Communities anticipating growth or service area expansion can easily install additional AdvanTex filters in parallel with existing infrastructure to accommodate future connections. This defers up-front capital costs and operational costs until growth or expansion occurs.

- Do Orenco's integrated/complete systems with effluent sewer and AdvanTex Treatment require mandatory connections upon system commissioning?

No. Mandatory connections are not required with Orenco Effluent Sewers and AdvanTex Treatment Systems. Residents with on-site systems that have been approved by local regulators have the option of deferring connections because up to 85% of the cost of Orenco Effluent Sewers (up-front and future O&M) is associated with the on-lot equipment packages, not the sewer lines. In addition, AdvanTex Treatment Systems facilitate capacity on demand. On the other hand, because of their large upfront capital costs, conventional sewer systems with gravity collection lines and package treatment plants cannot "phase in" their systems; they require mandatory connections to fund their high costs.

- Can Orenco's Effluent Sewers be integrated into existing municipal infrastructure?

Yes, hundreds of effluent sewers convey primary treated effluent to existing gravity collection system infrastructure, lagoons, package plants, and any other secondary treatment process. Because Orenco Effluent Sewers provide primary treatment, secondary treatment technologies can be downsized.

- Have other communities implemented similar solutions?

Hundreds of communities have installed Orenco Effluent Sewer systems and/or AdvanTex Treatment Systems throughout the United States and internationally. Dozens of case studies are available, as well as operator/utility references or site visits.

STEP/STEG System and AdvanTex System Literature

Orenco Corporate Summary	Web Link
Orenco Solutions Brochure	http://sfdocs.orenco.com/2012/3/SolutionsBrochure.pdf

Effluent Sewer Literature	Web Link
Effluent Sewer Brochure	http://www.orenco.com/doclib/documents/abr-efs-1.pdf
Effluent Sewers - LEED Profile	http://www.orenco.com/doclib/documents/aho-fs-efs-7.pdf
Environmental Profile - Effluent Sewers	http://www.orenco.com/doclib/documents/aho-fs-efs-6-1.pdf
Design of Septic Tanks	http://www.orenco.com/doclib/documents/ntp-tnk-trb-3.pdf
Specifications	http://sfdocs.orenco.com/2012/3/EffSewerSpecUpdate.pdf
Sewer Comparison Chart	http://sfdocs.orenco.com/2012/9/SewerComparisonChart.pdf
Yelm Case Study	http://www.orenco.com/doclib/documents/ncs-7.pdf
Air Release Valve Drawing	http://www.orenco.com/doclib/documents/NDW-TD-EFS-AR-01_Model_1.pdf
Service Connection Drawing	http://www.orenco.com/doclib/documents/NDW-TD-EFS-SCA-01.pdf
STEP Drawing - Simplex	http://www.orenco.com/doclib/documents/NDW-TD-EPS-01.pdf
STEP Drawing - Duplex	http://www.orenco.com/doclib/documents/NDW-TD-EPS-DAX-01.pdf
Life - Cycle Paper - Effluent Sewers	http://www.orenco.com/doclib/documents/ntp-stp-tjm-1.pdf
O&M Considerations - STEP Systems	http://www.orenco.com/doclib/documents/ntp-stp-mls-1.pdf
STEP v. Grinder Paper	http://sfdocs.orenco.com/2012/10/ntp-stp-tjm-2.pdf
ProSTEP Brochure	http://www.orenco.com/doclib/documents/abr-stp-1.pdf
Tank Sizing For Large Flows	http://www.orenco.com/doclib/documents/ntp-tnk-trb-2.pdf
STEP Installation Manual	http://www.orenco.com/doclib/documents/nim-eps-1.pdf
Tank Pumping Intervals	http://www.orenco.com/doclib/documents/ntp-tnk-trb-1.pdf
Watertight Septic Tanks Paper	http://www.orenco.com/doclib/documents/ntp-tnk-esb-1.pdf
Glide Audit_Sludge/Scum Accumulation Rates	http://www.orenco.com/doclib/documents/ntp-tnk-trb-4.pdf

Treatment Facility Literature	Web Link
Sample Treatment Facility Layout – AX100s	http://sfdocs.orenco.com/2012/3/8_pod_-_Fiberglass_TNKAGM-opt2.pdf
Residential AX20 Brochure	http://www.orenco.com/doclib/documents/abr-atx-1.pdf
AX100 Treatment System Brochure	http://www.orenco.com/doclib/documents/abr-atx-ax100-1.pdf
Small Community Case Studies / Summary	http://www.orenco.com/doclib/documents/abr-smallcomm-1_prn.pdf
SAU Case Study	http://www.orenco.com/doclib/documents/ncs-28.pdf
Bethel Heights Case Study	http://www.orenco.com/doclib/documents/ncs-1.pdf

LEED Profile - AdvanTex	http://www.orenco.com/doclib/documents/aho-fs-atx-3.pdf
Environmental Profile - AdvanTex	http://www.orenco.com/doclib/documents/aho-fs-atx-5.pdf
AX100 Installation Manual	http://www.orenco.com/doclib/documents/nim-atx-ax-2.pdf
AX100 Misc. Detail Drawing	http://sfdocs.orenco.com/2012/3/ax100_misc_details.pdf
AX100 Detail Drawing	http://sfdocs.orenco.com/2012/3/AX100_pod_with_dims.pdf
AXMAX Brochure	http://www.orenco.com/doclib/documents/abr-atx-max-1.pdf
AdvanTex Design Criteria	http://www.orenco.com/doclib/documents/nda-atx-comm-pkg-1.pdf
Truesdale Case Study	http://www.orenco.com/doclib/documents/ncs-2.pdf
Wapsie Valley Case Study	http://www.orenco.com/doclib/documents/ncs-3.pdf
Amesville Case Study	http://www.orenco.com/doclib/documents/ncs-6.pdf
Performance Textile Systems Paper	http://www.orenco.com/doclib/documents/ntp-flt-trb-1.pdf

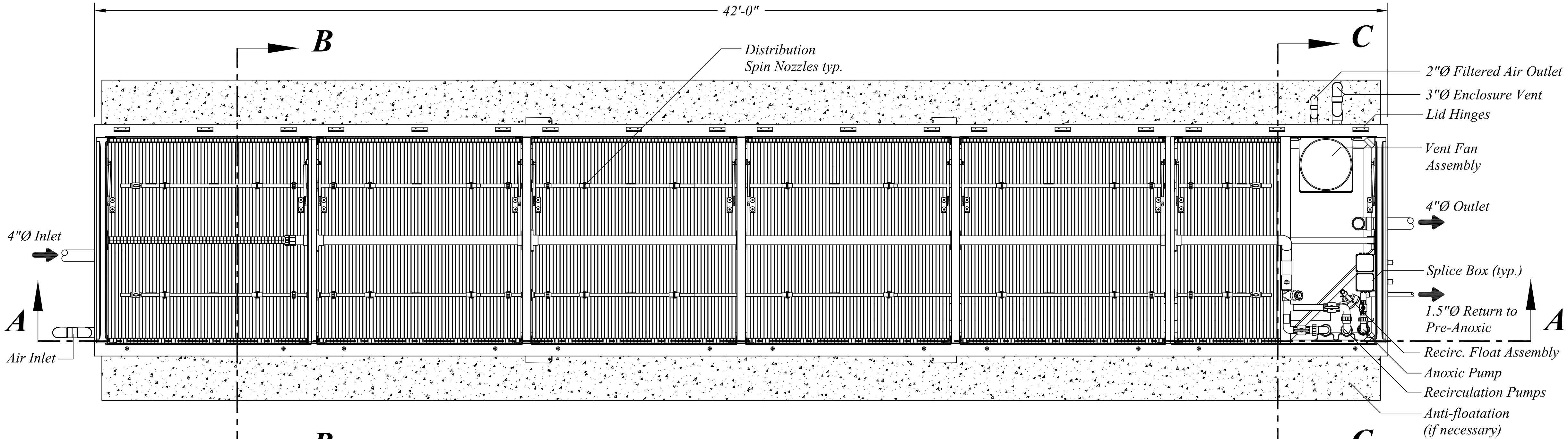
STEP/STEG System and AdvanTex System Drawings

Example Bid Tabulations

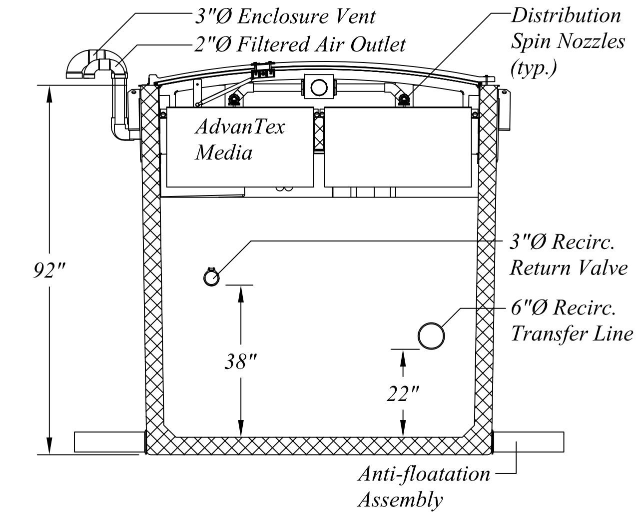
Detailed Cost Estimates

- Internal Design Inputs
- External Design Inputs
- Cost Summary for 1,500 gal STEP/STEG and AdvanTex System
- Cost Summary for 1,000 gal STEP/STEG and AdvanTex System
- Life-Cycle Cost Summary / Rate Structure Analysis
- Wastewater Treatment Facility Scope of Supply
- Wastewater Treatment Facility Cost Estimate
- Operation and Maintenance Estimate: AdvanTex Treatment Facility
- STEP/STEG System Scope of Supply
- STEP/STEG System Cost Estimate
- Operation and Maintenance Estimate: STEP/STEG System

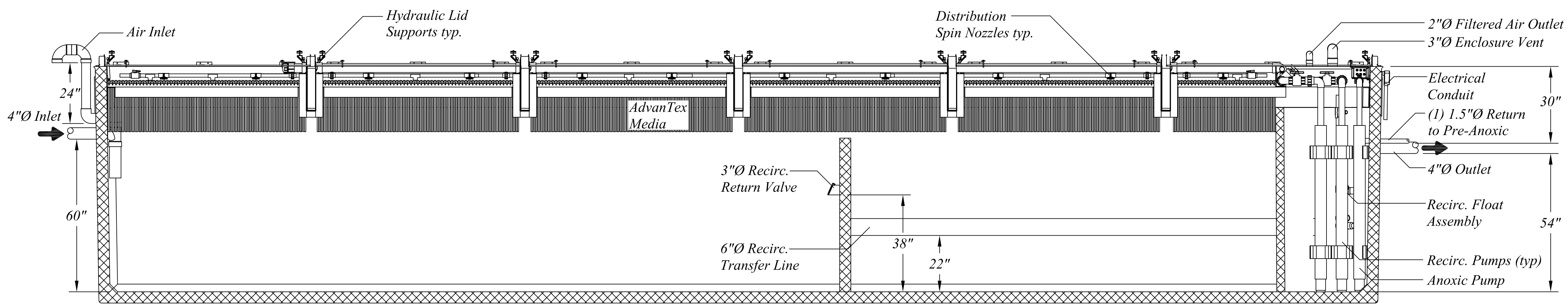
Appendix D – North East Facility Sample Drawing



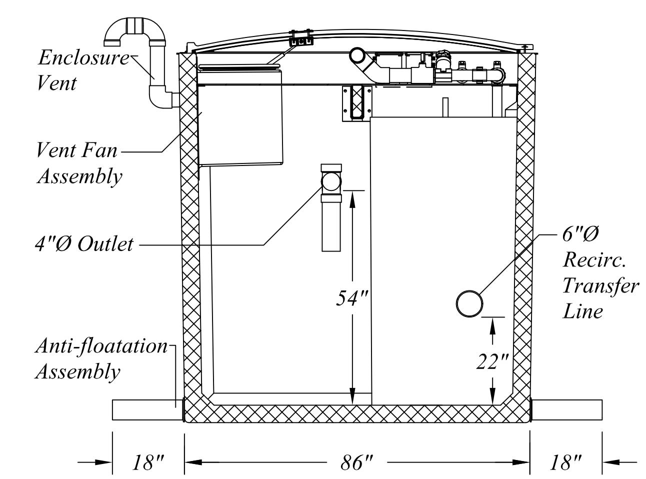
TOP VIEW



SECTION B-B



SECTION A-A



SECTION C-C

APPROVED:	
DATE APPROVED:	

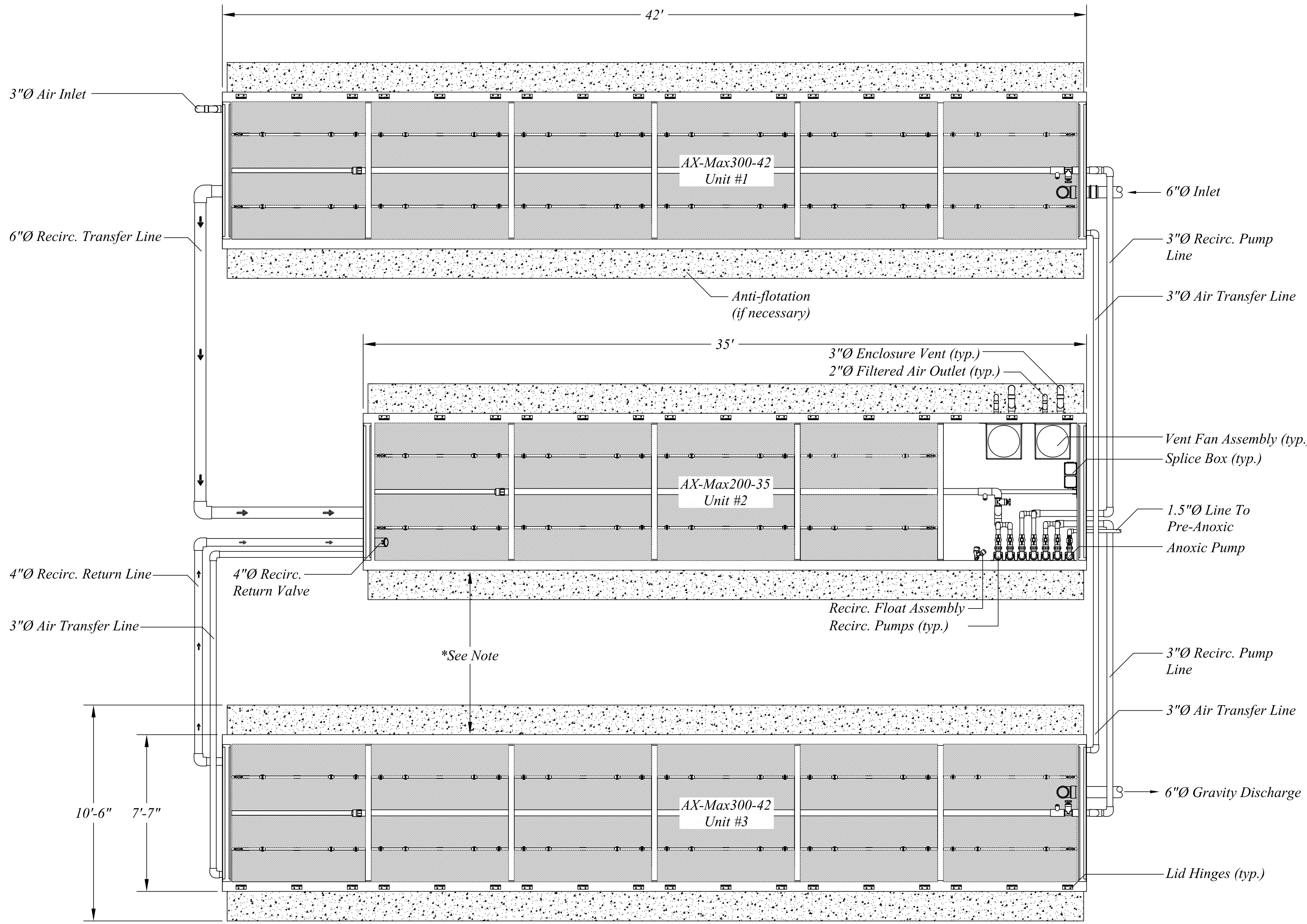
PRODUCT CONFIGURATION DRAWINGS

Orenco Systems® Incorporated
Changing the Way the World Does Wastewater®

Drawn By: DSM	Project: AX-MAX275-42 Gravity Discharge	Scale: 1" = 4'-0"	
Drawn For:		Sheet: 1 OF 1	
	Title: System Details	Rev: 1.1	Date: 05/20/14

Appendix E – South West Facility Sample Drawing

Note: Spacing between AX-Max units is dependent on desired bury depth. Consult Orenco Engineering for details.

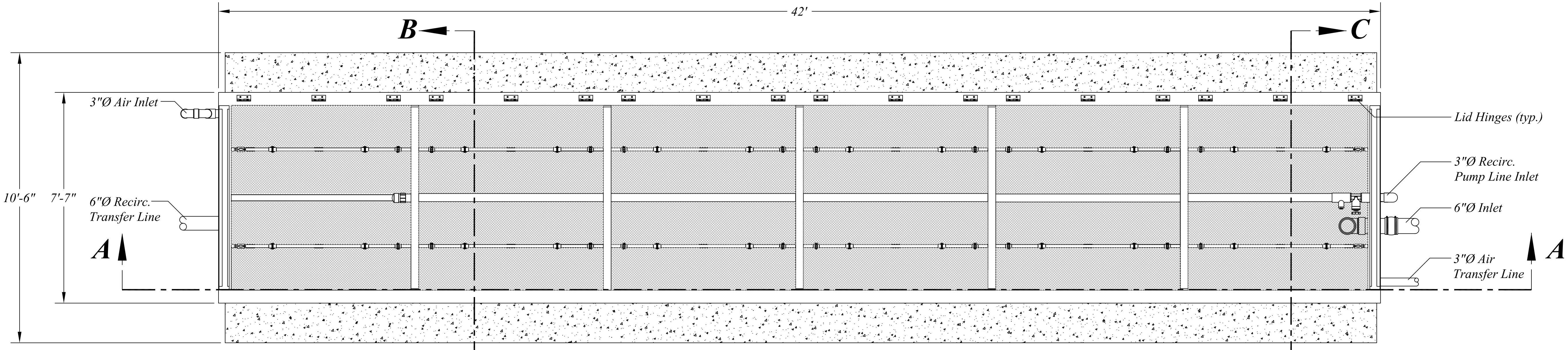


Approved:	
Date Approved:	

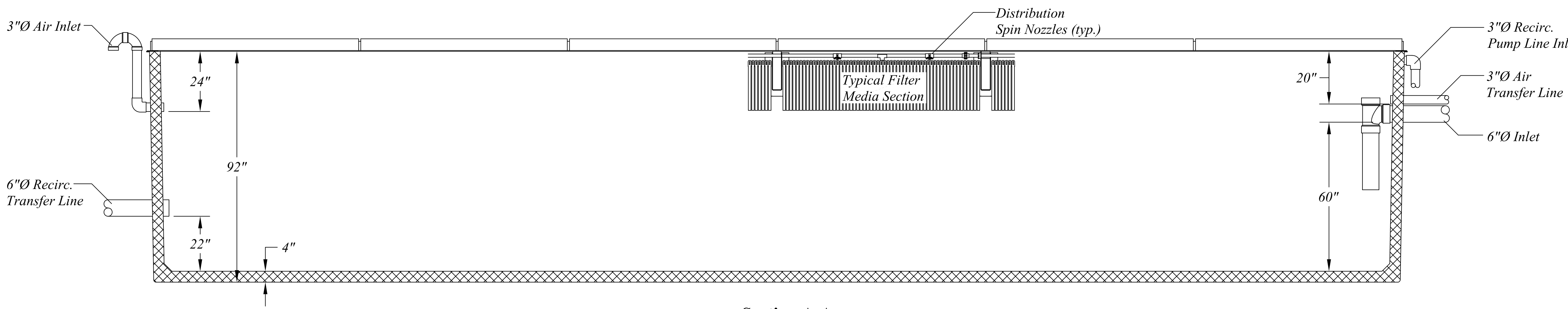
Product Configuration Drawings

Orenco Systems® Incorporated
Changing the Way the World Does Wastewater®

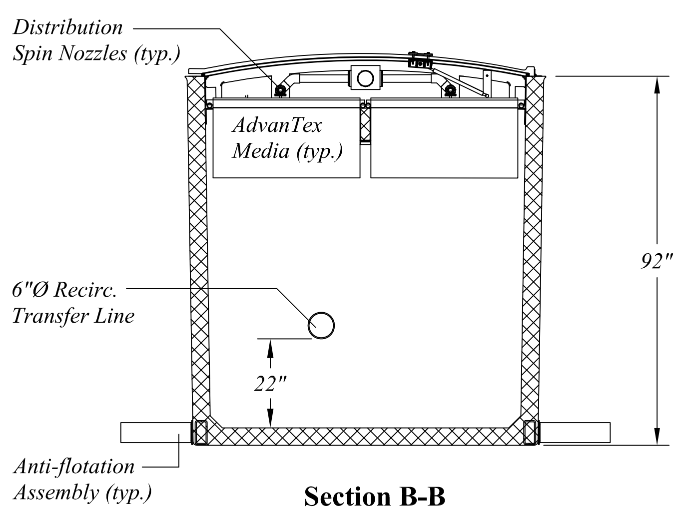
Drawn By: DSM	Project: AdvanTex AX-MAX 800 Gravity Discharge	Scale: 1" = 6'-0"	
Drawn For:		Sheet: 1 OF 4	
	Title: Plan View	Rev: 1.0	Date: 10/13/14



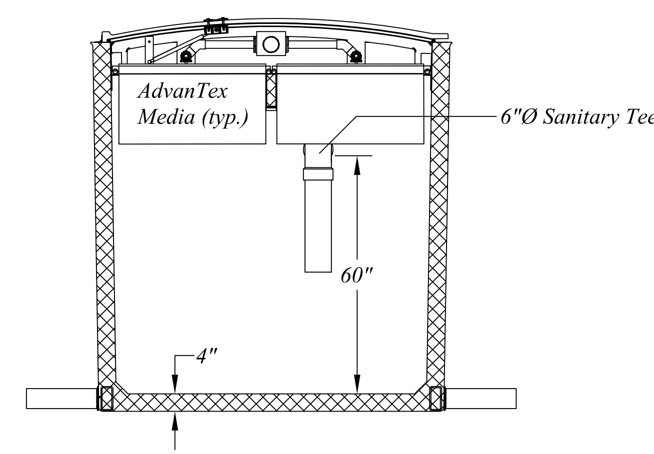
AX-Max 300-42
Unit #1 Planview
Scale: 1" = 4'-0"



Section A-A
Scale: 1" = 4'-0"



Section B-B
Scale: 1" = 4'-0"



Section C-C
Scale: 1" = 4'-0"

APPROVED:

DATE APPROVED:

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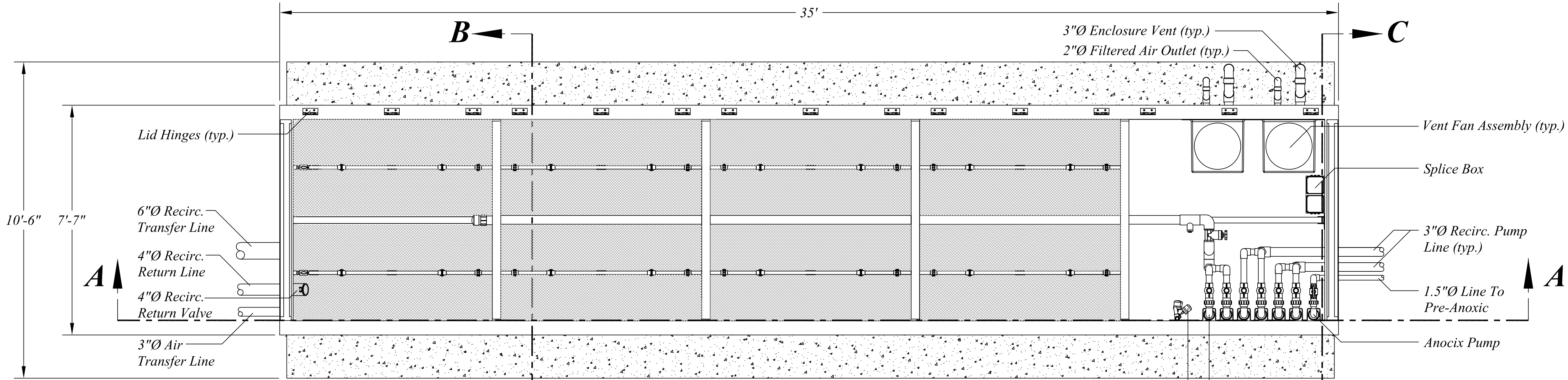
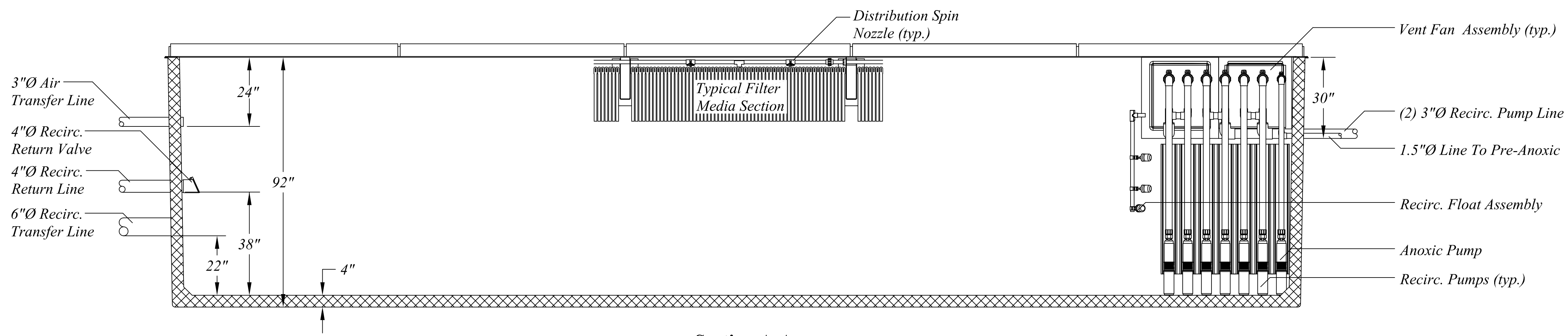
PRODUCT CONFIGURATION DRAWINGS

Orenco Systems® Incorporated
Changing the Way the World Does Wastewater®

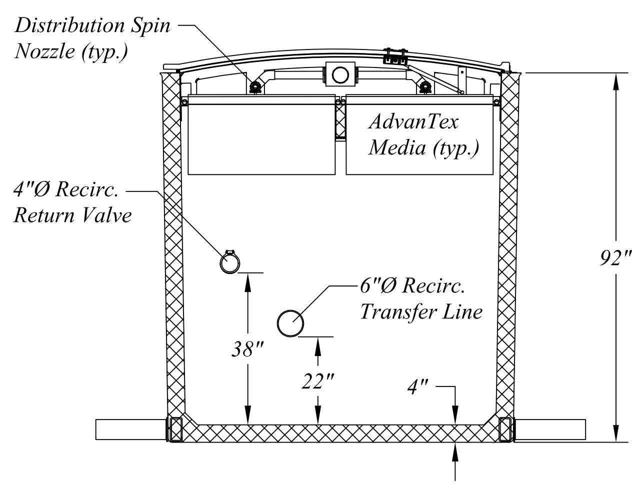
Drawn By: DSM	Project: AdvanTex AX-MAX 800 Gravity Discharge	Scale: 1" = 4'-0"	
Drawn For:		Sheet: 2 OF 4	
	Title: Unit #1 Details	Rev: 1.0	Date: 10/13/14



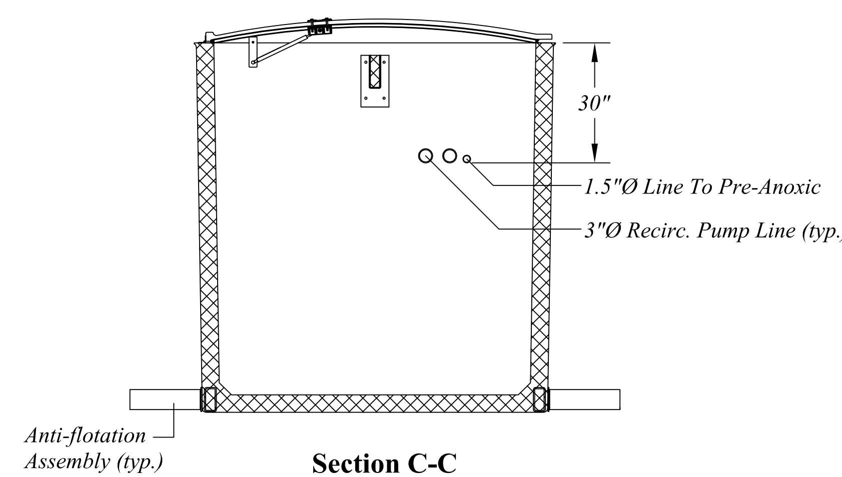
AX-Max 200-35
Unit #2 Planview
Scale: 1" = 4'-0"



Section A-A
Scale: 1" = 4'-0"



Section B-B
Scale: 1" = 4'-0"



Section C-C
Scale: 1" = 4'-0"

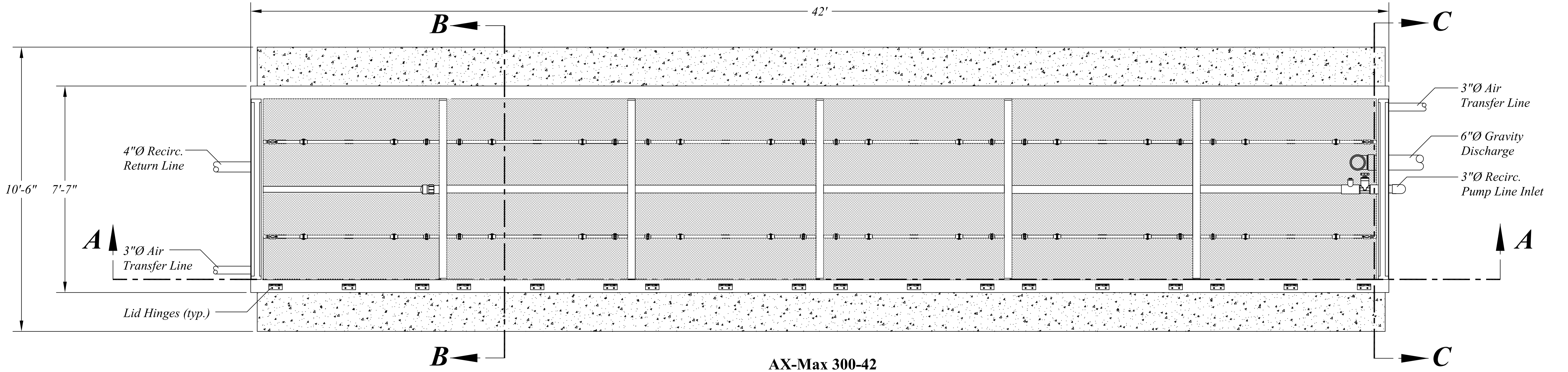
APPROVED:

DATE APPROVED:

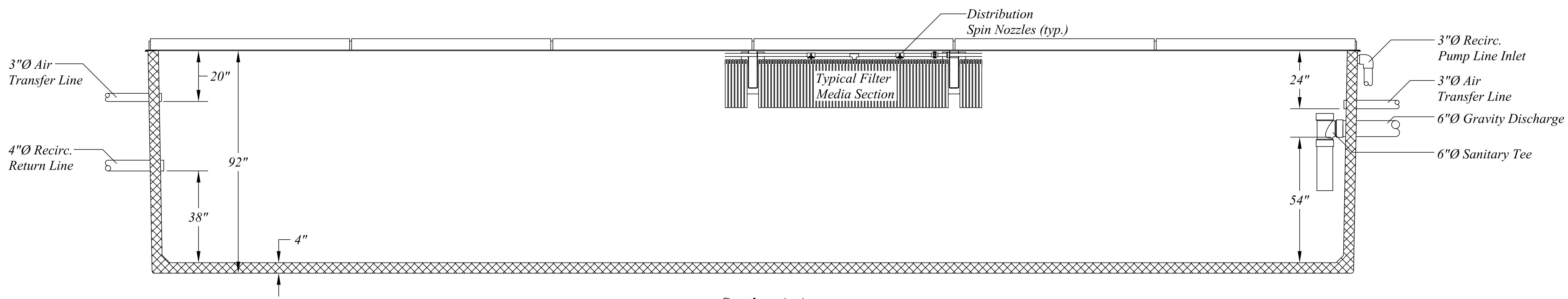
PRODUCT CONFIGURATION DRAWINGS

Orenco Systems® Incorporated
Changing the Way the World Does Wastewater®

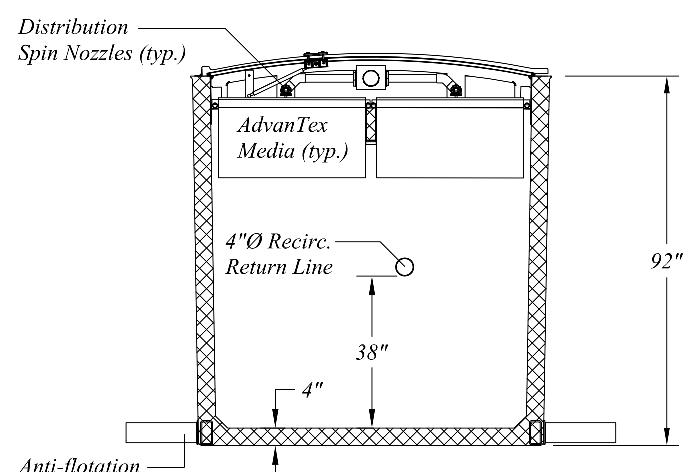
Drawn By:	DSM
Drawn For:	
Project:	AdvanTex AX-MAX 800 Gravity Discharge
Title:	Unit #2 Details
Scale:	1" = 4'-0"
Sheet:	3 OF 4
Rev:	1.0
Date:	10/13/14



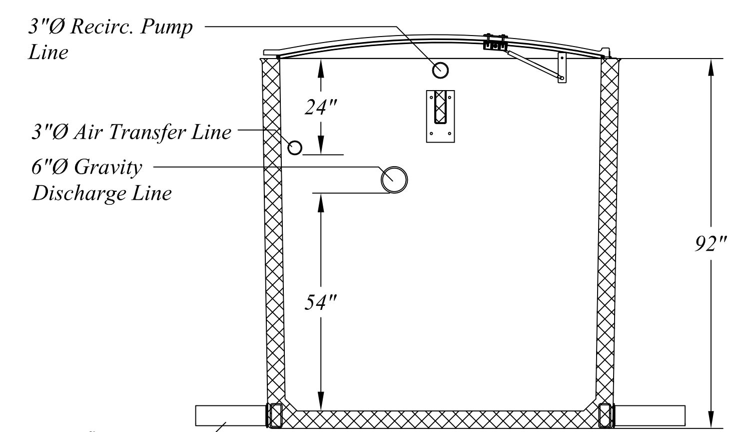
AX-Max 300-42
Unit #3 Planview
Scale: 1" = 4'-0"



Section A-A
Scale: 1" = 4'-0"



Section B-B
Scale: 1" = 4'-0"



Section C-C
Scale: 1" = 4'-0"

Approved:	
Date Approved:	

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Product Configuration Drawings

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Drawn By:	DSM
Drawn For:	
Project:	AdvanTex AX-MAX 800 Gravity Discharge
Title:	Unit #3 Details
Scale:	1" = 4'-0"
Sheet:	4 OF 4
Rev:	1.0
Date:	10/13/14