

Onsite Wastewater Reuse with Packed Bed Filters

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Ecovillage at Currumbin



Emirates One & Only Wolgan Valley



Audubon Center at Debs Park



LEED Platinum

EcoCenter at Heron's Head Park



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Tah.Mah.Lah.



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Nina Mason Pulliam Rio Salado Audubon Center



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Spaceport America



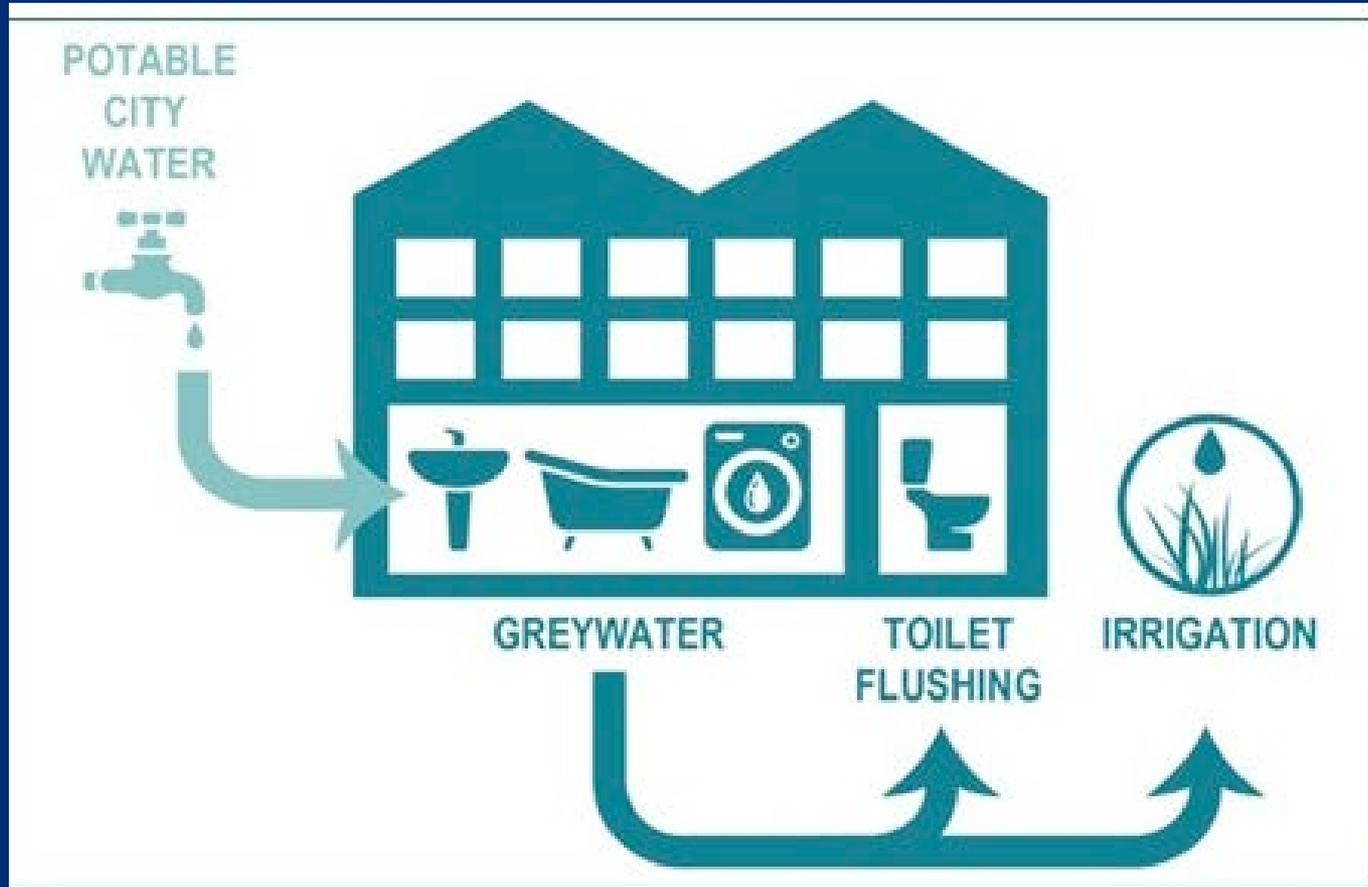
LEED Gold

Andrada Polytechnic and Pantano High Schools



LEED Silver

Greywater Treatment and Reuse



BSA Bechtel Summit



BSA Summit Project Goals

- Create a model for sustainability and environmental stewardship.
- Create a site that would be a “net zero energy” and “net zero carbon footprint environment
- Protect the New River by eliminating any direct discharge of treated wastewater



Boy Scouts of America

- 336 shower facilities
- Reuse of greywater for toilet flushing
- Rainwater makeup
- Potable water makeup



BSA Greywater System Requirements

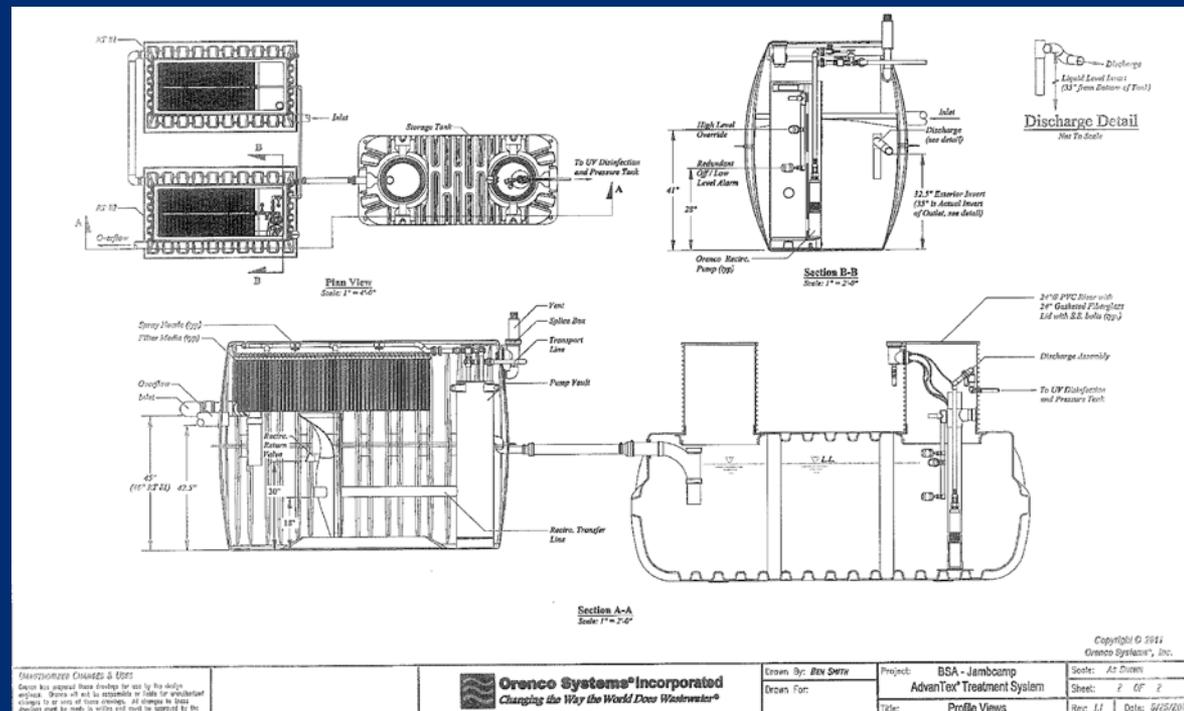
- Capable of treating 2,000 gpd per 24 hour period
- Minimal PVC. Preferable materials are fiberglass and HDPE
- Capable of using gravity only to divert flow to blackwater system, with no human interaction
- System to occupy as little ground space as possible
- 112 units required
- Capable of cycling from a non-use condition to full treatment use in 24 hours or less
- Energy efficient

BSA Greywater Treatment Criteria

	Avg	Max
cBOD5	10 mg/L	25 mg/L
Total Suspended Solids	10 mg/L	30 mg/L
Turbidity	10 NTU	20 NTU
E. coli	14 MPN/100 mL	240 MPN/100 mL
pH	6.5-8.5	

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- AX20-RT configuration
- Reuse for toilet flushing
- UV Disinfection



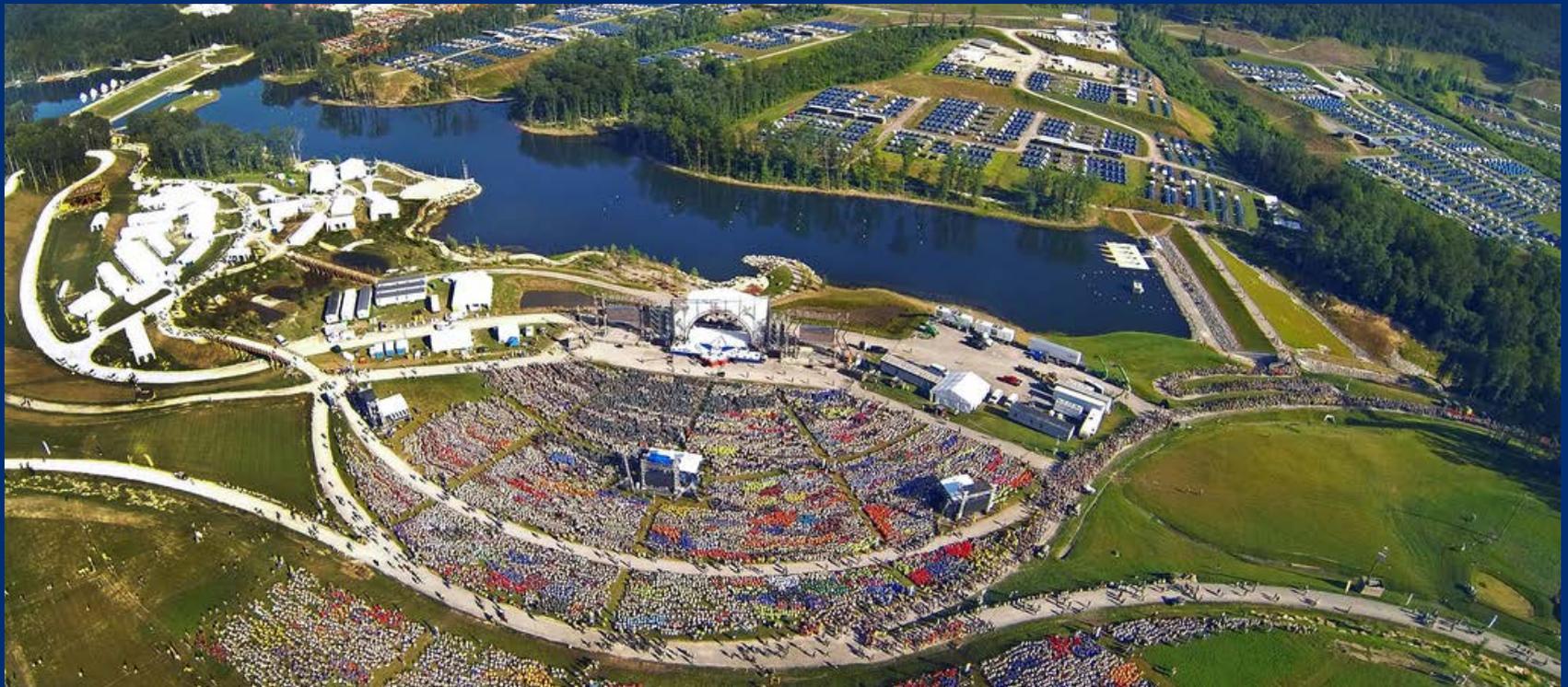
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BSA National Jamboree 2013



Typical Greywater Influent Characteristics

Determining Influent Constituent Concentrations:

Orenco prefers sampled data to establish influent waste strengths for greywater applications. When sample data is unavailable, NSF350-1 is typically used to estimate influent constituent concentrations. These concentrations are based upon what is being served and are listed in the tables below.

Table 4A-2: Expected Range of Greywater Constituents, 30-Day Average

Parameter	Application Type 6A, Shower/Bath Only	Application Type 6B, Laundry Only	Application Type 6C, Shower/Bath and Laundry
TSS	50-100 mg/L	50-100 mg/L	80-160 mg/L
BOD ₅	100-180 mg/L	220-300 mg/L	130-180 mg/L
Temperature	25-35° C	25-35° C	25-35° C
pH	6.0-7.5	7.0-8.5	6.5-8.0
Turbidity	30-70 NTU	50-90 NTU	50-100 NTU
Sodium	n/a	50-90 mg/L	50-90 mg/L
Total Phosphorous P	1.0-4.0 mg/L	<2.0 mg/L	1.0-3.0 mg/L
Total Kjeldahl nitrogen-N	3.0-5.0 mg/L	4.0-6.0 mg/L	3.0-5.0 mg/L
COD	200-400 mg/L	300-500 mg/L	250-400 mg/L
TOC	30-60 mg/L	50-100 mg/L	50-100 mg/L
E. coli	10 ² -10 ³ cfu/100 mL	10 ² -10 ³ cfu/100 mL	10 ² -10 ³ cfu/100 mL
Total coliforms	10 ³ -10 ⁴ cfu/100 mL	10 ³ -10 ⁴ cfu/100 mL	10 ³ -10 ⁴ cfu/100 mL

Table 1. Typical Residential Wastewater Flows per Person Per Day¹
 (40 to 70 gal/person/day, gpcd)

Source	Percent Daily Flow, %	Avg. Flow, gpcd
Dark water		
Toilets	26.7	14.2
Dishwasher	1.4	0.75
Kitchen sink w/grinder	1.1	0.6
Gray water		
Faucets	14.5	7.7
Clothes washer	21.8	11.6
Shower	16.8	8.9
Bath	1.7	0.9
Other domestic	2.3	1.2
Leakage	13.7	7.3

¹Adapted from EPA 2002, Metcalf & Eddy 4th Ed, WERF 2006, EPA Design Manual Onsite Wastewater Treatment and Disposal (1980):

Typical usage per person = 53 gpcd ±

Typical household usage per 3 to 5 occupants = 150 to 250 gpd/household

Greywater: 71% of 53 gpcd = 37.6 gpcd

2016 California Plumbing Code

1501.1.1 Allowable Use of Alternate Water. Where approved or required by the Authority Having Jurisdiction, alternate water sources [reclaimed (recycled) water, gray water, and on-site treated nonpotable *gray* water] shall be permitted to be used in lieu of potable water for the applications identified in this chapter.

2016 California Plumbing Code

1501.7 Minimum Water Quality Requirements. The minimum water quality for alternate water source systems shall meet the applicable water quality requirements for the intended application as determined by the Authority Having Jurisdiction. In the absence of water quality requirements *for on-site nonpotable treated gray water systems, the requirements of NSF 350 shall apply.*

2016 California Plumbing Code

1504.0 On-Site Treated Nonpotable *Gray* Water Systems.

1504.1 General. The provisions of this section shall apply to the installation, construction, alteration, and repair of on-site treated nonpotable *gray* water systems intended to supply uses such as water closets, urinals, trap primers for floor drains and floor sinks, above and belowground irrigation, and other uses approved by the Authority Having Jurisdiction. <<

2016 California Plumbing Code

1504.10.2 Minimum Water Quality. On-site treated nonpotable *gray* water supplied to toilets or urinals or for other uses in which it is sprayed or exposed shall be disinfected. Acceptable disinfection methods shall include chlorination, ultraviolet sterilization, ozone, or other methods as approved by the Authority Having Jurisdiction. The minimum water quality for on-site treated nonpotable *gray* water systems shall meet the applicable water quality requirements for the intended applications as determined by the public health Authority Having Jurisdiction. *In the absence of local water quality requirements for on-site treated nonpotable gray water, Section 1501.7 shall apply.*

2016 California Plumbing Code

1504.10.5 Required Filters. A filter permitting the passage of particulates no larger than 100 microns (100 μm) shall be provided for on-site treated nonpotable *gray* water supplied to water closets, urinals, trap primers, and drip irrigation system.

2016 California Plumbing Code

1502.8.3 Daily Discharge. *Gray water systems using tanks shall be designed to minimize the amount of time gray water is held in the tank and shall be sized to distribute the total amount of estimated gray water on a daily basis.*

Exception: *Approved on-site treated nonpotable gray water systems.*

NSF 350

TABLE 1 SCOPE OF NSF/ANSI STANDARDS 350 AND 350-1

NSF/ANSI Standard 350: On-site Residential and Commercial Water Reuse Treatment Systems	
Building Types	Residential, up to 1,500 gallons per day Commercial, more than 1,500 gallons per day and all capacities of commercial laundry water
Influent Types	Combined black and graywater Graywater Bathing water only Laundry water only
Effluent Uses	Nonpotable applications, such as surface and subsurface irrigation and toilet and urinal flushing
Ratings	Two classifications that vary slightly in effluent quality: <ul style="list-style-type: none"> • Class R: single-family residential • Class C: multifamily and commercial Systems are further described based on the type of influent (combined, graywater, bathing only, laundry only).
NSF/ANSI Standard 350-1: On-site Residential and Commercial Graywater Treatment Systems for Subsurface Discharge	
Building Types	Residential, up to 1,500 gallons per day Commercial, more than 1,500 gallons per day and all capacities of commercial laundry water
Influent Types	Combined black and graywater Graywater Bathing water only Laundry water only
Effluent Uses	Subsurface irrigation only
Ratings	Single effluent quality with no classifications

NSF 350

TABLE 6 SUMMARY OF DRAFT NSF STANDARD 350 EFFLUENT CRITERIA FOR INDIVIDUAL CLASSIFICATIONS

Parameter	Class R		Class C	
	Overall test average	Single sample maximum	Overall test average	Single sample maximum
CBOD ₅ (mg/L)	10	25	10	25
TSS (mg/L)	10	30	10	30
Turbidity (NTU)	5	10	2	5
E. coli ² (MPN/100 mL)	14	240	2.2	200
pH (SU)	6–9	NA ¹	6–9	NA
Storage vessel disinfection (mg/L) ³	≥0.5–≤2.5	NA	≥0.5–≤2.5	NA
Color	MR ⁴	NA	MR	NA
Odor	Non-offensive	NA	Non-offensive	NA
Oily film and foam	Non-detectable	Non-detectable	Non-detectable	Non-detectable
Energy consumption	MR	NA	MR	NA

From the California Plumbing Code, Section 1601.7 “for onsite nonpotable treated greywater systems the requirements of NSF350 shall apply.”

Cedar Springs Apartments

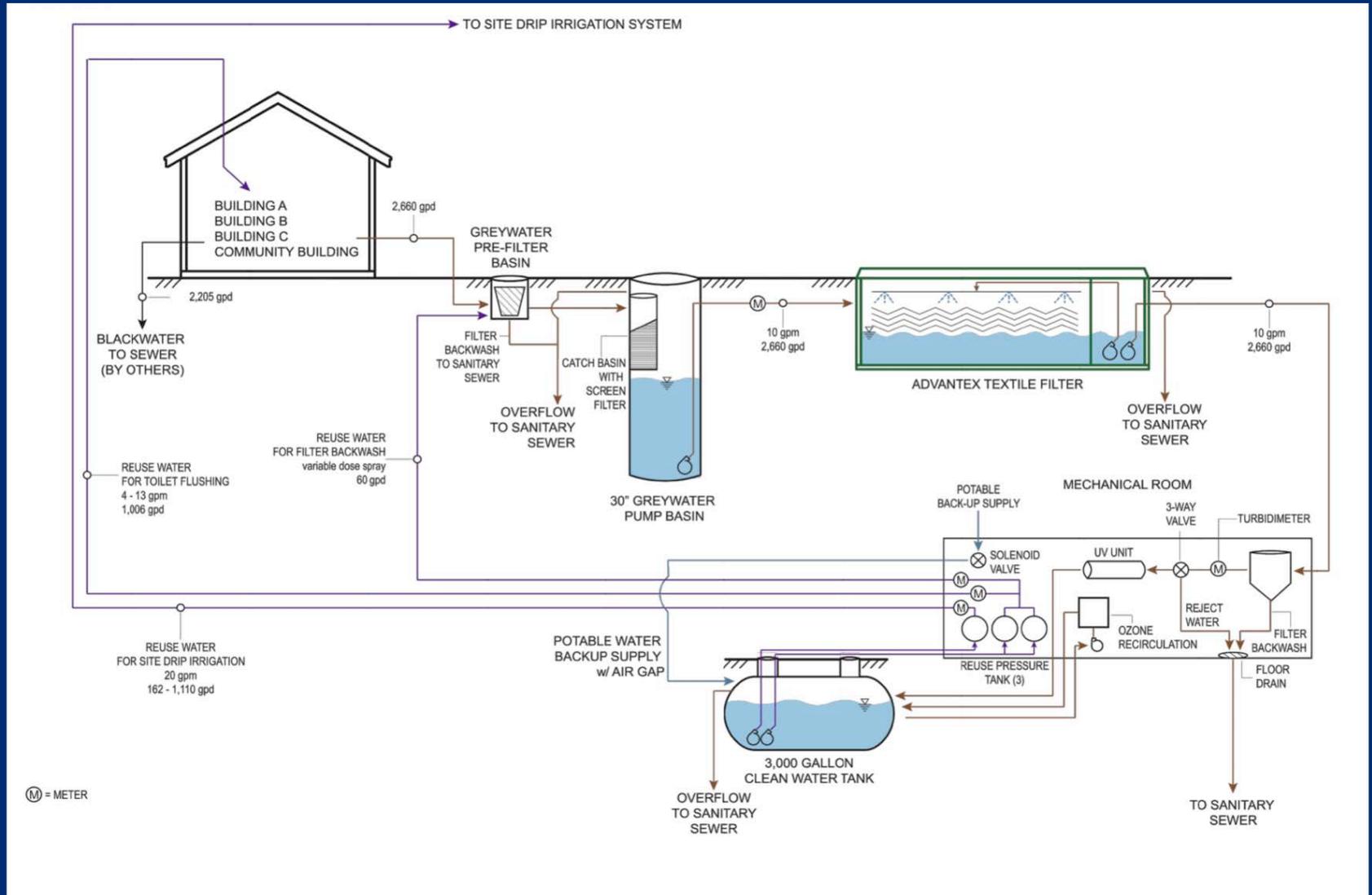


LEED Platinum and Net Zero Energy

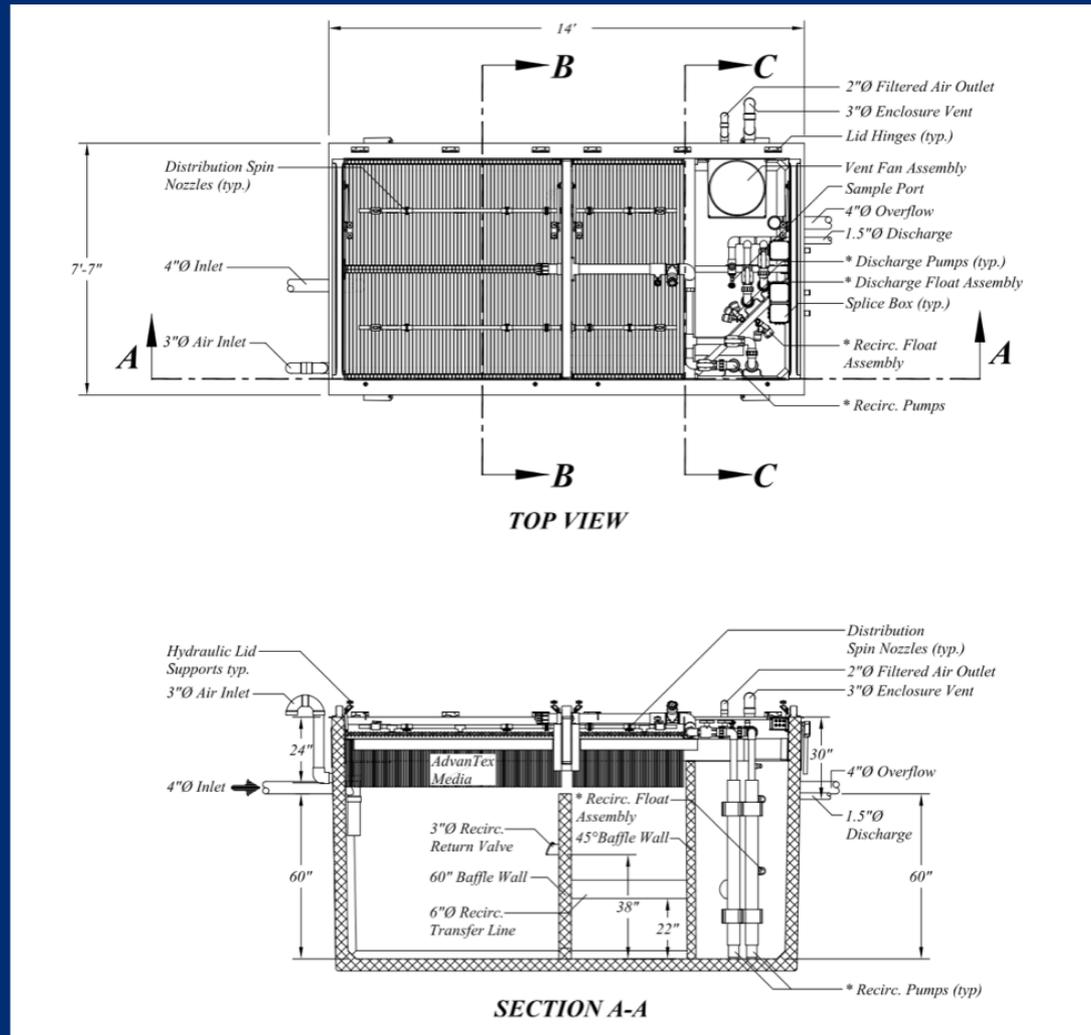
Cedar Springs Apartments



LEED Platinum and Net Zero Energy



AX-Max 075-14



Silver Star Apartments

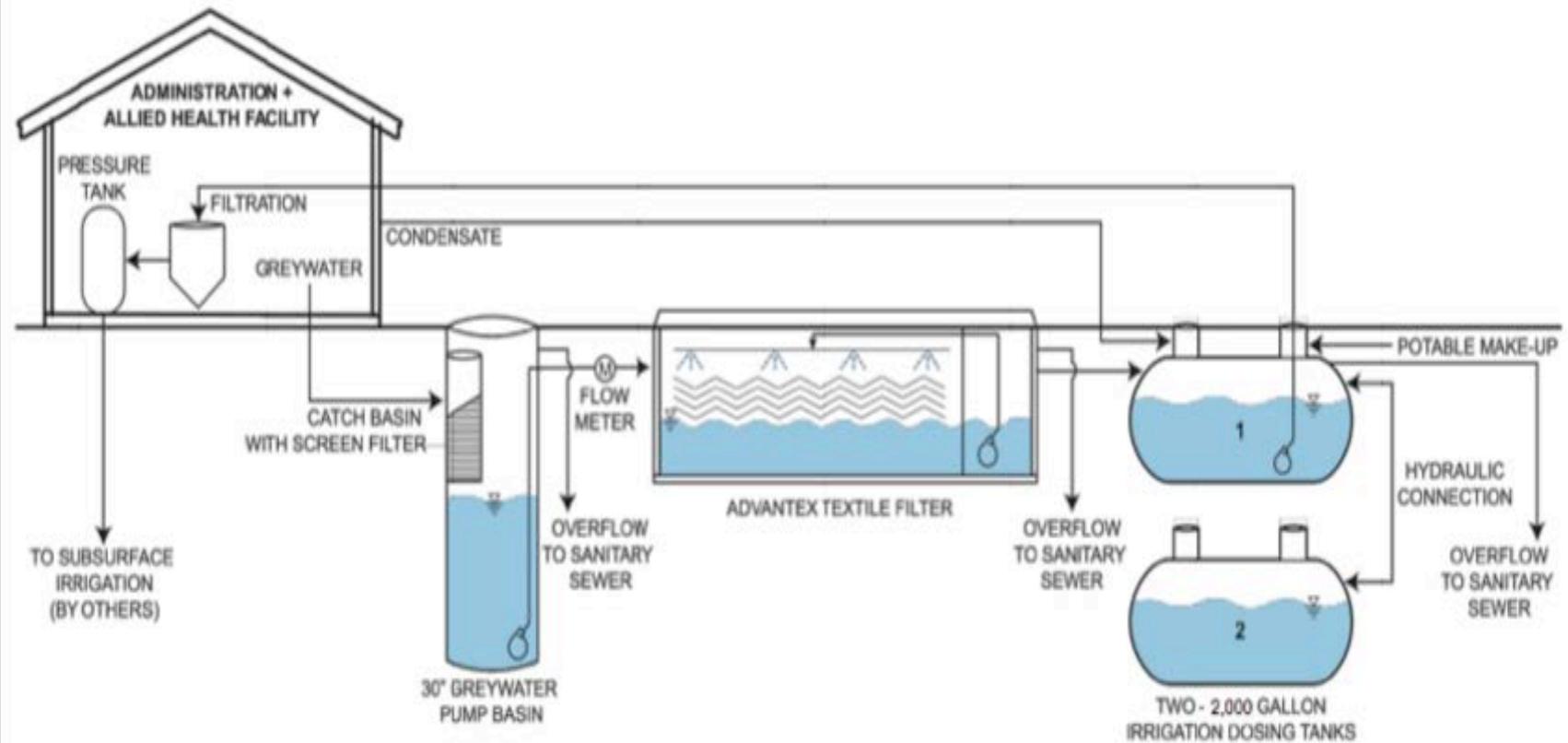


LEED Platinum and Net Zero Energy

University of Hawaii Administration Building



LEED Silver



Napa Creek Village



LEED Platinum

Harvest Village



LEED Platinum



La Kretz Innovation Center



Treatment System Energy Usage

Energy Intensity Values for Various WWTP Unit Processes (source: EPRI, 2013)

Unit Process	1 MGD Average Flow	5 MGD Average Flow
Attached Growth	630 kWh/MG	580 kWh/MG
Aeration with Nitrification	1080 kWh/MG	1080 kWh/MG
Sequencing Batch Reactors	1090 kWh/MG	1090 kWh/MG
Membrane Bioreactors	2700 kWh/MG	2706 kWh/MG

Solutions for Decentralized Wastewater Treatment

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