

Graywater System Specification

Issued by the Kansas Department of Health & Environment
February 14, 2014



Introduction

The drought that has affected Kansas since 2012 has prompted a closer look at water reuse opportunities. One option to conserve potable water is to recycle “graywater.” Such an option would include diverting the graywater from acceptable sources within a home to below the earth’s surface to irrigate lawns and other vegetation. This approach would allow the reuse of the graywater while preserving potable drinking water.

There are obvious benefits to graywater reuse; however, these benefits must be balanced with possible risks. Graywater is a source of bacteria, virus, protozoa and other pollutants that can pose health risks. The level of risk depends on the concentration of such sources, which varies depending on the graywater source. One of the primary risks associated with graywater reuse is illness from pathogens. It is commonly accepted that Fecal Coliform Bacteria or *E. coli*, which are found in the digestive systems of warm blooded animals, are indicators of potential disease causing organisms. A literature review of graywater research resulted in a finding that indicator organisms were present in all sources of graywater. The key is to minimize or eliminate exposure and eliminate sources of graywater in which the concentration of indicator bacteria is highest. Measures must be taken to minimize the risks and to insure the safety of public health and the environment.

Purpose

The purpose of the Graywater System Specification (Specification) is to offer guidance to local governments as well as homeowners on a recommended type of graywater reuse system that allows for the benefits of graywater reuse for subsurface irrigation while minimizing human health and environmental risks.

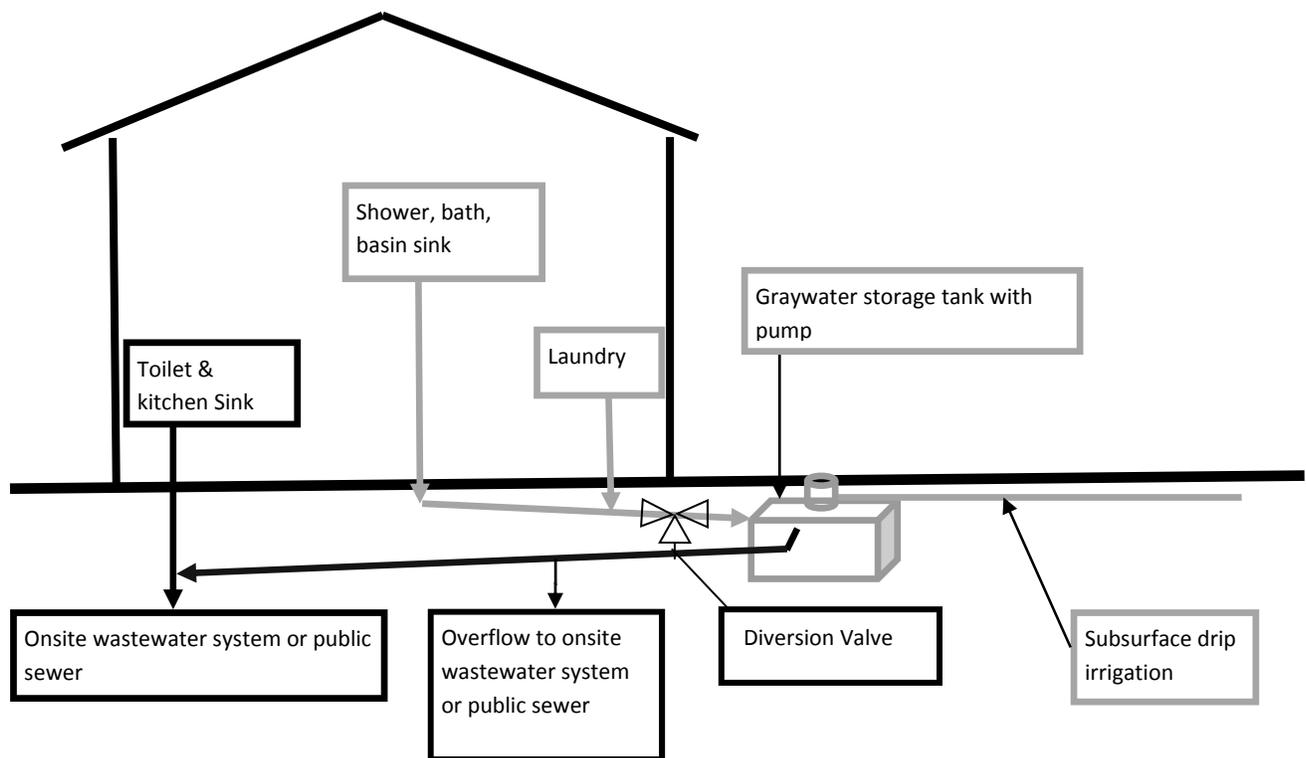
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What is Graywater?

For the purpose of this Specification, “graywater” is defined as wastewater from sources within single-family residences, including showers, bathtubs, clothes-washing machines, hand-washing lavatories and sinks that are not used for disposal of hazardous or toxic ingredients. Wastewater from sinks used for food preparation or disposal, sinks from workshops or garages, dishwashers, bidets, urinals, floor drains, reverse osmosis reject water and other water that has come in contact with toilet waste is defined as blackwater and is prohibited for a graywater reuse system. Any other source of wastewater not mentioned above is considered blackwater and therefore ineligible as part of this Specification.



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Graywater System Specifications

Article I. General Specifications

- Section 1.01 Graywater should only originate from a single-family residence that has an approved public or private onsite wastewater system. Wastewater from sources other than from a single-family residence is prohibited.
- Section 1.02 Wastewater from sinks used for food preparation or disposal, sinks from workshops or garages, dishwashers, bidets, urinals, floor drains, reverse osmosis reject water and other water that has come in contact with toilet waste is defined as blackwater and is prohibited for a graywater reuse system.
- Section 1.03 The total flow of graywater should not exceed the subsurface drip irrigation system flow, as designed.
- Section 1.04 An existing or proposed onsite wastewater treatment system should not be reduced in size with the addition of a graywater system.
- Section 1.05 Graywater System operation: Graywater should not be applied to food-producing plants. Graywater should only be used during the growing season. Graywater should not be applied when the soil is saturated.

Article II. Plumbing Specifications

- Section 2.01 All graywater system components should be designed and manufactured for the intended use of wastewater and/or graywater reuse systems.
- Section 2.02 The graywater system plumbing should include a diversion valve and an overflow pipe so graywater is redirected to an approved public or private onsite wastewater system when warranted. Such warranted cases include, but are not limited to: saturated or frozen soils, surface ponding and/or runoff, unusual odors, system back up, clogging of the filter, or when the graywater system has met flow capacity per the approved design calculations.
- Section 2.03 All installers of the plumbing should meet any and all licensing, certification, training or registration requirements as required by county or municipal code.

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Section 2.04 All piping outside of the house should be schedule 40 pipe or heavier with the exception of the subsurface drip irrigation lines.

Section 2.05 All plumbing materials should be clearly labeled to designate their use for graywater.

Article III. Subsurface Drip Irrigation Specifications

Section 3.01 Irrigation lines should be designed and manufactured for the use of wastewater and/or graywater systems. Irrigation lines designed and manufactured for the use of potable water for use in traditional irrigation systems are prohibited.

Section 3.02 The graywater system should utilize a filter designed and manufactured for use with wastewater /graywater and/or subsurface drip irrigation systems.

Section 3.03 The filter should be accessible, and maintained and cleaned per manufacturer instructions.

Section 3.04 All subsurface drip irrigation systems should be designed by a landscape architect, engineer licensed to practice in the State of Kansas, or by a designer licensed by the local authority.

Section 3.05 All graywater system designs should consider the graywater flow, land use and the vegetation being irrigated, the evapotranspiration rate, the type of soil, the grade of the site, and the total lot size to be irrigated when selecting appropriate tubing, valves, flush points and pipe size.

Section 3.06 All installers of subsurface irrigation systems should meet any and all licensing, certification, training or registration requirements, required by the local authority.

Section 3.07 The subsurface drip irrigation system should meet the following setback requirements:

- (a) 1 foot from all building foundations;
- (b) 2 feet from all property lines and/or easements;
- (c) 25 feet from a public water main;

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- (d) 10 feet from an in-ground swimming pool;
- (e) 50 feet from a spring, or from the bank of a surface water course, or from the overflow level (full pool elevation) of a pond, lake, or reservoir;
- (f) 50 feet from a private domestic water well or suction line;
- (g) 3 feet from the lateral field and tank of an approved private onsite wastewater system; and
- (h) 100 feet from a public water supply well.

Section 3.08 The subsurface drip irrigation system lines and components should be installed with minimum of 4 inches of soil cover and a maximum of 10 inches of soil cover.

Section 3.09 The subsurface drip irrigation system lines and components should be a minimum of 12 inches apart.

Section 3.10 If the subsurface drip irrigation system fails or failure is suspected, the owner should divert the graywater to the approved public or private onsite wastewater system until corrected.

Article IV. Tank and Pump Specifications

Section 4.01 All tanks, pumps and related components should be designed and manufactured for the use of wastewater and/or graywater reuse systems.

Section 4.02 All tanks and pumps should be installed according to manufacturer specifications.

Section 4.03 Design of the graywater system should not allow graywater to be stored in the tank for more than 24 hours.

Section 4.04 Tanks should meet the setback requirements in Bulletin 4-2 table 5.

Section 4.05 All tank and tank components should be exterior of the home and all structures.

Section 4.06 The tank including all extensions to the surface should be watertight to prevent leakage into or out of the tank. It should be structurally sound, meet H-10 loading rate standards, and made of materials resistant to corrosion from soil and acids produced from tank gases. Because of corrosion, steel tanks are prohibited.

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Section 4.07 Tanks should have an access opening with 20 inches minimum dimension to grade. Any opening extending to the surface should be child and tamper resistant. Ways to accomplish this include lids weighing at least 65 pounds, locks, or anchors that are not removable without special tools.

Article V. Variance Requests

Section 5.01 Homeowners residing in jurisdictions (example County or Municipality) without sanitary codes should submit the variance request directly to KDHE as follows:

- (a) The Homeowner submits a variance request to KDHE. The request should contain the following:
 - (i) Location / Address of proposed system;
 - (ii) Whether the proposed system is for a new construction or existing home;
 - (iii) Whether the home is/will be on an approved public or private onsite wastewater system;
 - (iv) Number of bedrooms and bathrooms;
 - (v) Number of fixtures for the following– Showers, hand washing lavatories and sinks, bathtubs, clothes washing machines;
 - (vi) Lot size;
 - (vii) Plot plan showing the following (if applicable): foundation of all structures, proposed location of graywater system lines, tank, pump, property lines, easement locations, waterways, public water main, swimming pools, surface water course (creek, pond, lake, stream, river), private water wells and lines, public water supply well, approved private onsite wastewater system or public wastewater lines;
 - (viii) Subsurface drip irrigation system should be stamped or sealed by a landscape architect, engineer licensed to practice in the State of Kansas, or by a designer licensed by the local authority.

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(ix) A copy of the designs indicating the amount of graywater captured per day, the proposed watering rate and maximum gallon per day allowances.

(x) Identification of the diversion valve, tank, pump, irrigation lines and filter.

(b) KDHE will review the variance request and notify the homeowner of their decision.

Section 5.02 Homeowners residing in jurisdictions (example County or Municipality) with local sanitary codes should submit the variance request to the local authority. The KDHE Watershed Management Section is available to assist the local authorities in evaluating variance requests. The KDHE Watershed Field Coordinators are the first point of contact for such requests.

Section 5.03 During construction of an approved graywater system, no changes to the design should be made. A new variance should be required if changes to the graywater system design are made.

Section 5.04 If modifications are made to an existing graywater system at anytime, a new variance should be required.

Section 5.05 Abandoned or unused graywater systems that have received graywater should be emptied and plugged in compliance with state law.

Section 5.06 Inspections of graywater systems should be required to the extent private wastewater system inspections are otherwise required.

Section 5.07 Graywater system resale inspections should be required to the extent private onsite wastewater system resale inspections are required by the local authority. Upon change of ownership or occupancy, the new owner or tenant should be notified that the residence contains a graywater system.

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Article VI. Best Practice Recommendations

- Section 6.01 It is recommended that graywater system owners maintain records that show the system design, location, identifies the fixtures that are the source of the graywater, describes maintenance requirements of this Specification and shows how the minimum irrigation area was calculated.
- Section 6.02 It is recommended that during the growing season the soil is kept at a constant moisture level without over-saturating the soil.
- Section 6.03 Pathogens, excreta, FOG (Fat, Oil, and Greases) and other impurities exist in a graywater system. Care should be taken to not introduce an excess amount of these items to the graywater system.
- Section 6.04 The following should be washed in a system that is connected to an approved public or private onsite wastewater system:
- (a) Soiled diapers, under garments and bedding.
 - (b) Bedding, rags, and clothing, etc. from persons infected with the flu, communicable diseases, or other illnesses.
 - (c) Washing hands that have been in contact with the above items.
- Section 6.05 Subsurface drip irrigation lines will be shallow. Care should be taken when excavating, coring, or verticutting in a subsurface drip irrigation area.
- Section 6.06 Use plant friendly products, which are biodegradable, non-toxic and free of salt (sodium), boron (borax), and chlorine bleach. These products can be damaging to plants. Never wash anything containing, harsh cleaners or oil.
- Section 6.07 Beauty products can affect pH levels in graywater and can be harmful to plants.
- Section 6.08 Avoid contact with graywater and soil irrigated by graywater at all times.
- Section 6.09 At the beginning of the irrigation season and periodically thereafter check for even distribution of graywater.
- Section 6.10 Special considerations for homes with lagoons and their function without graywater:

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- (a) Graywater systems will reduce the amount of flow to a lagoon. This may result in lower water levels and may require the periodic addition of water to a lagoon. Downspouts may be connected to the lagoon as necessary to add water. In drought time, potable water may need to be added to the lagoon.
- (b) Lagoon maintenance is essential to the operation of the system:
 - (i) Not maintaining an adequate level in the lagoon will allow for increased vegetation growth and make it harder to prevent unwanted plants (i.e. smartweed, cattails, cottonwood/willow trees).
 - (ii) Increased concentration of organic load from toilets and kitchens could lead to odor issues and mosquito breeding in the lagoon.
 - (iii) The lagoon may have an over abundance of unfavorable or harmful bacteria or algae due to the lack of incoming water, which could lead to odor issues and mosquito breeding.
 - (iv) The lagoon may have structural issues due to low water levels and insufficient soil saturation (e.g. cracks).
 - (v) A lagoon with low water, odor and vegetation issues could be considered an “attractive nuisance” or may become a septic condition.

Section 6.11 In designing a graywater system, a backflow valve and drip line relief valve should be considered.

Section 6.12 To ensure the graywater system is in working-order and functions as designed, home owners should be willing to perform yearly/routine maintenance.

Section 6.13 Building inspectors should be involved in the permitting process of an approved graywater system if the homeowner resides in a county or municipality with a building code.

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Article VII. Effective

Section 7.01 This Specification takes effect on February 14, 2014.

Article VIII. Definitions

Section 8.01 For purposes of this Specification:

“Blackwater” - Wastewater from sinks used for food preparation or disposal, sinks from workshops or garages, dishwashers, bidets, urinals, floor drains, reverse osmosis reject water and other water that has come in contact with toilet waste.

“Disposition” - The act of disposing or transferring to the care or possession of another.

“Easement” - An interest in real property consisting of the right to use or control the land, or an area above or below it, for a specific limited purpose benefitting a separate parcel of real property.

“Grade” - The inclination of a physical feature, landform or constructed line to the horizontal.

“Graywater” - Wastewater from sources within single-family residences, including showers, bathtubs, clothes-washing machines, hand-washing lavatories and sinks that are not used for disposal of hazardous or toxic ingredients.

“Graywater system” or “graywater reuse system” - A system used to recycle or reuse graywater for a purpose, instead of disposing the graywater to an onsite waste water system or a public sewer system that contains plumbing from applicable sources, a diversion and overflow valve, a filter, a pump, a tank and subsurface drip irrigation lines.

“Growing season” - A period of time in a year when plant growth occurs, on average in Kansas, this time period ranges from 180 to 190 days between March 1st and October 31st annually.

“H-10 loading rate standard” - A structural load rate of 16,000 lb/axle and following manufacturer’s recommendation for amount of properly compacted fill.

“Local authority” - The governing body of a county or municipality.

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“Public water supply” - A system for the provision to the public of piped water for human consumption, if such system has at least ten (10) service connections or regularly serves an average of at least twenty-five (25) individuals daily at least sixty (60) days out of the year. Such term includes any source, treatment, storage or distribution facilities under control of the operator of the system and used primarily in connection with the system, and any source, treatment, storage or distribution facilities not under such control but which are used in connection with such system.

“Private onsite wastewater system” - A system present on the subject property designed for the collection, storage, treatment, neutralization, or stabilization of sewage.

“Resale inspection” - A procedure performed by the local authority to determine the functional status of a private onsite wastewater system prior to the conveyance of property.

“Schedule 40 pipe” - Pipe that has a wall thickness of 6.02 millimeters, and the bored hole for stream movement is 102.26 mm in diameter.

“Setback requirements” - A distance from one location to another location, between which installation is prohibited.

“Single-family residence” - A house that is not used for multi-residential, commercial, or other nonresidential purpose.

“Subsurface drip irrigation system” - A network of pipes or tubes for controlled delivery of graywater directly to plants.

“Suction line” - A pipe or tubing feeding into the inlet of a fluid impelling device (for example, pump, compressor, or blower), consequently under suction.

“Variance” - An official authorization from KDHE or a local authority to depart from wastewater management regulations.

“Wastewater” - Any water that contains waste products; for example, water used for washing, flushing or in a manufacturing process.

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Article IX. Literature Review

Section 9.01 *"Graywater Reuse in Washington State."* Rule Development Committee Issue Research Report. Washing State Department of Health, 2009.

"Water Conservation Using Greywater." Washington State Department of Health May 2005.

"Dual Water Systems." Tech Brief, National Environmental Services Center Fall 2009, Vol. 9, Issue 3.

"Reclaimed Water for Beneficial Reuse". New Jersey Department of Environmental Protection. January 2005.

"Onsite Residential and Commercial Graywater Treatment Systems for Subsurface Discharge". Approved American National Standard. NSF/ANSI 350-1-2012.

"Onsite Residential and Commercial Water Reuse Treatment Systems". Approved American National Standard. NSF/ANSI 350 - 2011.

"Losing the "Ick" Factor". Water Efficiency. September/October 2013.

"Guidance Manual for Separation of Graywater from Blackwater for Graywater Reuse." Water Environment Research Foundation. Stock No. INFR4SG09a.

"Long-Term Effects of Landscape Irrigation Using Household Graywater – Literature Review and Synthesis." Water Environment Research Foundation. Report 03-cts-18co.

"Safe Use of Household Greywater." New Mexico State University February 1994.

"Using Gray Water on the Landscape" University of Georgia, College of Agricultural and Environmental Sciences 4 May 1999.

"Greywater" Department of Energy, Utilities and Sustainability: New South Wales Government 2006.

"Graywater Reuse and Rainwater Harvesting." Colorado State University Cooperative Extension April 2003.

"Can I Water my Lawn with Last Night's Bathwater? Information on Gray Water Reuse in Boulder County." Boulder County Colorado.

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“Residential Graywater Reuse: The Good, The Bad, The Healthy.” Water Conservation Alliance of Southern Arizona. July 2007.

“Using Graywater in Your Home Landscape: Graywater Guide.” California Department of Water Resources. January 1995. 14 July 2007.

“Using Gray Water in New Mexico’s Residential Landscapes” New Mexico Office of the State Engineer.

“Using Gray Water at Home” Arizona Department of Environmental Quality. Publication No. C 07-01.

Reuse of Reclaimed Water and Land Application. Chapter 62-610. Florida Department of Environmental Protection.

Greywater Reuse for Subsurface Irrigation. Chapter 246-274. Washington Administrative Code.

Use of Graywater Systems. Subchapter F: 210.81 – 201.85. Texas Commission on Environmental Quality.

Graywater Standards. Section 341.039. Texas Health & Safety Code.

For more information about Graywater Reuse or this Specification please contact:

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