

变生活灰水为园艺用水讲座

Greywater Workshop

之圣盖博谷上谷水区

For Upper San Gabriel Valley MWD

第一部分：灰水简介

Part 1: Greywater 101

9am-10am

第二部分：如何设计和构建 L2L 系统

Part 2: How to Design and Build a Laundry-to-Landscape System

10am-12pm



Presentation by 主讲：丁连葳，谢飞

圣盖博谷市政水管上区

Upper San Gabriel Valley Municipal Water District

- 一个成立于 1960 年的特殊区

A special district formed in 1960

- 144 平方英里的服务区域

144 square mile service area

- 服务九十万人口

Population served: 900,000

- 为圣盖博谷社区提供了补充水

Provides supplemental water to San Gabriel

Valley communities

- 城市水域成员机构

Metropolitan Water District member agency



Division 1
Director Dr.
Anthony R. Fellow



Division 2
Director Charles M.
Treviño



Division 3
Director Ed Chavez



Division 4
Director Alfonso "Al"
Contreras



Division 5
Director Bryan Urias

www.upperdistrict.org



城市水域服务区域

Metropolitan Water District Service Area

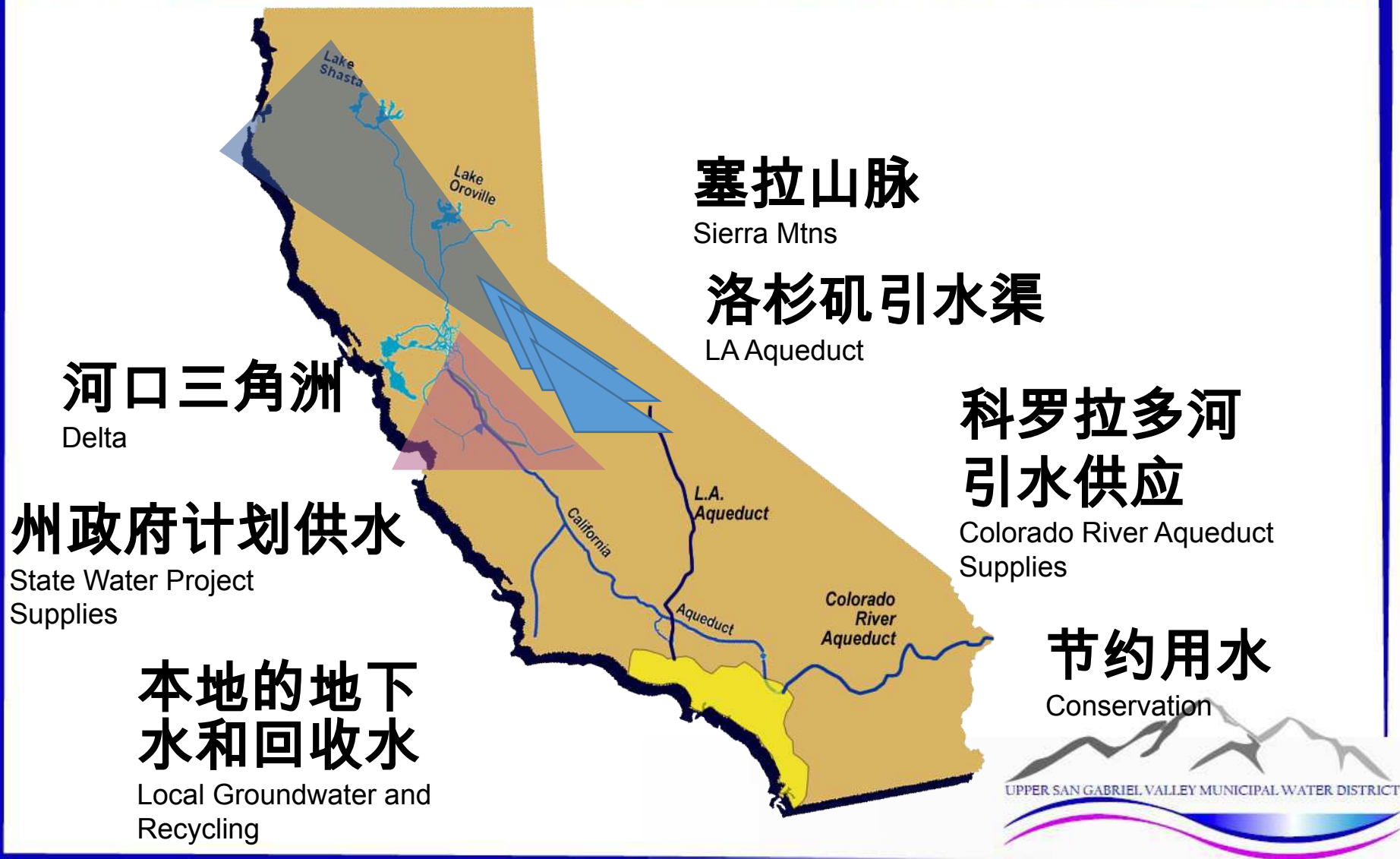


The Metropolitan Water District of
Southern California

UPPER SAN GABRIEL VALLEY MUNICIPAL WATER DISTRICT

南加州的水源

Sources of Water for Southern California



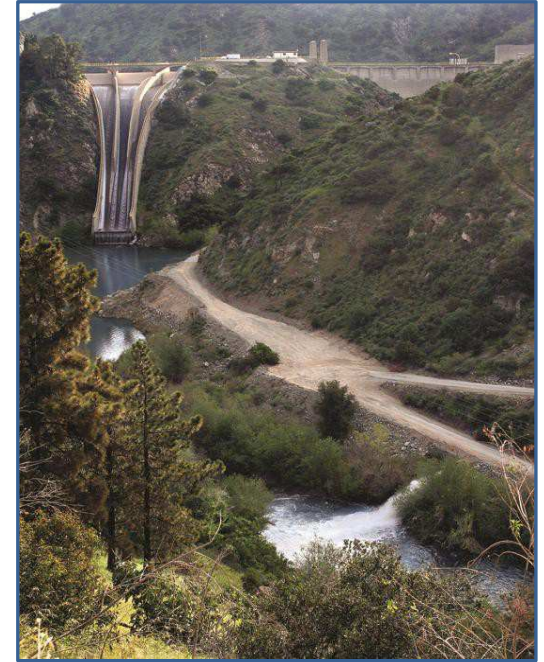
我们的水源供应来自哪里？

Where does our water supply come from?



引进水资源
占 23%
Imported
Water,
23%

本地水资源
占 77%
Local
Water,
77%



本地的山脉融雪和雨水是我们的主要用水来源

Water from the local mountains and rainfall makes up most of our water supply







你每天用多少
水？

HOW MUCH WATER DO YOU USE EACH DAY?

全球用水对比

THE GLOBAL WATER GAP

莫桑比克

Mozambique

1 加仑每人
1 gal/person

中国

China: 22

22 加仑每人
22 gal/person

法国

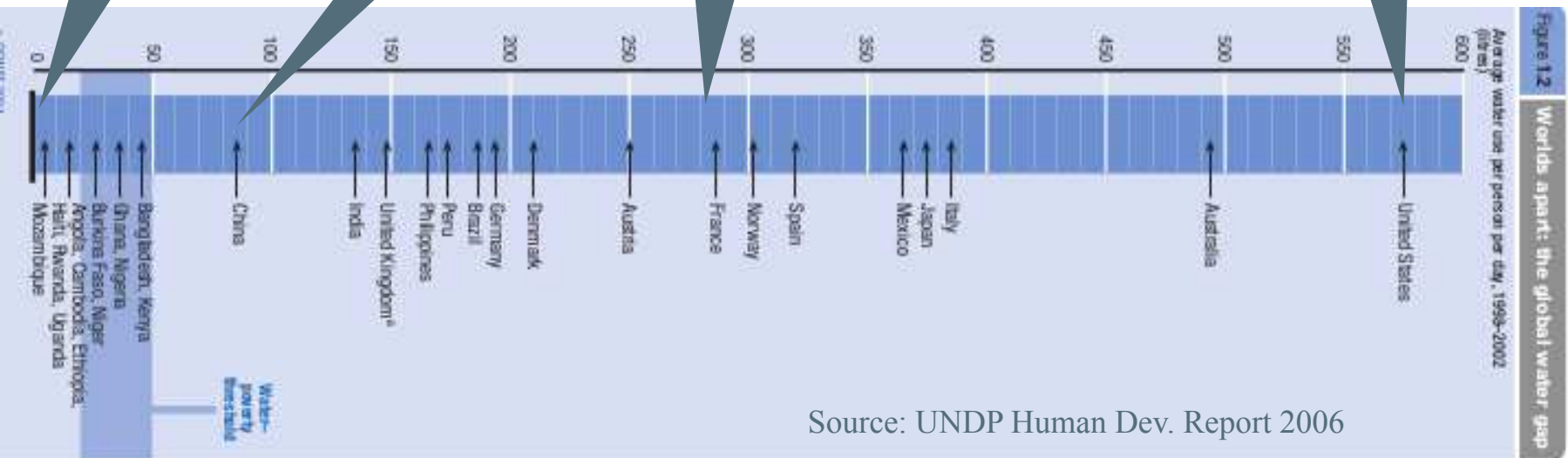
France: 76

76 加仑每人
76 gal/person

美国

US: 150

150 加仑每人
150 gal/person



Source: UNDP Human Dev. Report 2006





水进入下水道后去了哪里？

Where does the water go after the drain?

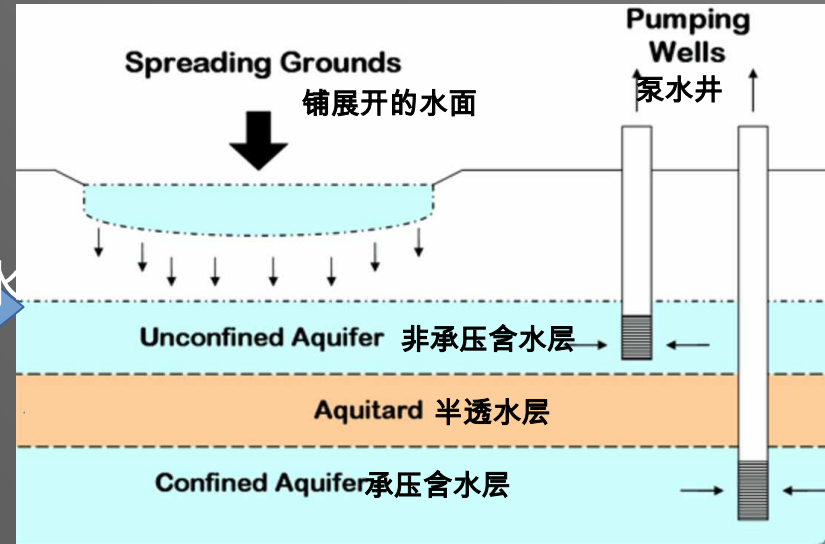


圣何塞溪水处理厂

San Jose Creek Treatment Plan

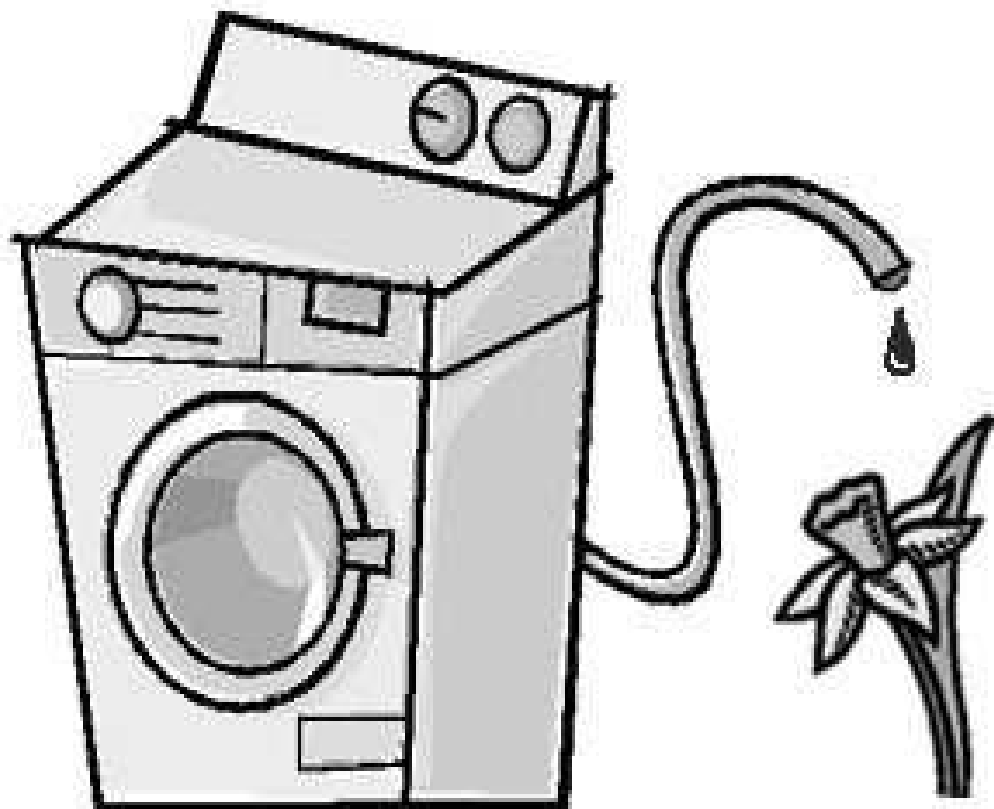
每天 1 亿加仑
100 million gallons/day

4200 万加仑再利用水
42 MGD reused



5800 万加仑水排入河流
58 MGD discharged into river





大约 50% 的住宅用水是用于灌溉

About 50% of residential water is used for irrigation



我不需要清洁的饮用水！

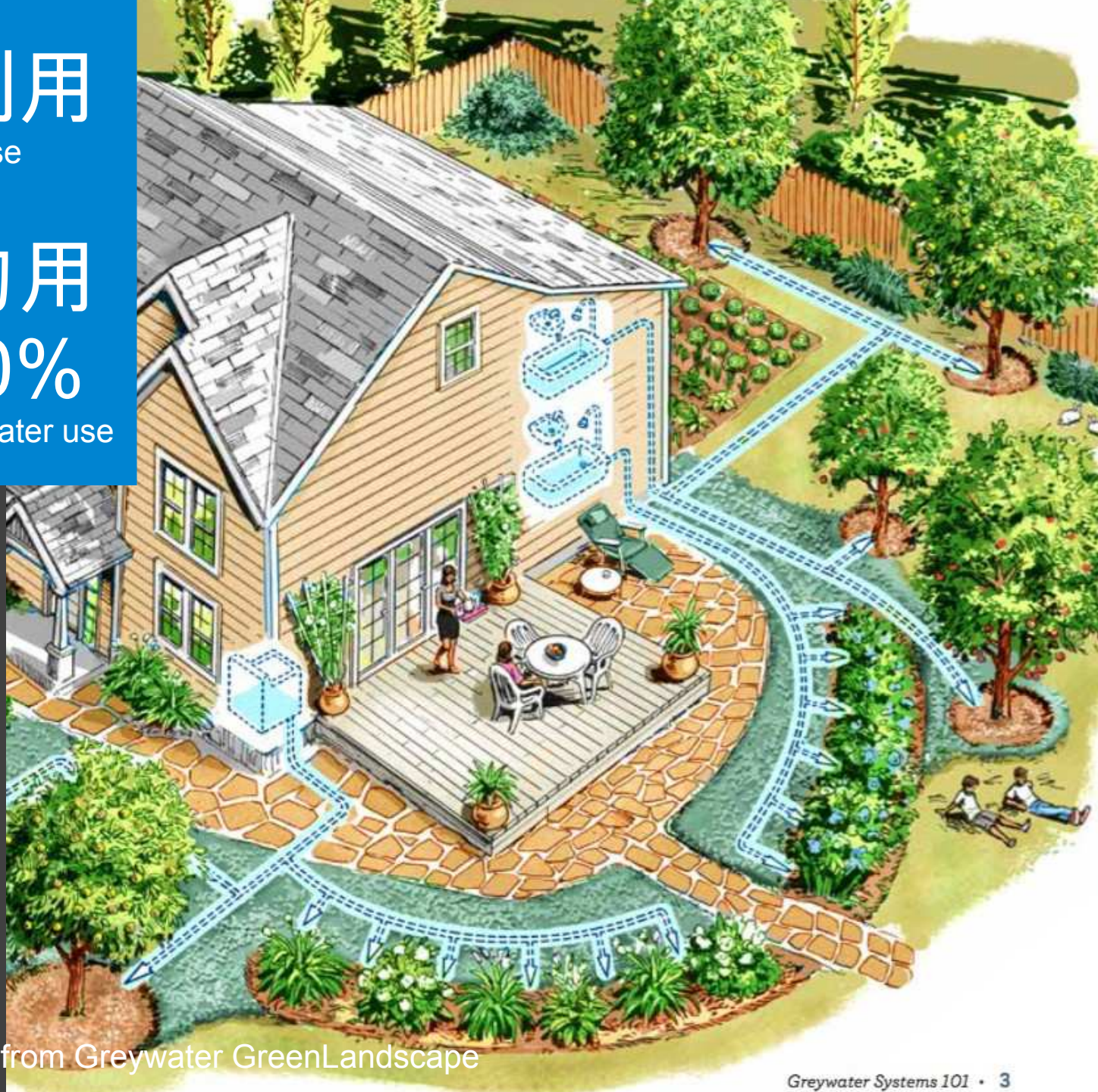
I don't need clean drinking water!

灰水再利用

Greywater Reuse

可以节约用水 16-40%

16-40% reduction in water use



加州居民每天产生 10 亿加仑的灰水

Californian's produce around 1 billion gallons of greywater every day

灰水来自：

Greywater is water from:

#1 洗衣机 Washing machines

- 顶装式洗衣机 Top loading machine:
30-50 加仑 / 次 30-50 gallons/load
- 前装式洗衣机 Front loading machine:
12-25 加仑 / 次 12-25 gallons/load
- 顶装式高效节能洗衣机 Top efficient:
15-25 加仑 / 次 15-25 gallons/load



灰水来自：

Greywater is water from:

#2 淋浴和浴缸泡澡用水 Showers and baths



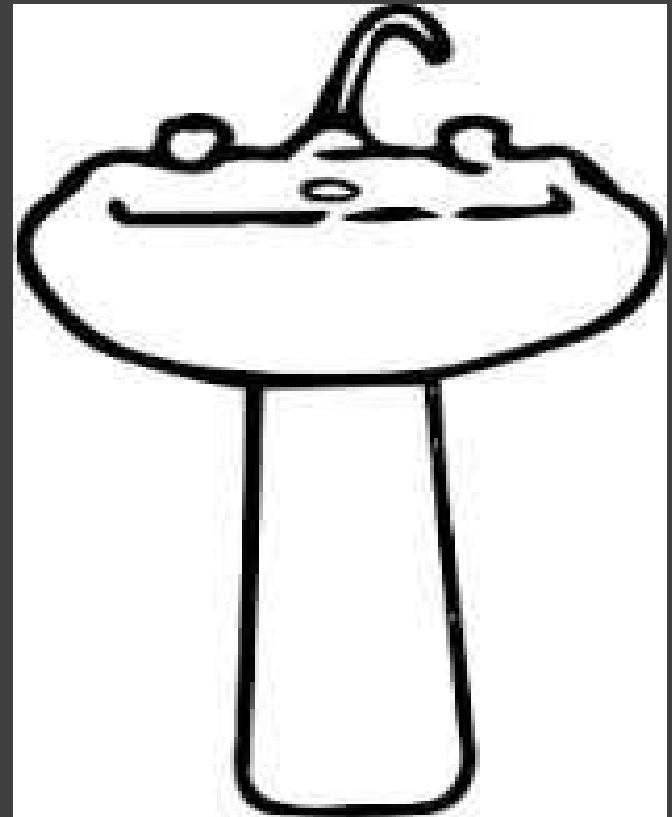
灰水来自：

Greywater is water from:

#3 洗手池 Sinks

(厨房废水目前不被加州
认可为合法灰水，而且也
很难合法的再利用)

(Kitchen sink water is not currently
considered greywater in California
and is difficult to legally reuse)



来自马桶的**决不是**灰水！

Greywater is **never** from toilets!



灰水合法化简史：

A brief history of the **legality** of greywater:

2009 年之前 Before 2009:

- 不可能安装一个合法系统，在加州有 160 万非法系统

It was not possible to install a legal system, there were 1.6 million illegal systems in California.

2009 年之后 After 2009:

- 可以合法安装多种系统，并且有一些系统不需要许可证。

It is possible to install several types of systems legally, some don't require a permit.

利用灰水是合法的吗？当然！

Is greywater legal? Yes!

灰水被加州管道法规，第 15 章所约束。

Greywater is regulated by **Chapter 15** of the California Plumbing Code.



灰水再用的益处

Benefits of Greywater

- 节约用水 .Save water
- 节省时间 .Save time
- 节约能源 .Save energy
- 培养一个连接到大自然的通道 .Fosters a connection to our landscapes
- 还有其它吗？ What else?

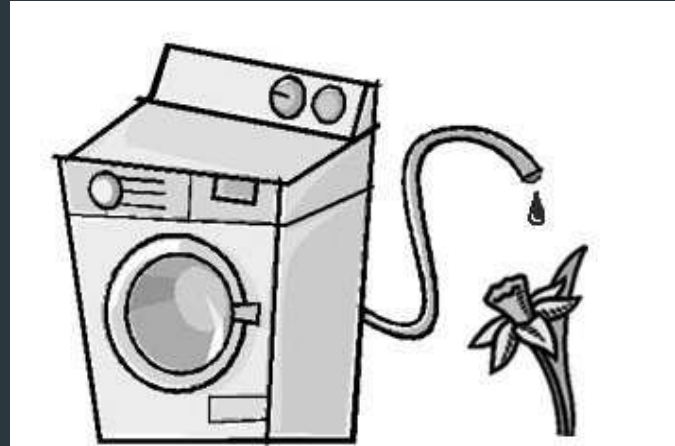


你要怎么利用灰水？

How can you use greywater?

#1 用于室外灌溉

For outdoor irrigation

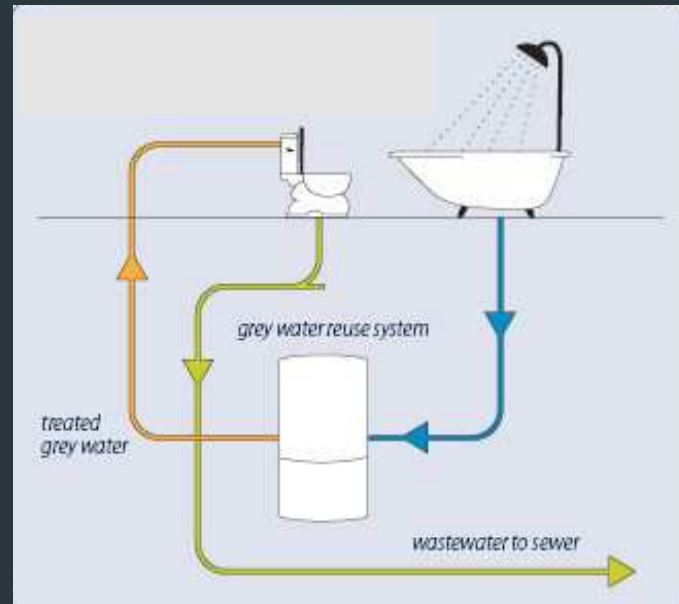


#2 冲马桶

To flush toilets

这种系统需要过滤，消毒，和频繁
的维护。他们很难获得许可
去建造。

These systems require filtration, disinfection, and frequent maintenance. They are difficult to obtain permits for.



使用对植物无害产品

Use Plant Friendly Products

这些产品不含大量的盐，硼和氯。

These products don't contain lots of SALT, BORON, or CHLORINE.

例如以下产品：

ECOS, Biopac, Trader Joes, Oasis, Vaska, Aubrey Organics, 和过氧化氢漂白剂

For example: ECOS, Biopac, Trader Joes, Oasis, Vaska, Aubrey Organics, hydrogen peroxide bleach.

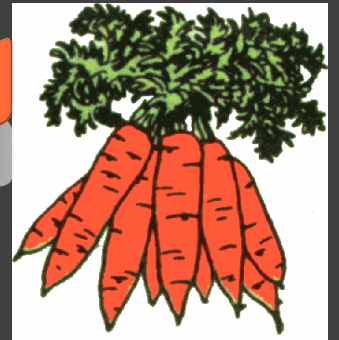
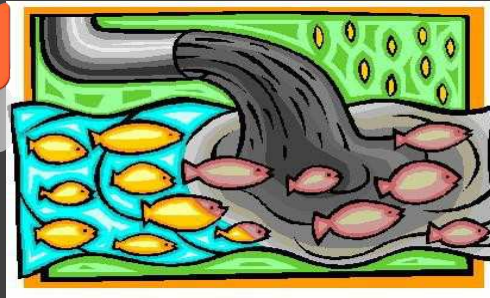
不要用钠基水软化水。

Don't use sodium based water softened water.



灰水不可以饮用

Greywater is NOT Potable



覆盖物“Mulch”

木屑可以在它渗入土壤之前过滤和吸收灰水。

Wood chips filter and absorb greywater before it soaks into the soil.



覆盖物低洼地

“Mulch Basin”

低洼的地方填满覆盖物（木屑）。

A shallow basin filled with mulch (wood chips).

低洼的地形可以让灰水迅速扩散，有抗冲击能力，并且防止淤积或流失。

The basin spreads greywater out, provides surge capacity, and prevents pooling or runoff .



This man is filling the basin with wood chips.

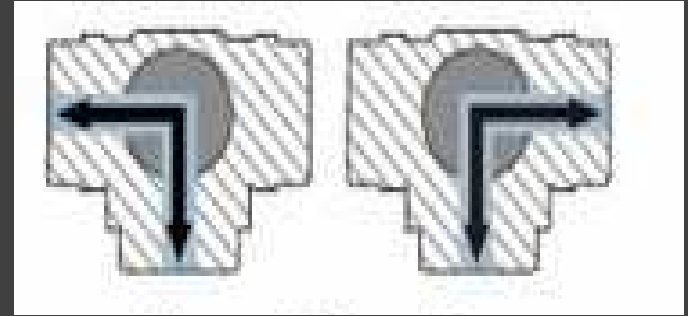
他在用木屑覆盖低洼地。

分流闸

“Diverter Valve”

闸门可以让我们自由控制灰水水流（流向植被，或者下水管道或腐化系统）

The valves allows us to control the flow of greywater (either to the landscape, or to the sewer/septic)



水流方向 Direction of flow



一个水桶

A Bucket



- 用来收集洗澡水加热之前的冷水 Collect cold water as shower heats up
- 放在水槽里可以收集洗涤废水 Dishpan in sink to collect wash water
- 用于灌溉植物 Use for irrigation
- 用于冲马桶（用水桶将水倒入马桶） Use to “bucket” flush toilet (pour into toilet bowl)

灰水再利用系统可以很简单， 也可以运用高科技

Greywater Systems can be Simple or High-Tech

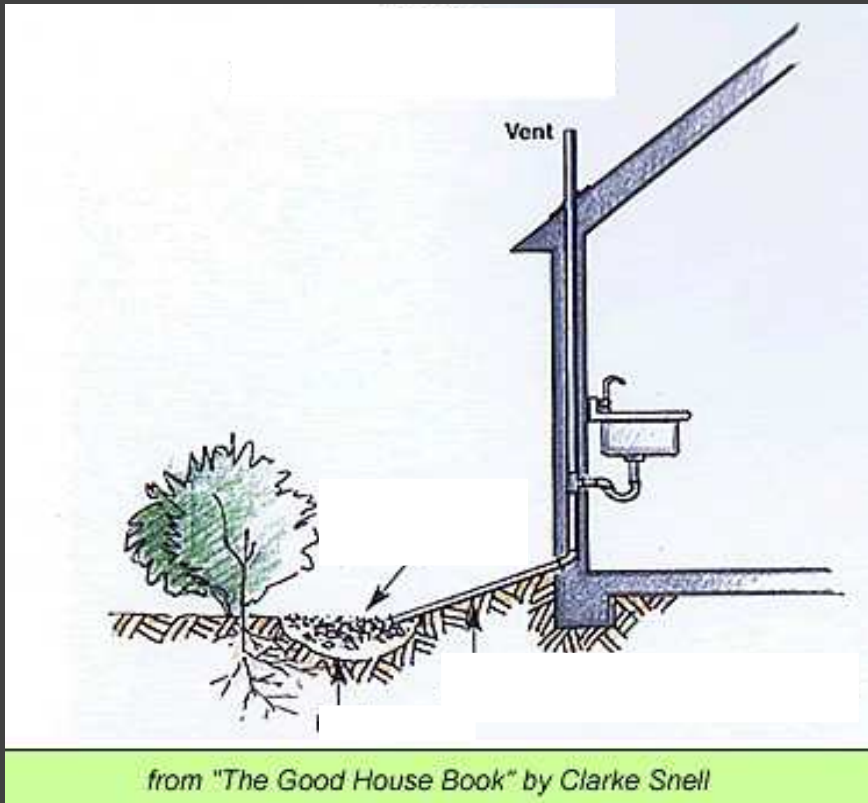


Image Water Sprout
www.greywateraction.org 33

简单的灰水再利用系统可以灌溉大型植物

Simple Systems Irrigate Larger Plants

- 树 Trees
- 灌木 Bushes
- 攀藤植物 Vines
- 大型的一年生和多年生的植物 Larger annuals and perennials



但是不能用于灌溉草地和小型植物

...but not lawns or small plants



用于灌溉这些植物的水需要更复杂的过滤系统
Irrigating these types of plants requires a more complex type of system.

简单的系统： 洗衣机水灌溉花园系统 (L2L)

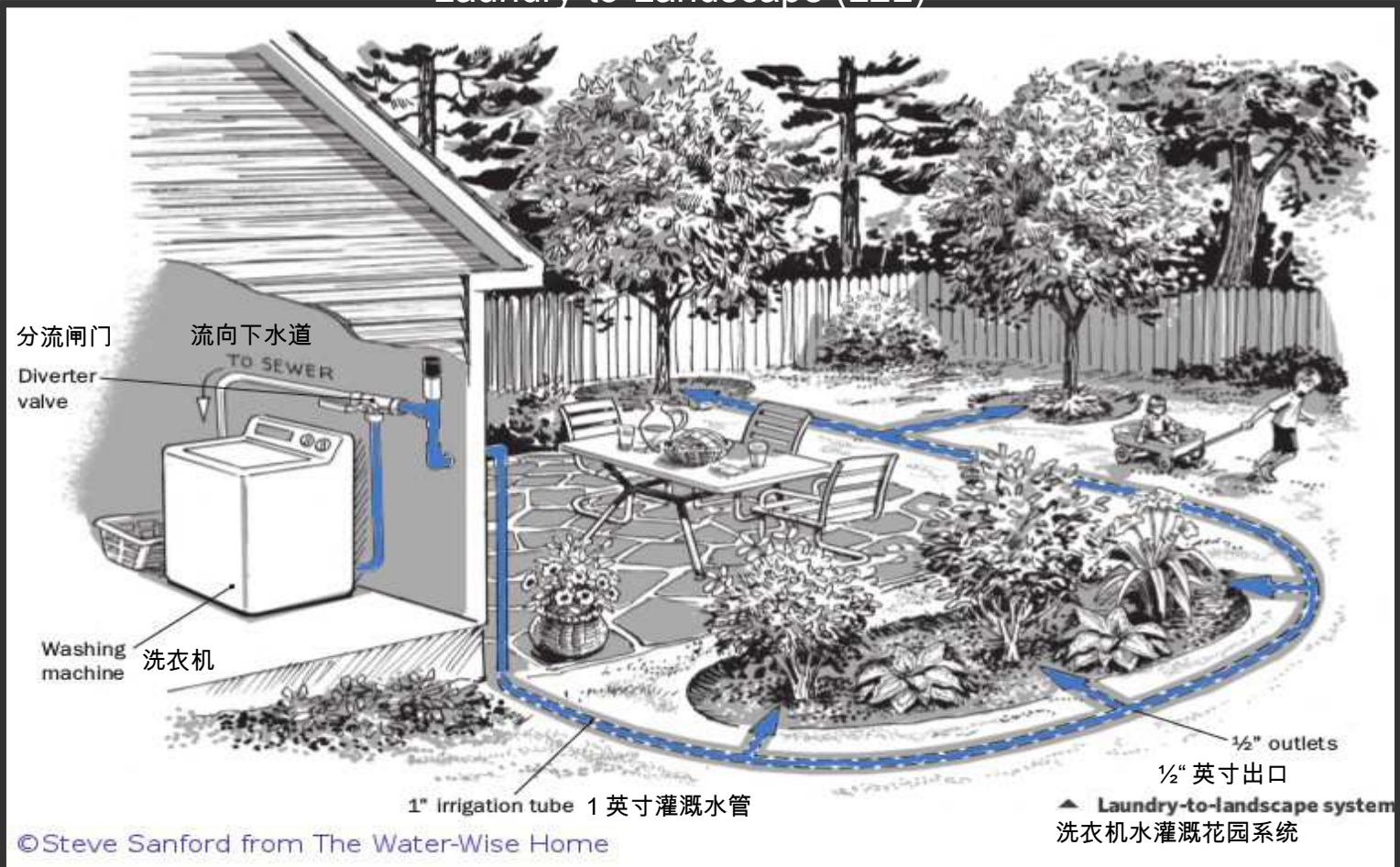
Simple System:
Laundry-to-Landscape (L2L)

一个洗衣机灌溉花园系统不需要改变水管道，也不需要许可（在遵循基本原则的基础上）。

A washing machine system that doesn't alter the plumbing and doesn't require a permit (if basic guidelines are followed).

简单的系统： 洗衣机水灌溉花园系统 (L2L)

Simple System:
Laundry-to-Landscape (L2L)



价格：150-250 美金的零件费，700-2,500 美金的专业安装费

Costs: \$150-\$250 parts, \$700-\$2,500 professional installation

洗衣机水灌溉花园系统

Laundry-to-Landscape System



下水道连接处
Sewer connection

分流闸
Diverter Valve

灰水流向室外花园
Greywater goes to landscape







Image: Leigh Jerrard



Image: Greg Bullock

分支式排水：地心引力系统

Branched Drain: A Gravity System

- 安装这个系统必须能够连接到排水管道

To install this system you must be able to access the drainage plumbing

- 需要一个排水管道改造许可证

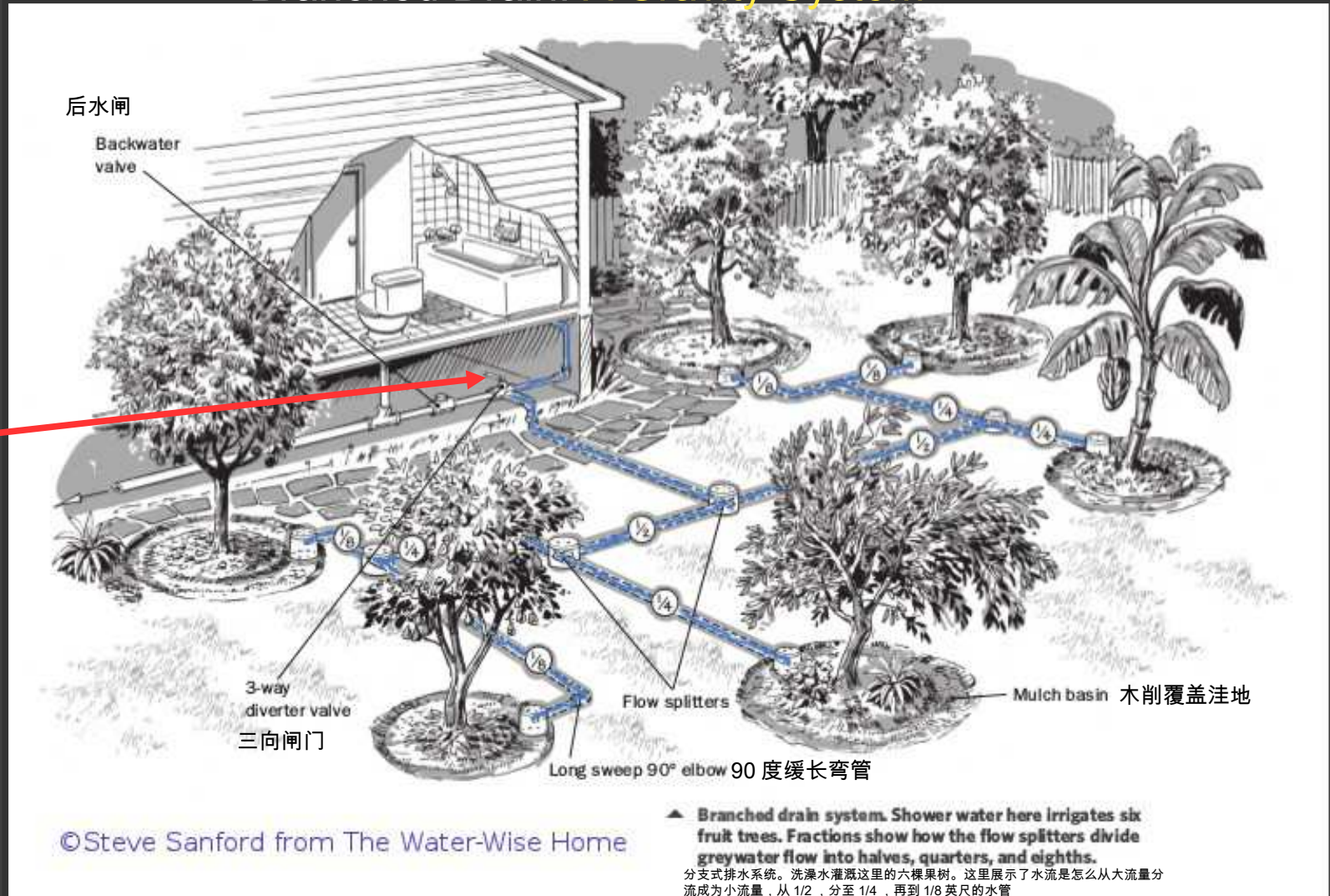
It requires a plumbing permit

- 要灌溉的植被区的地理位置要低于灰水的管道

The landscape must be lower than the greywater pipes

分支式排水：地心引力系统

Branched Drain: A Gravity System



价格：250-500 美元的零件费，800-4000 的专业安装费（允许证费用等另计）

Costs: \$250-\$500 parts, \$800-\$4,000 professional installation (permit fees cost more)

分流闸控制着灰水水流

A Diverter Valve Controls GW Flow



来自灰水源头

From Fixture

流向花园

To Landscape

流入下水道

To Sewer



一个马达 (称为致动器) 可以添加在阀门上, 使人可以在室内遥控分流闸。

A motor (called an actuator) can be added, enabling the valve to be controlled by a switch inside the house.

分支式排水系统

Branched Drain System



远离建筑物和用地界线

Setbacks from buildings and property lines



灰水出口安置在一个实体罩子下，
并流入一个覆盖物洼地。洼地的大
小取决于土壤类型和水的流量。

Greywater outlet is under a solid shield and flows
into a mulch basin. Size of basin depends on soil
type and amount of water.

刚建造完的 L2L 系统和一年后的样子

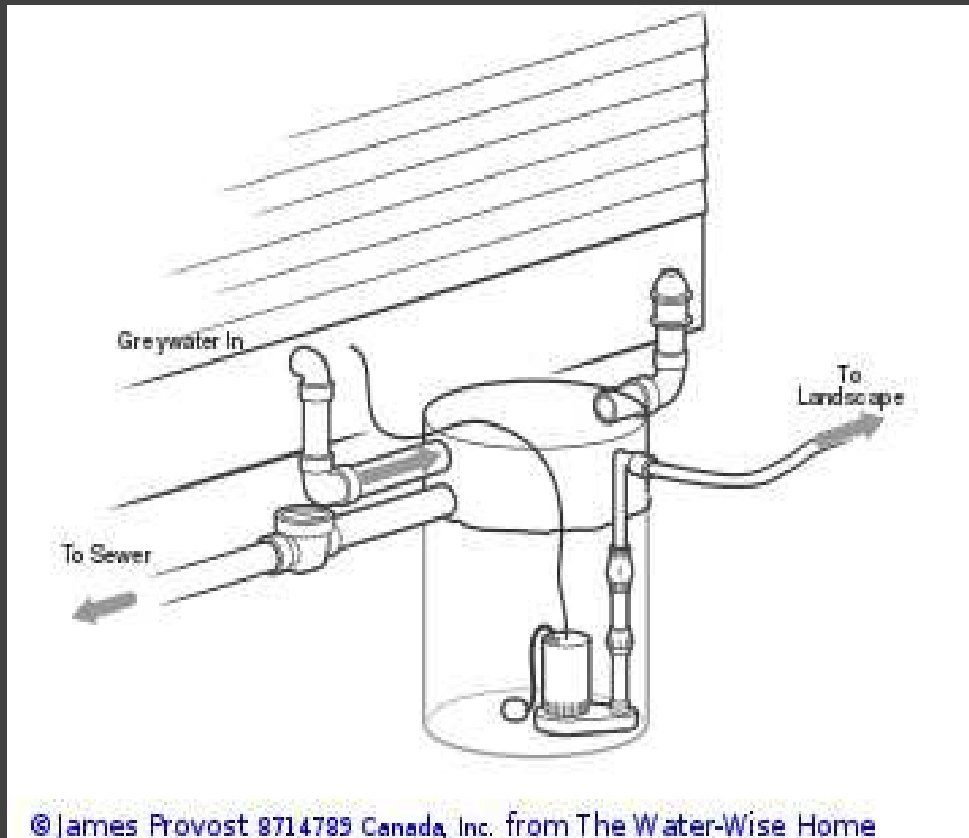
Completed System and 1 Year Later



Images: Josh Lowe

水泵抽水系统

Pumped System



- 分流闸将灰水引入储水缸 A diverter valve directs greywater to a tank
- 未经过滤的灰水被 1 英寸的管道和 1/2 英寸的排放口，抽出到植被区 Unfiltered greywater is pumped out to the landscape with 1" tubing and 1/2" outlets
- 系统需要一个排放口和电力 System requires an outlet and uses electricity
- 需要一个更严格的审批许可程序 Requires a more rigorous permitting process



Photo: Leigh Jerrard

专为滴灌系统使用的 -- 泵和人工过滤系统

Pump and Manually-Cleaned Filter System for Drip Irrigation



过滤系统需要人工清理，并且需要经常的维护

(Filters must be cleaned manually and require frequent maintenance)

Image: Leigh Jerrard



滴水灌溉实例

Example of drip irrigation

注释：有过滤的灰水系统需要专门的滴灌管道，并且这些管道不和标准的滴灌系统通用

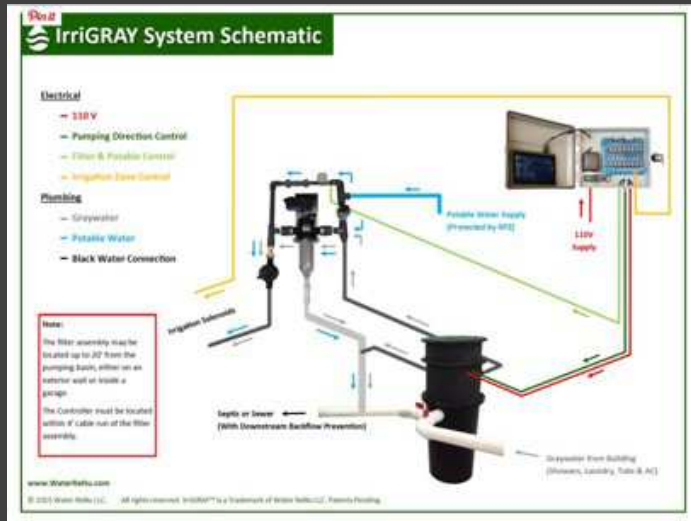
Note: Filtered greywater requires special drip tubing and is not compatible with most standard drip systems.

高科技滴水灌溉系统

其中包含饮用水逆流清洗过滤

(约 5 千 -1 万美元)

Higher Tech Systems for Drip Irrigation with potable backflush to clean filter
(~\$5-\$10 thousand)



WaterReNu “IrriGRAY”

ReWater Systems

更实惠的滴灌系统：灰水即插即用系统（约 2 千元）

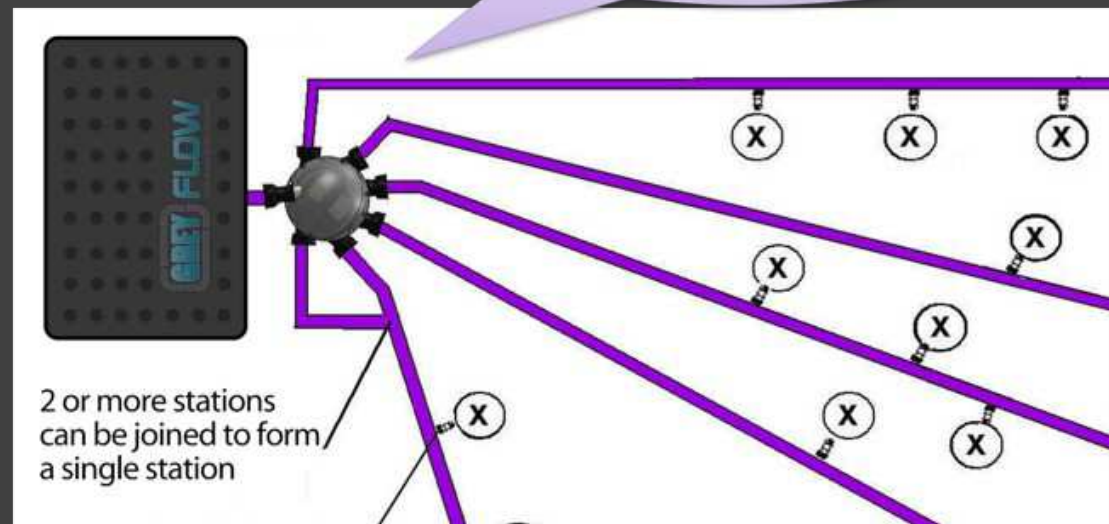
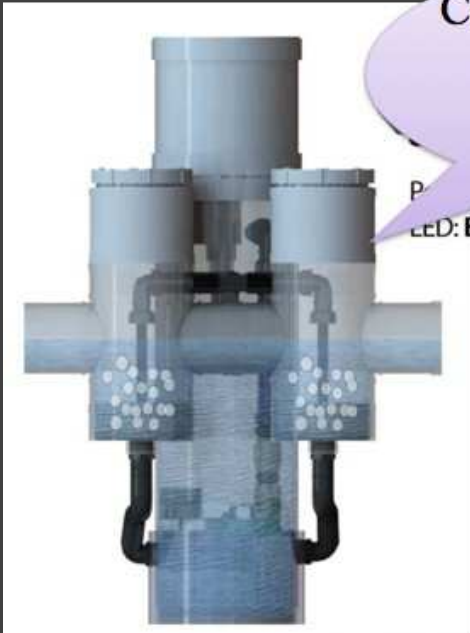
More affordable drip irrigation: Grey-Flow Plug and Play (~\$2 thousand)

压缩空气冲刷过滤器。
不需要连接可饮用水

六出口闸门可以在
不用控制器或定时器
灌溉多个区域

Compressed air flushes
filters. No potable
water connection.

6 station roto valve
allows for irrigation zones
without controller or timers

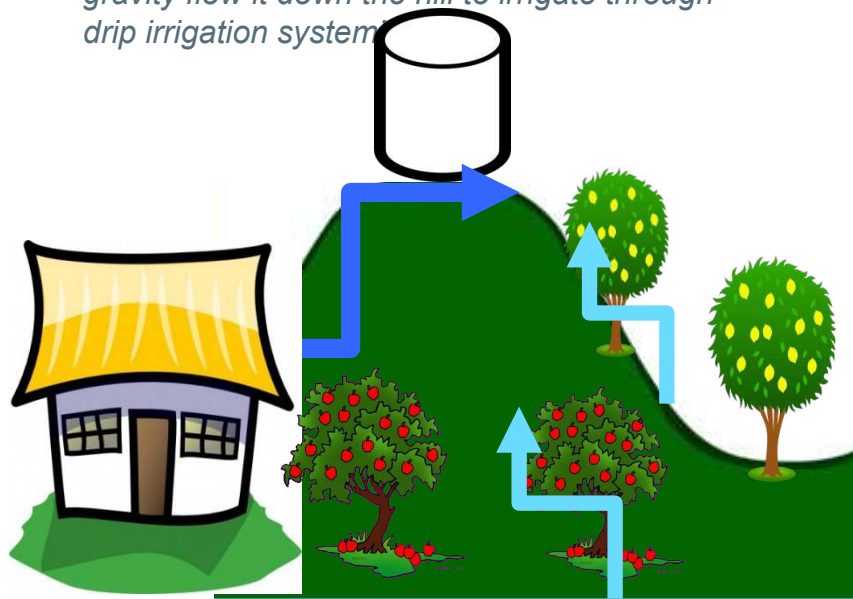


常见误区

Common Errors

我要将灰水抽到高的地方，
并储存在水缸里。再利用引
力将灰水通过滴灌系统灌溉
为于地理位置较低的植被

❌ “I’m going to pump my greywater to the top
of my property and store it a large tank, then
gravity flow it down the hill to irrigate through
drip irrigation system”



#1 储水缸 Storage tank

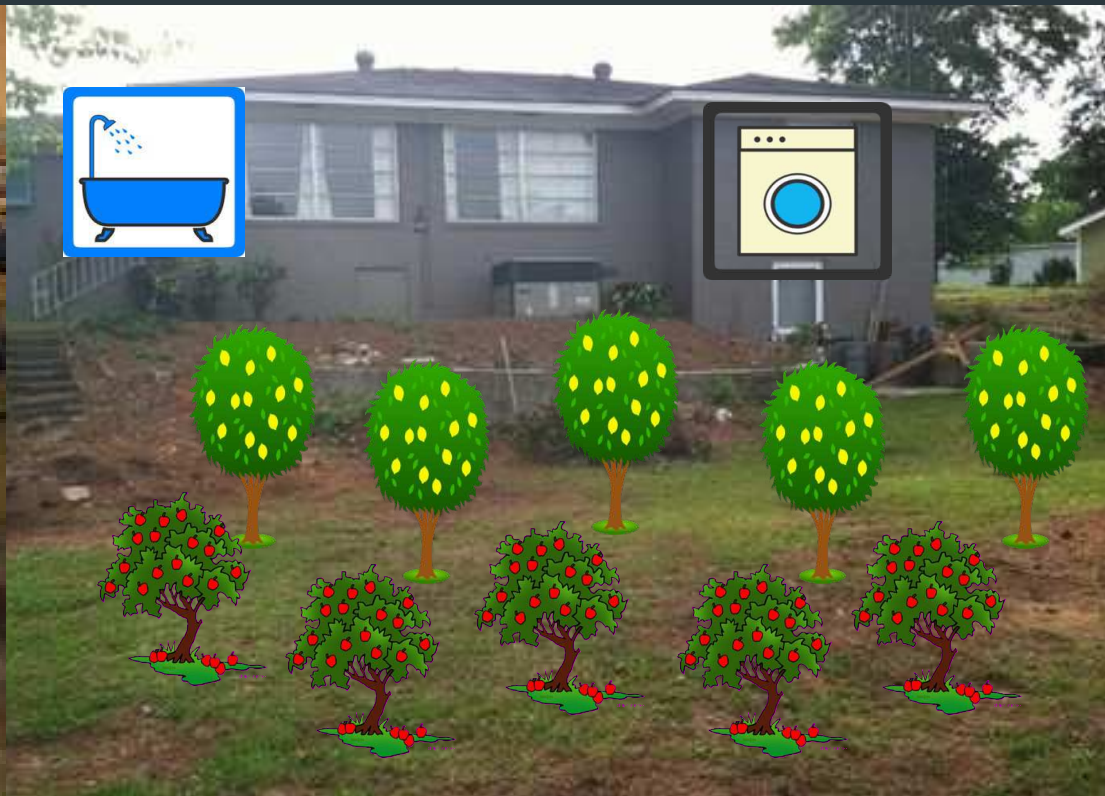
#2 过度使用水泵 Overuse
of pumps

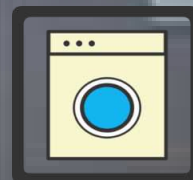
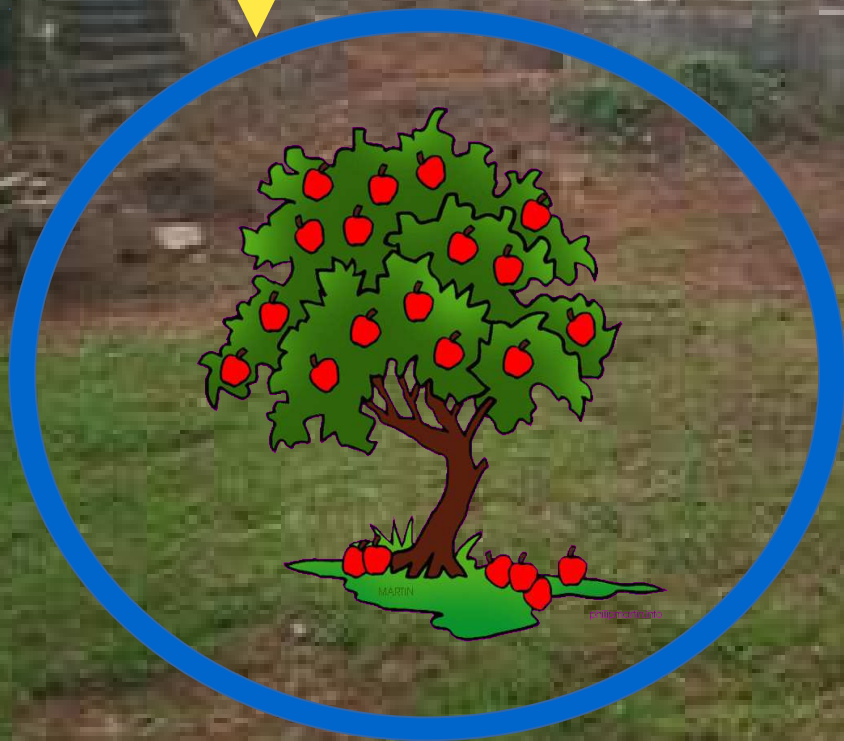
#3 错误使用过滤 Misuse
of filters

你会为他推荐什么样的灰水再利用系统？

What **system** would you recommend here?

我的花园在下坡区。所有的水管道都在一个 3 尺高的狭小空间里。我想用灰水灌溉 10 颗果树。“My yard slopes downhill. All the plumbing is accessible in my 3 foot high crawl space. I want to irrigate 10 fruit trees.”





设计要素

Design Considerations

- 有哪些灰水你可以使用？

WHAT sources of greywater can you access?

- 你家能生产多少灰水？

HOW much greywater does your home produce?

- 你要灌溉什么植物？

WHAT plants will you irrigate?

- 灰水灌溉量要符合植物的需水的量。要记住要将相同需水量的植物放在一起

Match the amount of GW with their weekly irrigation needs. Remember to “hydro-zone”! (Keep plants with similar water needs together.)

- 选择一个满足你需要的灰水再利用系统

CHOOSE a system to meet your needs.

需要更多信息请访问

For more information visit

greywateraction.org

Resources: 参考文献 :

- *San Francisco Graywater Design Guidelines for Outdoor Irrigation* (downloadable manual- sfwater.org/graywater)
- *Greywater, Greenlandscape* by Laura Allen. How-to book with instructions for greywater irrigation systems.
- Ask This Old House episode “*Graywater, Small Engines*”
- Kit for L2L www.cleanwatercomponents.com
- L2L DVD from Oasisdesign.net (originators of L2L and Branched drain systems)
- Greywater Action's Q&A forum