Final Evaluation and Progress Report, November 15, 2005

Project Title:	**Increasing Community Awareness and Beneficial Use of Water**
Project Number:	**2004-E-04**
Agreement Number:	**113334G019**
Date Submitted:	**November 15, 2005**
Funded Group:	**Mid Klamath Watershed Council/ Salmon River Restoration Council**

1. Abstract

Over a two-year period the Mid Klamath Watershed Council (MKWC) has taught a series of workshops and produced educational materials for basin stakeholders on the topics of water conservation and proper road maintenance. This project started in June of 2004 and was originally to have expired on May 2005. In April MKWC requested and was granted a six-month extension so that we could complete a second season of water efficiency workshops. This is the final report for this project, which expires on November 15, 2005

2. Introduction

Klamath Basin residents have considerable cumulative impact on the water quality of the Klamath River via water consumption, road building and maintenance and vegetation management. As the population of the basin continues to grow residential water use will continue to rise and both private and municipal water diversions will increase. Many of the roads used by private residences are unimproved dirt roads that are poorly maintained and deliver unnecessary quantities of sediment to the basin's watersheds. Residential landscaping impacts the Klamath River through water use, the introduction and the spread of noxious weeds. Water conservation, proper road maintenance, landscape design and vegetation management can save money and labor and increase landowner safety while simultaneously reducing water use, reducing erosion and enhancing riparian habitat. By showing both the economic and ecological benefits this project aims to enlist landowner's support and raise awareness and concern for the basin's water resources.

3. Description of Study Area

The Mid Klamath Watershed Council is active on the main stem of the Klamath from Weitchpec to Interstate 5, including major tributaries. This project is aimed towards landowners, residents and business owners within this area.

4. Methods and Materials

This project spans two years. MKWC initiated this project in May 2004 by gathering existing information and educational materials on water conservation and proper roads maintenance, as detailed in our first Evaluation and Progress Report submitted October 30, 2004. We contacted and obtained materials from several groups and incorporated this into handouts and workshop curriculum. Research showed that landscape and garden irrigation accounts for more than 50% of residential water use, and this occurs in warm summer months, when water flows are critical to anadromous fish, thus we emphasized efficient irrigation techniques in our workshops and educational materials.

MKWC identified what we feel are the most effective educational pamphlets. We have modified and amended these materials and developed our own to make them more appropriate to the context of

Klamath Basin communities. We have distributed these printed these materials throughout the Mid Klamath Watershed and printed more for future workshops and outreach.

5. Results and Discussion of Accomplishments During the Project

We will discuss three components of the project, Water Efficiency, Roads Maintenance, and Educational Materials.

Water Efficiency Workshops – MKWC held a total of three drip irrigation workshops and installed drip irrigation systems at high-profile locations. Two workshops were taught in June of '04: one at the Somes Bar General Store and a second at the Forks of Salmon Elementary School. One drip irrigation workshop was held in June '05 at The Klamath Knots Arts Council in Happy Camp, where a drip irrigation system was installed for a native plant garden and technical support, and drip irrigation equipment was donated to the Happy Camp Community Garden. Dripworks, a regional supplier of drip irrigation components, made a generous donation of over $500 worth of drip irrigation components and equipment. Harmony Farm Supply agreed to allow MKWC to reproduce its educational publication "Drip Irrigation Design". We distributed a variety of educational materials on drip irrigation and residential water efficiency at the workshops, through the MKWC office and at events that we tabled throughout the year.

One of the biggest challenges we faced was attendance at drip irrigation workshops. Despite a considerable amount of publicity (including flyers, posters, ads and announcements in local press and our newsletters and general word of mouth) and a high degree of interest expressed by locals, attendance at workshops ranged from 8-12 participants. While this is a reflection of the dispersed population in our area, we feel the need to reach more stakeholders. There is an apparent interest in drip irrigation, expressed through inquiries and requests for consultation, but this does not typically result in a large attendance at workshops. We have managed to reach more people by making staff available for advice and consultation on drip irrigation design and installation, and we will continue to promote water conservation through educational materials, technical information and consultation.

Native Plant Workshop – On Sunday, April 17th, MKWC sponsored a workshop on Native Plants for Restoration and Landscape in Orleans. The workshop was attended by landowners, members of the Karuk Tribe, representatives from the US Forest Service and private nurseries; and presented native plant propagation and the use of native plants for water conservation and noxious weed management.

Roads Maintenance– Given the low stakeholder attendance we encountered in our water conservation workshops we determined that it would be more efficient to promote roads maintenance through printing and distributing educational materials and facilitating interagency communication and exchange of ideas. On September 7 2004, MKWC organized a workshop entitled "Watershed Restoration Review", with an emphasis on road maintenance and decommissioning that was funded by California Department of Fish and Game. This was an interagency workshop, with participation from the US Forest Service, CA Fish & Game, The Salmon River Restoration Council and the Karuk Tribe, as well as local landowners. Since our original funding request of $11,000 was reduced to $5,000, we implemented this roads workshop under a different project and intend to use the funds from this USF&W project to reprint and distribute the tri-fold brochure entitled "Safe Roads", developed by the Salmon River Restoration Council (see attached). This flyer was incorporated into our fall newsletter (also attached) and is being distributed and posted throughout the Mid Klamath Watershed this fall to encourage stakeholders to be proactive with proper road maintenance.

Educational Materials

Saving Water for the River - We have incorporated the information that we gathered in the first phase of this project into this pamphlet, it includes the following components:

- **Drip Irrigation Design** – Reprinted with permission of Harmony Farm Supply, Graton CA, this article is accessible enough to be useful to the homeowner yet concise and technically informative to be applicable to larger landowners. Includes a list of resources for water conservation.
- **Water Saving Tips** – a single page of water conservation tips outlining a wide variety of ways to conserve water.
- **Greywater** – a one page information sheet
- **List of Native Plants for Landscaping** – A matrix of over 50 native species and their cultural requirements and uses that can be used to design a water efficient, and fire safe landscape.
- **Mulch** – A one page description of mulching to conserve water

Each of these components can be printed alone to be used as flyer or educational materials to respond to specific inquiries and support other projects and programs.

Safe Roads – The Salmon River Restoration Council has already produced a simple but very effective tri-fold brochure on road maintenance with support from the CA Dept of Fish & Game and the US Dept. of Fish & Wildlife. MKWC will reproduce this pamphlet for future distribution and workshops. See Attachment. This flyer was incorporated into our fall newsletter (also attached), and the flyer is being distributed and posted throughout the Mid Klamath Watershed this fall to encourage stakeholders to be proactive with proper road maintenance.

6. Summary and Conclusions

The tasks scheduled for this project have been successfully completed, including the following, as written in the original proposal:

- MKWC will contact and consult with experts in workshop topics
- MKWC will research and gather existing educational materials on workshop topics
- The Mid-Klamath Watershed Council conducted three workshops on Water Conservation in the Home and Landscape and one on Native Plants for Restoration and Landscape
- MKWC has developed and is distributing educational materials on water conservation to sub-basin stakeholders
- MKWC has printed and is distributing existing materials on proper road maintenance to sub-basin stakeholders
- MKWC has submitted Progress, and Final Reports, including this Draft Final Report, to the Yreka Fish & Wildlife Office.

The three Drip Irrigation workshops resulted in the installation of three drip irrigation systems in prominent public areas and several home drip irrigation systems. MKWC has provided follow-up technical assistance to residents and schools and continues to distribute educational materials on water conservation, native plants and safe roads. We have compiled a pamphlet on Water Conservation and will print 1500 copies for future distribution, pending final review by USF&W. This information is available to stakeholders and watershed groups as a pamphlet or as stand-alone documents. We will also reprint 500 copies of the brochure Safe Roads, by the Salmon River Restoration Council. This brochure has been reprinted in MKWC's October newsletter (attached), posted and distributed along the Highway 96 corridor and will continue to be distributed to basin stakeholders.

7. Summary of Final Expenditures

The following summary of expenditures is contingent upon a final review of the documents "Saving Water for the River, a Practical Guide to Saving Water in River Communities" and "Safe Roads"

Final Summary of Expenditures			
PERSONNEL COSTS	***Amount***	***Cost Share***	**Total**
Position			
Project Coordinator @ $20/Hr			
Instructors @ $25/Hr			
MKWC Staff @ $15/hour	$1,882.50	$1,132.50 [1]	$3,015.00
Staff Benefits @ 15.85%	$208.22		$208.22
Graphic Design			
Total Personnel Costs:	**$2,090.72**	**$1,132.50**	**$3,223.22**
OPERATING EXPENSES			
Supplies & Materials	$123.41	$635.46 [2]	$758.87
Water Conservation Pamphlet	$1,290.00	$0.00	$1,290.00
Roads Brochure	$455.00	$0.00	$455.00
Mailing - Brochures			
Mileage 2300 Mi @ $.36/Mi	$172.66	$43.92	$216.58
Phone	$150.00	$0.00	$150.00
Total Operating Expenses:	**$2,191.07**	**$679.38**	**$2,870.45**
subtotal	$4,356.79	$1,936.61	$6,293.40
Administrative Overhead @ 15%	$653.52	$110.23	$763.74
Project Totals	**$5,010.30**	**$2,046.84** [3]	**$7,057.14**
Percent Cost Share:	71.00%	29.00%	

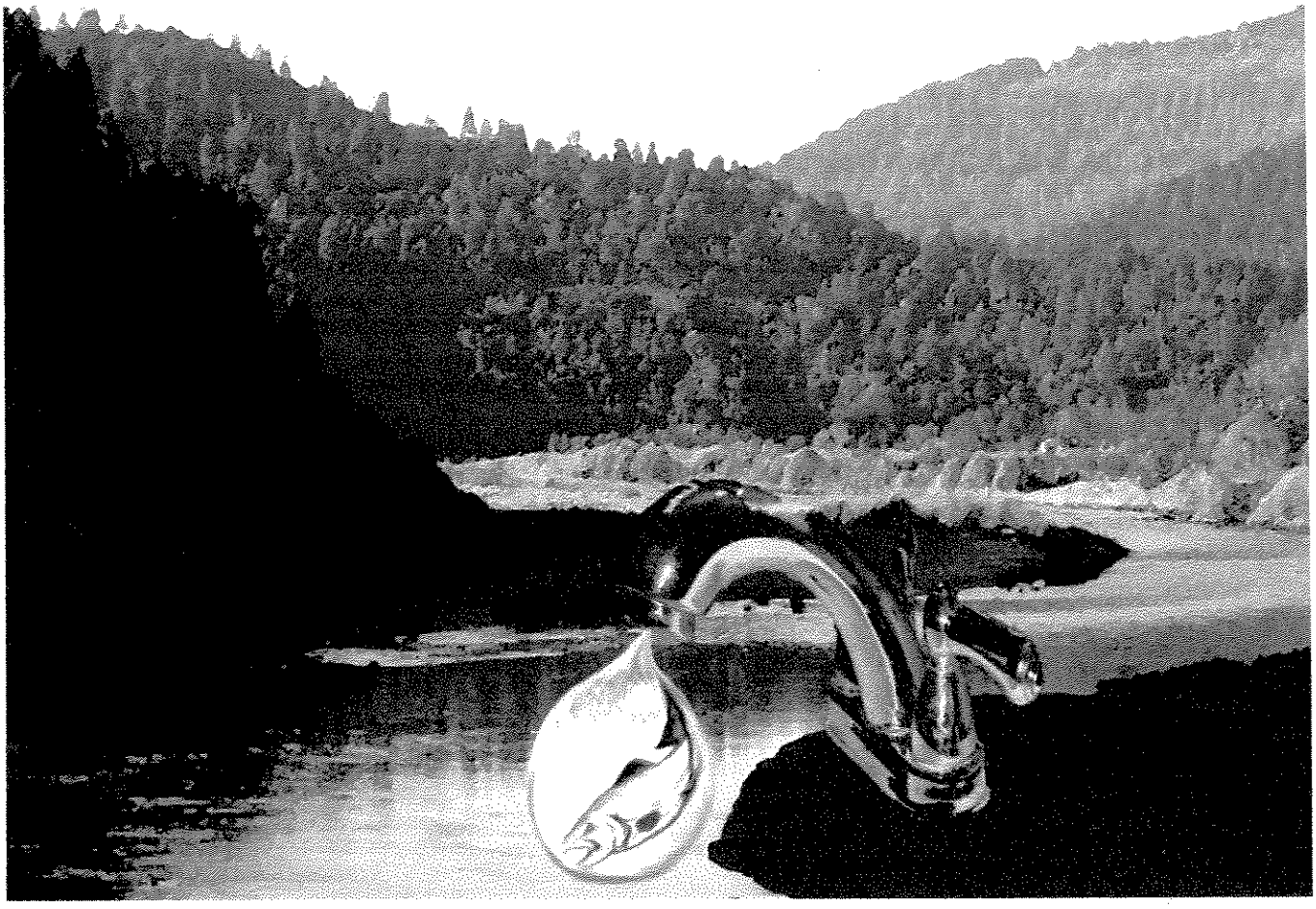
Notes on Expenditures:

1) MKWC staff provided a total of 75.5 hours of volunteer time to this project. A log detailing activities and hours is available upon request
2) Dripworks company, Willits CA, donated a total os $635.46 of drip irrigation for classes and demonstration instillations.
3) None of the cost share was from federal agencies

8. Addendum

- **a. Draft – Saving Water for the River, a Practical Guide to Conserving Water in River Communities**
- **b. Safe Roads – Trifold Brochure**
- **c. Mid Klamath Watershed Council Newsletter, October 2005**
- **d. Workshop Flyers:**
  - **i. Drip Irrigation Workshops**
  - **ii. Native Plants Restoration Workshop**
  - **iii. Watershed Restoration Workshop**
- **e. Notes on Summary of Final Expenditures**

Saving Water for the River



Every Drop Counts...

DRAFT

A Practical Guide for Conserving Water in River Communities

Drip Irrigation
Home Water Conservation
Landscaping with Native Plants
Greywater Management

U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

MID KLAMATH WATERSHED COUNCIL

Salmon River Restoration Council

Water Efficiency on The River – Every Drop Counts

It's been said that water will be to the 21st century what oil was to the 20th century, and in many ways the comparison holds true. Clean water, once thought of as in infinite resource, is now bottled and sold for more than the cost of gasoline. We are already seeing serious conflicts across state and national borders concerning water use & rights, and no doubt these will continue to heighten. We need to conserve water wherever it is found, from the headwaters to the mouth of a river, from the kitchen to the garden & landscape, to the way we dispose of waste and the choices we make when shopping. River communities bear an additional responsibility when it comes to water. The hottest, driest months of the year are a critical period when our local anadromous fish populations need clean, cold water. It's also when we use the most water in our gardens & landscapes. As water flows diminish more and more fish seek cold-water refugia where mountain streams and creeks spill into larger tributaries. Each drop of water that goes to our garden or household is one less for the fish.

A person can live for 30 days without food, but only 3 to 4 days without water. Only 2.8% of the world's water is fresh, and only 0.6% is available as groundwater and .01% available in lakes and streams. This makes fresh water one of the most precious elements on earth, yet one would hardly know by the way in which it is used. Consider the following:

- A typical impact sprinkler uses about 5 gallons a minute or 300 gallons an hour, 2400 gallons in an 8-hour period. If used during a hot day, up to half of this water is lost to evapotranspiration and never reaches the ground.

- A faucet that drips once each second wastes 259 gallons a month, or 3,153 gallons a year. Multiply that by the number of leaky faucets around your house, then around your garden, then around your community, and you've got more than a trickle.

- Agriculture in the West occurs largely in arid to semiarid regions and requires large water subsidies. It takes about 2500 gallons of water to produce 1 lb. of beef, 1600 gallons of water to produce 1 LB of pork, 815 gallons to produce 1 lb. of chicken.

- Each quart of oil dripped on the ground or in a waterway contaminates 2500 gallons of water.

Our salmon runs are now on the brink of survival. They need clean, cold water to survive. While the tendency is to look upriver to scrutinize how water is being used, we all live upstream from somebody else. If we take only what we need form the creek, stream or river where we live and use it wisely, we can set an example for the entire watershed.

The Mid Klamath Watershed Council would like to thank the US Fish & Wildlife Service for a grant that made this pamphlet possible, Dripworks of Willits, CA for their generous technical support and donation of drip irrigation supplies for our workshops, Kate Burroughs of Harmony Farm Supply for allowing us to reprint her excellent article Drip Irrigation Design, to Art Ludwig of Oasis Design for information on Grey Water Design & Management, and the Salmon River Restoration Council for administrative and logistical support for this project.

DRIP IRRIGATION DESIGN

Many farmers and gardeners have found drip irrigation to be a great time saver as well as giving them better yields from healthier plants. Use of drip irrigation has decreased the incidence of plant disease which might overwise occur with overhead sprinkler irrigation. Many soluble fertilizers can be applied thru the drip system, keeping nutrients near the root zone and allowing the plants to get the most value from each fertilizer application.

Most of the drip components were originally derived from Israeli engineers who were the pioneers in this field. Since then many systems have been devised in the United States, being field tested in California, Florida and Hawaii.

The advantage of a drip system is that you water the plants you want to water, keeping weed growth out of your plantings. And you don't have to worry about whether you have stood there long enough with the hose (most of us never do!) or whether there will be enough rain to keep the plants going.

If you have ever put something together with Tinker-Toys, you have the basic ability to put together a drip system. It is that simple! Just get the components you need and assemble the system-- most home garden systems can be assembled in one afternoon.

HOW CLEAN IS YOUR WATER?

The main question you need to answer concerns the quality of your water. While there are things which can be done to mitigate the effects of bad water, the dirtier your water is, the more careful you will have to be with the components chosen to achieve satisfaction and low maintainence with your drip system.

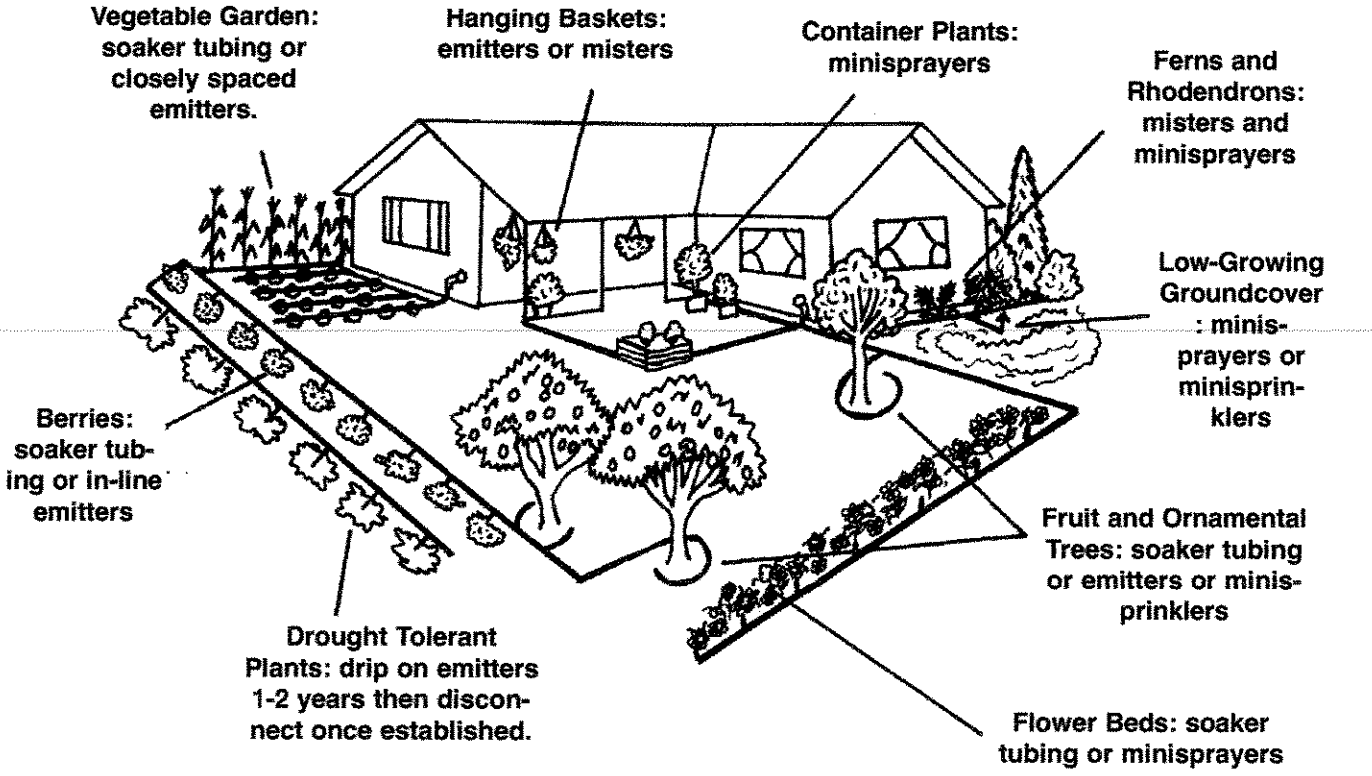
From most easily clogged to hardest to clog:

1. **soaker type tubing** such as T-Tape
2. **small orifice emitters** such as 1/2 gph emitters
3. **larger orifice emitters** such as 1 and 2 gph emitters
4. **minisprayers & sprinklers** over 3 gph
5. **in-line emitters** such as Netafim & Dripperline

Within each classification there are differences in performance with various products (advantages and disadvantages) so don't take this as an ironclad rule of thumb.

The worst water is from ponds or lakes that have algae, etc. The next worst is water containing iron slime bacteria (these will not filter out, they only come out of solution when they hit the air) and water that contains calcium or magnesium that precipitates out when it hits

DRIP SYSTEM APPLICATIONS



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air and leaves deposits. Then comes water high in sand (many wells pump some sand). Believe it or not, even some municipal water systems have crud in them, although most city water is pretty clean.

WHAT EVERY SYSTEM NEEDS

All drip systems should have a **filter** on them, regardless of water source. It is very cheap insurance so contaminants in the water clog the filter, not the emitters. Some people don't like how often they have to clean their filter-- if that is the case, get the next larger size so you won't have to do it so often. Some systems require cleaning out the filter every time the system is run and some people only have to do it once a year (depends totally on your water quality).

Most drip systems should have a **pressure regulator**-- especially if you are on city water or have a well set to run between 40 and 60 psi. If you are on a spring box or have a gravity fed tank with not much head above the drip system, you probably won't need a pressure regulator. Most emitters and minisprinklers are designed to give the rated gallonage at 20 to 25 psi. Most soaker type tubing is designed to run at 10 to 15 psi.

CHOOSING COMPONENTS

How do you choose which types of emitters, soaker type tubing or minisprinklers you want for your system? It is an individual choice and here are our recommendations on what most people have found to work well for them:

EMITTERS-- Generally, people choose to use emitters when the plants are spaced somewhat far apart as is the case with perennial shrubs, fruit trees and vines and vegetables planted in hills. On flat ground you can use either the Hardie DBK, Netafim button or 36" or 48" Dripperline emitters for evenly spaced trees and vines. The DBK emitters can be opened to be cleaned if necessary. The Netafim buttons cannot be opened but they very rarely clog. On hilly ground (greater than 20 ft. vertical change up or down a hill), one should definitely chose from the pressure compensating emitters(which can be either in-line or punched into hose) so that all of your plants get the same amount of water per irrigation. Only the Turbo SC emitters (of all the pressure compensating emitters) can be opened to be cleaned if necessary. All pressure compensating emitters are self-flushing.

SOAKER TYPE TUBING-- these are ideal for watering intensively planted beds of vegetables or flowers, also berries, turf, and other areas where you want to evenly water an entire swath of plants.

T-Tape is mostly used by vegetable growers, both large and small. T-Tape tubing must be used in straight runs- do not run around corners or bend (unless you use fittings) or the flow of water will be cut.

Soaker Dripline is often used in ornamental settings and can be bent gradually without affecting their performance.

T-Tape requires 10 psi operating pressure. Soaker Dripline should be run at 15 psi. Dripperline works best at 20 psi. Only Soaker Dripline, 12" Dripperline and 12" RAM P/C Dripperline are recommended for use as a soaker where heavy iron (i.e. when water stains fixtures) or calcium is present in the water.

MINISPRAYERS AND MINISPRINKLERS-These are used where people want to water a larger area. They can be utilized more like standard sprinklers in that there are many different patterns available for use, although the gallonage and radius involved is much less. This means more drip minisprinklers can be run on one line than would be possible with standard sprinklers. One thing you should be aware of is that the minisprayers and minisprinklers do not work well in heavy winds- due to the finer droplet size, they will not give you the desired coverage if operated when there is a lot of wind. You can compensate for this by running the system in the evening or early morning when wind is not usually a problem.

DRIP IRRIGATION SYSTEMS DESIGN

Start by making a sketch or scale drawing of the areas you want to drip. Note the location and size of plants to be irrigated, and whether they are native (and drought tolerant) or introduced (requiring more water), and the location of water sources. Note distances needed for tubing and what fittings will be needed to layout the system (tees, elbows, etc.). Based on the size and type of plant (see watering guide), determine how many and what type of emitters or sprayers will be required.

When designing your drip system make sure to plan for the future. When plants mature, they will require more water. This can be accomplished by watering longer but it is usually more satisfactory to add more emitters as plants grow at different rates. Also, new plants may be added to the landscape so leave about 25% more water capacity available for growth needs.

Garden valves and standard 3/4" sprinkler valves will almost always provide more than enough water for most home landscape/garden needs. To determine how much water the drip system will require simply add up the total number of emitters and their flow rates. (Example: 20- 1 gph emitters = 20 gph; 20-2 gph emitters = 40 gph; 20 + 40 = 60 gph total).

If in doubt about the capacity of a water source, simply time how long the valve takes to fill a measured container. (Example: If it takes 30 seconds to fill a five-gallon bucket, then the maximum flow available is 600 gallons

DRIP IRRIGATION DESIGN

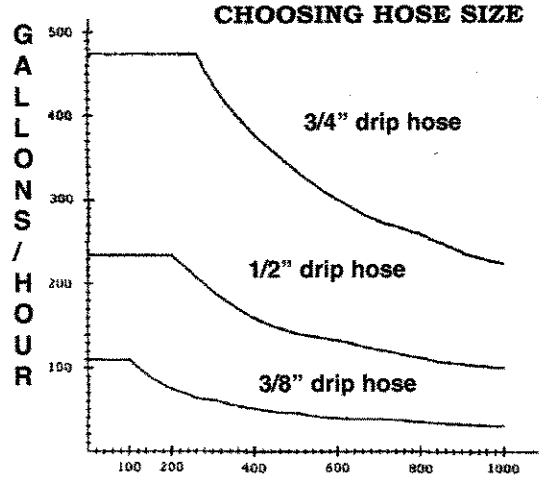
per hour. The formula is to take the GPM x 60 to get GPH). Should the system require more water than is available, divide the system by using multiple valves or a hose Y connector and run one system at a time.

Because drip irrigation operates at low pressures, effects on pressure caused by changes in elevation should be considered if elevation varies over 20 vertical feet from water source. If elevation changes are a problem, use pressure compensating emitters.

When designing your drip irrigation system keep in mind questions like: Will it get in the way when cultivating, raking or weeding? Should the drip tubing be hidden from view? Is it out of the way of foot-traffic areas? In areas where gophers and other rodents are problems, no drip or spaghetti tubing should be buried or they will chew through it. Mulch can be used to cover tubing.

The following chart is useful in determining what size drip hose should be used as a main line (regardless of whether you are using emitters, soaker type tubing or minisprinklers).

CHOOSING HOSE SIZE



The information represented by this chart assumes the drip system contains evenly spaced outlets (i.e. emitters, microsprayers, etc.) along the entire run with a minimum of 30 outlets. The chart represents approximately 5 psi TOTAL loss.

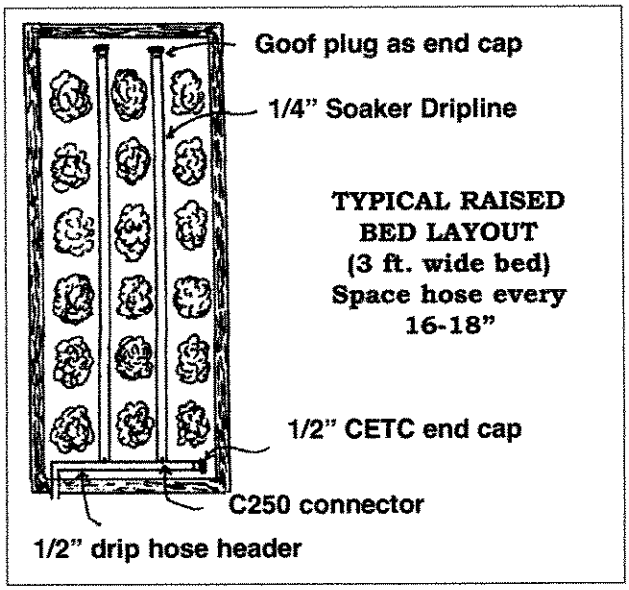
First, design your system and add up the gallonage required as well as the length the main line tubing will have to run, then look at the chart to see what size drip hose you should use. Most home landscape/garden systems use 1/2" drip hose. Very small systems may be run on 3/8" hose while large systems should use 3/4" hose (or break the system into segments or use more than one faucet hook-up).

For very large agricultural and commercial landscape drip systems, please contact our Certified Irrigation Designers: David Henry, Angela Albini, Chad Griffith and Patty Hamilton.

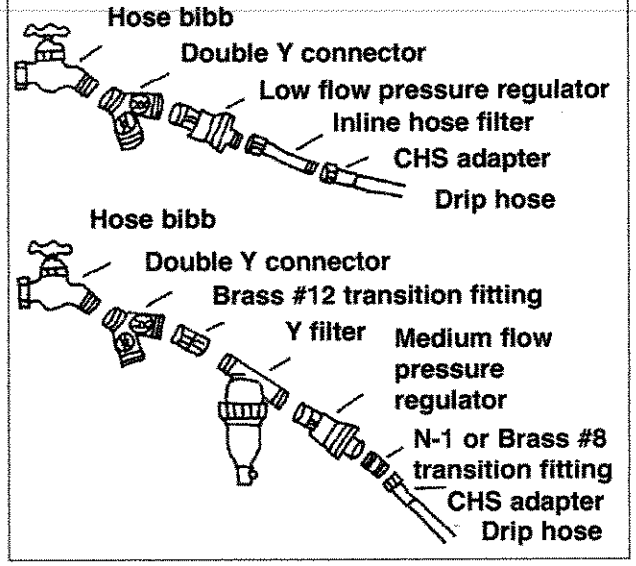
SYSTEM HEAD ASSEMBLIES

At the beginning of your drip system, you should install a backflow prevention device or check valve to prevent back siphonage of irrigation water into drinking water systems. Most municipal building codes require the use of these devices. If you are on a well and plan to do fertilizer injection, you should definitely use one.

Depending on what type of filter and pressure regulator will be required for your system, PVC transition fittings may be needed to get from pipe thread to hose thread connections. Use teflon tape on all pipe thread joints (not pipe dope). Hose thread connections will seal with the washer included on them. Do not use a wrench to tighten plastic threads, hand-tighten only!



TYPICAL DRIP SYSTEM HEAD ASSEMBLIES



DRIP IRRIGATION DESIGN

If you want to automate your drip system be sure to select a controller designed to water at least two hours per station. We feature a number of controllers which are appropriate for drip systems- many older controllers were designed strictly for use on standard sprinklers and will not run long enough to use with drip systems.

INSTALLATION OF TUBING

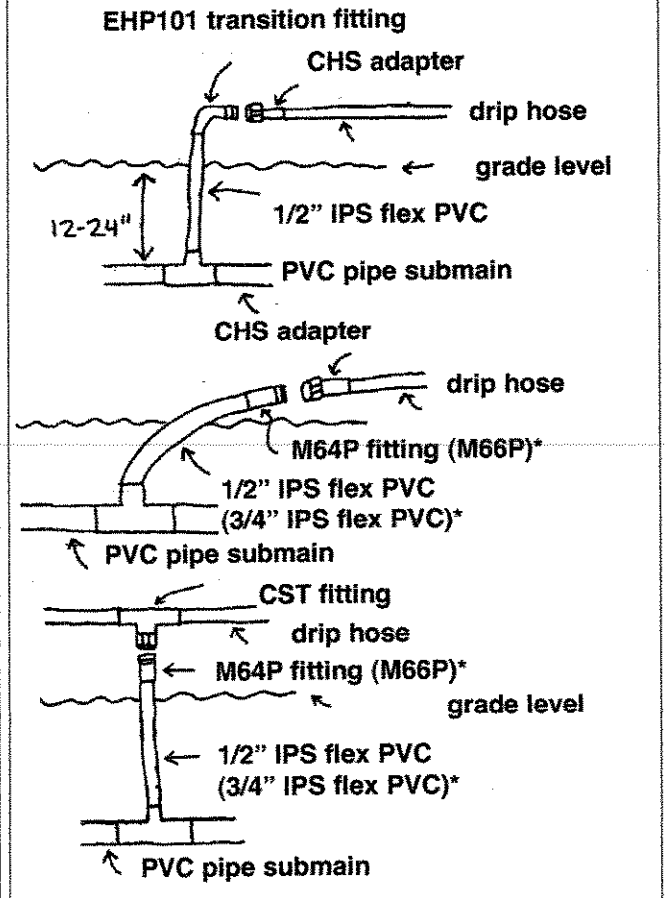
Allowing the tubing to sit in the sun before installation will make it easier to work with. Lay out tubing as per sketch. When assembling fittings, cut the tubing with pruning shears or a sharp knife and be careful to keep dirt out of tubing and fittings.

Where permanent installation of drip tubing is desired, we recommend using underground PVC pipe and coming up with various riser assemblies utilizing flexible PVC IPS hose to connect to the drip tubing (see accompanying drawings).

Be sure not to bury the ends of tubing. You will need to have access to them for periodic line flushing.

TYPICAL VINEYARD OR ORCHARD RISER DETAIL

Used where permanent installation of drip hose and feeder lines are desired



*Note: if flow through riser exceeds 240 gph, use 3/4" IPS hose and M66P fitting.

EMITTER PLACEMENT

Punch holes in tubing with a punch. Using an ice pick or a nail is not recommended because the hole is not evenly punched and often results in stress cracks and leaks around the hole. Also, you can go all the way through the other side!

Water should be filling the drip hose in warm weather when you punch in emitters. This will help make the tubing firm and easier to punch into as well as make the holes the right size for the emitters (no leaking around barbs).

Insert emitters, etc. carefully. For small plants, emitters are often placed fairly close to the trunk. Do not place emitters, etc. such that they will get the trunk wet. This is especially important with perennial plants such as fruit trees and vines which are susceptible to root rots. A general rule of thumb is to keep emitters 12-18" away from the trunks of plants.

The area wetted by an emitter will vary according to soil types. Sandy soil allows water to percolate down rapidly while water on clay soil moves horizontally much further before it goes down below the root zone. On sandy, coarse soil, a 1 gph emitter will wet an area on the surface about 12-15" in diameter. On clay soils, the emitter may wet an area 24" in diameter. Below the surface, a large onion shaped area is wetted as water percolates down. Emitters should be placed to cover root zones well.

Emitters themselves should never be buried because it is much easier to check and maintain them when you can see them. Also, buried emitters can have problems with clogging due to root intrusion or back- siphonage of dirt.

DETERMINE YOUR SOIL TYPE

Fill 2/3 of a quart jar with water and add soil until jar is almost full. Attach the lid and shake vigorously, until all the clumps of soil have gone into solution with the water.

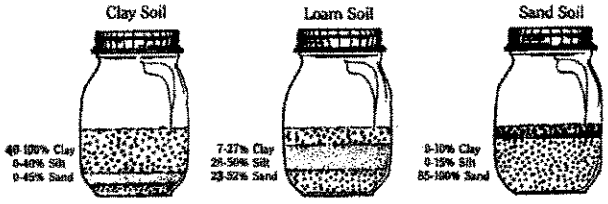
Begin taking measurements as the soil particles start settling out. The first to settle are the larger particles. After one to two minutes, mark the sand level on the jar.

Leave the jar undisturbed for several hours. The finer silt particles will settle out on top of the sand. Often, the layers are slightly different colors, indicating various types of particles. Mark the silt layer after a few hours.

USING DRIP IRRIGATION

Leave the jar overnight and measure the settled clay particles. It may take a few days for some soils to settle.

The following drawing shows the proportions of sand. silt and clay for the 3 major soil types. This is useful in determining how far apart emitters and soaker tubing should be placed to water the plants effectively.



INITIAL SYSTEM START-UP

Once emitters have been punched in, open all tubing end caps and allow water to flush the lines for several minutes. Close the end caps and check emitter operation. If you have an emitter placed where you don't want it, remove emitter and insert goof plug in hole. Punch a new hole in the appropriate place and install emitter.

HOW MUCH TO WATER

Look up the type of plant material you want to water in the above chart to determine the water requirement in gallons per day. Divide the gallons per day required by the gallonage of the emitter delivering the water to each plant to determine hours of watering per day. Determine the days between waterings from the above chart. Multiply the hours of watering per day by the days between waterings to determine how long to run the system. The days between waterings will need to be seasonally adjusted, to account for rain.

DAYS BETWEEN WATERINGS

SOIL TYPE	ZONE	ROOT DEPTH (FT.) 1	2	3	4.5
SAND	Coastal	2	3	5	7
	Inland	1	2	3	5
LOAM	Coastal	3	5	8	11
	Inland	2	3	5	8
CLAY	Coastal	3	7	10	15
	Inland	2	4	7	10

MAINTENANCE

Inspect emitters and microtubing periodically to ensure no emitters are clogged or that sprayers have moved.

Filter screens should be flushed out at least once a month. We recommend checking the filter screen for debris after each irrigation for the first couple of times to determine how often you will need to clean it. Some people have to clean the filter after every irrigation.

WATER REQUIREMENT IN GALLONS PER DAY

TYPE OF PLANT MATERIAL	ZONE	PLANT CANOPY DIAMETER (FT.) 1.0	1.5	2.0	2.5	3.0	3.5	4	5	6	8	10	12	15	20
Flower Beds Thirsty Ground Cover Vines	Coastal	.1	.2	.4	.7	1.0	1.3	1.7	2.7	4	7	11	16	24	43
Young Trees & Shrubs Perennials Small shrubs Vegetables	Inland	.17	.4	.7	1.1	1.6	2.1	2.8	4.3	6	11	17	25	39	69
Fruit Trees	Coastal	.08	.2	.3	.5	.7	.9	1.2	1.9	2.7	5	8	11	17	30
Mature Ornamental Trees	Inland	.12	.3	.6	.9	1.2	1.5	2.0	3.2	4.8	8	13	17	29	51
Citrus Avocadoes DT Ground Cover & Vines	Coastal	.07	.1	.3	.5	.7	.9	1.2	1.9	2.7	5	8	10	17	30
DT Trees & Shrubs Large Shrubs	Inland	.12	.2	.5	.8	1.1	1.5	1.9	3.0	4.4	8	12	17	27	48
Mature, DT Trees & Shrubs	Coastal	.04	.1	.2	.3	.4	.5	.7	1.1	1.6	2.8	4.3	6	10	17
Established Natives	Inland	.07	.2	.3	.4	.6	.8	1.1	1.7	2.5	4.4	7	10	16	28

DT= Drought tolerant

TROUBLESHOOTING

Tubing lines should be flushed periodically, at least once a year. Again, water quality will determine frequency.

FROST PROTECTING YOUR SYSTEM

Any time the temperature goes below freezing, your drip system can be in jeopardy. For most locations, this means winterizing your system or else you will find broken parts come next spring.

The simplest way to winterize either a sprinkler or drip system is to install drain valves which automatically drain the line of water every time your system goes off, so you don't have to think about it. They are very inexpensive and cheap insurance against broken valves, filters and pipe due to being filled with water when freezing temperatures come. These are installed at the lowest point in the pipe run, with a gravel sump to provide drainage.

Otherwise, leaving part of the drip or sprinkler system open will prevent water from freezing until the temperature gets down into the teens (°F.), where you really need a drain valve or flushing end caps to drain the system (see page 15 & 24).

TROUBLESHOOTING

Proper filter maintenance will preclude most emitter clogging problems, except in the case of iron slime bacteria, minerals and other contaminants that do not come out of solution with the water until they hit the air. Clogged emitters can often be cleaned by backflushing: While the system is in operation, hold a finger over the emitter outlet for a few seconds. Hardie DBK , Turbo-Key and Turbo SC emitters can be manually opened and cleaned if necessary. In a worst case situation, the old emitter can be removed, the hole filled with a goof plug and a new emitter installed in a new hole.

If the problem is more widespread- if many emitters appear clogged or are not putting out as much water as they should- check for a break in the lines. After repairing any breaks, open end-caps and flush lines for several minutes. If there are no line breaks, try turning on and off the system several times. This often helps purge debris from clogged emitters.

If the above tips don't help, more than likely there is a design problem- not enough pressure and/or water to operate the system properly. In this case, dividing the system will generally solve the problem.

PHONE ORDERS (707) 823-9125
FAX (707) 823-1734
www.harmonyfarm.com

RESOURCES FOR WATER CONSERVATION

DRIP IRRIGATION

The following mail order businesses carry drip irrigation supplies and ship to our area and have free catalogues available:

Dripworks, 190 Sanhendrin Circle , Willits, CA, 95490-8753, 800-522-3747, www.dripworksusa.com - Specialists in irrigation, an excellent, local source for anything to do with drip and water efficient irrigation. They have an excellent tech support department that can answer questions on the phone. Most orders ship the same day; since they're so close to us you can receive your order within a few days of placing it.

Harmony Farm Supply, PO Box 460, Graton, CA, 95444, 707-823-9125, www.harmonyfarm.com - Their catalogue includes the best summary of drip design available – reprinted in this publication. They carry a wide selection of drip and standard irrigation components, as well as organic fertilizers & pest control, solar electric systems, and horticultural tools & supplies

Peaceful Valley Farm Supply, PO Box 2209, 125 Clydsdale Court, Grass Valley, CA, 95945, 888-784-1722, www.groworganic.com, Suppliers of Drip Irrigation and Organic farming supplies

GREYWATER

Oasis Design – Oasis Design offers a wealth of practical information on ecological living through their website and publications, including one the best resources for greywater – "Create an Oasis with Greywater" www.oasisdesign.net

WATER CONSERVATION

Water Education Foundation - An impartial non-profit organization, is to create a better understanding of water issues and help resolve water resource problems through educational programs. Their website has a wide variety of educational materials on water resources and conservation. www.water-ed.org

Ecotrust - Ecotrust's mission is to build Salmon Nation, a place where people and wild salmon thrive. Their website strives to knit together the communities and salmon-bearing watersheds of the US Pacific Basin. Their website includes essays, resource links and conservation tips for fish-friendly living. www.salmonnation.com

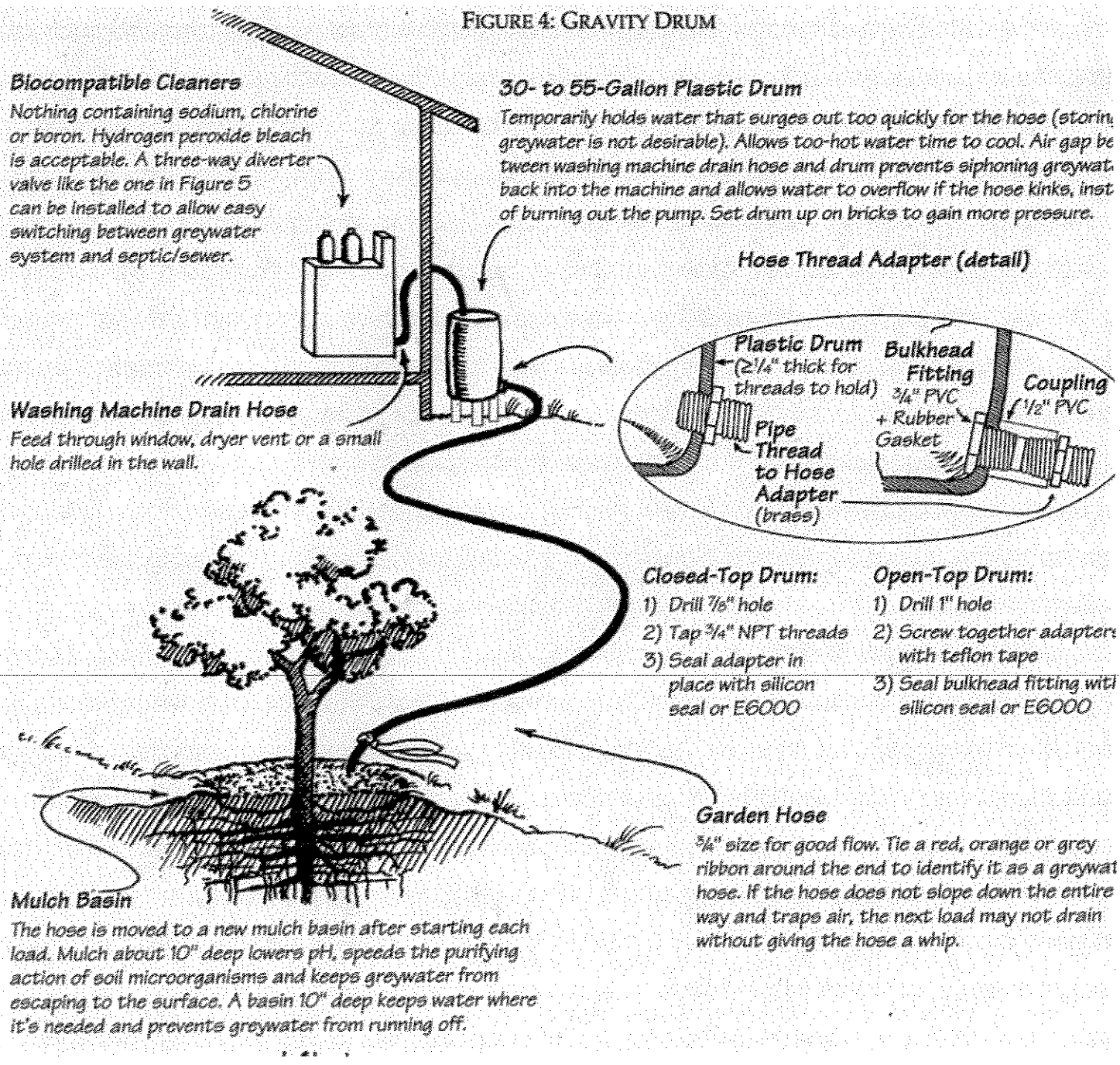
Water Efficient Landscaping

The Sunset Western Garden Book, by Sunset Publishers, Palo Alto, contains a water efficient gardening and variety selection. Available at most bookstores.

Grey Water –Using Water More Than Once

One of the best ways to conserve water is to use it as many times as possible. Greywater is any water that has been used in the home, except water from toilets. Dish, shower, sink, and laundry water comprise 50-80% of residential "waste" water. This may be reused for other purposes, especially landscape irrigation. The following is excerpted from the booklet "Create and Oasis with Greywater, Your Complete Guide to Managing Greywater in the Landscape", by Art Ludwig. This is the single best resource we have found on greywater design and use, loaded with practical information and diagrams, highly recommended. Available from Oasis Design, www.oasisdesign.net, Phone 805 967-9956

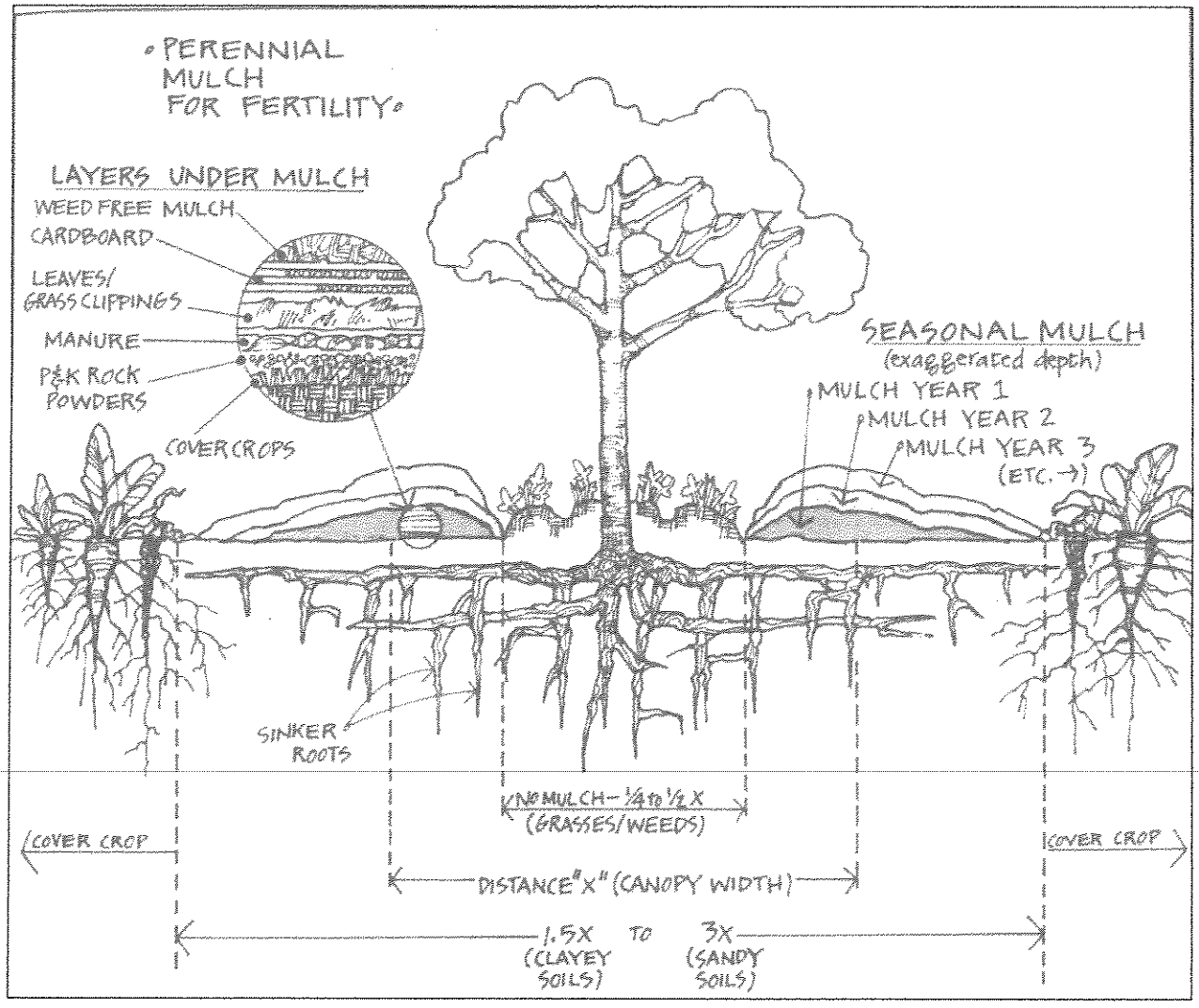
FIGURE 4: GRAVITY DRUM



* Consult your local planning department for local regulations governing greywater use.

Mulch Saves Labor, Time and Water

A good, thick layer of mulch can smother weeds, improve the fertility of the soil, increase your yields and reduce the amount of watering you need to do, all at the same time. You can bury drip irrigation line underneath the mulch to make watering easier. Mulch in layers, with nutrient rich materials (lawn clippings, garden weeds, animal manure, rock powders etc.) near the bottom and rougher materials (such as cardboard, rice straw and wood chips) near the top. You can lay one year's mulch right on top of the previous year's.



Be sure to use weed free mulch material, such as cardboard, lawn clippings, wood ships and rice straw. Hay and straw other than rice straw may contain noxious weeds that will cost you more labor than the mulch saves you!

List of Native Plant Species Desirable for Landscaping Projects

This year, design a fire-safe landscape for the safety of your home and a water-conserving landscape for the sake of your watershed. There are many native plants that are 1) resistant to fire (less likely than most to carry a fire), 2) drought tolerant (adapted to less water compared to other plants), and 3) tolerant of fire (able to re-sprout, re-grow, or re-establish after a fire). While it may seem strange to use species on your property that are tolerant of fire, as we begin to introduce fire to the landscape, for both fuels reduction and the health of the landscape, we want to make sure that the species we plant will survive. While it is always wise to use native plants that are fire resistant and drought tolerant, keep in mind that the plants closest to your home should be maintained. Keep low lying plants closest to your home, then shrubs, and trees the furthest away. Planting and encouraging native plants provides competition to exotic invasive species, a problem you may not have in your yard, but one which is of importance for the larger landscape.

Common Name	*Scientific Name*	drought tolerant	fire tolerant	fire resistant	height at maturity	sun requirements	edible	medicinal	wildlife	
										S=Sun, Sh=Shade, PS=Partial Sun / **L = Low, M = Moderate, H = High**
Ground Cover										
Kinnikinnick	*Arctostaphylos uva-ursi*	H	L		< 6"	S PS		x	L	good on slopes, can creep to 15' wide
Sedum or stonecrops	*Sedum species*		x		< 12"	S PS				hardy succulent, some up to 5' tall
Prostrate ceanothus	*Ceanothus prostratus*	H	H	x	< 6"	S			L	useful ground cover for sunny slopes, flowers used as green dye, all parts used as soap, nitrogen fixer
Wild strawberry	*Fragaria spp*		M		< 12"	S PS	x	x	L	Sudden Oak Death host
Yerba Buena	*Clinopodium douglasii, Satureja douglasii*	x			< 1'	S PS	x	x		prostrate habit, can spread to 3 ft.; used for tea, aromatic foliage
Grasses										
California Brome	*Bromus carinatus*	L	L		1'-4'	S			H	rapid establisher; good soil stabilizer; can withstand periodic drought, listed as invasive in many states outside of native range
California Fescue	*Festuca californica*	H	H		16"-47"	S			H	recommended for stabilizing or restoring disturbed or degraded areas, for erosion control, and for wildlife food and cover
California oatgrass	*Danthonia californica Boland.*	M	H	x	<2'	S			H	vigorous grass, available commercially
Idaho Fescue	*Festuca idahoensis*	M	M		< 2'	S PS			M	fairly drought resistant, adapted to stabilization of disturbed soils
Perennials, Annuals, Bulbs										
American Brooklime, American Speedwell	*Veronica americana*		H	x	.8'	PS Sh	x	x	M	requires moist soil, leaves can be used as a watercress substitute, used as expectorant
Blueeyed grass	*Sisyrinchium bellum*	x	x		1'	S		x		cold hardy to 0 degrees F, Miwok use as tea to treat stomach-aches/reduce fever.
Blue Dicks, Brodiaea, firecracker	*Dichelostemma spp*		x		varies	S PS	x		M	most varieties are edible
California Poppy	*Eschscholzia californica*	M	L		< 2'	S		x	L	naturalizes easily, various medicinal uses
Cleavers, bedstraw	*Galium aparine, Galium oreganum Britt.*		M	x	2'-6'	S PS		x	L	goose forage, seeds can be used as coffee substitute,

Common Name	*Scientific Name*	drought tolerant	fire tolerant	fire resistant	height at maturity	sun requirements	edible	medicinal	wildlife
		S=Sun Sh=Shade PS=Partial Sun					L = Low M = Moderate H = High		
Coral Bells	*Heuchera spp*	x	x		2'	S PS			cold hardy, fast growing, attracts hummingbirds (some species are native - H. micrantha is native)
Fireweed	*Epilobium angustifolium*	L	H		1'-2'	S PS	x	x	H	needs moderate water; good forage; used for revegetation of disturbed sites; can become a weed; young shoots used for food in BC; petals made into jelly, mature leaves dried and used as tea.
Iris	*Iris spp*	M	L		< 2'	S PS		x		hundreds of types, *Iris tenax, bracteata, chrysophylla, douglasiana* are native. *Iris douglasiana* fibers used for rope, root used as medicine, but fresh root may be toxic
Lily	*Lilium spp*		x		varies	S PS		x	x	various native lilies are adapted to fire due to bulbous growth form, many are edible.
Lupine	*Lupinus spp*	x	x		2'	S PS			H	Some species more drought tolerant, e.g. *L.caudatus Kellogg* , all need good drainage, nitrogen fixers
Monkey Flower	*Mimulus aurantiacus*	H			36" - 4'	S			M	good for water-wise landscaping and revegetation; provides nectar to hummingbirds and large bees; important larval host of the checkerspot butterfly
Pacific bleeding heart	*Dicentra formosa (Haw.) Walp.*		H	x	< 1.5'	S PS		x	L	various medicinal uses
Penstemon	*Penstemon spp*	x	x		2'-4'	S PS			M	try *P.eatonii* for drought tolerance, all species are valued in mixes for erosion control and beautification.
Prince's pine, pipsissewa	*Chimaphila umbellata*	M	H	x	4"-12"	PS Sh		x		mixed reports about tolerance of fire, but should resprout from rhizomes following low or medium severity fire; prized herb
Threadleaf fleabane	*Erigeron filifolius* (Hook.) Nutt.	H		x	< 1'	S			L	pretty, late summer blooms
Western columbine	*Aquilegia formosa*	M	H		1'-3'	S PS	x	x	H	frequently used in native North America to treat a variety of complaints; seldom used in modern herbalism; flowers are sweet, look good in salads.
Yarrow	*Achillea spp*	M	H		10'-5'	S		x	L	moderate water use when young; due to its extensive system of rhizomes, western yarrow is a good soil binder, low ignitability
Deciduous Shrubs									
California Redbud	*Cercis occidentalis Greene*	x	x		< 25'	S PS	x		x	flowers, buds and pods are edible, attracts birds; good soil stabilizer along streams, can withstand flooding, respouts vigorously after fire
Currant	*Ribes sanguineum, Ribes lacustre*	H	M	x	12'	S PS	x		H	attracts birds, *R. sanguineum* berries edible, but insipid; spines of *R. lacustre* may cause allergic reaction
Hazel	*Corylus cornuta*	L	H		5'-12'	S PS Sh	x	x	M	valuable as a soil binder on slopes, infusion of the branches and leaves treats heart complaints and intestinal disorders, shoots used in basketry, nuts used by animals and humans
Mockorange	*Philadelphus spp*	L	M		10'	S PS			M	P. lewisii is somewhat drought tolerant; browse palatability increases following fire.
Oceanspray	*Holodiscus discolor*	L	M		3'-20'	S PS			L	tall only in moist conditions, readily rehabilitates disturbed sites, shade tolerant, fast growing, resistant to trampling, disease resistant

Pacific serviceberry	*Amelanchier alnifolia*	M	H		< 20'	S	x	x	H	needs moderate water, various medicinal uses, resprouts vigorously following fire.
Pacific dogwood	*Cornus nuttallii*	L	M		15'	S PS		x	M	readily sprouts following disturbance, grows rapidly, spreads from roots, high flood tolerance, sprouts heavily browsed
Snowberry	*Symphoricarpos albus*	H	H		2'-6'	S PS		x	H	good for erosion control, widely used in rehabilitation of disturbed sites, tolerates poor soil, important browse; will have a high flammability if there are many dead stems.
Skunkbrush sumac	*Rhus trilobata*	M	H		varies	S PS Sh			M	grows principally from 3,500-9,000 feet; useful for wind barriers, reclamation of disturbed areas, erosion control and survives on untreated mine spoils
Vine maple	*Acer circinatum*	L	M		5'-35'	S PS			M	brilliant fall color; abundant foliage is a preferred food of black-tailed deer and elk
Western (Rose) spirea	*Spiraea douglasii*	M	H		4'-8'	S PS			L	needs moderate water; used in riparian revegetation programs in the Pacific Northwest, sensitive to trampling and soil compaction
Wood's rose	*Rosa woodsii*	M	H		< 6'	PS	x	x	M	best hips for tea of any rose, effective in erosion control, used to revegetate disturbed sites along road cuts, streambanks, and seeps,
Evergreen Shrubs										
Ceanothus	Ceanothus cuneatus, Ceanothus sanguineus	M	M	x	3'-11'	S PS	x		L	Nitrogen fixer
Chamise	*Adenostoma fasciculatum*	H	H	x	< 6'	S			M	wood has been used in basketry, good soil binder, leaves used antirheumatic and disinfectant.
Creeping holly, Oregon-grape, creeping barberry	*Mahonia repens*	H	H		3'	S PS			M	attracts birds, creeps underground, erosion control, fruits are eaten by a number of bird and mammal species, evergreen ground cover that is both heat and drought tolerant
Dwarf Oregon grape	*Berberis nervosa*	H	H		< 6'	S PS	x	x	M	fruit used for jelly and wine, out competes weeds, roots are medicinal and used as dye
Evergreen huckleberry	*Vaccinium ovatum*	M	M		1.5' - 9'	S PS Sh	x	x	H	frost tender, decoction of the leaves has been used in the treatment of diabetes, berries most abundant in partial sun, Sudden Oak Death host
Oregon boxwood, falsebox	*Pachystima myrsinites, P. myrsinites*		M		2'-4'	S PS			M	important forage for deer and elk; root cuttings can be used to revegetate disturbed sites
Oregon Grape	*Mahonia aquifolium or Berberis aquifolium*	H	?		< 8'	S PS Sh	x	x	M	Fruit has little flesh and many seeds, cooked fruit tastes like blackcurrants, can be dried and stored, yellow dye is obtained from the inner bark of the stem and roots
Pacific Rhododendron	*Rhododendron macrophyllum*		M		4'-10'	PS			L	need acid soil, hardy to 5 degrees F., eaten by mountain beaver, erosion protection on steep watersheds, often indicates low soil nitrogen content, Sudden Oak Death host
Salal	*Gaultheria shallon*	L	H	x	4'-10'	S PS	x	x	M	needs acidic soil, well-suited for use as a ground cover on erosive banks and other types of reclaimed ground
Toyon	*Heteromeles arbutifolia*	M	M		6 - 10'	S	x	x	M	Useful for erosion control on dry, steep hillsides; usually boiled or roasted before consuming; relatively nonflammable
Western azalea	*Rhododendron occidentale*		M		10'	S PS				needs water, attractive, fragrant blossoms , Sudden Oak Death host

Common Name	*Scientific Name*	drought tolerant	fire tolerant	fire resistant	height at maturity	sun requirements	edible	medicinal	wildlife	
										S=Sun Sh=Shade PS=Partial Sun L = Low M = Moderate H = High
Deciduous Trees										
Aspen/cottonwoods	*Populus spp*		x		< 60'	S PS				Populus fremontii is native and drought tolerant, all can have invasive roots, P. balsamifera ssp. Trichocarpa is native, but low fire and drought tolerance
Bigleaf maple	*Acer macrophyllum*		H		30'-95'	S PS	x	x	H	maple sugar, attracts bees, good furniture wood, an infusion of the bark was used in the treatment of tuberculosis,
California Black Oak	*Quercus kelloggii*	M	M		< 85'	S PS	x	x	H	acorns relished as food; high-grade lumber; once established, quite fire-tolerant; following prescribed spring burn surviving oaks produce a bumper crop of sound acorns, Sudden Oak Death host
Chokecherry	*Prunus virginiana*	M	H		< 25'	S PS	x	x	H	nutritional browse, bark used as respiratory sedative, used in revegetation for wildlife habitat, shelterbelts, mine spoils and soil stabilization, aesthetically pleasing
Klamath Plum	*Prunus subcordata*	M	H		< 25'	S PS	x		M	thicket forming, tolerates poor soil, slopes, green dye can be obtained from the leaves
Madrone	*Arbutus menziesii*	H	M		40'-130'	S PS	x	x	L	firewood, cabinetry; attracts bees; tea made from leaves treats bladder infections; can prevent erosion, Sudden Oak Death host
Oregon white oak	*Quercus garryana*	H	L		40'-90'	S PS	x	x	H	acorns are important source of food for animals and humans, extensive root system helps stabilize steep slopes in watershed areas, leaves for stock food, firewood
Red alder	*Alnus rubra*	M	H		45'-50'	S	x	x	M	coastal; roots used in baskets; effective in controlling erosion; high quality hardwood; nitrogen fixer; fire hazard low in red alder stands
Red Elderberry	*Sambucus racemosa var. racemosa*	L	H		< 18'	S PS	x	x	H	Leaves and stems are poisonous; high water use; rich in vitamin C, the seed can be removed and the fruit used in jellies, preserves.
Willow	*Salix spp*	L	H		varies	S		x	L	grows quickly near water, good for erosion control, S. exigua is native - used in bank and sediment stabilization, maintenance of channel morphology, water quality improvement, ground-water recharge, flood abatement, habitat for fish and wildlife
Evergreen Trees										
Ponderosa pine	*Pinus ponderosa*	H	H		100'-250'	S	x	x	L	rapid growing; suitable as a windbreak species; cover and erosion control on rehabilitated sites; high-grade lumber; food for many species; needles used as dermatological and gynecological aids, pitch used as ointment
Sugar pine	*Pinus lambertiana*	M	M		160'-270'	S	x	x	M	pinenuts, lumber, highly susceptible to white pine blister rust caused by the fungus Cronartium ribicola
Tan Oak	*Lithocarpus densiflorus*	H	M		< 100'	S PS	x	x	H	important staple for Native American groups; bark is very astringent - an infusion is used as a wash for face sores; tannin from bark is used commercially to cure leathers, Sudden Oak Death host

Compiled by Nancy Bailey and Luna Latimer, Mid Klamath Watershed Council, www.mkwc.org, with support from the Department of Fish and Game and the United States Fish and Wildlife Service.

DO YOUR PART TO SAVE WATER THIS YEAR!!!

Conserving summertime water means keeping more water in our streams and rivers. For the sake of the fish and their riparian habitat; for the sake of overall watershed health; for the sake of yourself and your community:

Water Saving Tips:

Plant native grasses, plants and trees that are drought tolerant.

Consider a graywater system to recycle household water for use as outdoor irrigation water.

Water your lawn at dawn or dusk to reduce evaporation loss.
AND
Install a drip irrigation system in your garden or yard.

If you have an irrigation ditch, pipe or line it.

Buy an on-demand hot water heater

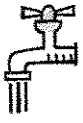
Fix leaks around your home to save as much as 9000 gallons in a year.

Wash only full loads in your washing machine and dishwasher (saves up to 2,000 gallons a year). Get a tax refund when you buy water-efficient versions of these appliances.

Use a broom instead of a hose to clean your driveway.

Wash your car with a bucket, not a hose.

Buy a low-flush toilet or put a brick in your toilet tank.



Turn off faucet any time you're not using it.

Take a shorter shower or install a water conserving shower head.

Use recycled paper (saves 60,000 gallons of water per ton of paper).

These ideas brought to you by the Mid Klamath Watershed Council. For more information or to add your own ideas to this document, call (530) 469-3216

News from the
Mid Klamath Watershed Council
October 2005, Sixth Edition

toxic algae plagues Klamath Reservoirs

S. Craig Tucker, Ph.D.
Klamath Campaign Coordinator, Karuk and Yurok Tribes

We all know that the dams play a major role in the decline of salmon. The dams deny access to over 350 miles of historical spawning grounds, act as 'heat sinks' as shallow reservoirs warm to temperatures lethal to salmon, and degrade water quality. All this you know by now.

What you may not know is that the reservoirs are toxic to humans too.

This summer, in an effort to better understand and describe the water quality problems the dams create, Karuk Water Quality staff began sampling the reservoirs to learn more about the blue-green algal blooms that occur each summer. What they found could lead to the closure of the reservoirs.

Blue-green algae, or cyanobacteria, come in many varieties-some benign, some toxic. The toxic varieties typically fall into two categories those that secrete neuro-toxins and those that secrete liver toxins. What the Water Quality Crew has found is called *microcystis eroginosa*, which secretes a cyclic polypeptide called microcystin. Microcystin is a liver toxin and proven tumor promoter.

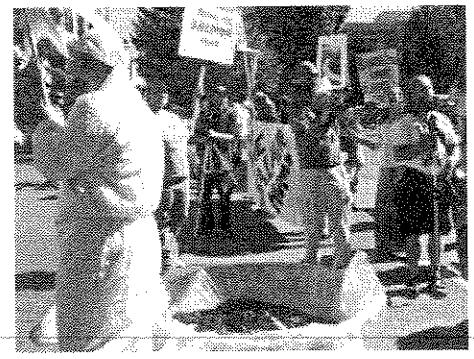
Although the United States EPA does not have guidelines for acceptable levels of microcystin, the World Health Organization (WHO) does. According to the WHO, algal levels of 100,000 cells/milliliter of water represent a moderate health risk for recreational users. The Tribe found sample sites with over 11 million cells/ml-***110 times greater that the WHO moderate risk levels!*** Although the WHO does not give specific numbers for a high health risk, it notes that visible blue-green scum on the water's surface is considered a high health risk and should be avoided.

At this level of toxicity, an adult would only have to ingest about half a cup of the water to exceed the WHO Tolerable Daily Intake (TDI) by 28 fold. A child ingesting a quarter cup of water would exceed the TDI by 228 fold.

The symptoms of microcystin poisoning include: skin rash, eye irritation, nausea, vomiting, diarrhea, mouth ulcers, liver damage, kidney damage, and in extreme cases, liver failure and death.

The Tribe is now sampling sites in the river downstream of the reservoirs as is the Fish and Wildlife Service and the Yurok Tribe. As daytime temperatures drop, the blooms will subside until next year. Using the data collected this year, we hope to convince Siskiyou County to set firm standards for closing the reservoirs to recreational use when toxic blooms erupt in the future.

Studies suggest that the toxin can accumulate in the flesh of fish, however the Tribe has not determined whether or not the toxin is present in Klamath salmon



locals respond to toxic algae threat

Angered by the impacts of dams to fish and now to human health, local activists joined forces with salmon supporters in Portland to return some Toxic Algae to PacifiCorp, owner of Klamath dams on Monday, September 26th. The colorful demonstration included activists in hazmat suits with algae and dead fish, giant fish puppets, and banners. The group was comprised of members of several Klamath Basin Tribes as well as non-native supporters of a healthy river system.

Native Plant Garden & Workshops

Nancy Bailey

A series of workshops will occur in concert with the development of a new *Native Plant Demonstration Garden* at a site behind the Orleans Karuk Dept of Natural Resources (DNR), in the "Daryl 'Daypay' McCovey Memorial Park." This project is a cooperative venture sponsored by the Karuk DNR, the Karuk Indigenous Basketweavers and MKWC. We will be soliciting local schools to get involved as well.

The goals and objectives for the *Garden* project include:

- *Education regarding native plants, their names (Karuk, Botanical, and English) and traditional/historic uses.*
- *Education regarding current uses of native plants for restoration projects.*
- *Education and demonstration of traditional management of specific plants.*
- *Providing a venue for native plant research.*
- *Providing a friendly and beautiful environment for use by community members and visitors.*

The project is still in its developmental stage, and will require input and involvement of many. There is a wealth of knowledge amongst tribal members and

see Native Plants, page 7

Free Workshop on Drip Irrigation

Come learn how to design & install a drip irrigation system and how to save water, time & energy in your home, garden and landscape.

- Reduce water use up to 50%
- Water your garden, not the weeds
- Reduce plant stress.
- Increase yields
- Reduce disease problems
- Reduce soil compaction & erosion

Drip & micro sprinkler irrigation can save you time & energy, increase yields and save thousands of gallons of water. This free workshop will cover all of the basic information you need to know to design and install a drip irrigation, including assessing the volume & pressure of your water source, filtration, layout, assembling components and troubleshooting.

SUNDAY JUNE 12th 2005
9-12

KLAMATH KNOT ARTS COUNCIL
HWY 96 HAPPY CAMP

For more information contact Mark at 627-3379
or Nancy at MKWC 469-3216

Sponsored by the Mid Klamath Watershed Council
In cooperation with the US Fish and Wildlife Service

Free Workshops on Drip Irrigation

Come learn how to design & install a drip irrigation system and how to save water, time & energy in your home, garden and landscape.

- Reduce water use up to 50%
- Water your garden, not the weeds
- Reduce plant stress.
- Increase yields
- Reduce disease problems
- Reduce soil compaction & erosion

Drip & micro sprinkler irrigation can save you time & energy, increase yields and save thousands of gallons of water. This free workshop will cover all of the basic information you need to know to design and install a drip irrigation, including assessing the volume & pressure of your water source, filtration, layout, assembling components and troubleshooting.

Two Workshop Dates & Locations:

Somes Bar General Store, May 29, 1:00 PM

Forks of Salmon Elementary School, June 14, 4:00 PM (bring a snack to get through dinnertime)

For more information contact Mark at 627-3379

Sponsored by the Mid Klamath Watershed Council and the Salmon River Restoration Council.

NATIVE PLANTS
FOR RESTORATION AND LANDSCAPE
WORKSHOP
SUNDAY APRIL 17TH 2005
10AM KARUK COMMUNITY CENTER
ORLEANS

(snack lunch provided, feel free to bring food to share)

Native Plants are often:
water conserving (we are in a drought year)
fire resistant (for the safety of your home)

Native Plants can provide:
good competition to noxious weeds
erosion control
wildlife habitat

California redbud ~ *Cercis occidentalis*

Learn:

- to match appropriate species with projects or sites
- how to propagate plants from seeds or cuttings
- resources for seeds or plants

Participate:

- Help with the initial planning and design for the ***Demonstration Native Plant Garden*** to be created at the ***Daryl "Day-Pay" McCovey (1965-1982) Memorial Park***

Sponsored by Mid Klamath Watershed Council and
Karuk Department of Natural Resources

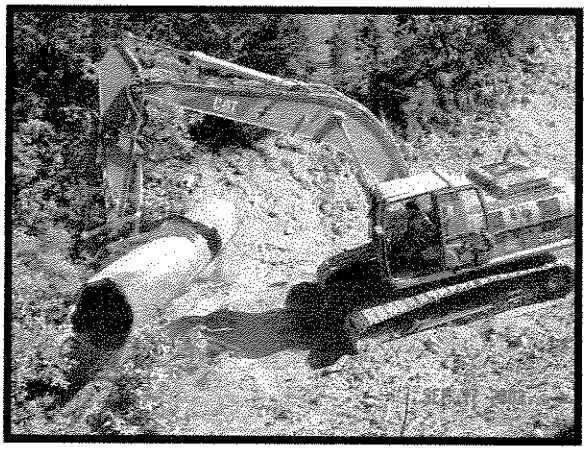
Watershed Restoration Review

Presentation and Field Trip

Tuesday Sept 7th

Presentation: Karuk Tribe Community Center, Orleans, 9am

Field Trip: *Carpool to road* 12N08, *(near Camp Three) a Cooperative Road Decommissioning Project in progress.*



Bring: * Sack lunch * Walking shoes * Water * Questions and concerns

Objectives:

- Increase stakeholder awareness about watershed restoration and road decommissioning projects in the Mid Klamath and Salmon River subbasins
- Facilitate dialogue between community members, the Tribe, USFS, and other agencies with regards to watershed restoration and road decommissioning
- Provide the opportunity to see the process of decommissioning a road first hand
- Review Project and Provide Opportunity for Input

Sponsors: Karuk Tribe Watershed Restoration Program, Mid Klamath Watershed Council, Salmon River Restoration Council, USFS, Klamath Salmon Anglers & Guides Association, California Department of Fish and Game

Accommodations:

Sandy Bar Ranch (530) 627-3379
Marble Mountain Ranch (530) 469-3322
Orleans Mining Company (530) 627-3213

RSVP: If possible please call or email Earl Crosby (530)469-3454 ecrosby@karuk.us or Nancy Bailey (530)469-3216 nb_rorisang@yahoo.com if you are able to attend.

Addendum

Notes on Final Expense Report

A strong volunteerism in organizing and teaching workshops meant that MKWC saved $581 on personnel costs. In the the Summary of Pending Expenditures in this Report we propose using $455 of this money to print 500 copies of the trifold brochure "Safe Roads" developed by the Salmon River Restoration Council, attached.

MID KLAMATH WATERSHED COUNCIL
PO Box 347
Orleans, CA, 95556
Phone (530) 627-3379
mail@ sandybar.com

RECEIVED
DEC 0 9 2005
YREKA F.W.O.

December 7, 2005

Jennifer Silvera
US Fish & Wildlife Service
Yreka Fish & Wildlife Service
1829 South Oregon St.
Yreka, CA, 96067

Dear Jennifer:

I'm sending along a copy and one disk of the Final Progress and Evaluation Report for **Increasing Community Awareness and Beneficial Use of Water Resources in The Mid Klamath Basin, 2004-E-04,Agreement No. 113334G019** submitted by the Mid Klamath Watershed Council. Thanks for your input on this! I will send you a few copies of the pamphlet (Saving Water for the River) when it's done. Please let me know if you have any questions.

Sincerely,

Mark DuPont
Mid Klamath Watershed Council

MID KLAMATH WATERSHED COUNCIL
PO Box 347
Orleans, CA, 95556
Phone (530) 627-3379
mail@ sandybar.com

RECEIVED
NOV 04 2004
YREKA FWO

October 30, 2004

Phil Detrich
Field Supervisor
US Fish & Wildlife Service
Yreka Fish & Wildlife Service
1829 South Oregon St.
Yreka, CA, 96067

Dear Mr. Detrich:

Enclosed you will find 2 hard copies and one disk of the Progress and Evaluation Report for **Increasing Community Awareness and Beneficial Use of Water Resources in The Mid Klamath Basin, 2004-E-04,Agreement No. 113334G019** submitted by the Mid Klamath Watershed Council. We look forward to any feedback or input you or your office may have for this project. Should any questions arise concerning this proposal I can be reached at the numbers listed above. Thank you.

Sincerely,

Mark DuPont
Mid Klamath Watershed Council

Evaluation and Progress Report, May through October, 2004

Project Title:	**Increasing Community Awareness and Beneficial Use of Water Resources**
Project Number:	**2004-E-04**
Agreement Number:	**113334G019**
Date Submitted:	**October 30, 2004**
Funded Group:	**Mid Klamath Watershed Council/ Salmon River Restoration Council**

Evaluation and Progress Report, May through October, 2004

Project Title:	**Increasing Community Awareness and Beneficial Use of Water**
Project Number:	**2004-E-04**
Agreement Number:	**113334G019**
Date Submitted:	**October 30, 2004**
Funded Group:	**Mid Klamath Watershed Council/ Salmon River Restoration Council**

1. Abstract

Over a two-year period the Mid Klamath Watershed Council (MKWC) is implementing a series of workshops and producing educational materials for basin stakeholders on the topics of water conservation and proper road maintenance. During this first phase we have gathered and evaluated educational materials and designed and taught three workshops.

2. Introduction

Klamath Basin residents have considerable cumulative impact on the water quality of the Klamath River via water consumption, road building and maintenance and vegetation management. As the population of the basin continues to grow residential water use will continue to rise and both private and municipal water diversions will increase. Many of the roads used by private residences are unimproved dirt roads that are poorly maintained and deliver unnecessary quantities of sediment to the basin's watersheds. Residential landscaping impacts the Klamath River through water use, the introduction and the spread of noxious weeds. Water conservation, proper road maintenance, landscape design and vegetation management can save money and labor and increase landowner safety while simultaneously reducing water use, reducing erosion and enhancing riparian habitat. By showing both the economic and ecological benefits this project aims to enlist landowner's support and raise awareness and concern for the basin's water resources.

3. Description of Study Area

The Mid Klamath Watershed Council is active on the main stem of the Klamath from Weitchpec to Interstate 5, including major tributaries. This project is aimed towards residents and business owners within this area.

4. Methods and Materials

This project spans two years. MKWC initiated this project in May 2004 by gathering existing information and educational materials on water conservation and proper roads maintenance. We contacted and obtained materials from several groups including the Water Education Foundation, Ecotrust/ Salmon Nation, The Salmon River Restoration Council, Dripworks, and Harmony Farm Supply. Research showed that landscape and garden irrigation accounts for more than 50% of residential water use, and this occurs in warm summer months, when water flows are critical to anadromous fish. We decided that drip irrigation would draw the most interest as a workshop topic and also have the biggest impact on improving water use efficiency among mid-basin residents, so we made drip irrigation the focus of our water conservation workshops. We also decided to hold these workshops and install drip irrigation systems at high-profile locations such as school/ community gardens and general stores. Dripworks, a regional supplier of drip irrigation components, made a generous donation of over $400 worth of drip irrigation components and equipment. Harmony Farm Supply has agreed to allow MKWC to reproduce it's educational publication "Drip Irrigation Design".

MKWC has identified what we feel are the most effective educational pamphlets and resources. Some of these materials will be modified or amended to make them more appropriate to the context of Klamath River communities. Next year these materials will be reproduced for future workshops. MKWC will continue to teach more workshops and produce and distribute these materials to basin stakeholders.

8. Results and Discussion of Accomplishments During the Project

We will discuss three components of the project, Water Efficiency, Roads Maintenance, and Educational Materials.

Water Efficiency - We held one workshop at the Somes Bar General Store on Saturday, May 29, and the second one at the Forks of Salmon Elementary School on June 12. The workshops were very successful and resulted in the installation of two drip irrigation systems in prominent public areas. Several workshop participants have installed their own home drip irrigation systems. MKWC has been asked to teach more drip irrigation workshops in communities along the river and we will be scheduling those for spring/ summer 2005. Note - This project was written to conduct only three workshops (one on roads maintenance and two on water conservation). We have found that the water conservation workshops are most effective as half-day workshops and are easily taught by MKWC personnel, and therefore are less expensive to implement than we had anticipated. Also, the drip irrigation workshops were taught shortly before the final draft agreement was signed by Fish & Wildlife. We felt it necessary to teach these workshops early in the summer when people start to set up their irrigation systems. Next year we will be ready to teach this workshops early in the season and plan to hold more workshops in the Orleans-Some Bar area and also extend into the areas of Happy Camp, Seiad Valley and Horse Creek.

Roads Maintenance– We will teach the roads maintenance workshop for this project in 2005. (Initially this proposal called for teaching two workshops on road maintenance. When the original funding request was reduced we then reduced the number to one.) This year MKWC organized a workshop on roads maintenance that was funded by US Fish and Game. This was an interagency workshop, with participation of the US Forest Service, US Fish & Game, The Salmon River Restoration Council and the Karuk Tribe, as well as local landowners. This workshop laid important groundwork for our next workshop to be taught in 2005, which will be oriented specifically towards landowners.

Educational Materials – The most significant product of this project will be educational materials that will be used in future workshops, made available to basin stakeholders in public places, and actively distributed by MKWC. A goal of the first phase of the project has been to identify, gather and assess existing materials and use them in our workshops to test their usefulness and applicability to our particular region. We have already identified several materials that have proven useful to stakeholders including:

Drip Irrigation Design, by Harmony Farm Supply. Of all the resources on home water conservation that we have reviewed, this is the most complete and concise guide to designing and installing drip irrigation systems. It is short (five pages) and thus can be cheaply replicated, yet it is complete enough to provide all of the information a homeowner needs to design and install a system, including useful diagrams and reference charts . (See attachment A) The authors, Harmony Farm Supply, have agreed to allow us to reproduce it for distribution as part of this project.

Safe Roads – The Salmon River Restoration Council has already produced a simple but very effective flyer on road maintenance with support from the CA Dept of Fish & Game and the US Dept. of Fish & Wildlife. MKWC plans to reproduce this pamphlet for future distribution and workshops. See Attachment B.

Water Education Foundation Publications - The Water Education Foundation publishes several useful pamphlets, including the Water Conservation Tipsheet, Water Facts brochure, Landscape Design Brochure, as well as a Drought Survival kit, that includes simple materials that can be used for home water conservation. Some of these written materials will need to be modified to be made more applicable to the communities of the Klamath River; others are very useful as they are. See Attachment C.

Plant Matrix – The choices that residents make in landscape plantings have a large impact on water use and noxious weed infestations. Some noxious weeds, such as scotch broom and buddleia, are sold in coastal nurseries as ornamental plants, thus it is important to educate homeowners on proper plant selection. We are preparing a guide in the form of a plant matrix that will list native, ornamental and food plants and show which are drought tolerant and fire resistant as well as their specific tolerances and cultural requirements. The matrix will also highlight certain plant species that gardeners should avoid that could result in increased fire danger and/or noxious weed infestations. Attachment D is an example of a Plant Matrix that we plan to modify for our region.

6. Summary and Conclusions

The tasks scheduled for the fist phase of this project have been successfully completed, including the following, as written in the original proposal:

- MKWC will contact and consult with experts in workshop topics
- MKWC will research and gather existing educational materials on workshop topics
- The Mid-Klamath Watershed Council will conduct workshops on the following topics:
    - Water Conservation in the Home and Landscape
    - How to Save Money and Reduce Erosion through Proper Road Maintenance

The workshops were very successful and resulted in the installation of two drip irrigation systems in prominent public areas. Several workshop participants have installed their own home drip irrigation systems. MKWC has been asked to teach more drip irrigation workshops in communities along the river and we will be scheduling those for spring/ summer 2005. We have found that the Water Conservation workshop can be implemented for less expense than anticipated – it can be taught by MKWC personnel and works well as a half-day workshop, thus we will be able to teach several more than the two listed in our original proposal.

During 2005, MKWC will:

- Continue to teach workshops on Water Efficiency in the Orleans/ Somes Bar area and will expand into the upper reaches of the Mid Klamath Watershed.
- Develop and distribute educational materials on water conservation, proper road maintenance and identification and prevention of noxious weeds to sub basin stakeholders.
- Evaluate project and submit a final progress report to the Yreka Fish and Wildlife office.

MKWC looks forward to input and feedback from The US Fish and Wildlife on this project.

7. Summary of Expenditures

Summary of Expenditures as of 10/31/04

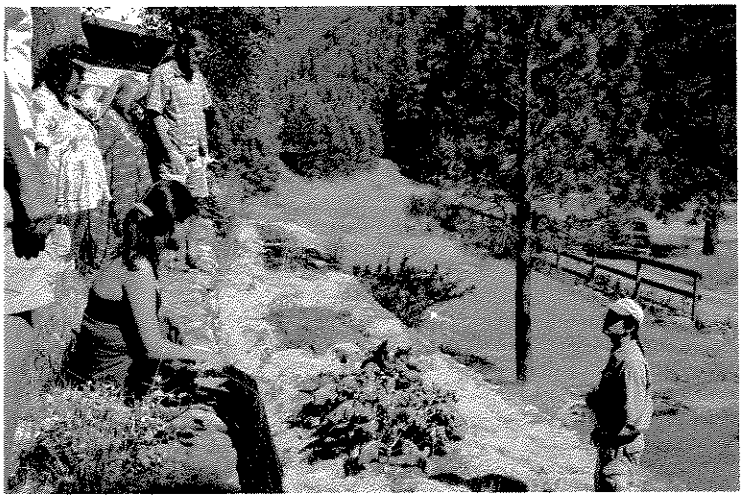
PERSONNEL COSTS			Paid Hours	Cost Share MKWC	Total
Position	Hours	Hourly Rate			
MKWC Staff	73	15	$645.00	$442.50	$1,087.50
Staff Benefits @ 15.85%			$102.23	$70.14	$172.37
Total Personnel Costs:			**$747.23**	**$512.64**	$1,259.87
OPERATING EXPENSES					
Drip Irrigation Donation				$435.82	$435.82
Mileage @ $.36/Mi	0.36		$46.44	$18.72	$65.16
Phone			$0.00	$0.00	$0.00
Total Operating Expenses:			**$46.44**	**$454.54**	$500.98
Administrative Overhead @ 15%			$119.05	$145.08	$264.13
Project Totals			**$912.72**	**$1,112.25**	**$2,024.98**

8. Addendum

List Of Attachments:

A. Photos from Drip Irrigation Workshop, Somes Bar, May 29, 2004
B. Drip Irrigation Design by Harmony Farm Supply
C. Safe Roads, put together by SRRC
D. Water Education Foundation Publications
~~E. Sample Plant Species Matrix~~

Photos from Drip Irrigation Workshop, Somes Bar, May 29, 2004



ATTACHMENT B

DRIP IRRIGATION DESIGN

Many farmers and gardeners have found drip irrigation to be a great time saver as well as giving them better yields from healthier plants. Use of drip irrigation has decreased the incidence of plant disease which might overwise occur with overhead sprinkler irrigation. Many soluble fertilizers can be applied thru the drip system, keeping nutrients near the root zone and allowing the plants to get the most value from each fertilizer application.

Most of the drip components were originally derived from Israeli engineers who were the pioneers in this field. Since then many systems have been devised in the United States, being field tested in California, Florida and Hawaii.

The advantage of a drip system is that you water the plants you want to water, keeping weed growth out of your plantings. And you don't have to worry about whether you have stood there long enough with the hose (most of us never do!) or whether there will be enough rain to keep the plants going.

If you have ever put something together with Tinker-Toys, you have the basic ability to put together a drip system. It is that simple! Just get the components you need and assemble the system-- most home garden systems can be assembled in one afternoon.

HOW CLEAN IS YOUR WATER?

The main question you need to answer concerns the quality of your water. While there are things which can be done to mitigate the effects of bad water, the dirtier your water is, the more careful you will have to be with the components chosen to achieve satisfaction and low maintainence with your drip system.

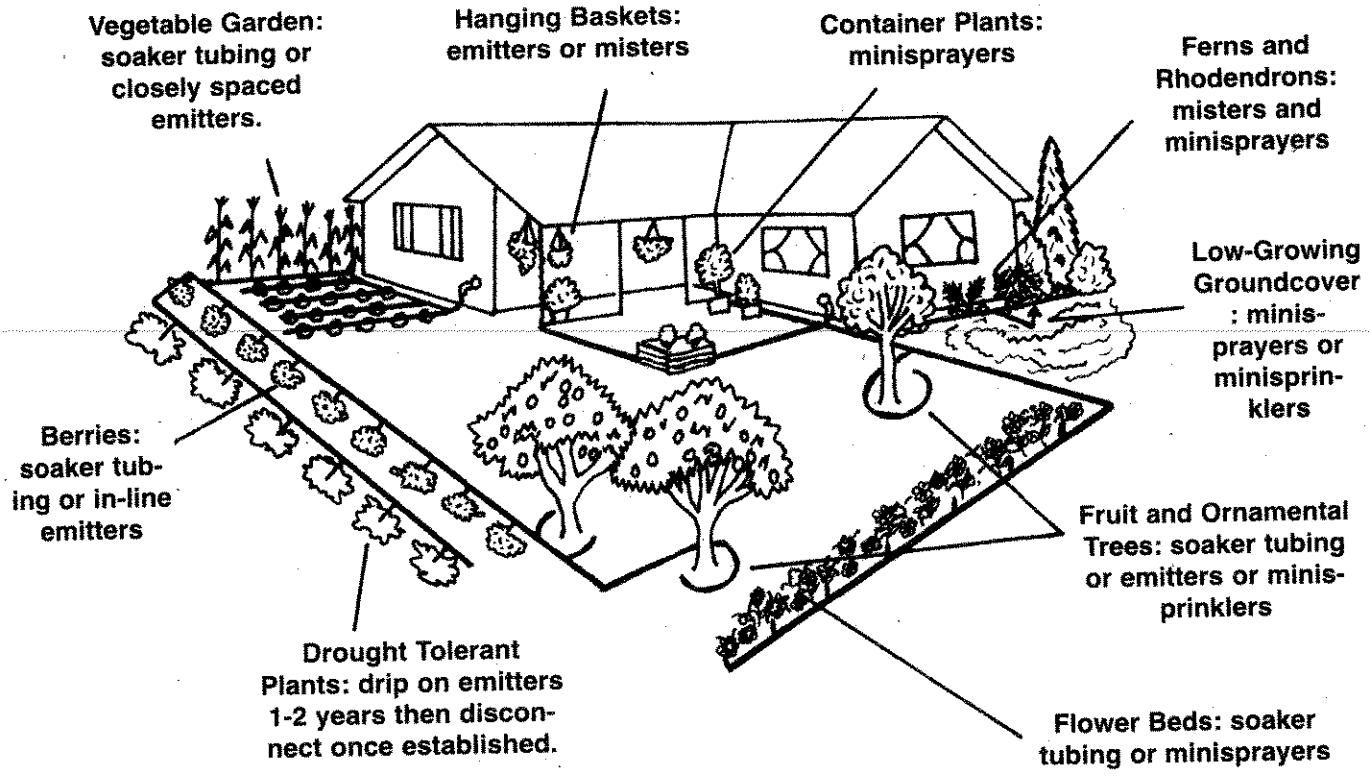
From most easily clogged to hardest to clog:

1. **soaker type tubing** such as T-Tape
2. **small orifice emitters** such as 1/2 gph emitters
3. **larger orifice emitters** such as 1 and 2 gph emitters
4. **minisprayers & sprinklers** over 3 gph
5. **in-line emitters** such as Netafim & Dripperline

Within each classification there are differences in performance with various products (advantages and disadvantages) so don't take this as an ironclad rule of thumb.

The worst water is from ponds or lakes that have algae, etc. The next worst is water containing iron slime bacteria (these will not filter out, they only come out of solution when they hit the air) and water that contains calcium or magnesium that precipitates out when it hits

DRIP SYSTEM APPLICATIONS



© 1997 Harmony Farm Supply

air and leaves deposits. Then comes water high in sand (many wells pump some sand). Believe it or not, even some municipal water systems have crud in them, although most city water is pretty clean.

WHAT EVERY SYSTEM NEEDS

All drip systems should have a **filter** on them, regardless of water source. It is very cheap insurance so contaminants in the water clog the filter, not the emitters. Some people don't like how often they have to clean their filter-- if that is the case, get the next larger size so you won't have to do it so often. Some systems require cleaning out the filter every time the system is run and some people only have to do it once a year (depends totally on your water quality).

Most drip systems should have a **pressure regulator**-- especially if you are on city water or have a well set to run between 40 and 60 psi. If you are on a spring box or have a gravity fed tank with not much head above the drip system, you probably won't need a pressure regulator. Most emitters and minisprinklers are designed to give the rated gallonage at 20 to 25 psi. Most soaker type tubing is designed to run at 10 to 15 psi.

CHOOSING COMPONENTS

How do you choose which types of emitters, soaker type tubing or minisprinklers you want for your system? It is an individual choice and here are our recommendations on what most people have found to work well for them:

EMITTERS-- Generally, people choose to use emitters when the plants are spaced somewhat far apart as is the case with perennial shrubs, fruit trees and vines and vegetables planted in hills. On flat ground you can use either the Hardie DBK, Netafim button or 36" or 48" Dripperline emitters for evenly spaced trees and vines. The DBK emitters can be opened to be cleaned if necessary. The Netafim buttons cannot be opened but they very rarely clog. On hilly ground (greater than 20 ft. vertical change up or down a hill), one should definitely chose from the pressure compensating emitters(which can be either in-line or punched into hose) so that all of your plants get the same amount of water per irrigation. Only the Turbo SC emitters (of all the pressure compensating emitters) can be opened to be cleaned if necessary. All pressure compensating emitters are self-flushing.

SOAKER TYPE TUBING-- these are ideal for watering intensively planted beds of vegetables or flowers, also berries, turf, and other areas where you want to evenly water an entire swath of plants.

T-Tape is mostly used by vegetable growers, both large and small. T-Tape tubing must be used in straight runs- do not run around corners or bend (unless you use fittings) or the flow of water will be cut.

Soaker Dripline is often used in ornamental settings and can be bent gradually without affecting their performance.

T-Tape requires 10 psi operating pressure. Soaker Dripline should be run at 15 psi. Dripperline works best at 20 psi. Only Soaker Dripline, 12" Dripperline and 12" RAM P/C Dripperline are recommended for use as a soaker where heavy iron (i.e. when water stains fixtures) or calcium is present in the water.

MINISPRAYERS AND MINISPRINKLERS-These are used where people want to water a larger area. They can be utilized more like standard sprinklers in that there are many different patterns available for use, although the gallonage and radius involved is much less. This means more drip minisprinklers can be run on one line than would be possible with standard sprinklers. One thing you should be aware of is that the minisprayers and minisprinklers do not work well in heavy winds- due to the finer droplet size, they will not give you the desired coverage if operated when there is a lot of wind. You can compensate for this by running the system in the evening or early morning when wind is not usually a problem.

DRIP IRRIGATION SYSTEMS DESIGN

Start by making a sketch or scale drawing of the areas you want to drip. Note the location and size of plants to be irrigated, and whether they are native (and drought tolerant) or introduced (requiring more water), and the location of water sources. Note distances needed for tubing and what fittings will be needed to layout the system (tees, elbows, etc.). Based on the size and type of plant (see watering guide), determine how many and what type of emitters or sprayers will be required.

When designing your drip system make sure to plan for the future. When plants mature, they will require more water. This can be accomplished by watering longer but it is usually more satisfactory to add more emitters as plants grow at different rates. Also, new plants may be added to the landscape so leave about 25% more water capacity available for growth needs.

Garden valves and standard 3/4" sprinkler valves will almost always provide more than enough water for most home landscape/garden needs. To determine how much water the drip system will require simply add up the total number of emitters and their flow rates. (Example: 20- 1 gph emitters = 20 gph; 20-2 gph emitters = 40 gph; 20 + 40 = 60 gph total).

If in doubt about the capacity of a water source, simply time how long the valve takes to fill a measured container. (Example: If it takes 30 seconds to fill a five-gallon bucket, then the maximum flow available is 600 gallons

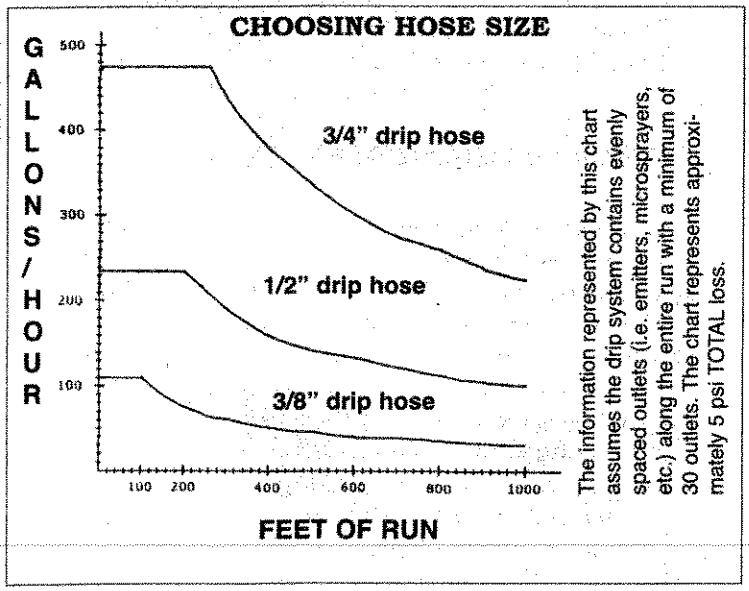
DRIP IRRIGATION DESIGN

per hour. The formula is to take the GPM x 60 to get GPH). Should the system require more water than is available, divide the system by using multiple valves or a hose Y connector and run one system at a time.

Because drip irrigation operates at low pressures, effects on pressure caused by changes in elevation should be considered if elevation varies over 20 vertical feet from water source. If elevation changes are a problem, use pressure compensating emitters.

When designing your drip irrigation system keep in mind questions like: Will it get in the way when cultivating, raking or weeding? Should the drip tubing be hidden from view? Is it out of the way of foot-traffic areas? In areas where gophers and other rodents are problems, no drip or spaghetti tubing should be buried or they will chew through it. Mulch can be used to cover tubing.

The following chart is useful in determining what size drip hose should be used as a main line (regardless of whether you are using emitters, soaker type tubing or minisprinklers).



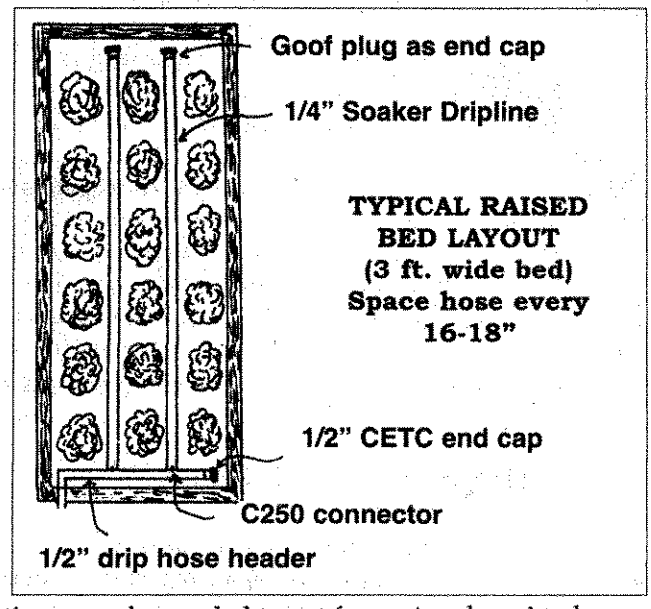
First, design your system and add up the gallonage required as well as the length the main line tubing will have to run, then look at the chart to see what size drip hose you should use. Most home landscape/garden systems use 1/2" drip hose. Very small systems may be run on 3/8" hose while large systems should use 3/4" hose (or break the system into segments or use more than one faucet hook-up).

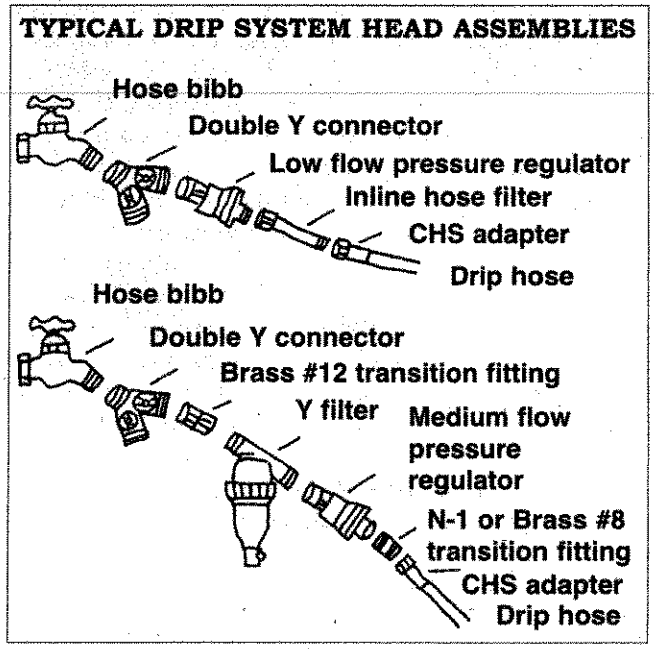
For very large agricultural and commercial landscape drip systems, please contact our Certified Irrigation Designers: David Henry, Angela Albini, Chad Griffith and Patty Hamilton.

SYSTEM HEAD ASSEMBLIES

At the beginning of your drip system, you should install a backflow prevention device or check valve to prevent back siphonage of irrigation water into drinking water systems. Most municipal building codes require the use of these devices. If you are on a well and plan to do fertilizer injection, you should definitely use one.

Depending on what type of filter and pressure regulator will be required for your system, PVC transition fittings may be needed to get from pipe thread to hose thread connections. Use teflon tape on all pipe thread joints (not pipe dope). Hose thread connections will seal with the washer included on them. Do not use a wrench to tighten plastic threads, hand-tighten only!





DRIP IRRIGATION DESIGN

If you want to automate your drip system be sure to select a controller designed to water at least two hours per station. We feature a number of controllers which are appropriate for drip systems- many older controllers were designed strictly for use on standard sprinklers and will not run long enough to use with drip systems.

INSTALLATION OF TUBING

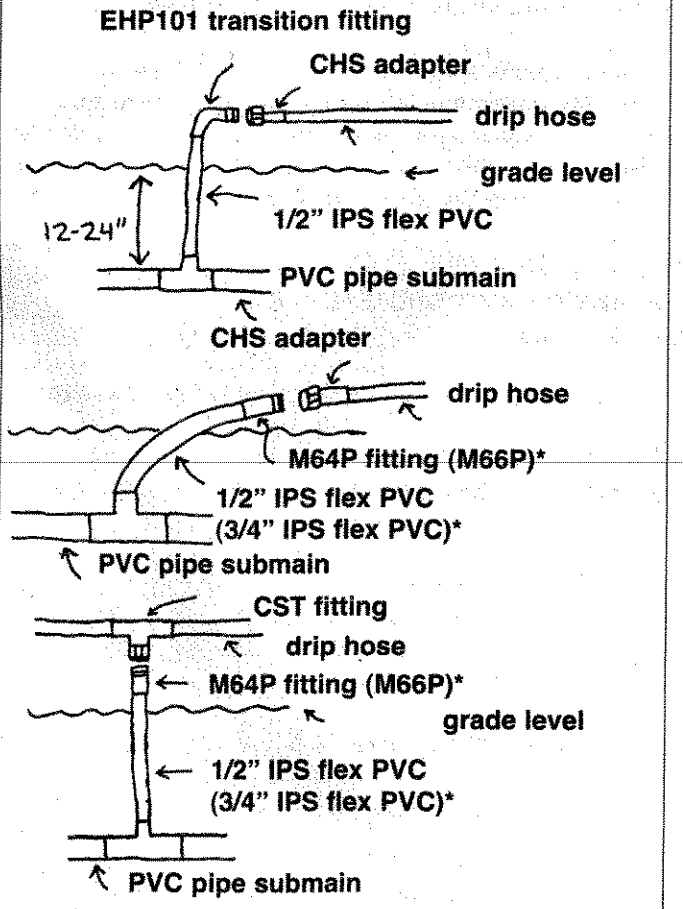
Allowing the tubing to sit in the sun before installation will make it easier to work with. Lay out tubing as per sketch. When assembling fittings, cut the tubing with pruning shears or a sharp knife and be careful to keep dirt out of tubing and fittings.

Where permanent installation of drip tubing is desired, we recommend using underground PVC pipe and coming up with various riser assemblies utilizing flexible PVC IPS hose to connect to the drip tubing (see accompanying drawings).

Be sure not to bury the ends of tubing. You will need to have access to them for periodic line flushing.

TYPICAL VINEYARD OR ORCHARD RISER DETAIL

Used where permanent installation of drip hose and feeder lines are desired



***Note: if flow through riser exceeds 240 gph, use 3/4" IPS hose and M66P fitting.**

EMITTER PLACEMENT

Punch holes in tubing with a punch. Using an ice pick or a nail is not recommended because the hole is not evenly punched and often results in stress cracks and leaks around the hole. Also, you can go all the way through the other side!

Water should be filling the drip hose in warm weather when you punch in emitters. This will help make the tubing firm and easier to punch into as well as make the holes the right size for the emitters (no leaking around barbs).

Insert emitters, etc. carefully. For small plants, emitters are often placed fairly close to the trunk. Do not place emitters, etc. such that they will get the trunk wet. This is especially important with perennial plants such as fruit trees and vines which are susceptible to root rots. A general rule of thumb is to keep emitters 12-18" away from the trunks of plants.

The area wetted by an emitter will vary according to soil types. Sandy soil allows water to percolate down rapidly while water on clay soil moves horizontally much further before it goes down below the root zone. On sandy, coarse soil, a 1 gph emitter will wet an area on the surface about 12-15" in diameter. On clay soils, the emitter may wet an area 24" in diameter. Below the surface, a large onion shaped area is wetted as water percolates down. Emitters should be placed to cover root zones well.

Emitters themselves should never be buried because it is much easier to check and maintain them when you can see them. Also, buried emitters can have problems with clogging due to root intrusion or back- siphonage of dirt.

DETERMINE YOUR SOIL TYPE

Fill 2/3 of a quart jar with water and add soil until jar is almost full. Attach the lid and shake vigorously, until all the clumps of soil have gone into solution with the water.

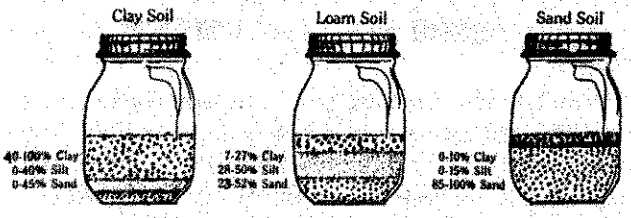
Begin taking measurements as the soil particles start settling out. The first to settle are the larger particles. After one to two minutes, mark the sand level on the jar.

Leave the jar undisturbed for several hours. The finer silt particles will settle out on top of the sand. Often, the layers are slightly different colors, indicating various types of particles. Mark the silt layer after a few hours.

USING DRIP IRRIGATION

Leave the jar overnight and measure the settled clay particles. It may take a few days for some soils to settle.

The following drawing shows the proportions of sand, silt and clay for the 3 major soil types. This is useful in determining how far apart emitters and soaker tubing should be placed to water the plants effectively.



INITIAL SYSTEM START-UP

Once emitters have been punched in, open all tubing end caps and allow water to flush the lines for several minutes. Close the end caps and check emitter operation. If you have an emitter placed where you don't want it, remove emitter and insert goof plug in hole. Punch a new hole in the appropriate place and install emitter.

HOW MUCH TO WATER

Look up the type of plant material you want to water in the above chart to determine the water requirement in gallons per day. Divide the gallons per day required by the gallonage of the emitter delivering the water to each plant to determine hours of watering per day. Determine the days between waterings from the above chart. Multiply the hours of watering per day by the days between waterings to determine how long to run the system. The days between waterings will need to be seasonally adjusted, to account for rain.

DAYS BETWEEN WATERINGS

SOIL TYPE	ZONE	ROOT DEPTH (FT.) 1	2	3	4.5
SAND	Coastal	2	3	5	7
	Inland	1	2	3	5
LOAM	Coastal	3	5	8	11
	Inland	2	3	5	8
CLAY	Coastal	3	7	10	15
	Inland	2	4	7	10

MAINTENANCE

Inspect emitters and microtubing periodically to ensure no emitters are clogged or that sprayers have moved.

Filter screens should be flushed out at least once a month. We recommend checking the filter screen for debris after each irrigation for the first couple of times to determine how often you will need to clean it. Some people have to clean the filter after every irrigation.

WATER REQUIREMENT IN GALLONS PER DAY

TYPE OF PLANT MATERIAL	ZONE	PLANT CANOPY DIAMETER (FT.) 1.0	1.5	2.0	2.5	3.0	3.5	4	5	6	8	10	12	15	20
Flower Beds Thirsty Ground Cover Vines Young Trees & Shrubs	Coastal	.1	.2	.4	.7	1.0	1.3	1.7	2.7	4	7	11	16	24	43
Perennials Small shrubs Vegetables	Inland	.17	.4	.7	1.1	1.6	2.1	2.8	4.3	6	11	17	25	39	69
Fruit Trees Mature Ornamental Trees	Coastal	.08	.2	.3	.5	.7	.9	1.2	1.9	2.7	5	8	11	17	30
	Inland	.12	.3	.6	.9	1.2	1.5	2.0	3.2	4.8	8	13	17	29	51
Citrus Avocadoes DT Ground Cover & Vines	Coastal	.07	.1	.3	.5	.7	.9	1.2	1.9	2.7	5	8	10	17	30
DT Trees & Shrubs Large Shrubs	Inland	.12	.2	.5	.8	1.1	1.5	1.9	3.0	4.4	8	12	17	27	48
Mature, DT Trees & Shrubs Established Natives	Coastal	.04	.1	.2	.3	.4	.5	.7	1.1	1.6	2.8	4.3	6	10	17
	Inland	.07	.2	.3	.4	.6	.8	1.1	1.7	2.5	4.4	7	10	16	28

DT= Drought tolerant