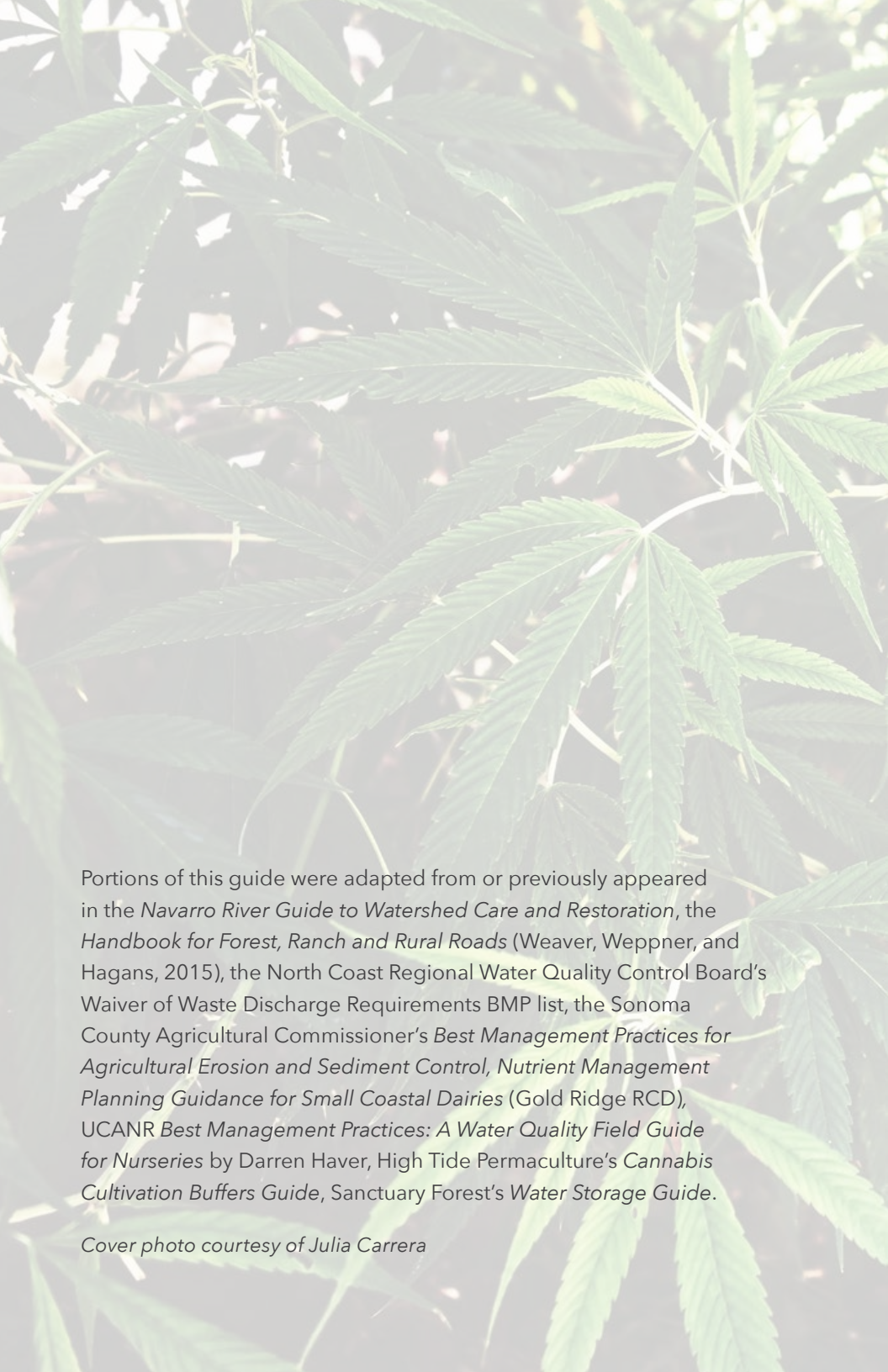


WATERSHED BEST MANAGEMENT PRACTICES
for
CANNABIS GROWERS
and other
RURAL GARDENERS





Portions of this guide were adapted from or previously appeared in the *Navarro River Guide to Watershed Care and Restoration*, the *Handbook for Forest, Ranch and Rural Roads* (Weaver, Weppner, and Hagens, 2015), the North Coast Regional Water Quality Control Board's Waiver of Waste Discharge Requirements BMP list, the Sonoma County Agricultural Commissioner's *Best Management Practices for Agricultural Erosion and Sediment Control, Nutrient Management Planning Guidance for Small Coastal Dairies* (Gold Ridge RCD), *UCANR Best Management Practices: A Water Quality Field Guide for Nurseries* by Darren Haver, High Tide Permaculture's *Cannabis Cultivation Buffers Guide*, Sanctuary Forest's *Water Storage Guide*.

Cover photo courtesy of Julia Carrera

WATERSHED BEST MANAGEMENT PRACTICES
for
CANNABIS GROWERS
and other
RURAL GARDENERS

Mendocino County Resource Conservation District



ACKNOWLEDGEMENTS

Many thanks to the State Water Resources Control Board and the North Coast Regional Water Quality Control Board for their support of this project, including Matt St. John, Diana Henriouille, Adona White, Justin Smith, Connor McIntee, and Kason Grady. Much gratitude for the assistance and collaboration from Patrick Higgins and the entire Eel River Recovery Project team especially Bruce Hilbach-Barger, Noah Cornell, and Dan Mar.

Thanks also to the many reviewers including North Coast Regional Water Quality Control Board staff, Patty Madigan, Linda MacElwee, Julia Carrera, Danny Hagans, Casey O'Neill, Jane Arnold, Chuck Morse, Mourad Gabriel, Devon Jones, and Scott Greacen. Any and all errors should be attributed to the MCRCD, not the reviewers!

We are indebted to Dan Mar and High Tide Permaculture for use of the Site Analysis Data sheets.

Special thanks to Shelley Janek for having the vision to initiate this project and to Indigo for editorial help.

First Edition: March 2016

Prepared and edited by Deborah Edelman,
Mendocino County Resource Conservation District

Graphic Design by Joan Grytness Graphic Design

MENDOCINO COUNTY
RESOURCE CONSERVATION DISTRICT



*Conserving Wild and Working
Landscapes since 1945*

Funding for this project was provided in part by
the State Water Resources Control Board.



TABLE OF CONTENTS

1	Introduction
----------	---------------------

2	Practicing Active Land Stewardship
----------	---

6	Permits and Regulations
----------	--------------------------------

7	Best Management Practices (BMPs) to Protect Water Quality and Quantity
7	Water Use, Capture and Storage
18	Roads, Land Development, and Site Maintenance: Protecting Land and Water from Erosion
32	Soil Health and Management
35	Fertilizer and Pest Management
39	Solid and Human Waste Disposal

41	Appendices
41	Appendix A: Useful BMP Reference Materials
42	Appendix B: Land Self-Assessment Checklist
44	Appendix C: BMP Checklist
47	Appendix D: Where to Find Help with BMPs
47	Appendix E: Agencies Involved in Water Quality Issues
48	Appendix F: Do I Need A Permit? A Quick Reference Guide
50	Appendix G: An Overview of Permitting
52	Appendix H: Synopsis of the North Coast Regional Water Board Permit



Photo courtesy of MCRDC

INTRODUCTION

The North Coast of California is one of the most beautiful and unique places on Earth. Sheltered by magnificent coastal mountains, historically abundant water resources, renowned salmon runs, and the largest trees on the planet, the North Coast has some of California's last undeveloped forests and undammed rivers. It is a sanctuary for rare and endangered species and independent thinkers alike.

WHY THIS GUIDE?


This guide is designed to help North Coast residents take an active stewardship role in caring for their land and the common resources that are the wellspring of our communities. The guide outlines best management practices, or BMPs, for rural farming with an emphasis on cannabis cultivation. BMPs have a proven track record of protecting water, soil, land value, sensitive habitats and endangered species. By practicing BMPs, you have the power to make an immediate difference to an important ecological resource, your own backyard!

WHAT ARE BMPs?

BMPs are practical ideas to help you manage your land, protect water resources and improve the value of your property. BMPs are also frequently required by regulations to ensure that land development and maintenance do not negatively impact water quality and quantity.



CANNABIS PLANT
Photo courtesy of Sunshine Johnson



BMPs can help you:

- Create a plan for your property to bring out its best qualities.
- Enhance stream flow and support aquatic life.
- Protect groundwater quality and quantity.
- Save money, soil, water, fertilizer and effort.
- Improve safety for people and wildlife.

- Improve your product and enhance marketing.
- Navigate the pathway to permitting and regulatory compliance.

WHO MIGHT USE THIS GUIDE?

Anyone! While this guide has been developed with small to medium sized cannabis cultivation in mind, the principles in this book apply to all backyard farms and can be adapted for any garden or agricultural producer.

PRACTICING ACTIVE LAND STEWARDSHIP

As the owner or manager of a rural property, you have a special opportunity to preserve and steward California's heritage and natural landscapes, landscapes that are disappearing at a rapid rate. California is one of only five regions in the world with a Mediterranean climate, characterized by mild, wet winters and hot, dry summers. Our unique biotic communities are linked to this weather cycle and it is part of what makes California a biological "hot spot."

One of the most powerful ways to steward your land is to get to know it well. Even if you've lived on your place for years, there are always opportunities for understanding it more deeply. Appendix B has an easy-to-use checklist to do a self-assessment.

Take your time, spend the day exploring all corners of your property, take photos and draw a map and pictures. Enjoy the beautiful place you live and work!

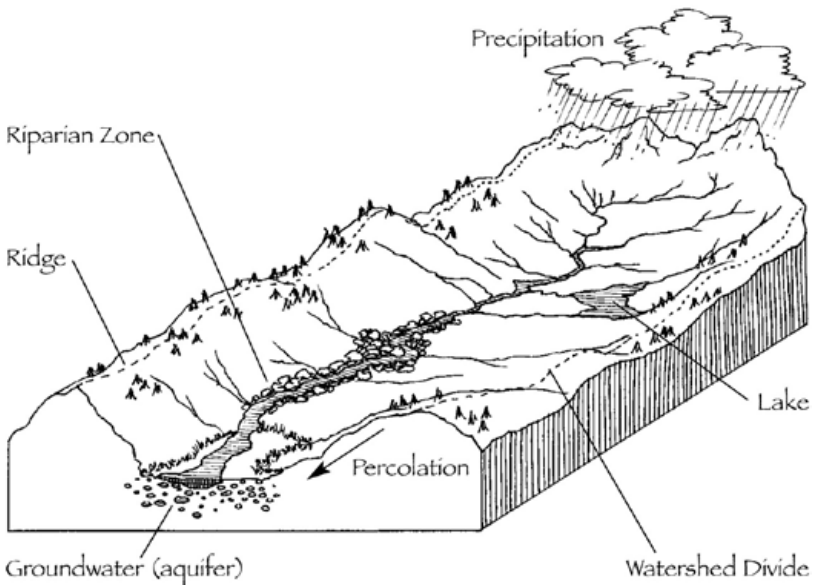
EVERYONE LIVES IN A WATERSHED

One lens into your property is to understand it as part of the larger watershed. A watershed is the area of land that collects, stores and releases water into a common point: a stream, a lake or the ocean. Everyone lives in a watershed; if you step outdoors, you may even be able to see the contours of the watershed you live in. The flow of water unites all the land and the conditions in one part of the watershed affect everything downstream.

Our actions influence the conditions of the watershed, either for the better or for the worse.

At the core of a healthy watershed are healthy streams. Healthy streams have clear, cool water; dense streamside vegetation (preferably native vegetation); overhead tree cover; streambed “complexity” such as fallen logs, gravel and cobble; deep pools and riffles; and sufficient summer water flow.

Watershed Anatomy



PARTS OF A WATERSHED

Illustration courtesy of Susan Riedley

Common stream concerns include:

- Excessive soil erosion from streambanks or unstable roads
- Stream diversions, including wells hydrologically connected to surface water
- Lack of fallen branches and other woody material
- Bare, unstable streambanks
- Nutrients and pollutants from fertilizers, pesticides, manure, motor oil, and gasoline

- Undersized or damaged culverts

WHY ALL THE CONCERN ABOUT FISH?

Salmon, steelhead and many other species depend on a healthy watershed to survive. Salmon in particular can only live in cool, clean water with complex habitat, suitable shade, and deep pools. For that reason, they are called an “indicator species.” Like a canary in a coal mine, salmon and steelhead give an indication of stream conditions. If the water is too warm, choked with sediment or laced with toxic



THREAT TO WATER QUALITY: BEAR DAMAGE TO FERTILIZER BAGS
Photo courtesy of Dan Mar



STEELHEAD JUVENILES

Photo courtesy of Phil Georgakakos

run-off, the fish will die—and many other species, including humans, will be impacted as well.

Even if no sensitive species are located on your property, your land may still play a role in helping them survive. A recent Audubon Society report found that the North Coast is a place of refuge for many bird species threatened by climate change and development pressures in other parts of the state. Likewise, springs and small streams are often the only sources contributing water to larger fish-bearing streams during the dry summer months.

WHAT'S IN IT FOR ME?

Being a good watershed steward goes beyond environmental concerns. BMPs can help protect your property value, increase the production capacity of your land, and save you money and effort. For example, proper road grading will reduce long-term maintenance costs. Properly sized culverts will not clog easily, so you won't have to get up at 3 a.m. to clear out storm debris. Good land management can also be a selling point for a "green" product.



WORKING WITH YOUR NEIGHBORS

Good stewardship involves on-the-ground techniques but perhaps the most important skills for protecting and restoring landscapes are interpersonal. Because streams and roads usually cross property boundaries, getting to know your neighbors can be an excellent way to strengthen your own efforts, improve safety, and share knowledge. Good coordination can also save you money.

ROAD ASSOCIATIONS

Historically, people got together to “fix the road,” sharing the labor and expenses. Establishing a functional organizational

structure for road maintenance can help you and your neighbors to address water quality compliance, share maintenance costs, and ensure fire and emergency vehicle access.

LOCAL WATER PLAN

Coordinating water withdrawals with your neighbors can ensure that the location, timing, and cumulative impacts of diversions do not strand fish or negatively impact other public trust resources. Sanctuary Forest has a guide to working with neighbors for coordinated withdrawals at <http://www.sanctuaryforest.org/wp-content/uploads/2014/12/Legal-Options-for-Streamflow-Protection.pdf>.

PERMITS AND REGULATIONS

California and the North Coast have a new and still evolving regulatory framework for cannabis cultivation at the state, regional and local levels. While this guide is consistent with state and regional permit requirements, it is not a summary or a complete listing of their BMPs. ***Before beginning your cultivation project, land development or retrofit project, contact the relevant agencies to ensure you understand their BMP standards and permitting requirements. See Appendix F for a quick reference guide, Appendix G for a synopsis of permit requirements and Appendix H for a synopsis of the North Coast Regional Water Board Permit.*** Permit requirements vary among agencies, depending on jurisdiction, but the permits generally require adherence to BMPs for water resource protection.



BEST MANAGEMENT PRACTICES (BMPS) TO PROTECT WATER QUALITY AND QUANTITY

WATER USE, CAPTURE AND STORAGE

Water is the source of life, of our livelihoods, of our communities. The North Coast has historically enjoyed ample rainfall and abundant streams. These once plentiful resources have been impacted by drought cycles and historic uses of the land have left legacy impacts that remain to this day. More recent influences, such as poorly constructed roads, stream diversions, and an increasing water demand for cultivation activities, have resulted in formerly perennial (year-round) streams becoming fragmented or going dry in the summer and fall.

WATER QUALITY AND QUANTITY CONCERNS:

- Too many diversions
- Withdrawals during summer and fall low flows
- Reduced stream flow and stranded fish
- Withdrawal systems that cause erosion
- Excess levels of sediment
- Water temperatures too high to support sensitive species such as salmon and steelhead trout
- Pollutants, such as fertilizers, pesticides and trash, entering stream systems

WATER USE AND CONSERVATION

With climate change deepening the effects of drought and evidence that decades-long droughts are the norm geologically speaking, it makes sense to get water conserving infrastructure and practices in place now to ensure present and future water sustainability.

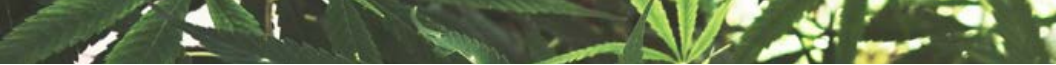
WATER USE AND CONSERVATION BMPs

- Plant with water conservation in mind. Identify opportunities to reduce your growing area and select crops that can be dry farmed. Plant early, to establish strong, healthy plants and root systems.
- Install a water meter on the outlet of your tank. The *single best way* to conserve water and ensure that it lasts you through the dry season is to know how much you are using. Water meters also enable you to detect leaks in your system and help you compile water use records required for permits.
- Mulch, mulch, mulch! Add 2"-3" inches of mulch around trees and plants to reduce evaporation. Mulch keeps the soil moist and protects your roots.
- Plant hedgerows: Hedgerows, such as of native wax myrtle, around your plots protect plants from wind and evaporation. For a list of native hedgerow plants, go to www.ucfoodsafety.ucdavis.edu/files/26499.pdf.
- Inspect for and repair leaks. A leak of only one drop per second wastes **3,153 gallons** per year! Inspect



POORLY PLANNED IRRIGATION LINES INCREASE EROSION POTENTIAL AND WATER WASTE

Photo courtesy of Integral Ecology Research Center



your entire system for leaks at the beginning of and throughout the season. Check mains, laterals, connections, and the ends of drip tape and feeder lines. Regularly replace worn, outdated, or inefficient components. Bury lines where feasible to prevent animal chewing.

- Conserve water inside your home. See the Save Our Water website at <http://saveourwater.com/what-you-can-do/tips/> for easy ways to reduce water demand in your home. H2Ouse (www.h2ouse.org/tour/index.cfm) is another fun, interactive site.

EFFICIENT IRRIGATION

Efficient irrigation provides a template for how and when to water. Overwatering not only wastes water and leads to nutrient runoff, but also increases pathogens and pests. Efficient irrigation will assist in combating botrytis and other fungi and diseases as well as preserving local waterways and improving farm bed structure. When irrigation is efficient, soil dries out between watering cycles.

You are overwatering if:

- Soil never dries out.
- Water runs out of pots.
- Water pools between beds.

Drip irrigation technologies can apply water directly to where the plant can use it and the rate of irrigation can be controlled and adjusted so that water can infiltrate and be absorbed by the soil and uptaken by the plant.

Columnar irrigation, also known as deep root watering, is a specialized form of drip irrigation that uses a specific volume of water applied infrequently but deeply to the root zone rather than the soil surface, saving water, time and labor costs. With columnar irrigation, 1–2 gallons per plant per watering event is generally sufficient. Columnar irrigation requires only a small financial investment and can be installed quickly and easily. For a helpful illustration of columnar irrigation, go to www.mcrcd.org/drought-water-conservation-resources/.



A SMALL RAINWATER CAPTURE SYSTEM

Photo courtesy of Anna Birkas

EFFICIENT IRRIGATION BMPS

- Install a weather or sensor-based, self-adjusting irrigation controller that has been certified by the Irrigation Association (www.irrigation.org) and has multi-cycle timers, a moisture sensor shutoff, and a controller that can detect problems.
- Water only when the soil is dry. A simple “finger check” is sufficient. Stick your finger 3” into the soil. If the soil is moist, there is no need to water.
- Water infrequently and deeply.
- Water in the late evening or at dawn to reduce evaporation from sun and wind. Watering at dawn in particular maximizes uptake by plants. Avoid watering in the wind and heat.
- Irrigate at rates that avoid runoff.
- Recapture and reuse water wherever possible. See the Water Reuse/Greywater section below for details.

WATER CAPTURE AND STORAGE

With its Mediterranean climate, the North Coast gets almost no rain in the summertime, so it is essential to reduce the amount of water used, that water is not wasted, and that diversions don't imperil fish or wildlife. Storing water during abundant winter flows for use during the summer and fall low flows is a practical and fish-friendly way to meet water needs. Note that if you are diverting and storing water you need a permit. See Appendix G for details.

WATER CAPTURE AND STORAGE BASIC PRINCIPLES

- Capture only what you need.
- Fill your storage during the wet months for use during the summer.
- Do not divert water during the dry season.


Set a goal of becoming water self-sufficient. The key to success is organizing your water storage and water budget to enable you to forego withdrawals during the summer months.

Begin by assessing what you will need. Calculate your water needs for your household and garden to last you throughout the dry season of May to mid-November, or 6½ months. With good conservation, you can reduce your personal water usage to as low as 25 gallons per day (gpd) per person. Calculate garden water usage at 18.5 gpd per 100 square feet of garden and reserve 2500 gallons for fire protection.

RAINWATER HARVEST

Rainwater harvest is one of the best ways to meet your water needs without ever having to pump from a well or divert water from a stream. As of 2012, rainwater harvest is explicitly legal in California, and many systems do not require a permit from the state. Best of all, the potential water capture is truly astonishing. A 1,000 ft² roof structure can capture 600 gallons per 1 inch rainstorm. Even in a drought year, rainwater harvest can capture 10,000 gallons over the course of the rainy season, and in a more average season, it could capture **30,000-50,000 gallons**.

The Greywater Action website (<http://greywateraction.org/content/about-rainwater-harvesting/>) has excellent



resources for building a rain-water collection system, as well as Frequently Asked Questions, system examples and a list of workshops throughout California. Note that collection tanks should be located 100 feet from the edge of a stream or river bank and 30 feet from the property line and county roads.

WATER REUSE/GREYWATER

Reusing water for irrigation is another excellent tool for reducing your withdrawal needs. Greywater is water from bathroom sinks, showers, bathtubs, and washing machines that may contain dirt, food, hair, and certain soaps and cleaners, but is not contaminated by feces. While greywater is a pollutant if it is released into streams or lakes (*and it is essential that greywater not runoff into water bodies!*), it is safe for irrigating plants and acts as a gentle fertilizer. Greywater can be used for ornamentals or vegetables as long as it doesn't touch the edible part of the plant.

Instructions and resources for using greywater can be found at Greywater Action's website: <http://greywateraction.org/content/about-greywater-reuse/>. **Please note that unlike fresh water, greywater cannot be stored. It**

must be used within 24 hours.

In addition, you must use cleaning products and soaps without chlorine bleach, salts or boron.

Some greywater systems require a permit. In Mendocino County, for example, a clothes washer system does not require a permit, but anything larger requires a Site Evaluation Report Review fee and a permit fee. See www.co.mendocino.ca.us/hhsa/pdf/chs_eh_landUse_Graywater_Brochure.pdf for more details. Check with your local county environmental health department to get local regulations.

SURFACE WATER WITHDRAWALS (DIVERSIONS)

A water diversion is any structure or feature that directs the flow of water from a spring or stream to another location. Any pipe, channel, or pump that takes water away from the natural flow of the river is a diversion, and may impair habitat for aquatic species. Diversions are especially problematic during the summer months when stream flow is already low. Low flows raise water temperatures and reduce dissolved oxygen, resulting in wildlife stranding, increased predation, and reduced survival for salmonids.



IMPROPER FISH SCREENING

Photo courtesy of Jane Arnold

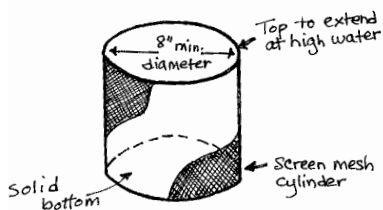
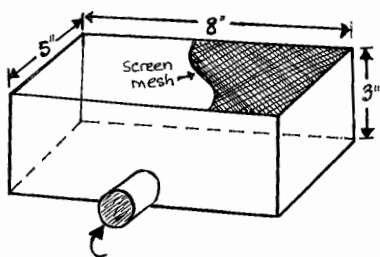
SURFACE WATER DIVERSION BMPS

- Understand the available streamflow. Understanding streamflow helps to inform how much water may be available for withdrawal. A citizen's guide to estimating streamflow can be found at www.ecy.wa.gov/programs/wq/plants/management/joysmanual/chapter5.html#Measuring%20Stream%20Flow
- Limit withdrawals to the wet months. Fill storage tanks during rain events in January to April.
- Stop pumping entirely from May 15 to November 15. Install float valves on all water storage to avoid overfilling water storage.
- Avoid emergency water loss. Design your system with backups and inspect regularly for leaks and maintenance issues. If you have an emergency water loss from storage, *do not refill between May 15 and November 15*. Diverting during this time could affect stream hydrology and impact the survival of fish and other aquatic species. In the event of a catastrophic loss, buy water from an approved retail water supplier or let some or all of your crop go without water for the duration of the season. The California Department of Public Health maintains a list of licensed water haulers at www.waterboards.ca.gov/drinking_water/pubsforms/documents/fdbBVVCountyList.pdf.
- Use fish screens. Install and maintain fish and amphibian exclusion screens on your pump screens. Screen openings

must not be more than 3/32" (i.e., small enough to exclude small fish) and screen diameter must be large enough that the suction pressure is invisible.

- Clean your screens regularly to avoid clogging! Replace screens yearly if they are bronze, and every other year if they are stainless steel. CDFW has detailed instructions for sizing fish screens at www.waterboards.ca.gov/waterri-ghts/publications_forms/forms/docs/cdfw_conditions.pdf.
- Limit the rate of diversion. Limit pump rates to no more than 10 gallons per minute, and no more than 5% of the streamflow.

- Coordinate with your neighbors. Working with your neighbors to coordinate water withdrawals can ensure that cumulative or simultaneous withdrawals do not dewater the streams in your watershed. See the link to Sanctuary Forest's Legal Options for Streamflow Protection, above or in Appendix A.
- Use wells carefully. Wells in riparian areas or upslope of surface watercourses are often hydrologically connected to surface water and should be avoided or treated like a surface water diversion. Take note that all wells require permits from your local county Environmental Health department as well as a filing with the state.



NON-SUBMERSIBLE PUMP APPLICATION SCREEN BOX (LEFT) AND SUBMERSIBLE PUMP APPLICATION SCREEN CYLINDER (RIGHT).

Illustrations adapted by Barbara Stanger from the CDFW Small Domestic Use Registration.

- Avoid water hauling. Use water delivery only in emergency situations and utilize the BMPs outlined here to ensure that hauling is not necessary. If water delivery is used, check that the water is from a legal source. Make sure that you are not contributing to water resource damage elsewhere!

WATER STORAGE

To increase water security, use rigid water storage (i.e., tanks) and lined ponds rather than bladders or unlined ponds for water storage. Locate all water storage a minimum of 100 feet from the edge of a stream or river bank and 30 feet from the property line and county roads.

TANK BMPs

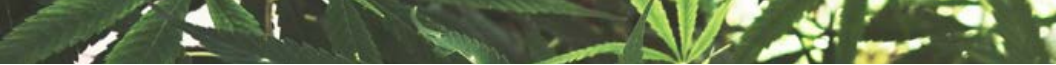
- Install float valves to prevent overflow and waste.
- Secure tanks to prevent breakage or movement. For vertical tanks, attach a tank restraint system (anchor using the molded-in tie down lugs with moderate tension, being careful not to over-tighten). For horizontal tanks, secure with bands and/or hoops to prevent tank movement.
- Provide for secondary containment in the event of rupture or overflow. Containment should be sufficient to capture or infiltrate the maximum contents of the tank.
- Locate tanks so that they are easy to access and maintain. Install tanks on firm, level, compacted soil that is free of rocks and capable of bearing the weight of the tank when it is full. Do not locate tanks in a flood plain or next to equipment that generates heat.
- For tanks 8,000 gallons or more, install on a reinforced concrete pad in order to provide adequate support. A building permit will likely be required for tanks over 5,000 gallons. Check with your County Building and Planning department for information.



RAIN COLLECTION & A RAIN CHAIN
Photo courtesy of Anna Birkas

POND BMPS

- Design and construct ponds to avoid or minimize water resource impacts. Be sure to consult with an engineer or geologist. Do not construct ponds in stream channels. Contact CDFW if you have questions about pond location.
- Ensure your pond has a stable outlet to control pond overflows in the event that the pond becomes too full. Size your spillway to accommodate extreme weather events.
- Line ponds to prevent water loss through seepage. Use liners such as biodegradable geotextiles that won't trap wildlife.
- To protect wildlife and children, fence off access to ponds!
- Provide an opening, ramp or floating dock on ponds or any water containment system as an escape route for wildlife that accidentally gets caught in the system.
- Plant vegetation along the perimeter of the pond (but not on the dam itself) to minimize erosion, provide shade, protect from wind, and reduce evaporation.
- Do not introduce non-native plants or animals into your pond, as they can escape and harm native species.
- Draw water level down for three weeks once per year at the end of the season to discourage bullfrog occupancy and allow for predation of bullfrogs.
- However, do not release pond water to streams because it is often warmer or higher in nutrients than surrounding natural surface waters. Release slowly to a vegetated swale or across fields to allow groundwater infiltration and recharge.



Note that diverting surface water into ponds requires permits from the Division of Water Rights and CDFW. More information regarding pond design, construction, and maintenance is available at: <https://nrcspad.sc.egov.usda.gov/DistributionCenter/pdf.aspx?productID=115>

BLADDERS

Bladders, in particular military surplus bladders, have become a popular way for rural residents and farmers to store water, in part due to their lower cost and ease of transport. However, there are a number of problems with using bladders for water storage. Unlike tanks, bladders cannot have a float valve attached to

them to prevent overflow and water waste. In addition, bladders tend to warm up with sun exposure and can sometimes burst, releasing warm or hot water into a stream, where it can harm or kill fish and wildlife, and strip out and destroy riparian habitat.

Bladders are not a best management practice and we recommend avoiding their use.

If you have a bladder, keep it in a containment system on a cement pad with a perimeter wall sized to hold the entire bladder's contents in the event of rupture. Inspect regularly to ensure the bladder is free of holes or leaks, and that the material is maintaining its integrity.



ROADS, LAND DEVELOPMENT, AND SITE MAINTENANCE: PROTECTING LAND AND WATER FROM EROSION

Sediment from erosion is the number one pollutant impairing North Coast streams. Excess sediment is defined as soil, rock, sand, silt, or clay that is delivered to waters in an amount that could negatively affect aquatic life and water quality. Roads, land development and site maintenance are key factors that can contribute to erosion.

Sediment pollutes in numerous ways. It reduces the amount of oxygen available to plants and animals and carries fertilizers and other chemicals into waterways. Once in the stream system, sediment locks gravel together like concrete, preventing salmon and steelhead from making their nests and suffocating eggs from lack of oxygen. It can cause or contribute to flooding, impede stream flow, increase water temperatures and promotes the growth of toxic algae in the summer and fall. Sediment-rich water has more erosive power, increasing bank and streambed damage downstream. Finally, erosion reduces the acreage and value of your land. For a striking image of sediment flowing into the ocean from the Eel River, go to <http://earthobservatory.nasa.gov/IOTD/view.php?id=79965&src=eoq-iotd>.

As a general rule, steep slopes are more vulnerable to erosion compared to gentle slopes, and bare ground is more likely to erode than vegetated areas. Vegetated areas, particularly those next to a water source, can act as a buffer, slowing runoff and capturing sediment, preventing it from settling in the stream.

When beginning a construction project, consider the natural contours and layout of your property. ***Your goal is to make roads and land development hydrologically invisible by designing for dispersed runoff.*** Outsloped roads with periodic rolling dips, with or without an inboard ditch, are the most effective way to attain dispersed road runoff. An excellent resource for road construction and maintenance is the *Handbook for Forest, Ranch and Rural Roads*, available as a free



AN ERODING STREAMBANK


Photo courtesy of MCRCD

download in English and Spanish at www.mcrcd.org/publications.

WATER QUALITY CONCERN: EROSION

- Poorly designed roads and stream crossings
- Bare or sparsely vegetated streambanks
- Livestock grazing in and near waterways
- Human-induced landslides
- Development of upland areas, such as home building and road construction.

Rural roads and cultivation areas should be planned to take advantage of natural drainage features and maximize infiltration. ***The best way to treat erosion is to prevent it.*** Upfront planning and design can help you achieve your goals with minimal disturbance to your landscape. Walk your property on a sunny day and also on a rainy day to look for signs of instability. Photographs can be very helpful for this process. Think about which roads you use less and consider making them seasonal use roads or decommissioning them altogether. Some erosion problems may require the assistance of a specialist such as a licensed road contractor, geologist or engineer.



Mature vegetation will prevent erosion and is your long-term erosion control goal for all your property. Vegetated swales and buffer zones are effective structural treatments that can provide a catchment system for slowing and infiltrating stormwater and sediments. For immediate short-term needs, cover crops and rice straw are inexpensive and effective erosion control stop gaps that provide a cushion between the disturbed soil and the velocity of the raindrop. Strive for clear (sediment-free) runoff from your roads and developed and cultivated areas.

EROSION PREVENTION BASIC PRINCIPLES

1. Design for dispersed runoff.
2. Vegetate bare ground, including fallow fields and streambanks.
3. Keep heavy equipment off soils where possible.
4. Limit footprint of disturbance.
5. Avoid disturbing stream-side riparian areas.
6. Conserve or restore natural areas and wildlife corridors.
7. Think about impacts on a landscape level with the sustainability of the watershed in mind.

USING SWALES AND VEGETATED BUFFERS

Swales and vegetated buffer zones are effective tools for dispersing flows, filtering pollutants, encouraging water infiltration, and creating wildlife habitat. A swale is a shallow channel covered with dense vegetation or filled with mulch to absorb and filter water and pollutants. Swales dug around the perimeter of cultivation sites will collect water and percolate it back into the soil.



REMEDICATION BUFFER - VEGETATED AND MULCHED BUFFER ZONE.

Photo courtesy of Dan Mar

Vegetated buffer zones consist of strategically placed permanent vegetation that slows water flow, for example, on the downslope side of cultivated areas.

The effectiveness of a vegetated buffer zone will depend on the concentration of pollutants entering the buffer, the width of the filter area, the slope of the area, the volume of water it will receive, and the type of vegetation planted. The wider and denser the zone, the more effective it will be.

Swales themselves can concentrate runoff, so careful design is essential for dispersing any outflow. Swales should be engineered to take the expected flow

of a 100-year storm without discharge to slopes or streams. For shallow slopes and for short-term, emergency filtration, straw wattles, coir fiber rolls or straw bale sediment barriers can also be used to minimize run-off. These methods are preferable to silt fences and sandbags. Details on how to use all these features can be found at http://www.sonoma-county.org/agcomm/pdf/bmp_handbook3.pdf.

Use only native plants and grasses in revegetation efforts. Non-native species, including some sold at nurseries, can invade natural areas, absorb large amounts of water, and create dense monocultures that alter natural stream processes.



GENERAL EROSION CONTROL BMPs FOR ALL APPLICATIONS

- Maintain adequate vegetation on all soils, including farm fields, streambanks and beside roads.
- Seed and mulch disturbed soils, bare areas and heavy use areas with native grasses, especially prior to winter rains. Protect exposed soils with a heavy application of weed-free straw mulch, secured using hand tools or with jute matting.
- Apply straw at the rate of two tons per acre (about 42 bales per acre). You should not be able to see any soil once the straw is applied. Use rice straw to prevent establishing weeds.
- Keep extra straw bales on hand for emergency erosion control but be sure to keep it clean and dry!
- The *Handbook for Forest, Ranch and Rural Roads* has helpful charts for selecting appropriate revegetation species and for effective seeding methods on pages 302-308.
- Minimize runoff by irrigating only as needed. See the water conservation BMPs above for tips on efficient irrigation.
- Install swales and vegetated buffers along the perimeter of greenhouses, cultivation sites, fueling areas, storage areas, along roads, streams and drain-ages, below animal use areas and surrounding the entire site.
- Use a mix of locally appropriate native grasses, shrubs and sedge species for vegetated areas.
- Create a graveled area surrounded by a vegetative buffer or straw wattles for mixing soil and watering new transplants.
- Clear sediment from sediment control areas as needed to ensure capacity is not exceeded.
- Place a secure tarp over soil, composting piles and other ag waste piles to protect them from wind and rain, and surround them with straw wattles or other appropriate erosion control.
- Contact a licensed road contractor, geologist, or restoration specialist to determine how you can address erosion problems.



A STREAMBANK REVEGETATED WITH NATIVE SPECIES

Photo courtesy of MCRCD

RIPARIAN ZONES AND STREAMBANK PROTECTION

Riparian zones are the land adjacent to a stream and provide a natural buffer between terrestrial and aquatic ecosystems. A well-functioning riparian zone has trees of different ages as well as a diversity of understory plants. Riparian areas help maintain healthy stream ecosystems by stabilizing streambanks, filtering sediments and pollutants, providing large wood

for habitat, moderating flood waters, lowering stream temperatures by providing shade, and contributing food to the aquatic ecosystem. For these reasons, it is important to maintain and protect your riparian zones and streambanks.



RIPARIAN ZONE AND STREAMBANK PROTECTION Bmps

- Walk your riparian areas regularly to assess their health and function. Look for bare or eroding soil.
- Maintain the existing vegetation within the riparian zone, especially trees and understory vegetation that shade the stream corridor.
- Revegetate bare ground and eroding areas with native vegetation. Native willows can be staked easily along your streambank without the assistance of a specialist, although the work will require a permit from the Regional Water Board and CDFW. (Note that most new plantings require irrigation for the first few years!)
- Retain large wood in the stream channel and do not remove trees that could fall into the stream.
- Exclude livestock from riparian areas and keep all livestock off steep slopes and erodible soils, especially during the rainy season. Livestock compact soil,

disturb roots, induce erosion and can contaminate surface water or groundwater with nutrients and pathogens.

- Provide water sources to livestock outside of riparian areas.

ROAD CONSTRUCTION AND MAINTENANCE

Roads contribute to sediment pollution when they concentrate runoff and cause erosion or landsliding. Road erosion and improper road drainage are some of the leading causes of stream sedimentation, stream channel instability, and habitat decline, even if a road is not directly adjacent to the water feature. Proper dispersed drainage is critical to ensuring the integrity of a road and to preventing and minimizing sediment discharges into watercourses. As a general rule, anywhere flowing water is allowed to concentrate, a road system will have problems. Storm-proofing roads, using certain roads only during specified months, and decommissioning unneeded roads to decrease road density can all help reduce the impact that roads can have on plants and animals.



A RUTTED AND GULLIED ROAD, BEFORE TREATMENT

Photo courtesy of Pacific Watershed Associates



THE SAME ROAD OUTSLOPED WITH ROLLING DIPS

Photo courtesy of Pacific Watershed Associates

The *Handbook for Forest, Ranch and Rural Roads* (www.mcrcd.org/publications) contains many useful illustrations and examples for road design, construction and maintenance.

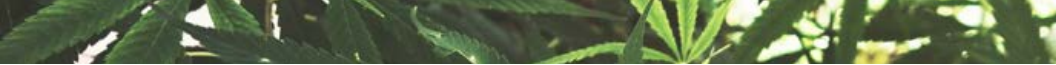


ROAD CONSTRUCTION AND MAINTENANCE BMPs

- Avoid building new roads. Use and improve existing ones whenever possible.
- Outslope roads to optimize drainage.
- Install properly sized rolling dips and water bars within the road surface for road drainage.
- Avoid disturbing eroding areas such as landslides, gullies and slips or directing water to them. Prior to construction, identify unstable areas and consult a licensed geologist or engineering geologist.
- Schedule excavation and grading during dry weather periods.
- Consolidate roads, staging areas, and parking away from the riparian zone.
- Do not use heavy equipment in flowing water and avoid use of heavy equipment in a channel bottom with rocky or cobbled substrate.
- Be sure not to contaminate water with petroleum products! Refuel at least 50 feet from waterbodies, inspect vehicles for leaks and repair immediately. Clean up leaks, drips and other spills immediately and conduct vehicle maintenance and washing off site.
- Road construction materials, such as concrete, should also be kept away from streams and springs to prevent accidental spillage into water sources.
- Be sure to use the proper materials for clearings, landings and road materials. Organic materials such as branches and brush will degrade and compromise structural integrity, ultimately leading to road instability and erosion.
- Remove spoils and excavated material to a stable location outside the 100-year floodplain. See Spoils Management section below for additional information.
- Avoid draining roads into watercourses and onto unstable areas.

ROAD MAINTENANCE

A storm-proofed road is not a maintenance-free road! You must still maintain your road and observe



any changes that require further reconstruction. Check roads, culverts and bridges periodically for signs of bank erosion. Inspect and clear all drainage systems and culverts before the start of the rainy season and again after large storms. Periodic re-grading of roads or reconstruction of water bars and rolling dips may be necessary.

ROAD SURFACING

Proper road surfacing will minimize sediment loss. Road surfacing can include pavement, chip-seal, lignin, rock, or other materials, depending on timing and nature of use. Weatherproof or harden high-use roads. Pave or chip seal well before the rainy season to allow toxic compounds in the oils to solidify, degrade or volatilize from the road surface and not be delivered to waterways. Establish a thick cover crop on temporary or seasonal ranch roads by October 15. Depending on traffic, this may require active seeding annually.

STREAM CROSSINGS

The biggest impacts to streams can result at stream crossings. Ideally, all roads would be located on ridge tops! When constructing a new road, it is best to minimize the number of stream crossings, and build stream crossings that produce the minimum impacts.

STREAM CROSSING CONSTRUCTION BMPs

- Design and size culverts appropriately to be in-line with the stream channel, to allow for a 100-year storm, and to permit passage of migrating fish during all life stages.
- Culverts should be designed to conform with NMFS Southwest Region's Guidelines for Salmonid Passage at Stream Crossings and CDFG's Culvert Criteria for Fish Passage.
- Check culverts and bridges periodically and especially during the rainy season for signs of bank erosion and to ensure that culverts are not plugged with debris.
- Install a critical dip at each culverted stream crossing. This reduces the potential for the stream crossing to fail catastrophically (i.e., blow out) or for the stream to be diverted and cause erosion into another stream channel.
- Install temporary stream crossings, when used, at locations where erosion potential is low.

PERMITTING FOR INSTREAM, ROAD AND LAND DEVELOPMENT

- Be sure you have the proper permits before you start working in or next to a stream. Stream crossings, water diversion structures, and other structures generally require a Lake and Streambed Alteration Agreement from the California Department of Fish and Wildlife (www.wildlife.ca.gov/Conservation/LSA).
- Consult with the Army Corps of Engineers (ACE) to determine if the project also requires a federal permit and with the North Coast Regional Water Quality Control Board to ensure the project activities will comply with state water quality standards (www.waterboards.ca.gov/northcoast/water_issues/programs/water_quality_certification.shtml).
- If harvesting timber, a permit from CALFIRE may be required. If you are removing trees on less than three acres, and post-harvest, the land will not be used for timber, a streamlined permit is available: http://calfire.ca.gov/resource_mgt/resource_mgt_EPRP_TimberlandConversions
- Cumulative site disturbance of an acre or more of land (e.g., for a driveway, landing, or building pad) requires enrollment and compliance with the State Water Resources Control Board's general construction stormwater permit: http://www.swrcb.ca.gov/water_issues/programs/stormwater/construction.shtml
- Depending on the volume of soil that will be moved or disturbed during site development, a grading permit may be required by your county—contact the County Building Department to find out if a grading permit is required.

LAND DEVELOPMENT

In many parts of the North Coast, the scars of legacy impacts are being exacerbated by land conversion on a massive scale. North Coast watersheds have been subjected to years of intensive logging, ranching, mining, poor road construction, and fire suppression, all of which have degraded the forest structure and hydrology. Unfortunately, many land owners bought their land not knowing they would inherit problems that needed fixing. The good news is that as a land steward, you have the opportunity to improve your property and mend these fragile ecosystems.

Think at a landscape level when designing your cultivation site. The reality of living in a watershed is that nothing is isolated—what you do on your property impacts and can be impacted by others in the watershed.

LAND DEVELOPMENT BMPs

- Develop as small a “footprint” as possible. Limit land disturbing activities to the actual site of the project and necessary access routes.
- Protect the riparian zone from development and removal of vegetation.
- Locate all roads, cultivated plots, greenhouses, potting operations, and chemical storage areas on flat surfaces at least 100 feet away from water sources. Surround with a vegetative buffer, straw wattles or detention/sedimentation pond to remove pollutants. (The Regional Water Board Cannabis Permit states that Tier 1 cultivation areas or associated facilities must not be located within 200 feet of a surface water [i.e., wetland, Class I, II, or III streams]. See Appendix H for details.)
- Avoid removing trees, shrubs and native vegetation. Replace any removed plants with similar native species appropriate to the site in at least a 3:1 ratio (3 shrubs for every one you remove).

- Before grading, remove and store topsoil in a stable location.
- Seed bare soil with a locally appropriate native seed mix or cover with straw if it will be exposed for more than a few days to reduce erosion and ward off invasive plants.
- Identify a limited construction area before work begins to prevent compaction of soils and to protect habitat. Install temporary fences to restrict heavy equipment movement.
- Avoid developing on steep slopes.

UC Cooperative Extension has an excellent guide to land development and nursery layout with many useful illustrations at <http://ceorange.ucanr.edu/files/132555.pdf>.

SPOILS MANAGEMENT

Spoils are leftover dirt from site development or cultivation. A tenet of best management practices is to reduce waste by not creating it in the first place. Good planning and clever site management can help reduce or eliminate the need for spoils piles.

SPOILS MANAGEMENT BMPS

- Eliminate or reduce your need for spoils piles by retaining as much of your soil in place as possible and reusing materials whenever possible.
- Remove spoils piles and excavated material to a stable location above the high water mark, outside the 100-year flood plain, and more than 200 feet from a waterbody.
- Place spoils in compacted layers and contour piles to mimic and blend into the surrounding topography.
- Surround by erosion control such as a vegetated swales, straw wattles earthened berms, or coir rolls to protect from runoff.
- Stabilize piles through compaction and revegetation. Revegetate with a native seed mix and mulch with straw.



BIOSWALES PREVENT SOIL FROM ENTERING WATERWAYS

Photo courtesy of Anna Birkas

- Avoid placing piles on steep and/or eroding slopes. If this is unavoidable, cover with jute netting if the slope is steeper than 2:1.
- Separate roots and stumps from spoils, keep spoils piles free of woody debris and do not place them on top of brush, logs or trees.

SOIL HEALTH AND MANAGEMENT

After water, nothing on your farm is more essential than your soil. Healthy soils are the keystone to a bountiful crop, a prosperous harvest, and vibrant flora and fauna. Fertile soils are living systems that serve many vital functions, including water purification and storage, carbon sequestration, and plant productivity. Think of your soil as one of your best “reservoirs” for water. The more you retain, the less you need to import into the farm system. Healthy, well-structured soils are porous, allow water infiltration and decrease runoff and erosion. The organization Kiss the Ground has produced an informative video about soil. Check it out at www.thesoilstory.com. Getting to know your soil is truly a joy, as its many daily miracles will unfold before you!

SOIL BASIC PRINCIPLES

- Soil is alive!
- Nurture your soil’s biotic community.
- Keep soil covered and amend it with compost.
- Avoid soil disturbance and soil compaction.
- Avoid the use of pesticides and herbicides.

Adapted from the USDA-NRCS Healthy, Productive Soils Checklist, www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/soils/health/?cid=stelprdb1049236.

How you manage your soil will dictate its productivity and how well it retains water and nutrients.

Crop diversity and cover crops will improve your soil and the health of your farm. Cover crops lower soil temperatures, reduce supplemental nutrient requirements, build organic material in the soil, and facilitate moisture retention. Planting cover crops is also the most cost effective way to prevent runoff and sheet erosion.

Compost can improve soil structure and improve fertility for your plants. Compost will increase soil cohesion and moisture retention, reducing water runoff. Compost reduces the need for herbicides, insecticides, and fungicides by promoting the immune system

of plants. Compost can also stimulate the soil to retain and absorb carbon from the atmosphere.

Compost tea is a biologically active extract of compost that contains plant growth compounds and beneficial microorganisms and helps to establish and maintain soil microbial populations. Compost tea is a natural fertilizer that can be made at home. **However, it is essential that compost tea be made, used, and stored as a chemical, as it can pollute waterways if run-off is not controlled.** Compost tea can be easily made from your compost and applied to plants to inoculate your soil and suppress fungal diseases. To make compost tea, start with mature compost that is crumbly and smells sweet (earthy). Place 10 pounds of compost in 10 gallons of water in a 40-gallon container. Protect the container from cold and heat and stir with a stick daily for a minimum of 5 days. Strain off the liquid and use within 4–6 hours. There should be no bubbling or off odors. Do not dilute.



CROP DIVERSITY

Photo courtesy of Jesse Dodd

Vermicompost is another good method for improving soil fertility. Vermicompost uses worms to break down compost. Worms have a variety of beneficial microorganisms in their intestines that become highly concentrated in the worm castings and work to improve pest and disease resistance for plants cultivated with them. Worm castings are inherently rich in plant available nitrogen, phosphorous, potassium, calcium and other nutrients. Because castings are highly concentrated, be careful not to over-apply them.

SOIL HEALTH BMPS

- Minimize tillage, especially if slopes are steeper than 5-10%, or if soils are highly erodible. If you do till, avoid tilling early in the spring or late in the fall.
- Prevent soil compaction. Do not work your soil when it is too wet, and avoid bringing equipment into the garden during the wet season.
- Grow a range of crops with an emphasis on attracting native pollinators.
- Increase soil organic matter by spreading manure or applying composts. Apply 2"-4" of well-rotted manure or finished compost to soils and work in to a depth of at least 5 inches.
- Apply a layer of mulch (leaves, wood chips, straw) around plants to retain moisture, fix nitrogen, and provide habitat for beneficial insects.
- Mulch soils following disturbance to minimize erosion and to minimize weeds.
- Maintain ground cover and seed nitrogen-fixing cover crops between rows.

- Establish cover crops by October 15 and maintain them throughout the rainy season.
- Avoid using pesticides and herbicides. See information about Integrated Pest Management in the Fertilizer and Pest Management section.

HOW SOIL HEALTH BMPS FIGHT CLIMATE CHANGE

- BMPs nurture the soil and improve its ability to store carbon by building soil organic matter, minimizing site and soil disturbance, and protecting the soil from compaction.
- BMPs decrease the burning of fossil fuels by composting plant material on-site and using on-site soil and soil amendments, composts and fertilizers.
- BMPs keep vegetative waste out of landfills where it decomposes anaerobically, releasing methane, a potent greenhouse gas.



FERTILIZER AND PEST MANAGEMENT

Plant size and vigor, pests, diseases, and molds are consuming concerns for all farmers. Ways to address these concerns vary widely, however, from chemically intensive systems heavy on external inputs to organic and permaculture systems which emphasize crop diversity, integrated pest management, and on-site solutions.


Chemicals that are used on farms have a way of finding their way into the water system, even when judiciously applied. Fertilizers, petroleum, rodenticides and other chemicals can persist in the water for days to years, killing fish and other animals, causing algae blooms that suffocate aquatic organisms, and threatening drinking water quality downstream. Regular use of herbicides, fungicides, and insecticides destroys beneficial soil life, such as earthworms, bacteria, and fungi. Pesticide and soluble fertilizer use also correlates with increasing soil compaction and acidification.

For these reasons, this BMP guide encourages all growers to minimize or eliminate their use of all off-farm generated fertilizers and other chemicals. This list of best practices identifies alternative methods for growth enhancement and weed/pest control, as well as best practices for storage and use in the event that chemicals are used.

INTEGRATED PEST MANAGEMENT

Integrated Pest Management (IPM) is an effective approach to controlling insects, plant diseases, and weeds while minimizing risks to people, pets, and water resources. IPM is based on scientific research, focusing on long-term prevention of pests by fostering an environment in which plants can resist disease and out-compete weeds naturally. IPM uses a combination of methods to achieve the desired goal, including biological controls (e.g., natural enemies), cultural controls (changing a management practice to inhibit growth of a pest), and mechanical/physical controls (e.g., mulches to control weeds, traps for rodents, nest boxes for beneficial predators). Chemical controls are only used if other methods fail or if targeted use can maximize the effectiveness of the other solutions.

The State of California's Department of Pesticide Regulation has released an excellent and easy-to-read guide



titled *Legal Pest Management Practices For Marijuana Growers In California*. It contains specific pest management suggestions for both indoor and outdoor cannabis grows for mites and insects, mammals, and diseases. The guide can be downloaded at: http://www.waterboards.ca.gov/water_issues/programs/enforcement/docs/cannabis_enfrmnt/pest_mgmt_practices.pdf.

FERTILIZERS AND PEST CONTROL BMPS

- Use Integrated Pest Management to manage and control weeds, disease, pests and molds.
- Use compost and nitrogen-fixing cover crops to fertilize your soil.
- Enhance your soil with compost tea and vermiculture castings.
- Avoid petroleum-based fertilizers and pesticides.
- Use non-toxic forms of pest control, including fencing, caging and trapping. However, avoid the use of poly mesh as it can trap wildlife.
- Never use pesticides or soluble fertilizers near water.

FERTILIZERS AND PEST CONTROL PRACTICES TO AVOID

- Applying pesticides on a prescheduled basis.
- Using broad-spectrum, synthetic chemical pesticides.
- Plastic bird netting as an exclusionary tool.
- Open Chemigation systems.

USE AND STORAGE OF TOXIC MATERIALS

Chemical controls should be specific to a particular problem, have evidence of effectiveness and should be applied with precision, if at all. All chemicals require careful storage and use, including fertilizer (synthetic or natural), pesticides, rodenticides, and petroleum products (e.g., gasoline, motor oil, diesel fuel). All of these should be considered toxic, as they can pollute and poison waterways and terrestrial and aquatic organisms. As we note above, the best approach to chemical storage is to not have the chemicals to store!

USE AND STORAGE OF TOXIC MATERIALS BMPS

- Follow the directions on the label exactly.
- Store toxic materials in their original containers with the original label intact in a locked leak-proof storage container located in a place where there is no threat of discharge to waterways, no threat of damage by animals, and with a secondary containment system in the event of a spill.
- When in active use outside, bags and containers should be kept closed and in a location to prevent accidental spillage or damage by wildlife.
- After active use, return bags and containers to storage area immediately.
- Post proper storage instructions in an open and conspicuous location.
- Clean up spills immediately.
- Prepare and keep onsite a Spill Prevention, Countermeasures, and Cleanup Plan (SPCC Plan) and keep an ample supply of appropriate spill clean-up material near storage areas. See [cfbf.com/cfbf/documents/issues/OilStorageOnTheFarmMemo.pdf](https://www.cfbf.com/cfbf/documents/issues/OilStorageOnTheFarmMemo.pdf) for details.



IMPROPER STORAGE

Photo courtesy of Jane Arnold



PROPER STORAGE

Photo courtesy of Dan Mar

- Empty containers, used motor oil, radiator coolant or other fluids, and vehicle batteries should be placed in the secure storage area (with their lids if appropriate) until they can be taken to a hazardous waste facility.
- Mix and load chemicals on an impermeable surface, such as concrete or a tarp, far from waterways.
- Do not assume a high percentage of inert ingredients means a product is not hazardous.
- Prevent chemical and soil spills and clean them up immediately. Pot plants and fill gas and chemical receptacles in an area with secondary containment. Remember that even if a spill occurs during the dry season, the chemical or soil will be transported to the stream during a storm event if protections are not in place.
- Use anti-backflow devices on water supply hoses, and other mixing/loading practices designed to reduce the risk of runoff and spills.

SOLID AND HUMAN WASTE DISPOSAL

Compost, feces, and ashes, though natural products, can all pollute waterways. Compostables and feces act like supercharged fertilizers in the water, encouraging algae growth and robbing the water of oxygen. Ashes increase the alkalinity of the water. Bacteria, excess nutrients, pathogens, and toxic materials and liquids will all contaminate drinking water and sicken or kill wildlife.

Do not dump anything—chemicals, trash, soil, compostables, food, human or animal feces, or ashes—into or near streams!!

ZERO WASTE ON THE FAMILY FARM

A farm is the ideal place for practicing zero waste, as there are personal and financial incentives for self-sufficiency, and ample land for composting and storage of recyclables. The long haul to landfills or public services encourages creative reuse.

Remember that there is no such thing as throwing something “away.” Materials sent to the landfill degrade very slowly and release methane gas, a very potent greenhouse gas trapper. Materials improperly disposed of on-site (such as thrown in or near the stream) pollute the water and kill aquatic species. It all goes somewhere and we are all downstream!

SOLID AND HUMAN WASTE DISPOSAL BMPS REDUCE WASTE

- Choose high performance, durable materials.
- Choose products that can be recycled, deconstructed and/or salvaged.
- Avoid materials that have a toxic lifecycle, such as PVC and other chlorinated products, products with lead (metal roofs), mercury, iron (i.e., rust) and zinc (anything galvanized), and wood treated with creosote, arsenic, or pentachlorophenol.
- Salvage materials for use onsite.



REUSE AND RECYCLE

- Compost planting waste, leaves and non-woody plants.
- Chip woody wastes for mulch.
- Recycle plastic pots.

STORAGE AND DISPOSAL OF WASTE

- Separate refuse to ensure that all items are recycled, reused, or composted.
- Designate a covered, contained area for waste and recycling.
- Cover waste and recycling containers to prevent materials from blowing or flowing into waterways.
- Cover trash loads when you transport them into town to prevent items from blowing off.
- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Consider using refuse containers that are bear-proof and/or secure from wildlife.

HUMAN AND ANIMAL WASTE BMPS

- Maintain portable and temporary restrooms regularly to avoid overspills. Check them for leaks regularly.
- Outhouses, composting toilets and the like must be constructed to prevent seepage into groundwater or surface water and must be sited properly and constructed according to the State Water Resources Control Board regulations for Onsite Wastewater Treatment Systems (OWTS). For more details see http://www.waterboards.ca.gov/board/decisions/adopted_orders/resolutions/2012/0032owts.pdf. County ordinances may preclude the use of outhouses or composting toilets. Check with your County Environmental Health Department.



APPENDICES

APPENDIX A:

USEFUL BMP REFERENCE MATERIALS

- The *Handbook for Forest, Ranch and Rural Roads* is available for free download at www.mcrcd.org/publications in both English and Spanish.
- A sample BMP Farm and Nursery Layout can be found at <http://ceorange.ucanr.edu/files/132555.pdf>.
- The Northern California Farmers Guide can be downloaded at <https://go.treesfoundation.org/inspiring/farmersguide/>.
- Legal Pest Management Practices For Marijuana Growers In California can be downloaded at http://www.waterboards.ca.gov/water_issues/programs/enforcement/docs/cannabis_enfrmnt/pest_mgmt_practices.pdf.
- The 5 Counties Stormwater Management Guide (how to test your soil by hand, how to make a rain barrel and cistern, how to find native plants for your area, how to create a vegetated swale, problems with compacted soils, etc.) can be downloaded at www.5counties.org/stormwater.htm.
- Salmonid Restoration Federation Emergency Tank and Water Rights guides can be found at <http://www.calsalmon.org/programs/water-rights-education/resources>.
- High Tide Permaculture has helpful references for using BMPs for cannabis cultivation. You can find them at: www.hightidepermaculture.com/www.hightidepermaculture.com/Watershed_Resources.html.
- ATTRA, the National Sustainable Agriculture Information Service, has publications, Q&A, and an 800 number for questions in English and Spanish. <http://attra.ncat.org> 800-346-9140



APPENDIX B: LAND SELF-ASSESSMENT CHECKLIST

Note: This checklist is for your personal use and differs from that required by the NCRWQCB permit.

To start, locate your land on a USGS quad map. If you have an aerial photo of your property, have that available as well. Walk your property and bring a clipboard, a map, a camera, and a GPS if you have one.

Property Owner _____ Date _____

Property Acreage _____

Watershed _____ Stream name _____

Soil Type _____ Slope _____

MAP AND WRITTEN SUMMARY OF YOUR PROPERTY:

A self-drawn map and written overview can serve as a powerful reference document for both business and conservation planning. Be sure to capture where all the constructed and biological features are located. Note any areas of obvious erosion, especially on areas impacted by poorly drained roads and streambanks.

PRIMARY WATER SOURCES (CIRCLE ALL THAT APPLY):

Rainwater	Stream/river	Spring
Well	Pond	Delivered

Water Available (Month) _____
to (Month) _____

For Stream Sources of Water

Tributary to: _____

Organisms Present: Fish Amphibians Invertebrates



Flow Rate at Diversion (where you pump from):

Today _____

Feb. 15 Median _____

July 15 Median _____

Type of diversion: Gravity Pump/Type: _____

Type of Storage: Bladder Tank Pond

Total Storage Volume:

General road condition _____

Stream Crossing Yes No

Erosion or Gullies Present? Yes No

During a rain event, does the road wash out and send sediment into the stream? Yes No

Do roads slope inward or outward? _____

References: Soil Type: A simple method for evaluating your soils is to use the "feel" test. See www.ext.colostate.edu/mg/gardennotes/214.html for instructions.

Slope: See http://www.ehow.com/how_6118577_calculate-slope-property.html for a simple method to estimate slopes. Smart phone users can download a clinometer app for easy measurement.

Measuring Flow Rate at Diversion: Page 2 of the UC ANR publication Low Cost Methods of Measuring Diverted Water <http://anrcatalog.ucanr.edu/pdf/8490.pdf> contains simple instructions for determining flow rate at diversion.

Adapted from High Tide Permaculture's Land Assessment Checklist



APPENDIX C:

BMP CHECKLIST

WATER SYSTEM

- Registration for water storage
- Initial Statement of Water Diversion and Use with annual reporting
- Water meter on tank outlet
- No leaks in system
- Organism excluders: maximum 3/32" screen
- Prefiltration prior to storage to prevent sedimentation
- Automatic shutoff float valve
- Drip irrigation
- Self-adjusting irrigation controller
- Anti-backflow devices on water supply hoses
- Withdrawals limited to wet season months

WATER STORAGE

- Available storage volume sufficient to provide water from May to November
- Rigid tank for storage
- Tank located 100 feet from the edge of stream and 30 feet from the property line and county roads.
- Ponds are lined with an environmentally friendly material (bentonite, bento-mat, degradable geotextiles)
- Escape route in ponds for amphibians/wildlife
- Storage elevated relative to site to eliminate pumps

HERBIVORY PREVENTION AND PEST CONTROL

- Fencing
- Animal-friendly materials for wildlife excluders
- Traps for pests
- Crop diversity
- Integrated pest management

CHEMICAL STORAGE

- Secured storage/locked shed
- Ventilated shed located in the shade
- Secondary containment capable of holding the maximum possible volume stored



CATCH BASIN FOR PETROLEUM-BASED PRODUCTS

- Storage located more than 100 feet from water source with no discharge path to water
- Proper storage instructions posted
- Supply of spill clean-up material near storage unit

ROADS AND CROSSINGS

- Stream crossings and culverts sized for a 100 year flood flow plus debris
- Culverts are consistent with NMFS Southwest Region’s Guidelines for Salmonid Passage at Stream Crossings and CDFG’s Culvert Criteria for Fish Passage.
- Energy dissipaters downstream of culverts
- Cap material from natural sources (bare soil, vegetation) or aggregate (paved, crushed, other)
- Proper drainage
 - Inboard ditch
 - Relief culverts
 - Outsloped
 - Rolling dips
 - Hydrologically disconnected from surface water
- Consultation with a licensed road contractor, engineer, or geologist.

DEVELOPED SITES (homes, sheds, greenhouses, cultivated areas, etc.):

Developed Site	Margins
1.	<ul style="list-style-type: none"> <input type="checkbox"/> Natural vegetated buffer zone of 100 feet between developed site and water source <input type="checkbox"/> Vegetated swales <input type="checkbox"/> French drain
2.	<ul style="list-style-type: none"> <input type="checkbox"/> Natural vegetated buffer zone of 100 feet between developed site and water source <input type="checkbox"/> Vegetated swales <input type="checkbox"/> French drain
3.	<ul style="list-style-type: none"> <input type="checkbox"/> Natural vegetated buffer zone of 100 feet between developed site and water source <input type="checkbox"/> Vegetated swales <input type="checkbox"/> French drain



SOILS

- Off-season cover crop
- Composting
- Use of on-site soils only (no spoils generated or soil amendments imported)
- Livestock have no or limited access to stream corridors and erodible soils
- 2-3 inches of mulch around plants
- Spoils piles are away from waterways and compacted or revegetated

STREAM BANKS

- Sloped to restore natural topography
- Adequate riparian buffer zone, planted with native vegetation.

WASTE MANAGEMENT

- Contained, covered area designated for waste and recycling
- Composting toilet located more than 100 feet from water source, sited and constructed according to SWRCB OWTS policy

HABITAT ENHANCEMENT AND PROTECTION

- Large trees in stream retained
- Ample riparian vegetation
- Bird habitat protected during construction and maintenance activities
- Large cavity trees and snags retained for birds.
- Trees on site with a variety of heights and diameter classes
- Beaver ponds left in place to slow the release of water, trap sediments, and create habitat.

Adapted from/Courtesy of High Tide Permaculture



APPENDIX D: WHERE TO FIND HELP WITH BMPS

The North Coast Regional Water Quality Control Board maintains a list of approved third party certifiers for their water quality permit program. The list can be found at www.waterboards.ca.gov/northcoast/water_issues/programs/cannabis/#_Third_Party_Programs.

The Eel River Recovery Project is a non-profit group that works with cannabis cultivators and others to institute watershed-friendly practices. The organization has put together a list of recommended contractors for the Eel River watershed. Contact them at www.eelriverrecovery.org.

Property owners can also work with consultant(s) of their choice on BMPS. If you use a private contractor who is not on a pre-screened list, make sure they are a reputable operator with the appropriate license and they are able to meet the performance standards outlined in the permits.

APPENDIX E: AGENCIES INVOLVED IN WATER QUALITY ISSUES (PARTIAL LIST)

FEDERAL

US Environmental Protection Agency (USEPA) www3.epa.gov

US Fish and Wildlife Service (USFW) www.fws.gov

Army Corps of Engineers (ACOE) www.usace.army.mil

National Oceanic and Atmospheric Administration (NOAA) www.noaa.gov

STATE

State Water Resources Control Board (SWRCB) www.swrcb.ca.gov

California Department of Fish and Game (CDFG) www.wildlife.ca.gov

California Department of Pesticide Regulation (CDPR) www.cdpr.ca.gov

REGIONAL

North Coast Regional Water Quality Control Board
(NCRWQCB) www.waterboards.ca.gov/northcoast

LOCAL

County Environmental Health Department



APPENDIX F:

DO I NEED A PERMIT?

A QUICK REFERENCE GUIDE

Activity	Applicable Permits	Agency
Movement of earthen materials in, or alteration of, the bed and/or banks of a watercourse	1602 lake and stream-bed alteration agreement (LSA)	California Department of Fish and Wildlife (CDFW)
	401 certification	North Coast Regional Water Quality Control Board (NCRWQCB)
	404 certification	US Army Corps of Engineers
Clearing, grading and/or conversion of land	3 acre conversion	CAL FIRE
	Construction Storm-water General Permit	NCRWQCB
	Grading Permit	Counties of Del Norte, Humboldt, Siskiyou, Modoc, Sonoma, Lake, Shasta
Structural development	Building Permit	Counties



Activity	Applicable Permits	Agency
Water diversion from hydrologically connected waters of the state and/or storage	1602 LSA (CDFW) Statement of Use (SWRCB) Appropriative Water Right (SWRCB) Building permit if storage tank is over 5,000 gallons (Counties)	California Department of Fish and Wildlife State Water Resources Control Board (SWRCB) Division of Water Rights Counties
Waste Discharges resulting from Cannabis Cultivation or operations with similar environmental effects	General Waiver	NCRWQCB
Human Waste Facilities, including outhouses and composting toilets	Onsite Wastewater Treatment System (OWTS)	SWRCB Counties' Environmental Health Depts.



APPENDIX G: AN OVERVIEW OF PERMITTING

Below is a brief synopsis of permits for new site development and for retrofitting existing homestead and cultivation operations to reduce threats to water resources. ***Be aware that in addition to the below listed permits and requirements, other local, state, or federal permits may be required. In addition, permits and licenses requirements are in flux as this guide goes to press. Be sure to check the websites of the appropriate agencies for updates.***

CANNABIS CULTIVATION

- **North Coast Regional Water Quality Control Board Waste Discharge Permit Program, also called Order No. R1-2015-0023.**
As of February 15, 2016 cultivators with more than 2000 square feet of cannabis cultivation production and/or associated activities are required to enroll for coverage under the Board's general waiver of waste discharge requirements either directly with the Regional Water Board, or via an approved third party program. The Regional Water Board Order regulates water and pollutants that have the potential to enter streams and other water bodies and applies to anyone who cultivates cannabis on the North Coast. For more information and the enrollment procedure: www.waterboards.ca.gov/northcoast/water_issues/programs/cannabis/
- **State cultivation permits** will be required and issued through the California Department of Food and Agriculture starting in 2017. Note that cultivation licenses and nursery licenses will be treated as two separate and distinct licenses and you cannot have both.
- **Local cultivation permits** will also be required for commercial cultivation. Contact your county government to help you determine which department will be issuing local cannabis cultivation permits.
- Be aware that in addition to those listed above, permits will likely be required from one or more state or federal agency for any project that involves heavy equipment work in a watercourse, wetland or in a



location where rain could wash soil into a year-round or seasonal stream; installing a culvert or a stream crossing; diverting water from a stream; or building roads, grading or excavating. Utilize the table in Appendix F of this guide for a quick reference to permitting and compliance. The North Coast Regional Water Quality Control Board also has a summary of permitting needs at www.waterboards.ca.gov/water_issues/programs/enforcement/docs/cannabis_cultivation_factsheet_english.pdf.

WATER DIVERSION AND STORAGE

- State water rights law requires any person diverting waters (springs, streams, and rivers) to file an initial statement of use and annual reporting with the Division of Water Rights for each point of diversion: http://www.swrcb.ca.gov/water-rights/water_issues/programs/diversion_use/index.shtml
- As of January 2016, anyone who diverts water from rivers and streams is required to measure and report how much they use annually. More information can be found at www.waterboards.ca.gov/waterrights/water_issues/programs/measurement_regulation/.
- The seasonal storage of surface water requires an Appropriative Water Right to be filed with the Division of Water Rights. Information on the types of Appropriative Water Rights and Registrations can be found at: www.waterboards.ca.gov/waterrights/publications_forms/forms/.
- The Division of Water Rights notifies the California Department of Fish and Wildlife (CDFW) of diversion and storage registrations and CDFW may put additional terms and conditions on the water right.



APPENDIX H: SYNOPSIS OF THE NORTH COAST REGIONAL WATER BOARD PERMIT

This synopsis is for informational purposes only and provides only a snapshot of the Regional Board permitting program. Many more details and requirements are included in the Order itself. The Order applies to parcels with cannabis cultivation and/or operations of more than 2,000 square feet. Refer to the Cannabis Permit for details at www.waterboards.ca.gov/northcoast/water_issues/programs/cannabis/

TIER 1: LOW RISK TO WATER QUALITY QUALIFICATIONS

- Cultivation sites with slopes less than 35%
- Total cultivation area of less than 5,000 square feet
- Cultivation areas or associated facilities located 200 feet or more from surface water (i.e., wetland, Class I, II, or III streams)
- No surface water diversions between May 15 and October 15.
- Meets the Standard Conditions (outlined in section 1A of the Order).

REQUIREMENTS

- Must enroll in the discharge program
- Must pay an annual fee
- Must submit annual reports that certify that their site meets Tier 1 characteristics and Standard Conditions.
- May enroll, participate and comply with the Order through an approved third party.

TIER 2: WATER RESOURCES PROTECTION PLAN QUALIFICATIONS

- Does not meet the characteristics of Tier 1 or Tier 3 or the Standard Conditions in section 1A.



- Cultivation areas and associated facilities located at least 100 feet from any Class I or II watercourse or within 50 feet of any Class III watercourse or wetlands. Two hundred (200) foot buffers are preferred. Alternative riparian setbacks may be required or approved on a site-specific basis.
- Cultivation areas of less than 10,000 square feet that have a fully implemented water resource protection plan, meet the Standard Conditions and have been verified by the Regional Water Board or an approved third party may qualify for star status (Tier 2*) and be subject to Tier 1 fees.

REQUIREMENTS

- Must enroll in the discharge program
- Must pay an annual fee
- Must submit annual reports.
- Must develop and implement a water resource protection plan (outlined in section 1B).
- May enroll, participate and comply with the Order through an approved third party.

TIER 3: REMEDIATION SITES

QUALIFICATIONS

- For sites that pose an immediate threat to water quality and require cleanup, restoration, and/or remediation. Refer to the Order for details about these sites.

REQUIREMENTS

- Tier 3 dischargers must develop and implement a cleanup and restoration plan as detailed in the Order in section 1C.
- Must enroll in the discharge program
- Must pay an annual fee
- If cultivating cannabis, must also adhere to the Standard Conditions (section 1A) and implement a water resource protection plan (section 1B), including the annual fees associated with them.

