This article is from the January/February 2005 issue of Practical Winery & Vineyard Magazine. Order current or back issues [here](#).

GRAPEGROWING

January/February 2005

BMP practices were implemented along this road at a Santa Maria, CA, demonstration site to help reduce soil and water runoff, including road grading (to remove rills and gullies), seeding with fescues and Juan triticale (along the fence), and use of jute netting. (Photo by Marilyn Brooks)

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Growers implement cover crop programs for a variety of reasons including erosion control, nutrient re-cycling, and dust control. New regulations, regarding water quality, provide added incentive to implement cost-effective cover cropping programs that effectively reduce vineyard erosion.

New water quality regulations

As part of the California State Water Resource Control Board's (SWRCB) Conditional Waiver for Agriculture Discharge, each of seven Regional Water Quality Control Boards (RWQCB) must develop a replacement waiver program that

Historically, this road cut (approximately seven-feet deep) eroded during the rainy season, depositing several feet of soil onto a nearby vineyard that had to be manually removed each year. BMP implementation included grading and planting of barley and fescues to reduce erosion and stabilize the area. (Photo by Dawn Stimson)

will protect water quality within its region.

The replacement waiver program was created by the SWRCB to replace the Agriculture Discharge Permit, which expired January 2003. The old permit allowed growers to discharge water from fields without restrictions. Each water board is required to develop a replacement waiver program for growers within its region that addresses the quality of water leaving agriculture areas.

As part of the replacement waiver program, growers are being required to complete a Farm Water Quality Plan that addresses several components of the farming operation and documents future practices to be adopted. On the Central Coast of California (Region 3), growers can complete a Farm Water Quality Plan through the University of California Cooperative Extension, or they can complete the Positive Points System (PPS) evaluation with the Future Plans Form from the Central Coast Vineyard Team (CCVT). 1

The PPS evaluation presents a series of yes/no questions and addresses the "whole farming system" by reviewing six categories of farming practices. The grower must also document future plans for improving water quality by implementing best management practices (BMPs) on a particular site. (the Positive Points System and the Future Plans Form)

Regardless of which farm plan growers choose to utilize — the UC Farm Water Quality Plan or CCVT's Positive Points System — they must develop a list of BMPs to deal with each of the four areas associated with irrigated agriculture's contribution to Non-Point Source (NPS) pollution: fertilizer, pesticide, irrigation, and soil management.

Each farm plan must include a list of BMPs that the grower will employ (or currently uses) to control erosion by reducing off-site movement of soil and water into nearby water bodies. In many cases, these are inexpensive and efficient practices that can save growers time and money.

Types of BMPs

BMPs are a combination of management, cultural, and structural practices that growers can implement to effectively control problems in the field. In regard to NPS pollution (related to agriculture), one area of BMPs includes practices that keep soil and water in place, thus controlling erosion.2

The SWRCB recommends several BMPs to reduce erosion in vineyards. Four are:

1. Cover crops — Cover crops can be planted in vineyards between vines to control erosion, increase infiltration, reduce soil compaction, and improve soil tilth, and to add organic matter and nutrients to the soil.
   Cover crops (either annual or perennial) are usually planted in the fall, following harvest. Perennials or reseeding annuals can provide long-term protective cover lasting more than three years. Examples of commonly used cover crops in vineyards include erosion mixes (including various grass species and annual legumes):
   • Zorro fescue (Festuca megulura fast-establishing annual grass);
   • Clovers (Trifolium-legumes including rose clover [Trifolium hirtum], crimson clover [Trifolium incarnatum], and Persian clover [Trifolium resupinatum]); and
   • Triticale (Triticale hexaploide fast-growing annual).
   In addition, cover crops can support populations of beneficial insects, which is important in promoting biological diversity within a vineyard.
2. Filter strips — Filter strips are planted parallel or adjacent to vineyards or along waterways to slow and reduce run-off and remove sediment and pollutants through infiltration. They can also enhance wildlife habitat when native species are used. Planted with dense vegetation in areas between five and 10 feet wide, filter strips can include grasses, such as tall fescue (Festuca arundinacea), switch grasss (Panicum virgatum), creeping wildrye (Leymus triticoides), and blando brome (Bromus hordeaceus).
3. Tree/shrub establishment — Trees and shrubs are commonly planted along bare hillsides of vineyards to reduce erosion by increasing water penetration and infiltration rates. They can also enhance wildlife habitat. Trees and/or shrubs can be planted any time during the year, but they may require additional irrigation if not planted prior to winter.
4. Land smoothing — Removing rills and gullies on land surfaces with earth-moving equipment can reduce erosion and improve water drainage and water distribution. Land smoothing is usually conducted prior to planting or construction. The work usually requires the use of scrapers, land levelers, and backhoes. Land smoothing can be costly, but most of the time the benefits outweigh the costs. Smooth land is easier to plant and less likely to erode.3

Approximately 1.5 feet of soil built up along vines as a result of an eroding road cut uphill. (Photo by Dawn Stimson)

Growers frequently spend significant time and money each year taking corrective action to mitigate existing problematic field conditions, such as sediment build-up at the end of bare roads, rills, and gullies and large amounts of water run-off, which can carry nutrients and pesticides into nearby fields and water bodies. For example, many growers use the following techniques every year:

- Sand bagging — Anticipating winter rains, some growers place sandbags at the bottom of roads and hillsides to prevent erosion.
- Road re-grading — Every year growers must re-grade bare roads that were wiped out during the rainy season.
- Sedimentation removal — Large amounts of soil and sediment can build up at the end of bare roads and hillsides when proper cover is not placed on a surface. Growers must then remove the soil every year after the rainy season.

Kevin Merrill, vineyard manager, in a newly planted demonstration block with a perennial erosion cover crop mix (crimson clover, rose clover, subterranean clover, medic, Persian clover, dwarf perennial ryegrass, and fine fescues) drilled at 35 lbs./acre. (Photo by Dawn Stimson)

Unfortunately, these costly efforts must be repeated every year, and they don't correct the problem. BMPs are longer-lasting solutions that can save growers time and money.

Clean Water Project

In 2002, the CCVT, a non-profit vineyard grower group on the Central Coast of California (Monterey, San Luis Obispo, and Santa Barbara counties), received a three-year Clean Water Act, Section 319(h) Grant for Water Quality Implementation Projects administered through the SWRCB. Goals of the grant were to reduce, eliminate, or prevent NPS water pollution resulting from agricultural run-off and to enhance water quality in impaired water bodies.

Funds available through the 319(h) program were directed toward demonstration projects that would achieve these goals.4 CCVT developed the Clean Water Project to assess and reduce non-point source pollution from Central Coast vineyards through the implementation of BMPs.

As part of the CCVT Clean Water Project, ten demonstration sites were established at vineyards between Monterey and Santa Barbara counties to demonstrate the effectiveness of BMPs in reducing soil and water run-off. For example, a demonstration site was established at a vineyard in Santa Maria, CA, which was located inland on slopes ranging from 5% to 15% with Betteravia Loamy Sand, dark variant. Previously, the vineyard manager had problems with the roads eroding within the vineyard due to rains and lack of cover crop.

"In years past, we regraded and refilled the sandy roads after the rainy season," states Kevin Merrill, vineyard manager. "Graders, scrapers, and bulldozers were used to smooth the roads and re-allocate excess soil at the bottom of the roads." He estimates that between $10,000 and $15,000 were spent annually for this work.

In 2003, Merrill (with help from the Cachuma Resource Conservation District [RCD] and CCVT staff) implemented several BMPs to reduce soil run-off and to reduce costs. The RCD was chosen for its experience with local erosion issues. RCD staff helped Merrill select the following BMPs for the site:

- Smoothing and leveling roads;
- Planting grassed roads; and
- Planting filter strips.

In the summer of 2003, roads were smoothed over an area equivalent to 10 acres. Gullies and rills were removed. Following harvest, the roads were seeded to establish cover crop and reduce runoff. A mix of sheep fescue (Festuca ovina) and hard fescue (Festuca longifolia) was selected because of its drought tolerance, longevity (as a perennial), and deep-rooting properties. The fescue mix was drilled along the roads at 30 pounds per acre (lbs/acre).

Straw was spread on top of the road at one ton per acre (approximately one to two inches deep) to secure the seeds against the first rains. In one area more susceptible to erosion, jute netting was secured on top of the road for additional support to the seeds. Along the fence beside a couple of roads, triticale was planted as a filter strip to slow water run-off from the adjacent property. Triticale was selected because of its early ripening and large yielding capacity and was broadcast at 90 lbs/acre.

Table I. Implementation costs for Best Management Practices (includes management, labor, equipment, and material costs).

Demo BMP	Implementation Costs ($/ac)		
	Year 1	Year 2	Difference
Grading, grassed roads, use of jute netting	$642.50	$199.75	–$442.75
Filter strip and cover crop	$352.48	$314.88	–$37.60
Grassed roads	$112.60	$118.33	$5.73
Cover crops in vine middles	$210.25	$300.75	$90.50
Cover crops under vines and in middles	$152.88	$30.00	–$122.88
Grassed roads and use of jute netting	n/d	$128.70	n/a
Cover crops in vine middles	$41.70	$40.20	–$1.50
Cover crops in vine middles	$347.50	$347.50	$0.00
Grassed roads	$150.80	n/d	n/a
Water diversion, cover crop, grassed road	$129.13	$100.00	–$29.13
Grassed roads	n/d	$121.40	n/a
Average	**$237.76**	**$170.15**	**–$67.20**

BMP benefits at project sites

Many benefits were evident through implementing selected BMPs along these demonstration roads: an increase in cover from 10% to 75%, a reduction in soil leaving the roads, and reduced re-grading expenditures.

Total cost to implement BMPs at this site was approximately $1,500 ($150/acre), including seed costs, implementation, and maintenance. This cost was considerably lower than the approximate $10,000 spent annually on grading and staff time. In addition, BMP benefits can last for two to four years.5

At another vineyard in Los Olivos, CA, a demonstration site was established along a highway on slopes ranging from 9% to 15%. The area was subject to large amounts of runoff from nearby hills. In years past, run-off removed Elder Sandy Loam soils from the vineyard and deposited them onto the road below. Sandbags were placed around the vineyard before the rains, and then excess soil was removed from the bottom of the vineyard. Average cost was between $500 and $1,000 per year.

Table II. Estimated changes in soil loss at Clean Water Project demonstration sites using the RUSLE2 model.

Demonstration Practice	Estimated Soil Loss from Demonstration Area (ton/ac/yr)		
	Without Demo BMP	With Demo BMP	Difference
Grading, grassed roads, use of jute netting	32.50	0.75	31.75
Filter strip and cover crop	24.50	0.90	23.60
Grassed roads	42.00	0.21	41.79
Cover crops in vine middles	7.00	5.75	1.25
Cover crops in under vines and in middles	2.35	0.22	2.13
Grassed roads and use of jute netting	20.00	1.00	19.00
Cover crops in vine middles	3.87	2.67	1.20
Cover crops in vine middles	3.00	1.50	1.50
Grassed roads	17.00	2.00	15.00
Average:	**16.91**	**1.67**	**15.25**

*Two of the sites did not meet the RUSLE 2 requirements for calculations and therefore could not be included in this table.

As part of the Clean Water Project, a 50-acre parcel within the Los Olivos Vineyard was established as another demonstration site. Following harvest in 2002, BMPs were implemented to reduce and infiltrate run-off through the site. Staff from the Cachuma RCD helped develop a work-plan to determine which cover crops would work best to reduce run-off and be most cost-effective.

The area was divided into four blocks. One block was drilled with 35 lbs/acre of Perennial Erosion Mix6 of crimson clover, rose clover, subterranean clover (Trifolium subterraneum), medic (Medicago), Persian clover, dwarf rye grass, and fine fescues. Another block was drilled with 35 lbs/acre of Drought Annual Mix (crimson clover, rose clover, subterranean clover, medics, Persian clover).6 A third block was divided in two sections. The upper most half of the block was drilled with 80 lbs/acre of Juan triticale (Triticosecale Wittm). The lower half of the block was drilled with 10 lbs/acre of Zorro fescue, as was the fourth block.

Benefits of implemented BMPs were seen in each of the subplots. The Perennial Erosion Mix grew to heights of eight to 12 inches and covered about 85% of the planted area. The Annual Erosion Mix grew six to eight inches in height and covered about 50% to 60% of the area. Juan triticale grew to 18 to 36 inches in height and covered almost 90% of the planted area. Zorro fescue grew four to six inches and covered about 50% of the planted area (lack of better establishment may have resulted from insufficient rain after planting).

Total cost to implement and maintain BMPs at this site was approximately $2,000, or $40/acre. This included the cost of seeds, two-thirds of which were perennial and would re-seed annually up to five years. In addition, the cost for the Juan triticale (the most effective) was minimal ($0.30/lb) and could easily be replanted yearly if needed.

In the Clean Water Project as a whole, the average cost to implement best management practices decreased from $237.76/acre to $170.15/acre from Year 1 to Year 2 (Table I) for vineyards participating for multiple years. At some sites, costs remained constant or increased, due to the type of practices implemented or problems with establishing cover during the first season. But for the most part, growers were pleased with the cost-reduction and cost-effectiveness of the practices.

Estimated soil loss reductions

In the second year of the Clean Water Project, CCVT staff worked with the Templeton Natural Resource Conservation Service staff to estimate soil loss prevented from demonstration sites using the Revised Universal Soil Loss Equation (RUSLE) 2.

RUSLE 2 is a computerized model used to plan conservation practices; it provides an estimate of soil loss in tons per acre per year (tons/acre/year) that would occur with various practices. The equation considers five factors: climate (precipitation and temperature); soil type (series); slope; crop management (equipment used); and conservation practices (sediment basins, cover crops, etc.).7

By using the RUSLE 2 model, CCVT estimated that, without implemented BMPs, soil loss ranged from 2.35 to 42.0 tons/acre per year at demonstration sites. With implemented BMPs, soil loss ranged from 0.21 to 5.75 tons/acre per year. On average, project staff estimated that the implemented BMPs reduced soil loss by 15.25 tons/ acre per year (Table II).

Ripple effect

Demonstration projects such as the Clean Water Project help growers see the specific costs and benefits of implementing BMPs, in addition to learning the “how-to” for specific practices.

By providing technical assistance and documenting specific project information, the Clean Water Project capitalizes on the growers’ willingness to adopt new practices and leverages their contributions of time and resources.

Growers provide a living laboratory that helps develop information that can be extended to a broader audience. This paves the way for more growers to adopt similar practices with less risk because of lessons learned in demonstration projects.

With the current Agriculture Discharge Waiver in place, such lessons will help growers be successful in adopting BMPs that protect water quality.

Further Reading:
"Conditional Waiver of Waste Discharge Requirements for Irrigated Lands".

"Non-Point Source (NPS) Pollution and Best Management Practices (BMPs)".

"Central Coast Vineyard Team's (CCVT) Clean Water Project (CWP)" or contact Dawn Stimson; Clean Water Project Coordinator at 805.369.2288 or via email.

California Stormwater Quality Association. (2003). "Vegetate Buffer Strip." California Stormwater BMP Handbook, TC-31, California.

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4. "319 Program Fact Sheet." (Document) (2003).

5. Huebner, G. "Forage and Grass Seed Production Guide 2002" (2001).

6. Seed mixes were purchased from Lockwood Seed and Grain located in Chowchilla, CA.

7. "Revised Universal Soil Loss Equation, Version 2 (RUSLE)." (2004).