

REVEGETATION TEST PLOTS GUIDELINES

The following are recommended guidelines for the creation and maintenance of revegetation test plots for surface mine reclamation plans. If there is a conflict between these guidelines and the specific conditions of approval of a reclamation plan, the conditions of approval must be followed or an application for a modification to the reclamation plan must be submitted to, and approved by, the County.

Why establish test plots?

The reason to establish test plots is to be able to determine in advance the most successful strategy for revegetation of a mine site. Although a reclamation plan establishes requirements for revegetation, it is not known at the time the reclamation plan is approved whether the approved revegetation will actually be successful.

Test plots help determine which plant species will actually grow on site, and what conditions of microclimate, soil, nutrients, etc. are necessary to achieve revegetation success. Test plots are typically required by reclamation plans.

Who is responsible for test plots?

The mine operator is responsible for establishment, maintenance and monitoring of the test plot. The work may be delegated to a consultant, contractor, employee, etc. However, the operator remains responsible.

Where should test plots be located?

Test plots should be located in an area or areas of the mine where they are unlikely to be disturbed during the rest of the time the mine is being operated. If this is not feasible, then locate test plots in an area that will not be disturbed for at least 4 or 5 years. If possible, the test plots should mimic the ultimate condition of the site. For example, test plots should be located in areas which are representative of the various significant microclimates which may exist on the mine site, such as slope (how steep the finished grade will be), aspect (the direction the slope faces), wet or dry conditions, etc. When possible, the soil or growth media that has been salvaged should be used in the test plots. More than one test plot area may be necessary to represent all conditions at the mine site.

What size should a test plot be?

A test plot should be large enough to:

1. Have adequate area to plant a representative sample of the plants proposed for revegetation and enough individuals of each of the plant species to be able to determine the survival and success of the plants to be used for revegetation.

2. Reduce the amount of blown-in seed and invasion of adjacent plants.
3. Have areas for different soil treatments, planting mixes, etc.
4. Have room for people to monitor the plot without trampling all the plants.

A recommended minimum size is approximately 32 feet by 32 feet or 10 meters by 10 meters.

How should a test plot be marked?

A recommended way of marking a test plot is to fence it with welded wire fencing, graduated hog wire or similar fencing, a minimum of 4 feet high, surrounding the plot. A gate and a cleared pathway to the plot are necessary for access. Fencing your test plot also discourages damage to the plants from browsing mammals. Deer and rodents will be attracted to the tender plants in your test plots and can ruin your data by destroying the plants. Test plot fencing in areas where deer are common should be 6 to 8 feet high. To prevent rodents from burrowing under the fencing, trench 6 to 8 inches beneath the soil surface, under the fence and install chicken wire at the base. Freeze-thaw cycles may damage the chicken wire by pushing it up and out of the soil, so you will need to watch for damage to the fence each spring.

What type of "soil" should be used?

Whatever is used for "soil" or growth medium for the test plots should be representative of what will be available and used at the time of reclamation. A test plot planted in native or "virgin" soil will not be helpful in determining how plants will grow in actual reclaimed mine conditions.

Where possible, soil should be replaced on the test plot in such a way so as to imitate and reconstruct the original soil on site and/or as specified in the reclamation plan. Where possible, coarse rock shall be placed down first, followed by finer rock, followed by subsoil and soil, and capped with topsoil. Soil compaction should not exceed 80 percent in areas to be revegetated.

Where soil is not available, the test plot should be established on whatever growth medium will be available and replaced in the same way it will be at the time of reclamation.

What about soil testing?

The soil or other growth medium used for reclamation should be tested to determine whether any nutrient amendment or other treatment is necessary. Many soil laboratories will conduct a basic soil analysis for approximately \$30. The soil test will provide you with important information that can save you money in the long run. The soil analysis will

determine what your soil pH is. Soil pH is a measurement of how acidic or how basic your soil is. Plants grow best in soil with a pH of 6.5, but will grow in soils with a pH of 5.5 to 7.5. Mining can alter soil pH by exposing your soils to overburden and tailings, which may contain very acidic or basic minerals. The soil test will also determine if amendments are needed. The soil analyses are based on demands of agricultural crops, so you must extrapolate your results to native plants. Native plants are not adapted to nutrient rich soils. In addition, for many California native species, it may be helpful to inoculate the soil with mycorrhizae.

Fertilizer should be avoided, but if required, any fertilizer that you add should be a slow-release or encapsulated type and at a lower rate than recommended for agricultural crops. If your soil lacks organic matter, then you may need to increase the organic matter content of your soil by adding compost. Compost should be weed-free.

What plants should be planted in a test plot?

The plants used in the test plots should be the same as the species and density of plants approved in the reclamation plan. You may also consider native plants that are already coming in on the site.

What other conditions can I test in my test plots?

You can test the following conditions:

- Amended "soil" vs. non-amended "soil." Different trials can include: the use of compost, fertilizer, and soil additives such as lime to raise pH and sulfur to lower pH.
- Seeding methods, such as broadcast seeding, hydroseeding, and drill seeding can be tested.
- The need for plant protection can be tested outside of your fenced area. Try the different kinds of cages that are available from forestry suppliers.
- What species will work best and do they establish quicker as seeds or containerized plants.
- The need for weed control and what methods work best.
- The need for irrigation, or irrigation the first year to get the plants established.

What about irrigation?

Unless otherwise specified in the approved reclamation plan, permanent irrigation is not recommended. Plants should be planted during the optimum time of year for them to obtain the moisture they need. If possible, avoid irrigation entirely. If additional moisture is

needed, periodic irrigation for the first year may be used, keeping in mind that similar irrigation will likely be necessary for the entire mine site at the time of reclamation.

How should test plots be monitored?

The goal is for the test plot to show that if the "soil" is replaced and the former mine is planted according to the standards and conditions of the reclamation plan, the revegetation will be successful as specified in the plan.

The test plot should be monitored once a year, after the majority of growth has ceased, usually in the late summer. Plots should be monitored the same time each year, and within 2 weeks of the previous year's monitoring. Photographs of the overall plot(s) and of the plants shown next to a measuring device such as a ruler or tape measure, and showing the date are recommended. Make sure that you keep a record of the success rates of the various plant species, conditions, etc. The record should also compare the actual plant success rates with the success criteria specified in the reclamation plan. A copy of this record should be submitted to the Planning Division and/or provided to the inspector during the annual inspection.

After two or more years, it may become apparent that the survival rate of certain species specified in the reclamation plan is low and/or otherwise does not meet the success criteria for revegetation specified in the reclamation plan. If so, then other soil constructions, nutrient amendments, irrigation, and/or plant species should be tried. In this case, the operator may apply for and obtain approval of a minor modification to the reclamation plan to change the species to be planted.

When should test plots be established?

A test plot should be established within one year of the beginning of mining operations. In many cases this will allow a number of years of testing prior to reclamation.

How long should test plots be maintained and monitored?

A test plot should be maintained for at least four or five years, and monitored for the life of the mining operation. It may be helpful to consider the standard for determining revegetation success:

"The reclamation shall be monitored until the revegetation performance standards are met provided that, during the last two years, there has been no human intervention, including, for example, irrigation, fertilization, or weeding."