Reclamation Plan

PDC Energy
Metcalf Soil Treatment Facility

OLSSON ASSOCIATES

OA Project No. 013-0036
PDC ENERGY, INC.

MASTER RECLAMATION PLAN

OCTOBER, 2007
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1.0 INTRODUCTION

The Plan covers preliminary planning, pad construction, soil salvage, soil stockpiling, backfilling and grading, re-topsoiling, soil amendments/fertilization, seeding, seed mixtures, mulching, Best Management Practices (BMPs), fencing, weed control, revegetation inspections and revegetation monitoring. The Plan covers the Grand Valley, Parachute, and Rulison field proposed 10-acre density areas.

Chenoweth and Associates Environmental Consultants LLC (C&A) personnel completed field surveys for quantitative vegetation and soils data during June 2000. The data collection encompassed twenty (20) revegetated well sites and eleven (11) adjacent undisturbed range sites, which served as reference areas. The soils and vegetation data and associated summaries are presented in Appendix A. This data and associated summaries provide valuable information on maintaining and enhancing successful future reclamation efforts.

In addition, extensive high intensity soil surveys (including mapping, sampling and laboratory analyses) have been conducted since the year 2000 at all new 20-acre density well sites. Over 100 samples have been collected and analyzed. IRI, Inc. of Montrose and Cordilleran Compliance Services, Inc. of Grand Junction have also conducted annual Reclamation Success Monitoring and Revegetation Inspections.

2.0 RECLAMATION OBJECTIVES

The reclamation process has been divided into four major phases: 1) pre-disturbance planning and site preparation, 2) site stabilization during well construction, 3) interim reclamation and monitoring, and 4) final reclamation and success monitoring.

By minimizing the amount of land disturbed through pre-disturbance planning and initially preparing the site for construction activities with the understanding that the area would eventually be reclaimed (e.g., topsoil stripping and stockpiling for later use during site reconstruction, minimizing cut-and-fill slopes, and disturbing as small an area as possible), the acreage requiring disturbance would be reduced and reclamation success would be facilitated.

General reclamation objectives are:

- The isolation and/or removal of all undesirable materials (e.g., poor-quality subsoil, contaminated soil, potentially hazardous materials) to protect the reclaimed landscape from contamination;

- Re-contouring and implementation of other soil conservation, surface manipulation and water management techniques to establish stable slopes, water courses, and drainage features to minimize erosion and sedimentation;
• Revegetation of reclaimed areas to stabilize soils and establish a vigorous, diverse, self-perpetuating plant community, which contains little undesirable vegetation and is capable of supporting post disturbance land uses;

• Establishment of acceptable long-term visual aesthetics by minimizing visual contrasts.

Site stabilization during well construction consists of salvage of all usable topsoil and subsoil, immediate vegetation of all topsoil and subsoil stockpiles, and immediate stabilization of disturbed areas to control erosion and provide protection for adjacent undisturbed areas from unnecessary degradation. The vegetation mix used for all site stabilization is listed as the Temporary Mix shown in Table 15.1. The purpose of this mix is to obtain a rapid revegetation that will minimize erosion. This seed is applied to all cut and fill areas, subsoil and topsoil stockpiles and any other areas not needed for well drilling. The seed is not applied to the pad area. Erosion will be considered controlled when water naturally infiltrates into the soil; gullying, head cutting, or slumping is not observed; and rills are less than 6 inches deep. Specific measures to attain these goals are discussed in Section 17.0 (BMPs).

Interim reclamation involves the reclamation of those areas disturbed during well construction, but not needed during the production life of the well. These items consist of final grading, relieving of compaction, subsoil and topsoil replacement, seeding, mulching and fence installation to prevent future activity on the interim reclamation areas. Interim reclamation may also include roads leading to well sites. Interim sites will be monitored for reclamation success on an annual basis. Subject to landowner approval, seeding will be done with either the bottomland mix or the pinyon-juniper mix to establish ground cover. These mixes are provided in Tables 15.2 and 15.3. Interim reclamation shall occur no later than 3 months on crop land and 12 months on non-crop land and will last for the life of the well. Interim reclamation is done with the intent of final reclamation although certain sites may require re-contouring of the interim areas after the well has ended its useful life. An example of this is a pad that has cut/fill areas that are regraded and reclaimed after the well is finished.

Final reclamation includes the removal of all remaining equipment, tanks and structures at the site, final backfilling and full reclamation of those disturbed areas not reclaimed for interim reclamation. The same reclamation procedures described for interim reclamation would be employed. The seed mixes for final reclamation are the same as those for interim reclamation (Tables 15.2 and 15.3). A non-producing well location and associated access road are examples of final reclamation sites. Upon project completion, all disturbed areas except roads to be retained for other land uses would be reclaimed as designated by the landowner.

Reclamation success monitoring involves assessing the status of reclaimed areas to ensure they meet desired site stability and productivity standards. Reclamation monitoring would be performed by a 3rd party consultant and would include an evaluation of plant cover, density, and diversity as well as erosion and weed control.
Non-cropland vegetation would be expected to contain a diverse mixture of grasses, forbs, and shrubs as provided in Tables 15.2 and 15.3.

3.0 AFFECTED COMMUNITIES/HABITAT

Within the Grand Valley and Rulison projects areas, five general plant communities have been identified. These plant communities include steep-slope xeric shrub, pinyon/juniper woodland, big sagebrush, desert shrublands, and hay meadows. The steep-slope xeric shrub community contains mountain mahogany and antelope bitterbrush, often with an over story of pinyon and juniper. Pinyon/juniper woodlands consist of pinyon and juniper, with an under story of wheatgrass and needlegrass. The big sagebrush community contains sagebrush, saltbush, greasewood, and wheatgrass. The desert shrubland community primarily consists of saltbush, sagebrush, and warm-season grasses.

4.0 PREDISTURBANCE INVENTORY AND SITE PLANNING

PDC personnel and their reclamation consultant will review locations of well pads, access roads, and ancillary facilities prior to actual construction activities. The following items will be evaluated and/or inventoried.

- Suitability of slopes steeper than 2:1 for construction activities with special erosion control and slope stability measures as needed.

- Evaluation of true riparian/wetland areas for exclusion from construction disturbance vs. fringe areas that can be properly reclaimed without long term damage to true wetlands and as agreed to by land owners.

- Identify an appropriate buffer from intermittent and ephemeral streams.

- Identify soil-mapping units of proposed disturbed area; collect one soil sample for every soil series of the proposed disturbed areas, and complete soil physical and chemical analysis for topsoil stripping, stockpiling and replacement recommendations. Utilize a backhoe to construct a test pit that will facilitate review of soil profile(s) and collecting soil samples. A soil auger and/or additional test pits will be utilized every 1.5 acres to confirm if any additional soil mapping units exist on any given well site. If so, additional soil sampling will be completed. Collect soil samples in 6-inch lifts or by horizon as determined by a qualified soil scientist.

- Inventory any noxious weeds listed in the Colorado Noxious Weed Act (Colorado Department of Agriculture, 1996) and Garfield County Noxious Weed Management Plan (Garfield County Vegetation Management, 2000).

- Prepare a preliminary list of BMPs to be utilized during construction and as a part of final reclamation efforts. A list of actual BMPs may be better defined immediately prior to completion of construction activities.
• Prepare a preliminary sketch plan of fencing for proposed disturbance areas for rangelands.

• List fertilization, soil amendment, soil tillage, seed mixture, mulching methods (if deemed necessary by the reclamation consultant), and any other cultural practices to be used within defined vegetation zones.

A comprehensive description of revegetation and erosion control efforts is described in each the following sections of this Plan.

4.1 Wellpad and Facility Site Construction

Prior to construction, proposed pad and facility site locations would be surveyed and staked. Locations would be designed to parallel the contour with reserve pits on the uphill side of pads whenever possible. Well pads would be designed and constructed to disturb the smallest area necessary to provide for efficient and safe operations.

Excess cut material would be incorporated into fill slopes or placed in designated areas and stabilized. Backsloping would be necessary only in areas of steep terrain (>3:1 slopes). This material shall be utilized during the reclamation process.

During construction, interceptor ditches would be installed above cuts and around reserve pits, as necessary. Collector ditches and sediment control structures constructed for a storm event may be required below fill areas. Smaller flows would be diverted and/or collected before being discharged from the disturbed area. Qualified personnel would supervise the installation of all erosion control structures, including berms, dikes and trenches.

4.2 Roads

New roads generally would follow natural contours and would be constructed in accordance with industry road standards. For roads on slopes of less that 15%, available strippable/useable topsoil would be stripped from the construction area and placed in windrows within the construction ROW by side casting with a grader. Where roads must be constructed on slopes greater than 15%, and significant topsoil is present, topsoil would be transported to more level terrain for storage. After road construction, strippable/useable topsoil, if any, would be replaced on road out slopes, and these areas would be reseeded.

4.3 Pipelines

When constructing and reclaiming pipelines, existing crowned-and-ditched roads would be used for access, where practical, to minimize surface disturbance. Pipeline trenches would not be placed in access road borrow ditches unless other
reasonable locations are unavailable. Gathering pipelines may be installed on the surface in areas where slopes are greater than 25% and/or where rock outcrops are crossed; when possible, they would be built perpendicular to the contour to minimize the area required for construction.

Vegetation would be removed from pipeline ROWs so as to leave the root systems intact and the removed vegetation would be spread over disturbed areas to provide protection, nutrient recycling, and a natural seed source. If pipelines are trenched rather than plowed in, trenches would be excavated with a backhoe or similar equipment to minimize disturbance.

Frozen soils, vegetation, and snow would not be used to backfill pipeline trenches. This action would reduce trench compaction needs. In no event would backfill berms in excess of 6 inches in height be placed over backfilled trenches.

Construction of pipelines in wetlands would comply with U.S. Army Corps of Engineers (COE) permit requirements. Silt fences or other sediment control devices would also be installed along channel banks where sedimentation is excessive and at the bases of slopes adjacent to wetland/riparian areas (as necessary to control sediment).

Temporary sediment barriers would remain in place until final revegetation measures have been successfully implemented.

5.0 SOILS OF THE PROJECT SITES

The soils of the Grand Valley, Parachute, and Rulison areas tend to be shallow soils derived from alluvial and colluvial material. Restrictive features for plant growth result from high coarse fragment content, alkalinity, lack of carbonaceous material and poor soil texture. Existing sparse vegetative cover and the lack of desirable plant species in undisturbed areas reflects the shallow nature of in-situ soils. In addition, overgrazing has enhanced the presence of invader species (noxious weeds).

The soils of the Grand Valley project area tend to be poorer due to topography that exists in shale bluffs and rock outcrop areas. The soils in the Rulison project area contain somewhat deeper alluvial deposits containing more desirable plant growth media.

5.1 Topsoil Salvage

C&A utilized the Soil Survey of the Rifle Area (USDA Soil Conservation Service, 1985) and soil sampling of reclaimed well sites to prepare general recommendations for soil salvage on future well site installation. Additionally, over 100 soil samples have been extracted from well sites over the past few years (2000-2002) according to the soil scientist recommendations. These samples were analyzed and used to develop stripping procedures and reclamation plans. Site-specific topsoil salvage recommendations will range from 0” to 12” based on
present observations. Research indicates that it is better to replace a shallower layer of topsoil than to co-mingle undesirable physical and chemical properties resulting from deeper soil salvage.

A qualified soil specialist will make all topsoil salvage recommendations prior to land disturbance. These recommendations will be based on review of soil mapping units of specific well sites and soil sampling within common soil mapping units and vegetation communities. Specifically, due to the common characteristics of soil properties that occur within the same soil mapping unit and vegetation communities it is not necessary to soil sample every proposed well site. If additional soil mapping units exist on any given well site, additional soil sampling will occur.

Wyoming Department of Environmental Quality’s Guideline 1 Topsoil and Overburden will be used as a reference to rank soils as good, fair, or poor for topsoil salvage. In no case will soils rated poor for topsoil salvage be used unless properly amended, as determined by a qualified soil specialist (see soil amendment section for comprehensive discussion of proposed soil amendments).

The physical and chemical parameters proposed for use in determining topsoil quality will consist of the following: Soil texture, pH, Sodium Absorption Ratio (SAR), electrical conductivity, saturation percentage, Selenium, Nitrogen, Phosphorus, Potassium, cation exchange capacity, and organic matter content.

Any surplus topsoil material that is generated during the topsoil stripping operation will be stockpiled in a safe location on the property from which it was taken and utilized for other well site reclamation activities where a deficiency may exist. A deficiency in topsoil cover is defined as less than 3 inches of suitable un-amended topsoil.

Care will be taken to avoid stripping soils with coarse fragments greater than 35% in volume. A previous literature review completed by C&A indicates severe rooting restrictions for herbaceous species for areas containing higher amounts of rock fragments. If high coarse fragments are encountered, PDC’ reclamation consultant/qualified soil specialist may recommend rock picking, rock screening, or import of topsoil material. Screened or picked rock material will be buried in cuts, or placed deep enough below the soil surface to avoid rooting restrictions for reclamation efforts.

Alternate site preparation procedures may be applied in some areas to facilitate reclamation; however, it is assumed that most, if not all, of these areas can be avoided. In potential wetland areas, vegetation would be cut to ground level, leaving existing root systems intact. Grading activities would be limited to areas directly over pipeline trenches and road surface areas, and at least 12 inches of topsoil would be salvaged and replaced except in areas with standing water or saturated soils. Construction when the ground is frozen may be implemented as an alternative to minimize damage. Use of construction equipment would be
limited, and if standing water or saturated soils are present, wide-track or balloon-tire construction equipment or normal construction equipment operated on equipment pads or geotextile fabric overlain with gravel fill may be used. Equipment pads would be removed immediately following the completion of construction activities. Trench spoil would be placed at least 10 feet from drainage channel banks, and dirt, rock fill, and brush riprap would not be used to stabilize ROWs. All operations within jurisdictional wetland areas would comply with COE permit stipulations as necessary.

5.2 Subsoil Handling

During the installation of well pad sites, subsoil materials will be utilized to construct well pads. Information collected during the pre-disturbance inventory and site-planning phase will be utilized to determine if special handling of poor quality subsoil materials should occur. This information will include physical and chemical analysis from soil lab results. Poor quality subsoil materials may consist of calcareous, alkaline, and high coarse fragments soils, etc. Deleterious subsoil materials will be kept lower in the profile of well pads so as not to interfere with plant growth. Adequate topsoil cover and/or use of soil amendments will also be utilized to ensure a proper growth medium for reclamation efforts.

6.0 STOCKPILING

6.1 Topsoil Stockpiling

Topsoil will be stockpiled in such a manner that it can be readily recovered for reclamation purposes. Topsoil stockpiles will be located away from natural drainage courses. Stockpiles should be constructed with no greater than 3:1 side slopes and with a height of three to six feet where possible, given the flexibility needed in confined areas for stockpiles on drill sites. By constructing stockpiles in this manner, valuable soil fungi and bacteria will not be lost.

6.2 Pit Soil Stockpiling

Drilling pits are constructed by removing adequate subsoil and overburden materials to accommodate drilling fluids generated during the actual drilling process. The subsoil material will be stockpiled in an easily accessible area. Pit soils will be stockpiled in such a manner so as to avoid co-mingling with topsoil stockpiles.

7.0 TEMPORARY REVEGETATION EFFORTS

Topsoil stockpiles will be seeded immediately after placement with a quick germinating cover of grasses as presented in Table 15.1. Topsoil stockpiles will be dozer tracked on the contour to create cleat marks that will serve as erosion basins. Also, a continuous berm will be placed around any down slope sides of the topsoil stockpile to prevent addition runoff and potential erosion.
8.0 SOIL AMENDMENTS AND FERTILIZERS

8.1 Soil Amendments

At the advice of their reclamation consultant, PDC may elect to use one or more soil amendments to overcome poor chemical or physical conditions in existing surface soils. Poor soil conditions could include one or more of the following:

- High SAR values
- High electrical conductivity values
- High pH values
- Low nutrient content/low organic matter content.

The following amendments are listed for consideration. While these products have been proven beneficial on other projects, it is in PDC’s best interest to test their performance on selective well sites before committing to a final program. PDC’s reclamation consultant/qualified soil specialist will determine the well sites that may benefit from soil amendments and their application rates. The following is a list of soil amendments and the minimum recommended application rates. One or more of the following amendments may be utilized where 12 inches of favorable growth media cannot be salvaged and replaced at each well site.

- Composted materials consisting of manure (cow or pig preferred), wood chips, etc.
  Apply at 75 - 125 cubic yards per acre. Biosolids.
  Apply at 75 - 125 cubic yards per acre.

- Biosol organic fertilizer (as supplied by Rocky Mountain Bio-products).
  Apply at 1,000 – 1,400 pounds per acre.

- Humates consisting of humic and fulvic acids.
  Apply at 800 - 2,000 pounds per acre.

- Elemental Sulfur.
  Apply according to soil test recommendations.

These materials would be mixed with the existing soil material on site. Importation of good topsoil will also be considered. The quantity imported will depend on many factors, such as availability of the imported soil, the quality of the site soil, etc.

Compost, biosolids, and Biosol all provide macronutrients for plant growth and organic matter which helps create soil aggregation. Humate materials help create soil aggregation. Elemental sulfur helps displace sodium ions in the soil.
8.2 Fertilizers

Inorganic fertilizers will be applied to the soil surface as determined by soil test results indicating the need for nitrogen, phosphorous, or potassium fertilizers. Nitrogen fertilizer may not be added in many cases at the time of seeding because of its influence on rapid weed invasion at the expense of more desirable species. The revegetation specialist will make the final determination on the need for fertilizer applications. Any application of fertilizer will be followed by soil tillage to incorporate the material properly.

9.0 STABILIZATION AND INTERIM RECLAMATION

Stabilization and interim reclamation would occur on all areas where final reclamation cannot be applied, and on areas that may be re-disturbed during final reclamation. Disturbed areas subject to interim reclamation include road cut-and-fill areas and portions of each well pad and ancillary facility sites not needed for production-related activities. Interim reclamation measures would be applied only as needed, since final reclamation measures would be applied concurrently with the completion of most project construction activities (i.e., final reclamation measures would be applied on all areas that would likely remain undisturbed for the remainder of the LOW) (See Section 20.0)

Stabilization and interim reclamation objectives include:

- Stabilization of disturbed areas by providing wind and water erosion control to reduce soil loss and the chance of slope failure;

- Minimization of surface runoff to prevent the degradation of downstream receiving waters through the use of pollution control techniques (e.g., facility sites would be required to approach zero runoff from the location, using interception ditches, berms, or other structures to capture accidental spills);

- Establishment of non-intrusive plant communities to protect soil resources or;

- Establishment of agricultural production; and

- Minimization of visual impacts.

Upon completion of a specific development activity (e.g., road construction, well testing), the area to be reclaimed for the LOW would be delineated. For example, all road topsoil storage in out slope areas, as well as the potentially disturbed outer portions of road ROWs would be stabilized and reseeded until final road reclamation is initiated. Final reclamation practices would be applied on areas that would likely remain undisturbed for the remainder of the LOW.
Where possible, disturbed areas would be graded and contoured to slopes of 3:1 (horizontal: vertical) or less or as required to stabilize the area and provide a suitable seedbed. Well sites that need to be constructed on steeper slopes (>3:1) will be based on the ability to perform stable construction efforts as required. Contoured areas would be ripped, as necessary, to reduce soil compaction. Ripping in many areas may be conducted after topsoil replacement. Temporary erosion control measures (e.g., water bars, mulch application, and biodegradable netting installation) also would be applied as necessary. To minimize sedimentation of drainage channels and wetlands during the interim period between construction activity and final reclamation, temporary erosion and sediment control measures would be applied. Silt fences or other sediment filtering devices such as weed-free straw bales would be installed at drainage channel banks where sedimentation is excessive and at the base of all slopes adjacent to wetland/riparian areas. Sediment filtering devices would be maintained in functional condition until revegetation/reclamation efforts yield a stable vegetation cover. To avoid the possibility of mulching materials entering waterways, loose mulch (i.e., mulch not crimped into the soil surface, tackified, or incorporated into erosion control blankets) would not be applied to drainage channel banks. Section 17.0 describes BMPs in more detail.

Seedbed preparation activities would include topsoil replacement and harrowing, diskng, pitting, and/or ripping. After topsoil replacement and preparation, the area would be seeded at the first appropriate opportunity using a seed mixture developed to facilitate rapid establishment of vegetation and site stabilization (Table 15.1) or a seed mixture designed for interim or final reclamation (see Section 15.0), as appropriate. Landowner preferences will be honored in the development of seed mixes. Areas that have been seeded would be visually monitored for seedling establishment and the presence of erosional features and would be re-stabilized and reseeded, as necessary, until adequate vegetation establishment and site stability is achieved (see Section 21.0). In general, the annual Reclamation Success Monitoring and Revegetation Inspection procedures would also be applied at interim reclamation sites.

10.0 SOIL REPLACEMENT

10.1 Topsoil and Pit Soil Replacement

Immediately after drilling operations and pit processing has occurred, PDC will rip the existing subsoil surface to a depth of 18 inches (or that allowable if large rock fragments are present). Topsoil shall be replaced evenly over all disturbed areas using small dozers to prevent re-compaction of the growth medium. Topsoil will not be replaced in extremely wet or frozen conditions.

Thoroughly mixing pit contents with subsoil and covering processed pit materials with at least 3 feet of subsoil material and a final layer of topsoil will reclaim the pit area.
10.2 Wetland Soils

All operations within jurisdictional wetland areas would comply with COE permit stipulations as necessary.

11.0 FACILITY AND STRUCTURE REMOVAL

All gas wells would be abandoned according to Colorado Oil and Gas Conservation Commission (COGCC) regulations. All aboveground well pad, pipeline, and water disposal facilities, including buildings, structures, tanks, reserve pits, flare pits, and associated hardware, would be closed or dismantled and removed from the site. These materials would be removed and likely would be salvaged and re-used or disposed of at approved sites.

Any concrete foundations, pads, or footings would be adequately broken up and covered or removed. All aggregate used for well pad, road, and/or ancillary facility site construction also would be removed or suitably buried.

Road reclamation would be conducted as deemed appropriate by COGCC and the surface landowners; some roads may remain after project completion. Road reclamation would include the removal of bridges, culverts, cattle guards, sediment control structures, and signs. Drainage-crossing side slopes would be reduced in order to minimize bank erosion and produce stable side slopes. In addition, road barriers or signs may be used to discourage travel on reclaimed road surfaces.

11.0 SURFACE PREPARATION

Surface preparation includes backfilling, grading, and ripping of compacted soils. In some areas subjected to interim reclamation (See Section 7.0), topsoil removal and short-term storage may also be required.

12.1 Backfilling and Grading

After facilities and equipment have been removed, reclamation of pads would be conducted as deemed appropriate by PDC in conjunction with surface landowners, and some pads may remain after project completion. Final reclamation would be conducted in a manner to minimize any additional disturbance of native or previously reclaimed areas. Grading would be conducted as necessary to provide a surface suitable for the replacement of a uniform depth of topsoil, while promoting cohesion between subsoil and topsoil layers, reducing wind erosion, and facilitating moisture capture.

Specialized grading techniques would be applied as necessary and may include slope rounding, bench grading, stair-step grading, and/or contour furrowing. Equipment selection would be determined on a site-specific basis, depending upon the material to be graded, the size of the area, on-site operating conditions, and equipment availability.
No visible soil berm (i.e., in excess of 3 inches) would be allowed above pipeline trenches. PDC-provided reclamation specialists would ensure that backfilling and grading operations are conducted so as to provide a landscape suitable for successful reclamation. Ripping of the subsoil material will occur to a depth of 16 inches (where the nature of the material permits) to relieve compaction of the subsoil and provide better rooting medium for later plant growth. No heavy equipment will be moved over the prepared surface once it has been ripped. Small dozers will be used to replace subsoil and topsoil.

13.0 SEEDBED PREPARATION/SOIL TILLAGE

If the re-topsoiled surface is not loose and friable after topsoil application, soil tillage will be performed. Acceptable methods of soil tillage will consist of diskig, chisel plowing, or harrowing to a depth of 4 inches. No more than 10% of the reclaimed area will contain rocks greater than 8” in diameter. The only exception to this condition will be in-situ soils that naturally contain greater amounts of rock material. Also, as previously stated in the topsoil stripping section, no more than 35 – 40% coarse fragments of any size will be allowed on the soil surface, to avoid impacting revegetation success. Larger volumes of coarse fragment will either be screened or picked prior to seeding operations. Rock material will be buried in cut slope areas or buried under the well pad a minimum of 3 feet below the final soil surface so as not to interfere with the rooting depth of desirable vegetation species.

14.0 SEEDING METHODS

14.1 Seeding Times

Seeding shall be completed at any time of year except during ground freeze conditions and except from May 31 to August 15.

14.2 Seeding Methods

On slopes of 3:1 or flatter, drill seeding shall be utilized. Drill seeders shall be capable of handling a variety of different seed textures. Drill rows shall be no greater than 12 inches on center. All drilling shall be completed on the parallel to the contour of the land where practical. Seed will be drilled to a depth of .25 to .50 inches.

Steeper slope areas will be broadcast seeded or seeded with other methods. Broadcast seeding will be accomplished with hand held spreaders, ATV mounted, or tractor mounted and will be capable of spreading seed uniformly. All seed will be raked or harrowed to lightly cover seed with soil.

15.0 SEED MIXTURES

Tables 15.1 thru 15.3 have been created based on those species that have performed the best in the last four years of reclamation efforts.
**TABLE 15.1**
TEMPORARY SEED MIX

<table>
<thead>
<tr>
<th>COMMON NAME</th>
<th>SPECIES NAME</th>
<th>VARIETY</th>
<th>SEEDS/LB</th>
<th>SEEDS/SQFT</th>
<th>SEED RATE lbs (pls)/ac</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graminoids</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thickspike Wheatgrass</td>
<td><em>Agropyron dasystachyum</em></td>
<td>Critana</td>
<td>160,000</td>
<td>9</td>
<td>2.45</td>
</tr>
<tr>
<td>Smooth Brome</td>
<td><em>Bromis inermis</em></td>
<td>Lincoln</td>
<td>145,000</td>
<td>13</td>
<td>3.91</td>
</tr>
<tr>
<td>Sideoats Grama</td>
<td><em>Bouteloua curtipendula</em></td>
<td>Butte</td>
<td>190,000</td>
<td>10</td>
<td>2.29</td>
</tr>
<tr>
<td>Russian Wildrye</td>
<td><em>Elymus junceus</em></td>
<td>Vanall, Bozoisky-select</td>
<td>170,000</td>
<td>8</td>
<td>2.05</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>40</td>
</tr>
</tbody>
</table>

Note: rates proposed are for drill seeding, broadcast rate 2x

**TABLE 15.2**
BOTTOMLAND SEED MIX

<table>
<thead>
<tr>
<th>COMMON NAME</th>
<th>SPECIES NAME</th>
<th>VARIETY</th>
<th>SEEDS/LB</th>
<th>SEEDS/SQFT</th>
<th>SEED RATE lbs (pls)/ac</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graminoids</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tall Wheatgrass</td>
<td><em>Agropyron elongatum</em></td>
<td>Alkar, Jose</td>
<td>80,000</td>
<td>6</td>
<td>3.27</td>
</tr>
<tr>
<td>Western Wheatgrass</td>
<td><em>Agropyron smithii</em></td>
<td>Arriba</td>
<td>125,000</td>
<td>6</td>
<td>2.09</td>
</tr>
<tr>
<td>Russian Wildrye</td>
<td><em>Elymus junceus</em></td>
<td>Vanall, Bozoisky-select</td>
<td>170,000</td>
<td>8</td>
<td>2.05</td>
</tr>
<tr>
<td>Switchgrass</td>
<td><em>Panicum virgatum</em></td>
<td>Paloma</td>
<td>160,000</td>
<td>6</td>
<td>1.63</td>
</tr>
<tr>
<td>Alkali Sacaton</td>
<td><em>Sporobolus airoides</em></td>
<td></td>
<td>1,750,000</td>
<td>8</td>
<td>0.20</td>
</tr>
<tr>
<td>Forbs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scarlet Globemallow</td>
<td><em>Sphaeralcea coccinea</em></td>
<td>ARS 2936</td>
<td>500,000</td>
<td>4</td>
<td>0.35</td>
</tr>
<tr>
<td>Shrubs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black Greasewood</td>
<td><em>Sarcobatus vermiculatus</em></td>
<td></td>
<td>250,000</td>
<td>2</td>
<td>0.35</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>40</td>
</tr>
</tbody>
</table>

Note: rates proposed are for drill seeding, broadcast rate 2x

**TABLE 15.3** PINYON-JUNIPER SEED MIX

<table>
<thead>
<tr>
<th>COMMON NAME</th>
<th>SPECIES NAME</th>
<th>VARIETY</th>
<th>SEEDS/LB</th>
<th>SEEDS/SQFT</th>
<th>SEED RATE lbs (pls)/ac</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

15
<table>
<thead>
<tr>
<th>Graminoids</th>
<th>Species</th>
<th>Variety</th>
<th>Rate</th>
<th>Turns</th>
<th>P/C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western Wheatgrass</td>
<td><em>Agropyron smithii</em></td>
<td>Arriba</td>
<td>125,000</td>
<td>6</td>
<td>2.09</td>
</tr>
<tr>
<td>Thickspike Wheatgrass</td>
<td><em>Agropyron dasystachyum</em></td>
<td>Critana</td>
<td>160,000</td>
<td>8</td>
<td>2.18</td>
</tr>
<tr>
<td>Russian Wildrye</td>
<td><em>Elymus junceus</em></td>
<td>Vanall, Bozoisky-select</td>
<td>170,000</td>
<td>7</td>
<td>1.79</td>
</tr>
<tr>
<td>Galleta</td>
<td><em>Hilaria jamesii</em></td>
<td>Viva</td>
<td>160,000</td>
<td>10</td>
<td>2.72</td>
</tr>
<tr>
<td>Indian Ricegrass</td>
<td><em>Oryzopsis hymenoides</em></td>
<td>Paloma</td>
<td>155,000</td>
<td>6</td>
<td>1.69</td>
</tr>
<tr>
<td>Forbs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small Burnet</td>
<td><em>Sanguisorba minor</em></td>
<td>Delar</td>
<td>50,000</td>
<td>2</td>
<td>1.74</td>
</tr>
<tr>
<td>Shrubs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Big Sagebrush</td>
<td><em>Artemisia tridentata</em></td>
<td>Hobblecreek</td>
<td>2,500,000</td>
<td>1</td>
<td>0.02</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td></td>
<td></td>
<td></td>
<td>40</td>
<td>12.23</td>
</tr>
</tbody>
</table>

*Note: rates proposed are for drill seeding, broadcast rate 2x*

**16.0 MULCHING AND EROSION CONTROL BLANKETS**

**16.1 Mulch**

Mulching with either certified hay at 1.5 tons per acre or cereal grain straw at 2.0 tons per acre would be applied on all reclaimed sites. Mulch material will be crimped into the soil surface unless the slopes are steeper than 3H : 1V, in which case the mulch will be applied by broadcast methods. Hydro mulching using wood fiber at 1.5 tons per acre with an environmentally friendly tackifier may also be used.

**16.2 Erosion Control Blanket**

Erosion Control Blankets (ECBs) will only be utilized as necessary. ECBs will consist of excelsior material, straw blankets, or straw /coconut blankets. Because of the rocky nature of soils occurring in the Grand Valley, Parachute, and Rulison project areas, a Bonded Fiber Matrix (BFM) may be recommended for use. BFM s contain long fibers of hydro mulch with heavy guar tackifiers. BFM cures to appear like a hard foam insulation that adheres to the soil surface better than ECBs.

**17.0 BEST MANAGEMENT PRACTICES**

A number of different BMPs are anticipated for use on the various future well sites associated with the 10-acre well density. They are listed and described below.

**17.1 Sediment Basins**

Sediment basins are ponds created by excavation that are usually temporary in design and are intended to collect and store sediment form sites that are cleared
and/or graded during construction. Frequently these sites are left exposed for extended periods of time before either permanent vegetation is re-established or permanent drainage structure is completed. Basin construction is intended to trap sediment before it leaves the disturbed site. Since sediment basins are temporary, they must be maintained until the disturbance area is permanently stabilized.

17.2 Straw Bale Dikes

Straw bale dikes intercept and detain small amounts of sediment transported by sheet and rill type runoff. The dikes trap sediment by ponding water and allowing sediment to settle out. Straw bale dikes also slow runoff velocities acting to reduce sheet, rill and gully erosion. Straw bale dikes may also be used when installed to reduce erosion and sedimentations around the disturbance area perimeter. All straw bales will consist of certified weed-free materials.

17.3 Silt Fence

Silt fence is a temporary polypropylene sediment barrier placed on the slope contour to trap sediment by ponding water behind it and allowing sediment to settle out. Silt fence can effectively trap sheet and rill erosion within small drainage areas and on slopes with gradients up to 2:1. Silt fence is most cost effective when used for sediment and erosion control around the perimeter of a disturbance area.

17.4 Continuous Berms

A continuous berm is a temporary diversion or sediment barrier constructed with infill material and used to divert and intercept sheet runoff. Continuous berms are useful for erosion and sediment control around the perimeter of construction sites. The berms detain and pond sediment laden storm water resulting in sediment deposition.

17.5 Rock Check Dams

Check dams are rock dams constructed across drainage ways to dissipate the energy of flowing water and reduce gully erosion. They are temporary stabilization structures that are used until the drainage way is permanently stabilized. Check dams are used in ephemeral streams to reduce flow velocities, trap and store larger-sized sediment and provide stabilized drops.

18.0 FENCING

18.1 Installation

A four-strand barbed wire fence will be erected around the largest possible portion of the well site for interim reclamation. Adequate access must be left open to the actual wellhead and ancillary facilities.
A take down gate may be installed in the fenced enclosure area, for herbicide application vehicles; if it is determined that access to the revegetated area is large enough to warrant this feature.

T-posts will be placed every 16 feet with line braces installed for every 1,300 feet of run. Steel corner sets will be placed on every corner and either compacted in-place or cemented in.

18.2 Maintenance

Fences will be inspected on a regular basis and repaired as needed to exclude cattle from entering the reclaimed area. Fences will be kept in-place as necessary to allow vegetation in reclaimed areas to reach a self-sustaining cover.

19.0 WEED CONTROL PLAN

The Colorado Noxious Weed Management Act (Colorado Department of Agriculture – 1996) and the Garfield County Weed Management Plan (Garfield County Vegetation Management – 2000) provide for control of noxious weeds on all unincorporated lands within the county. PDC has developed a weed management plan that complies with state and county policies. There are 21 noxious weeds listed in the county list and 68 plants on the state list.

19.1 Post Revegetation Weed Inspections

A reclamation/revegetation specialist will conduct a Reclamation Success Monitoring and Revegetation Inspection annually, after green up of vegetation. If during these inspections it is determined that the noxious weed species presence and densities represent a threat to the revegetated areas or surrounding lands, mechanical or chemical control measures will be employed.

19.2 Weed Control Implementation

During the first growing season of native grasses, forbs, and shrubs use of chemical herbicides will not be feasible. Until newly reseeded species reach a height of 3-6 inches they are susceptible to damage from herbicides. Therefore, mechanical weed control is proposed for the first growing season if re-seeded species are not determined to be mature enough to withstand herbicide spray. Bush Hog mowers, weedeaters, and/or hand pulling of weeds will be employed as mechanical control devices.

During subsequent years herbicide applications will be utilized when weed densities are determined to pose a threat to revegetation success or spread to surrounding lands.

The county weed management specialist will be consulted to determine what chemical herbicides will be the most beneficial for controlling noxious weeds. It is anticipated that an aggressive revegetation and weed management program will
result in weed control only needing to be performed during the first three years after re-seeding efforts. A self-sustaining native species cover is the best mechanism for depleting weed species growth and spread to surrounding land areas.

20.0 FINAL RECLAMATION

Final reclamation would be completed as soon as practical, but within 3 months on crop land and 12 months on non-crop land after plugging a well. Permanent reclamation objectives include all those listed for interim reclamation (See Section 9.0), plus the following:

- The re-establishment of desirable self-sustaining vegetation communities that approximate pre-disturbance parameters for cover, density and diversity, as measured at adjacent undisturbed areas;

- The development of hydrologically stable landforms that meet future land uses including livestock grazing, wildlife habitat, and mineral exploration; and

- Establish conditions for the eventual restoration of the visual quality of the area.

21.0 RECLAMATION SUCCESS MONITORING AND REVEGETATION INSPECTIONS

21.1 Inspections

On an annual basis, a revegetation/reclamation specialist will inspect each 10-acre density well site. Observations will be made for weed species presence, fence damage, erosion occurrences, and bare ground resulting from lack of germination and fill-in of native seeded species. Evaluation of the vegetation will include estimates of species type, diversity, and ground cover.

Reclamation success monitoring will commence during the 1st growing season and continue until interim and final reclamation and revegetation efforts meet or exceed 90% of the desirable plant cover found on the reference area(s). Reference areas will generally be adjacent areas that best represent the original well site before disturbance.

Cover data will be collected by establishing fixed locations at each reclaimed area and the surrounding reference area. During each inspection, a qualified vegetation specialist will visually inspect the reclaimed and reference areas and take pictures at each fixed location to establish an ongoing record of the reclamation progress. These pictures will be taken using set procedures for consistency. The specialist will then estimate the percent live cover of the reclaimed area and make a comparison to the reference area(s). A detailed report
of this data as well as other inspection data, such as presence of noxious weeds, erosion, fence status, grazing, etc. will be incorporated into the annual inspection report for the specified well sites and filed with the COGCC on an annual basis by December 31.

21.2 Remediation

Observations of any problems will result in additional revegetation/reclamation efforts. Erosional features will be repaired by filling-in wash outs greater than 6 inches deep and re-grading. Areas containing less than 2 desirable species per square foot and/or areas greater than 2 square feet will result in touch-up hand seeding and raking. Larger areas exhibiting revegetation failure will be re-tilled and seeded as described above in corresponding sections of this Plan.

22.0 LITERATURE CITED


