

APPENDIX H

POST-CONSTRUCTION VEGETATION MONITORING DOCUMENT

Sierrita Pipeline Project

Docket No. CP13-73-000

Post-Construction Vegetation Monitoring Document

Sierrita Gas Pipeline LLC
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Colorado Springs, CO 80903

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Abbreviations and Acronyms

ASLD	Arizona State Land Department
ARS	Agriculture Research Service
CFR	Code of Federal Regulations
cm	centimeter
DIMA	Database for Inventory, Monitoring and Assessment
ETWS	extra temporary workspace
FERC	Federal Energy Regulatory Commission
ft	foot
GPS	global positioning system
m	meter
MP	milepost
NRCS	Natural Resources Conservation Service
OHV	off-highway vehicle
POD	Plan of Development
Project	Sierrita Pipeline Project
QA	Quality Assurance
ROW	right-of-way
Sierrita	Sierrita Pipeline, LLC
SOP	Standard Operating Procedure
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service

1.0 Introduction

Sierrita Gas Pipeline LLC (Sierrita) proposes to construct approximately 60 miles of 36-inch-diameter, high-pressure pipeline and associated measurement facilities to deliver natural gas from El Paso Natural Gas Company, L.L.C.'s existing pipeline system to an interconnect point at the U.S.-Mexico border near the Town of Sasabe, Arizona herein referred to as the Sierrita Pipeline (Project). A corresponding pipeline Mexico segment, known as the Sasabe-Guaymas Pipeline, would also be constructed in Mexico by a separate entity not associated with Sierrita. The U.S. and Mexican pipelines would serve to meet increased gas-fired electrical generation needs. Sierrita proposes to use a nominal 100-foot-wide construction right-of-way (ROW) for installation of the pipeline, and a 50-foot-wide permanent ROW to facilitate operation and maintenance of the pipeline, meter stations, and appurtenant installations. Sierrita has no plans for periodic vegetation maintenance of the ROW with the exception of large shrubs or trees located within 10 feet of the pipeline centerline with roots that could compromise the integrity of the pipeline or may interfere with periodic corrosion/leak surveys. The vegetation clearing would be performed by pedestrian means; no vehicles would be used for vegetation maintenance.

This Post Construction Monitoring Plan provides the standard operating procedures (SOPs) for the monitoring metrics and focuses on lands managed by the Arizona State Land Department (ASLD) crossed by the Project but may also apply to private lands, as requested by a landowner. The majority of the Project traverses lands managed by the ASLD and minor amounts of private lands (see Figure 1).

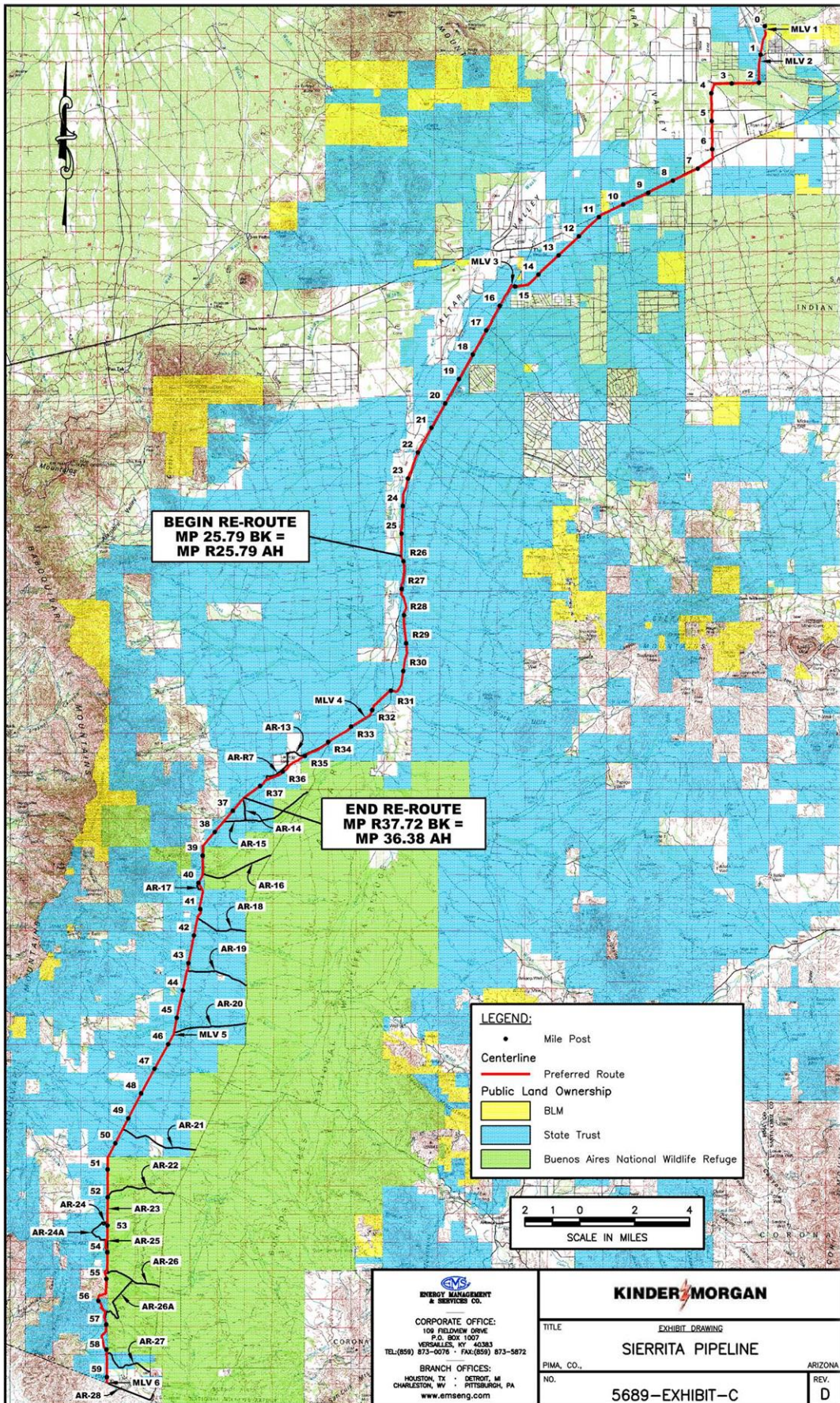
Vegetation monitoring will occur annually during the growing season for five years following the initial seeding and transplanting. Annual monitoring will continue until the Federal Energy Regulatory Commission (FERC), and the ASLD determine that restoration and revegetation goals have been achieved for a given ROW segment (i.e., that a plant cover similar to that of the areas adjacent to the Project ROW that were not disturbed by Project). Desirable plant cover would be permanent desired plant cover including seeded and salvaged succulent species (Sierrita would transplant Pima pineapple cactus [PPC; *Coryphantha scheeri var robustispina*], saguaro cacti [*Carnegiea gigantea*; less than nine feet tall and without arms], Palmer's agave [*Agave palmeri*], and approximately 30 percent of parviflora agave [*Agave parviflora*] that cannot be avoided during construction). Monitoring would be conducted beyond the fifth year as agreed upon by FERC and the ASLD if performance criteria have not been met (see Section 6 - *Performance Criteria*).

Monitoring will be performed using personnel from an organization or company under contract with Sierrita meeting the following requirements:

- a. Personnel leading the monitoring activities for a given monitoring team will hold a Bachelor's of Science degree in botany, range science, or other vegetation-related science field or will have ten years of equivalent professional or academic experience.
- b. Personnel should be able to demonstrate knowledge of local flora prior to fieldwork, including the identification of the range of native and non-native plant species expected to be encountered onsite. Personnel should be qualified to identify unknown plant species with a regional dichotomous key and/or herbarium work.

Sierrita will provide an annual post-restoration report to FERC and ASLD and appropriate agencies documenting compliance with this document as stated in Section 7 - *Monitoring Reports*. The annual monitoring report will document progress in achieving desirable plant establishment.

As part of its safety and operations activities, Kinder Morgan currently conducts over flights of its entire pipeline system, scheduled monthly, which would include the Project. These over flights are conducted to monitor third-party excavation activities and assess the Project for potential damage or leaks. During these over flights, conducted by fixed wing aircraft at approximately 1,000 feet altitude, the staff will note any extraordinary areas showing erosion or vegetation failure. Should there be any such situations, Sierrita will assess the issue and take appropriate action. Such corrective action will be reported to ASLD or landowner at the time the action is taken. However, these over flights and any related assessments are not part of the overall post-construction monitoring of Project restoration success and will not be further addressed in this document. No formal monitoring reports will be generated as a result of these over flights.



2.0 Purpose of Guidance Document

This document describes the procedures for post-construction monitoring of temporarily disturbed areas within the ROW and additional temporary workspaces (ATWS); and minimization of noxious and invasive weed establishment. This document also presents the SOPs for the monitoring metrics and criteria to judge revegetation success (Appendices A through C):

- **Appendix A** - Standard Operating Procedures for ROW Upland Seeded and Riparian Areas Monitoring;
- **Appendix B** - Standard Operating Procedures for PPC, Saguaro Cactus, and Palmer's Agave Monitoring; and
- **Appendix C** - Standard Operating Procedures for Noxious and Invasive Weed Monitoring

Restoration and revegetation efforts will cease with successful establishment of a perennial desirable plant cover for a given ROW segment as defined in Section 6 - *Performance Criteria*. Sierrita anticipates that successful restoration and revegetation efforts will vary for given ROW segments because of differences in variables such as soil, terrain, and grazing. Therefore, it is anticipated that various ROW segments will be released from restoration efforts and further monitoring at different time periods. Private landowners may request monitoring of revegetation success on their fee land. No eligible or unevaluated cultural sites would be disturbed during monitoring efforts without a data recovery (mitigation) plan.

3.0 Summary of the Restoration and Revegetation Approach

The purposes of the Project ROW restoration and revegetation (including PPC, saguaro cacti, Palmer's agave, and parviflora agave transplanting) efforts are to establish a perennial vegetation cover in accordance with FERC's guidelines on upland erosion control and revegetation (18 CRF § 380.15), minimize noxious and invasive weed establishment, and restore wildlife habitat. Restoration of the temporarily disturbed areas within the ROW and ATWSs will be performed in accordance with the *Sierrita Reclamation Plan* and the May 2013 version of FERC's *Upland Erosion Control, Revegetation, and Maintenance Plan* (Plan) and the *Wetland and Waterbody Construction and Mitigation Procedures* (Procedures) with modifications (Sierrita's Plan and Procedures).

Upland revegetation will be accomplished by the seeding of grass, forb, and shrub seed mixtures correlated to the spatial arrangement of ecological sites along the ROW. Based on the current construction plan, construction on the northern portion of the Project should be completed before the end of monsoon season. Seeding would occur following final clean-up between MP 0.0 and MP 26.0 and should also be completed before the end of the monsoon season. However, if construction is not completed before the end of the monsoon season (e.g., due to construction delays), then seeding for this portion of the Project ROW will occur before the end of the winter rain season. Based on the current construction plan, the remainder of the Project should be constructed before the end of the winter rain season. Seeding would be performed either by broadcast or aerial methods from MP 26.0 to MP 59.2 following recountoring and ROW-roughening activities and should be completed before the end of the winter rain season. The upland ROW seeding would be initiated within 6 days of final cleanup of the ROW, or variances from this timing would be requested by Sierrita to FERC. Sierrita anticipates that some areas will need to be reseeded in subsequent years to reach the success criteria. Sierrita will do this in an effort to establish at least a minimum of vegetative cover after construction. Sierrita would also maintain the root crown/structure in riparian habitats during construction as a means of maintaining the vegetative structure of these areas following construction.

PPC, saguaro cacti less than nine feet in height without arms, and Palmer's agave that cannot be avoided during construction will be removed by a qualified nursery or equivalent prior to land clearing activities. A qualified nursery or equivalent will inspect and maintain saguaro cacti, Palmer's agaves and 20 percent of the PPC that cannot be avoided during construction activities and will ensure that the PPC, saguaro cacti, and Palmer's agaves are tagged, marked, and temporarily and permanently transplanted appropriately. The remaining 80 percent of PPC will be relocated outside of the construction ROW, but within the 300-foot area that was surveyed prior to construction. Sierrita would replace all Palmer's agaves and all saguaros that cannot be avoided or transplanted during construction. Sierrita would supplement with nursery stock at a 3:1 ratio to obtain an overall 1:1 survivability ratio or no net loss.

A qualified nursery or equivalent will assess approximately 50 percent of the parviflora agaves that cannot be avoided and would relocate approximately 30 percent of the healthy / viable

parviflora agaves to an adjacent location outside of the construction ROW but within the previously surveyed 300-foot corridor. Limited vegetation clearing may be needed to access parviflora agaves. Monitoring or assessments of the transplanted parviflora agaves will not be performed.

4.0 Monitoring Goals and Objectives

The establishment of a perennial plant cover is essential to achieving soil stability, noxious and invasive weed abatement, and wildlife habitat restoration. Establishment of a perennial plant cover is the indicator of successful restoration as defined in Section 6 - *Performance Criteria*. The goals of the Project's post-construction monitoring program are to document the response to post-construction revegetation, transplanting, and treatment methods, and if the goals are not being achieved, to adaptively manage if necessary to achieve the goals. Sierrita will meet with ASLD and other appropriate agencies and landowners periodically to discuss restoration and revegetation success. Sierrita is responsible for success at particular locations along the ROW until released by the FERC and ASLD, assuming that such release is not unreasonably withheld.

The establishment of the perennial vegetation cover will be assessed through the detailed evaluation of monitoring plots. The monitoring plots will be placed in various locations along the ROW as described in Section 5 - *Monitoring Approach*. All equipment wash stations and areas where foreign rock is placed along the ROW will be examined for weed colonization. The ROW will also be monitored for newly established weed sites. Appropriate remedial action will occur to correct undesirable situations in consultation with FERC and ASLD.

While this document establishes the monitoring processes that will be used to assess Project success with restoration, Sierrita remains responsible for overall restoration of the ROW. Should Sierrita personnel, agency personnel, or members of the public identify specific areas of concern not included in the monitoring program, Sierrita will assess the success of restoration at such locations and take corrective action if agreed is necessary with ASLD or landowner.

The monitoring goals will be achieved by the following objectives:

- Identify appropriate monitoring plots for ROW upland and riparian areas;
- Develop SOPs for the monitoring metrics and train field crews in applying the SOPs;
- Annually survey the monitoring plots to obtain data for the metrics being examined;
- Identify the cause of failed revegetation efforts and take action to correct the situation, as necessary (adaptive management);
- Analyze and compare acquired monitoring data to the established performance criteria defined in Section 6 - *Performance Criteria*;
- Conduct ROW restoration monitoring for five years after initial seeding and transplanting. Monitoring beyond the fifth year may occur as agreed upon with FERC and ASLD. The USFWS, AGFD, and Pima County will also be consulted, as appropriate;
- Implement an adaptive management strategy to achieve successful revegetation by coordinating with FERC and the other appropriate agencies regarding the status of revegetation, the trend toward meeting the criteria, and appropriate action that may be required to achieve success criteria; and
- Prepare annual monitoring reports for submittal to FERC and ASLD and other agencies as appropriate after survey completion.

5.0 Monitoring Approach

Monitoring protocols will be applied to upland and riparian areas within the Project ROW. Monitoring will begin in the late summer following construction after all seeding and transplanting efforts are complete and will continue annually for five years. Sierrita will implement an adaptive management strategy to achieve successful revegetation. Following the second growing season, Sierrita will meet with FERC and other appropriate agencies to discuss the current status of revegetation, the trend toward meeting the criteria, and appropriate action(s) that could address areas not achieving success criteria.

Monitoring may continue beyond year five as agreed upon by FERC and ASDL with input from appropriate agencies. Negligible disturbance to soil, vegetation, and cultural resources within the ROW or control plots will occur during monitoring.

The approach to ROW monitoring will follow the protocols presented by Herrick et al. (2005a, 2005b). Training videos for applying these protocols are available at http://usda-ars.nmsu.edu/monit_assess/videos_main.php.

5.1 Upland and Riparian Area Monitoring

Revegetation will be accomplished by segregating topsoil mixed with hydroaxed vegetation during construction and redistributing the topsoil / hydroaxed vegetation to the Project ROW following construction as a means of erosion control and seed source, and aerially or drill seeding the ROW and other disturbed areas with an ecological site-specific seed mix (Table 1). Salvaged PPC, saguaro cacti, Palmer's agave, and parviflora agave will also be transplanted within or adjacent to the Project ROW in locations similar to where the vegetation was salvaged prior to construction activities. Both the seeding and transplanting efforts (for PPC, saguaro cacti, Palmer's agave) will be monitored in late summer to assess annual growth inclusive of both winter and monsoon growth.

5.1.1 Seeded Areas

A post-construction, quantitative monitoring program will document ROW vegetation establishment. If vegetation establishment and erosion in a monitoring plot is not making progress toward the objectives, then the adjacent ROW will also be inspected to document the extent of the potential issue.

Sierrita will select the permanent monitoring sites based on consultation with the ASLD. The monitoring sites will consist of both ROW and control plots. The monitoring sites will be stratified within both ecotypes (i.e., semi-desert grassland and Sonoran desert scrub) where different seed mixes would be used based on the ecotypes and riparian areas such that the sites are representative of the entire Project ROW. Sierrita will continue to consult with NRCS and other applicable agencies regarding additional input on seed mix based on the ecotypes crossed. Select monitoring locations may be identified to determine reclamation success for specific resources such as high quality wildlife habitat. High quality wildlife habitat plots will be coordinated with USFWS and AGFD prior to the start of construction.

Table 1				
Recommended Seed Mixture for the Sierrita Project				
Species	Scientific Name	Variety (suggested)	Percent of Mixture	PLS Seeding Rate/acre (pounds)
NRCS-Recommended Grass and Forb Seed Mix ^a				
Arizona Cottontop	<i>Digitaria californica</i>	Common or "Loetta"	5	0.18
Plains bristlegrass	<i>Setaria macrostachya</i>	Common	20	0.74
Sand dropseed	<i>Sporobolus cryptandrus</i>	Common	5	0.01
Spike dropseed	<i>Sporobolus contractus</i>	"Cochise" or Common	5	0.025
Green sprangletop	<i>Leptochloa dubia</i>	Common	20	0.4
Sideoats grama	<i>Bouteloua curtipendula</i>	"Vaughn"	25	1.9
Desert Marigold	<i>Baileya multiradiata</i>	Common	10	0.1
Globemallow	<i>Sphaeralcea ambigua</i>	Common	5	0.11
Penstemon	<i>Penstemon species</i>	Common	5	0.11
TOTAL			100	3.58 Lbs
USFWS Recommended Supplemental Shrub Seed Mix for Semidesert Grassland Areas ^b				
White ball acacia	<i>Acacia angustissima</i>	Common	--	5.0
Bundleflower	<i>Desmanthus cooleyi</i>	Common	--	5.0
USFWS Recommended Supplemental Shrub Seed Mix for Sonoran Desertscrub Areas ^b				
White-thorn acacia	<i>Acacia constricta</i>	Common	--	3.5
Greythorn	<i>Ziziphus obtusifolia</i>	Common	--	5.0
Fairy duster	<i>Calliandra eriophylla</i>	Common	--	5.0
Barrel cactus	<i>Ferocactus wislizenii</i>	Common	NA ³	NA ^c
Hedgehog cactus	<i>Echinocereus triglochidiatus</i>	Common	NA ³	NA ^c
<p>a - Seed mixture recommended by the NRCS, Tucson, Arizona.</p> <p>b - Supplemental seed mixture recommended by the USFWS in a letter dated January 22, 2013.</p> <p>When available, cultivars listed above are recommended because of known quality and adaptability to the area. Substitutions to species listed above may occur if the seed for a given species is not available. Use of species other than those listed above would be approved by the USFWS and NRCS prior to use.</p> <p>This seeding rate is based on drill seeding. If broadcast seeding or hydroseeding is used, the seeding rate should be doubled.</p> <p>c - Species recommended to be added to the seed mixture by USFWS; Based on correspondence from the NRCS, salvaged cacti would be replanted where feasible rather than seeded.</p>				

The overarching objective of monitoring site establishment is to select 20 sites in non-riparian areas and 10 sites in riparian areas that will be representative of the surrounding terrain, soils, vegetation, and land use. However, some sites may prove not to be suitable because they would not be representative of the surrounding land use (e.g., concentrated livestock areas such as a trail or area in the immediate vicinity of a stock tank or immediate edge of a roadway). Sierrita,

in consultation with ASLD, would identify these areas and determine how monitoring locations maybe modified if they are determined to be unsuitable. Prior to conducting monitoring activities, Sierrita will inspect each proposed monitoring site to determine if the site could be disproportionately impacted from proximity to activities such as concentrated livestock grazing areas and watering facilities, or off-highway vehicle (OHV)¹ use.

The monitoring approach will follow the methods presented by Herrick et al. (2005a; Appendix A). However, instead of using the spoke design for transect orientation as is the standard for the Herrick et al. approach, the monitoring and control plot transects will be established perpendicular to the ROW (Figure 2). The perpendicular placement of transects is appropriate for linear features such as ROW corridors and transportation infrastructure (Herrick et al 2005a; Duniway et al. 2010). Orienting transects perpendicular to ROW would better account for variability in the metrics and plant recruitment along the ROW from adjacent undisturbed vegetation than the spoke design.

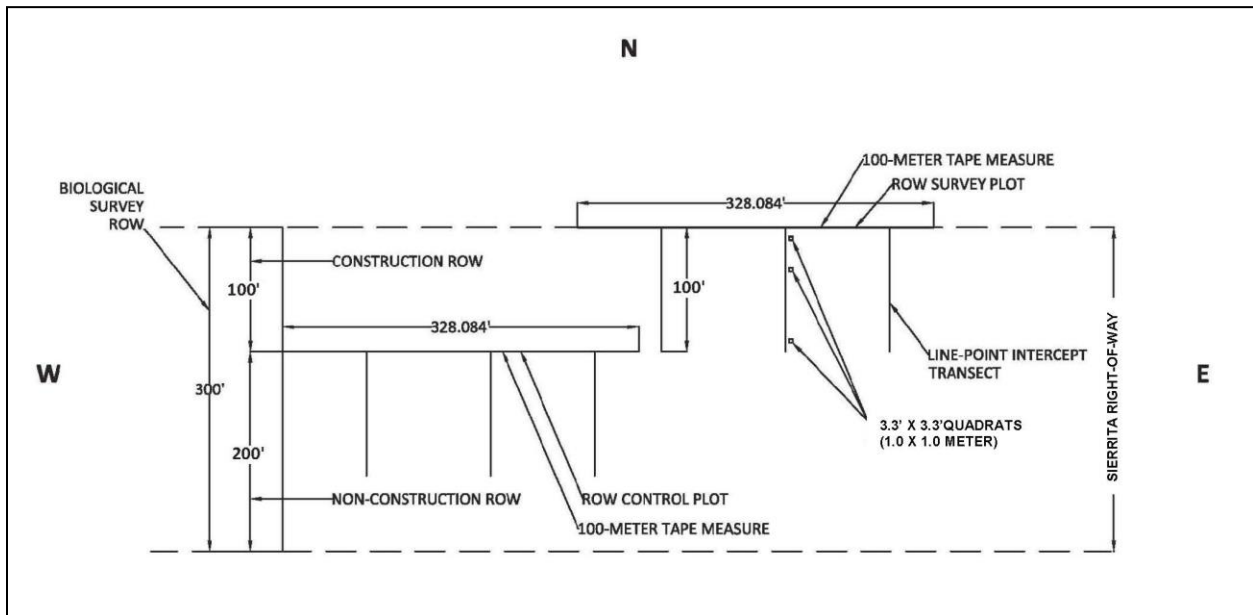


Figure 2: Establishment of the survey and control plots at a ROW monitoring site.

The randomly selected monitoring sites (20 sites in non-riparian areas and 10 sites in riparian areas), based on ecological parameters (e.g., vegetation type, soil type, land ownership) will be verified in the field. If a site is not acceptable because of unforeseen excessive disturbances (examples above) that are not representative of the surrounding land use, then the site will be relocated up to 300 feet to a location that would provide better representation of the overall condition of the ROW.

¹ Note that Sierrita intends to restore the ROW so that it is inaccessible to vehicles. Sierrita will note any vehicular use during post-construction monitoring and will notify appropriate law enforcement agencies.

Monitoring sites will consist of ROW and control plots (Figure 2). The control plots will be adjacent to the construction ROW and within the 300-foot biological survey corridor not disturbed by the Project. Control plots will not be located in known cultural sites. To the extent possible, the control plots will contain soil, aspect, and vegetation similar to that found on surrounding terrain. Sierrita will sample control plots to allow for the comparison of reclamation data across the length of the entire Project.

The monitoring and control plots will be GPS located and the same plots will be surveyed throughout the monitoring program. However, if the plots at a monitoring site become unacceptable for continued monitoring because of an event such as grazing, flooding, or wildfire, then new plots would be established. If the plots cannot be successfully relocated, then other options would be explored with FERC and ASLD. One such option would be monitoring site abandonment. The plot re-location discussion would take into account the number of years the plot has been monitored and the status of the vegetation and soil meeting the performance criteria. In addition, as plots reach the success criteria, Sierrita would not conduct further sampling of these plots. The ASLD will be consulted in this regard.

Each ROW monitoring plot will be 100 x 30 m (328 x 100 ft) or 100 x 50 m (328 x 150 ft) depending on ROW width (Figure 2). The three transects in a monitoring plot will be randomly located based on the meter marks along a 100-m metric tape. The tape measure will be located generally along the east or west side of the ROW. A transect will be located at a ninety degree angle to the 100-m tape measure. The beginning and ending points will be GPS-located and marked (the markings would be removed once monitoring is no longer warranted). The same transects will be measured throughout the monitoring program. The control plots will also consist of three transects established in the same manner and orientation as the ROW transects. Sierrita would buffer a maximum of 10 feet from the edge of the construction ROW unless the control plot cannot be contained within the 300-foot survey corridor.

Sixty points placed 0.5 meters apart will be scored for plant basal and foliar canopy cover, litter cover, or bare ground (Herrick et al. 2005a). These metrics are indicators of plant establishment and soil stability, which are important attributes to assessing revegetation success on the ROW. The number of point intercepts will depend on the length of the transect.

The following includes definitions of proposed metrics:

Species composition - the measure of the number of desirable species in the ROW versus the off-ROW control plots. Species composition will be determined by listing the total number of desirable species that occur within the 1 x 1-meter quadrats or along the line-point intercept transects within the ROW and off-ROW control plots. Criterion: The number of desirable species in the ROW plots will be \geq to 70 percent of the number of desirable species in off-ROW control plots.

Frequency - Frequency is a measure of how many times a species is recorded at a monitoring site. Frequency will be based on the occurrence of all desirable species from the data collected in the 1 x 1-meter quadrats. For example, if a plot contains 100 plants and 35 are species A, then

the frequency of species A would be 35 percent. Criterion: Frequency of desirable species in the ROW plots will be ≥ 50 percent of the frequency of desirable species in the off-ROW control plots.

Density - A measure of the number of desirable species per unit area. Density will be determined from the data collected in the 1 x 1-meter quadrats. Criterion: The density of desirable species in the ROW plots will be ≥ 70 percent of the density of desirable species in the control plots.

Dominance - Species dominance can be defined based on aerial foliar cover, density, or frequency. Since density and frequency are already accounted, dominance will be defined by aerial foliar plant cover. For a performance criterion, aerial foliar plant cover would be based on desirable plant species. Plant aerial foliar cover will be assessed from the line-point intercept transects. Criterion: The aerial foliar plant cover of desirable species in the ROW plots will be ≥ 70 percent of aerial foliar plant cover of the desirable species in the off-ROW control plots.

A 1.0 x 1.0 meter quadrat will be randomly located three times along the line-point intercept transects. Meter marks along the tape measure would be used to randomly select the three plot locations. The 1m² quadrat will be used to measure plant species composition, frequency, density and dominance (Herrick et al. 2005b). The quadrat will be oriented to a transect by placing one corner at the randomly chosen meter mark with the other corner placed at the next higher meter mark.

Sierrita will follow the guidelines of Herrick et al. (2005b) for determining the appropriate number of plots and transects per plot that are necessary to adequately monitor a site. Generally, there would be 10 monitoring sites and three transects per site for each of the two seed types and 10 monitoring sites and three transects per site in riparian areas.

Sierrita will use the data collected from the first year of monitoring to calculate the statistically robust number of monitoring plots and transects per site needed for years two through five sampling using the Herrick et al. Option 3, which calls for the use of statistical equations to determine the required number of monitoring plots and transects needed per monitoring site.

Photographic documentation of vegetation and soils along transects will occur per instruction in Appendix A following the guidelines of Herrick et al. (2005a). A GPS-referenced digital photograph will be taken. The digital camera will be placed at the beginning of a transect and it will be focused along the length of the transect. Photograph identification cards will show site, transect number, date, direction, and crew number.

In addition to the measurement of plant community metrics, qualitative observations of specific disturbances that may hinder plant establishment such as cattle grazing, OHV impacts, and pedestrian traffic will be documented at all monitoring sites (Table 2). This methodology is based on existing methodology developed by the BLM and Ruby Pipeline, LLC, a subsidiary of Kinder Morgan. The level of potential vehicle or OHV travel will be based on the percentage of the monitoring site covered with tire marks. The level of grazing (livestock) and browsing

(wildlife) would be judged based on apparent plant consumption (plants grazed per total plants), hoof prints, and fecal droppings covering the monitoring site. ROW and control plots will be assessed separately at a monitoring site. Corrective action will be addressed with the ASLD when grazing and/or OHV impacts are greater than Class 4.

Because much of the Project ROW is managed for grazing, fecal droppings and hoof prints would be common as the baseline condition on ASLD land and private ranches. Class 4 was selected as the trigger for implementing corrective action in recognition of the baseline conditions. This approach was originally developed in conjunction with the Bureau of Land Management for arid lands managed for grazing.

Index Class	Definition
1	No apparent grazing, fecal droppings, or hoof prints; No OHV tire marks; No evidence of pedestrian traffic in the plot.
2	<25 percent plants grazed, fecal droppings or hoof prints; <25 percent OHV tire marks; <25 percent pedestrian traffic in the plot.
3	25-50 percent plants grazed, fecal droppings or hoof prints; 25-50 percent OHV tire marks; 25-50 percent pedestrian traffic in the plot.
4	50-75 percent plants grazed, fecal droppings or hoof prints; 50-75 percent OHV tire marks; 50-75 percent pedestrian traffic in the plot.
5	>75 percent plants grazed, fecal droppings or hoof prints; >75 percent OHV tire marks; >75 percent pedestrian traffic in the plot.

a - The Project ROW will be roughened from MP 26.0 to MP 59.2 (except for portions of the ROW that abuts and parallels an existing road) to inhibit the use of the ROW by unauthorized vehicles. The OHV trend could apply to areas outside the ROW so it has been included.

5.1.2 PPC, Saguaro Cactus, and Palmer's Agave Monitoring

PPC, Saguaro cacti less than nine feet in height without arms, and Palmer's agave that cannot be avoided during construction will be removed by a qualified nursery or equivalent prior to land clearing activities. The qualified nursery or equivalent will inspect and maintain saguaro cacti, Palmer's agaves and 20 percent of the PPC that cannot be avoided during construction activities and will ensure that the PPC, saguaro cacti, and Palmer's agaves are tagged, marked, and temporarily and permanently transplanted appropriately. The remaining 80 percent of PPC will be relocated outside of the construction ROW, but within the 300-foot area that was surveyed prior to construction. Sierrita will ensure that transplanting will not occur within known cultural resource sites.

Monitoring of the PPC, saguaro cacti, and Palmer's agaves will include documentation overall health and survival. Monitoring requirements immediately following transplanting include:

1. Assigning an individual inventory number to each plant;

2. Photographing each individual plant;
3. Recording plant location with a GPS unit;
4. Recording plant height and circumference at chest height (saguaro cacti only) and overall health.

Inspection and recording of PPC, saguaro cacti, and Palmer's agaves will occur for five years and in conjunction with annual vegetative monitoring. Individual plants will be inspected annually to record plant height and circumference at breast height with a diameter at breast height (dbh) tape (saguaros only), overall health, and survival. In addition, Sierrita will visually inspect saguaro cacti in the vicinity of transplanted saguaro cacti that are outside the construction ROW, but within the 300 foot survey corridor as a control population.

After the second growing season, Sierrita, along with the USFWS will evaluate the survival of each monitored plant and will compare the survival of transplanted saguaro cacti with the control population. Should Sierrita and the USFWS determine that a plant did not survive transplanting, nursery stock at 3:1 ratio will be planted in an appropriate location within the Project area to support the USFWS' no net loss of saguaro cacti and Palmer's agave. If the total number of viable transplanted saguaro cacti and/or Palmer's agave are equal to or greater than the number disturbed by construction, then it would not be necessary to use nursery stock.

Results and associated adaptive management strategies (e.g., replanting ratio) will be included in Sierrita's Annual Monitoring Reports.

5.2 Access Roads

Sierrita will inspect access roads prior to start of construction and following construction to return access roads to pre-construction conditions and in accordance with the terms of all road use permits. To facilitate post-construction monitoring, the Project access roads will be divided into two groups based on the degree of reclamation required after Project construction is completed. Group 1 roads include those that would have required widening during construction to facilitate equipment access to the ROW. Post-construction monitoring of Group 1 access roads will include visual assessments, photo documentation, and GPS data collection in Years 1, 3 and 5 following construction. Group 2 roads are those that would have been utilized for the Project, but did not require modification for construction. Group 2 roads will not be monitored following construction activities.

Sierrita will utilize Project access roads to travel to and from the permanent Project ROW as in-kind use following construction. All Project access roads are existing roads; no new roads will be constructed as part of the Project. Noxious weed control, vegetation monitoring, and general maintenance activities will be performed within the ROW by pedestrian means. Vehicle use along the permanent ROW is not anticipated for monitoring or general maintenance activities following final restoration and clean-up. Should Sierrita need to access the ROW for an inspection or repair of a specific location along the pipeline, that action would be permitted separately with appropriate agencies and the ROW would be accessed utilizing the nearest access road. Following inspection and repair, the ROW would be restored using the restoration methods Provided in Sierrita's Reclamation Plan.

5.3 Noxious and Invasive Weed Monitoring

The Project area was surveyed for noxious weeds in 2012. Project biologists conducted field surveys of the Project area from March to May and July to September 2012 to inventory native and non-native vegetation. Table 3 lists the plant species observed in the Project area that are non-native, invasive, and/or noxious weed species. The location and distribution of species along the ROW are provided in Sierrita's *Noxious Weed Control Plan*.

Table 3		
Non-Native, Invasive, and Noxious Weed Species Observed in the Project Area In 2012		
Scientific Name	Common Name	Arizona Management Status^a
<i>Cuscuta</i> spp.	Dodder	1, 3
<i>Cynodon dactylon</i>	Bermuda grass	Non-native but not listed by ADA
<i>Eragrostis lehmanniana</i>	Lehmann's lovegrass	Non-native but not listed by ADA
<i>Ipomoea</i> sp.	Morning glory	1
<i>Ipomoea coccinea</i>	Redstar	1
<i>Mollugo cerviana</i>	Threadstem carpetweed	Non-native but not listed by ADA
<i>Pennisetum ciliare</i>	Buffelgrass	1, 2
<i>Salsola tragus</i>	Prickly Russian thistle	Non-native but not listed by ADA
<i>Sorghum halepense</i>	Johnsongrass	Non-native but not listed by ADA
<i>Tamarix ramosissima</i>	Saltcedar	Non-native but not listed by ADA
<i>Tribulus terrestris</i>	Puncturevine	1, 2
<p>a - Arizona Management Status</p> <p>1 - Prohibited: Noxious weeds (including plants, stolons, rhizomes, cuttings, and seeds) that are prohibited from entry into the state.</p> <p>2 - Regulated: Noxious weeds (including plants, stolons, rhizomes, cuttings, and seeds) that are regulated and, if found within the state, may be controlled or quarantined to prevent further infestation or contamination.</p> <p>3 - Restricted: Noxious weeds (including plants, stolons, rhizomes, cuttings, and seeds) that are restricted and, if found within the state, shall be quarantined to prevent further infestation or contamination.</p> <p>Source: SWCA 2012</p>		

It should be noted that repeated control measures are not always considered successful for certain weed species that are already well established and abundant. For example, most land management agencies recognize that the widespread distribution of some non-native species, such as cheatgrass and some other grasses, precludes the reasonable possibility of eradication. For this reason, the certain widespread invasive species that are not legally considered noxious, such as Russian thistle, would not be treated unless treatment is needed to ensure the success of Project restoration and revegetation efforts. Surveys and monitoring would be conducted as part of Project restoration and revegetation to identify areas where these invasive species would need to be treated. Project weed control contractors would treat noxious weed populations and invasive weed populations (not designated as noxious) as identified through such monitoring.

Sierrita will focus its weed survey within both the construction ROW and the undisturbed 300-foot survey corridor. A weed population will be treated if the percent cover is greater within the ROW than the percent cover of the same species outside of the ROW. Sierrita will work with the ASLD to also treat areas within the 300-foot survey corridor to the extent practicable.

Sierrita will monitor noxious weeds within areas disturbed by the Project. Monitoring will occur as both part of the long-term vegetation monitoring and the noxious weed monitoring. In areas where noxious weeds occur in undisturbed areas adjacent to the ROW, Sierrita will control weed densities on the ROW to a level that is at or below levels in adjacent areas. In areas where noxious weeds occur within the ROW, but not off the ROW, Sierrita will target areas for control when the weed cover exceeds 10 percent of the ROW. The percentages will be based on a visual estimate centered on the weed population. Sierrita will also monitor invasive species as a part of the Post-Construction Vegetation Monitoring. In areas where weed cover exceeds off-ROW plots by 25 percent, Sierrita will consult with the appropriate land management agencies to determine the need or level of control.

As a part of the annual Post-Construction Vegetation Monitoring, Sierrita will identify weed species occurring in proximity to ecologically sensitive areas. Sierrita will discuss with the appropriate land management agency suitable noxious weed control methods and timing in these areas.

The high-density weed monitoring sites identified during pre-construction field surveys for the Project will be monitored twice per year. Biennial high density weed monitoring would occur in May, June, or July and again in September or October or as appropriate based on local precipitation.

As populations of noxious weeds were identified in the Project area by MP during construction, the list of weed monitoring sites will be adjusted and updated as needed. The monitoring metric is percent relative plant cover by species. Photographs will be collected at GPS located photo points.

A visual assessment will be used to assess relative cover of weeds at a monitoring site. Control plots will not be necessary because the presence or absence of weeds will be assessed. If weeds are present, then their relative cover will be visually assessed. The Daubenmire cover-class scale (Elzinga et al., 1998) will be used to define relative cover by weed species in relationship to the other plant species present in the monitoring plot (Table 4). The size of the monitoring plot will vary depending on the extent of the weed infestation. The sites will be visited annually and the boundaries of the weed infestation would be located via GPS to document change. The surveyor will evaluate the plant community at the monitoring plot and assign a Daubenmire cover class to noxious and invasive weeds and desirable plants.

Table 4 Daubenmire Plant Cover Class Scale	
Plant Cover Class	Range of Plant Cover (%)
6	96-100
5	76-95
4	51-75
3	26-50
2	6-25
1	0-5

The need for treatment will be determined based on the relative cover of noxious or invasive weeds on the ROW, the potential to inhibit desirable plant establishment, and weed cover adjacent to the ROW of land not disturbed by the Project. The need for weed abatement procedures will be discussed with ASLD and grazing leasees prior to treatment application. Treating weeds on the ROW will not be effective abatement if there is a weed seed source in the immediate vicinity. Sierrita would be responsible for weed treatments on the ROW. The reseeded of the treated area may be necessary to reduce the chances of weed re-establishment after a treatment prescription. In the event that large weed infestations occur or reoccur, an evaluation would determine causes of infestation or re-infestation and an appropriate strategy for abatement.

6.0 Performance Criteria

Performance criteria describe the benchmarks by which successful vegetation establishment can be determined. The performance criteria must accommodate the inherent variability of restoring native vegetation and be applicable to the several different kinds of upland plant communities across the Project. Monitoring should document that progress is being made toward obtaining the end results of desirable plant community establishment and wildlife habitat restoration.

Adaptive Management

Sierrita will implement an adaptive management strategy to achieve successful revegetation. Successful revegetation will be achieved based on meeting the performance criteria of desirable plant composition, frequency, density, and dominance. If one or more of these criteria are not satisfied after the second growing season, Sierrita will meet with FERC and other appropriate agencies to discuss the current status of revegetation, the trend toward meeting the criteria, and appropriate action that may be required to achieve success criteria. Possible actions that could occur to address areas not achieving success criteria may include one or more of the following:

- Evaluating problem areas to determine the reasons for the lack of success including such variables as low precipitation, grazing, surface disturbances, soil crusting, and/or weed colonization;
- Reseeding problem areas with the original seed mix or modifying the seed mix based on the success of the original seeding mix;
- Removing or limiting disturbing influences such as livestock grazing or potential unauthorized access to the ROW. Sierrita will work with grazing leasees to determine if deferment is needed and can be applied to specific locations along the ROW. Other applications, such as limited fencing of the ROW or specification placement of salt licks may be implemented;
- Determining the need to control noxious and/or invasive weeds;
- Discuss methods to improve the capture of surface runoff water from precipitation events; and
- Deciding that no action is appropriate if the area is trending in the right direction.

6.1 Revegetation Performance Criteria

The following section presents plant establishment performance standards for defining successful ROW plant establishment. Plant establishment performance would be judged based on foliar cover of herbaceous and woody species in comparison with the foliar cover of herbaceous and woody plants in control plots. Revegetation will be considered successful when vegetation on the restored ROW supports desirable plants that are similar in forb, grass, and woody plant density and cover to those growing on adjacent lands within the 300-foot survey corridor undisturbed by construction (Table 5).

The statistical comparisons of the metrics measured in the ROW and control plots will provide a measure of the similarity between the plot sets. Using the first year data, Sierrita will compare bare soil and cover attributes using the 80 percent binomial confidence interval tables.

Monitoring will occur for a minimum of five years and an evaluation of performance criteria over time will be conducted to identify potential trends in the respective monitoring and control plots. Monitoring may be conducted beyond the fifth year as agreed upon by FERC and the ASLD if performance criteria have not been met. Where initial restoration and plant establishment efforts fail to make progress toward meeting revegetation standards after the third year, reseeded may be necessary on some ROW segments as determined by the FERC and ASLD.

Table 5 Revegetation Criteria		
Land Management Agency	Seeded	Noxious Weed Relative Cover (%)
	Herbaceous and Shrubs (%)	
ASLD	Species composition - The number of desirable species in the ROW plots will be \geq to 70 percent of the number of desirable species in off-ROW control plots.	\leq 10 when noxious weed species is not present outside of the ROW; Densities on the ROW will be maintained to a level that is at or below levels in adjacent areas
ASLD	Frequency - Desirable species in the ROW plots will be \geq 50 percent of the frequency of desirable species in the off-ROW control plots.	
ASLD	Density - Desirable species in the ROW plots will be \geq 70 percent of the density of desirable species in the control plots.	
ASLD	Dominance - aerial foliar plant cover of desirable species in the ROW plots will be \geq 70 percent of aerial foliar plant cover of the desirable species in the off-ROW control plots.	

6.2 Noxious and Invasive Weed Performance Criteria

Performance criteria will require total relative cover of noxious and invasive weeds (see Section 5.3) to be less than 10 percent. However, if visual observation of weed cover on lands immediately adjacent to the ROW is greater than 10 percent, then the 10 percent criterion for weed cover on the ROW will not apply. Performance criteria will require total relative cover of noxious and invasive weeds to be less than 10 percent. All application of pesticide will be conducted by a certified applicator. All Federal and state laws and regulations will be followed. All herbicides will be approved by the ASLD or landowner.

7.0 Monitoring Reports and Release from Monitoring Obligation

7.1 Annual Monitoring Reports

Sierrita will monitor plant establishment and soil stability for a minimum of five years after revegetation is completed. Annual monitoring reports will be submitted to FERC and ASLD and other appropriate agencies as requested after the annual monitoring is completed. In addition, Sierrita will report any emergency corrective action to FERC and the ASLD that might be taken separate from the data provided in the annual report.

The annual monitoring reports will include the following information:

- An evaluation of PPC, saguaro cactus, and Palmer's agave establishment and comparison of saguaro cacti to saguaro cacti control populations;
- Percent cover, frequency, density, and dominance of graminoids, forbs, and shrubs for years 2 through 5;
- An evaluation of performance criteria over time to identify potential trends in the respective monitoring and control plots.
- Noxious weeds and invasive weed locations and percent cover relative to the areas outside of the ROW and proposed actions;
- Photographs of plant establishment within the monitoring plots;
- Areas requiring remedial action and proposed corrective actions or actions taken during the year; and
- Areas impacted by OHV travel, grazing, wildfire, pedestrian traffic, and annual invasive weeds and proposed actions to reduce impacts to the extent possible.

The first annual monitoring report will include the following information:

- Documentation of plant and seed materials received from commercial sources;
- Comparison of bare soil and cover attributes using the 80 percent binomial confidence interval tables;
- Pre-construction weed treatments;
- Seed mixes and methods of application;
- Soil amendment and mulch applications; and
- Saguaro cactus and Palmer's agave plantings.

7.2 ROW Release from Monitoring Obligation

Sierrita will request formal release from monitoring when it determines that all, or portions of, the Project area that comply with the performance criteria presented in Section 6. Once monitoring plots are determined to meet performance criteria, they will no longer be included in the annual monitoring. Determination of restoration and revegetation compliance would rest with FERC and ASLD.

8.0 References

Belnap, J., R. Rosentreter, S. Leonard, J.H. Kaltenecker, J. Williams, D. Eldridge. 2001. Biological soil crusts: Ecology and management. Technical Reference 1730-2. Bureau of Land Management, Denver, CO.

Duniway, M.C., J.E. Herrick, D.A. Pyke, and D.Toledo P. 2010. Assessing transportation infrastructure impacts on rangelands: Test of a standard rangeland assessment protocol. *Rangeland Ecology and Management* 63 (5): 524-536.

Elzinga, C.L., D.W. Salzer, and J.W. Willoughby. 1998. Measuring & monitoring plant populations. Technical Reference 1730-1. Bureau of Land Management, Denver, CO.

Herrick, J.E., J.W. Van Zee, K.M. Havstad, L.M. Burkett, and W.G. Whitford. 2005a. Monitoring manual: For grassland, shrubland, and savanna ecosystems: Quick Start, Vol. I. USDA, ARS Jornada Experimental Range. Las Cruces, NM.

Herrick, J.E., J.W. Van Zee, K.M. Havstad, L.M. Burkett, and W.G. Whitford. 2005b. Monitoring manual: For grassland, shrubland, and savanna ecosystems: Design, supplementary methods and interpretation, Vol. II. USDA, ARS Jornada Experimental Range. Las Cruces, NM.

Appendix A

Standard Operating Procedures for ROW Seeded and Riparian Areas Monitoring

Training

The following training sources teach the fundamentals of applying the line-point intercept method for collecting vegetation data on the ROW and control plots in seeded upland areas and riparian areas:

Herrick, J.E., J.W. Van Zee, K.M. Havstad, L.M. Burkett, and W.G. Whitford. 2005. Monitoring manual: For grassland, shrubland, and savanna ecosystems, Vol. I. USDA, ARS Jornada Experimental Range. Las Cruces, NM.

<http://jornada.nmsu.edu/monit-assess/manuals/monitoring>
<http://jornada.nmsu.edu/monit-assess/training/videos>

Training videos

- Introduction
- Establish a transect
- Line-point intercept
- Photo points

Equipment

- 100-m tape
- Two steel pins
- Pointer – long pin flag
- GPS unit and compass
- Clipboard and data form
- Pencils
- Thick-point marking pen
- Digital camera with 50 mm lens
- Four 60 cm rebar stakes
- Whiteboard or ID card on clipboard
- 1.5 m long, $\frac{3}{4}$ in diameter PVC pipe
- Laptop computer
- Colored rebar

Approach

Line-point intercept: At the monitoring site establish the ROW and control plots. At each plot lay out the 100-m tape measure on the westerly side of the plots. Use a random number generator to locate the three transects. The beginning of the transects will be GPS-located and marked with a red-colored rebar stake and covered with PVC pipe for safety. Each transect will be located at a ninety-degree angle to the tape measure and run at the same compass orientation the width of the ROW. The end of the transect will be GPS-located and marked with a blue-colored rebar. The control-plot transects will be established in the same manner. Record the azimuth of all transects. Use the compass to ensure that the tape measure is laid out in the proper orientation on each transect. Use the first steel pin to anchor the tape. Extend the tape out the width of the ROW by walking on the right-hand side of the tape. Place the tape on the ground and pull it taut. Use the second steel pin to anchor the far end of the tape. Point intercepts will be scored for plant foliar and basal cover, litter cover, rock cover, and bare ground at each meter mark. Record point intercept on data sheet. Scan data sheet each day to produce a digital copy. Store data sheet in safe place.

Plant density: A one-meter square quadrat will be randomly placed three times (no overlap) along each transect to measure species density. Use a random number generator to select the placement of the quadrats. One corner of the quadrat will be placed on the randomly selected meter mark with the second corner placed at the next higher meter mark. Record the plant species in the plot and count the number of individuals. Greater than 50 percent of the basal portion of the plant must be in the plot for it to be counted. Assess grazing and OHV travel within the quadrat and at the MP using the categories presented in Table 2.

Digital photos – One photo will be taken per transect. Record the date, location, plot, transect number, and direction on the whiteboard and place at the beginning of the transect leaning against the rebar stake. Locate the whiteboard in the bottom center of the photo. Take the photo. Repeat the procedure for transects 2 and 3. Download the photo image to a laptop computer at night.

Control or reference plots will be set up outside of the ROW in the 300-ft survey boundary. These plots need to be established within the same terrain, aspect, and soils as the ROW plot, to the greatest extent possible. The plant community should be representative of the surrounding vegetation. The control plot will be set up and sampled in the same manner as the ROW plot.

QA – make sure that all data sheets are completely filled out and accounted for prior to leaving the site. Store the data sheets in a closeable file. Scan all data sheets each night. Make back-copies of all digital photos. If using data recorders make sure that the data was stored and backup files created prior to leaving the site. Double check that digital photos were saved and backup files prior to leaving the site. Account for all field equipment. Collect samples of unknown plant species to identify at a later date.

Data Sheet – Upland Seeded and Riparian Areas

Date _____ Location _____

Transect # _____ Azimuth _____ Crew No. _____

PT	Top canopy	Lower canopy layers			Soil	PT	Top canopy	Lower canopy layers			Soil
		Code 1	Code 2	Code 3				Code 1	Code 2	Code 3	
1						26					
2						27					
3						28					
4						29					
5						30					
6						31					
7						32					
8						33					
9						34					
10						35					
11						36					
12						37					
13						38					
14						39					
15						40					
16						41					
17						42					
18						43					
19						44					
20						45					
21						46					
22						47					
23						48					
24						49					
25						50					

Top canopy codes: Species code, common name, or NONE (no canopy)
Lower canopy codes: species code, common name, L (herbaceous litter), W (woody litter, >5mm diameter)
Unknown Species Codes: AF# = annual forb; PF# = perennial forb; AG# = annual graminoid; PG# - perennial graminoid; SH# - shrub; TR# = tree
Soil Surface (do not use litter): R = rock >5 mm diameter; BR = bedrock; BSC = biological soil crust; S = Soil without any other soil surface code

Species Density

Transect - Quadrat	Plant Species Code – No. individuals
1 - 1	
1-2	
1-3	
2-1	
2-2	
2-3	
3-1	
3-2	
3-3	

Noxious Weeds Cover Class

Weed Species Code	Cover Class	Weed Species Code	Cover Class
Cover class (%): 1 = 0–5; 2 = 5–25; 3 = 25–50; 4 = 50–75; 5 = 75–95; 6 = 05–100			

Grazing class _____ OHV travel class _____ Pedestrian Traffic class _____

Index Class	Definition
1	No apparent grazing, fecal droppings, or hoof prints; No OHV tire marks; No evidence of pedestrian traffic in the plot.
2	<25 percent plants grazed, fecal droppings or hoof prints; <25 percent OHV tire marks; <25 percent pedestrian traffic in the plot.
3	25-50 percent plants grazed, fecal droppings or hoof prints; 25-50 percent OHV tire marks; 25-50 percent pedestrian traffic in the plot.
4	50-75 percent plants grazed, fecal droppings or hoof prints; 50-75 percent OHV tire marks; 50-75 percent pedestrian traffic in the plot.
5	>75 percent plants grazed, fecal droppings or hoof prints; >75 percent OHV tire marks; >75 percent pedestrian traffic in the plot.
The Project ROW will be roughened from MP 26.0 to MP 59.2 (except for portions of the ROW that abuts and parallels an existing road) to inhibit the use of the ROW by unauthorized vehicles. The OHV trend could apply to areas outside the ROW so it has been included.	

Appendix B

Standard Operating Procedures for Saguaro Cactus and Palmer's Agave Monitoring

Training

Review of proper identification of saguaro cacti and Palmer's agave transplanted on the ROW.

Equipment

- 50-m tape
- 3-m PVC pole marked in meters
- GPS unit
- Clipboard and data form
- Whiteboard
- Digital camera with 1.5 m PVC pole

Approach

- Measure height using PVC pole.
- Measure circumference of saguaro cacti at midpoint.
- Record the four corners of the plot using GPS.
- Record on the data sheet whether each saguaro cactus or Palmer's agave is alive or dead.
- Record livestock/wildlife grazing in the area, using the categories presented in Table 2.
- Record a digital photo of each plant.

Data Sheet – Salvaged Saguaro Cactus, Palmer’s Agave, and Pima Pineapple Cactus Survival Monitoring

Date _____

Location _____ Crew No. _____

Species Number	Alive	Dead	Height	Circumference ^a

a - Circumference measured at breast height with a diameter at breast height (dbh) tape.

Add general observations about site and surrounding area control populations for saguaro cacti.

Appendix C

Standard Operating Procedures for Noxious and Invasive Weed Monitoring

Training

Noxious and invasive weed characteristics and photos:

<http://plants.usda.gov/java/noxiousDriver>

Noxious and Invasive Weed Control Plan, Table A-1 lists noxious weeds identified during the pre-construction weed surveys.

Equipment

- GPS unit
- Clipboard and data form
- Digital camera w/ 1.5m PVC pole
- Whiteboard

Approach

- **Weed area** - record the area of investigation using GPS.
- List the noxious, invasive, and desirable plants in the area of investigation.
- Assign a cover class to each species.
- Record a **digital photo** of the weed area using the methods described for the line intercept method. GPS the photo location. More than one photo may be taken if necessary.
- **QA** procedures will follow those outlined for the line intercept method.

Plant cover classes

Plant Species Code	Cover Class	Plant Species Code	Cover Class
Cover class (%): 1 = 0–5; 2 = 5–25; 3 = 25–50; 4 = 50–75; 5 = 75–95; 6 = 05–100			