

# KERN RIVER NATURAL GAS LINE EXPANSION: A CASE STUDY IN OVERCOMING ADVERSITY ON A MOUNTAINOUS LINEAL RECLAMATION PROJECT<sup>1</sup>

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**Abstract.** WSRII, a sister company to Western States Reclamation, Inc. (WSRI), contracted with Barnard Pipeline Company of Bozeman, Montana to complete all revegetation efforts for a 28 mile pipeline north of Salt Lake City, UT. The steep mountainous terrain of the project is considered by many to be one of the most dangerous and difficult pipeline projects to be completed in the western United States. The pipeline started on the outskirts of Salt Lake City, Utah and terminated six miles south of Henefer, UT. WSRII was required to complete the revegetation portions of the project by October 24, 2011 in order to avoid potential liquidated damages of \$115,000 per day. This \$2,500,000 project was successfully completed by WSRII between July 15<sup>th</sup>, 2011 and October 24<sup>th</sup>, 2011. WSRII's scope of work entailed completing 390 acres of revegetation, which consisted of 850,000 square yards (175 acres) of erosion control blanket and 215 acres of seeding with straw mulch. Steep slopes and canyons often times approached two to one slope ratios. Limited access required WSRII to utilize two helicopters daily to fly crews and materials to work areas. WSRII also utilized a total of six ATVs and UTVs to haul personnel and supplies between canyons. At peak production WSRII employed over 100 people in order to complete the project by the project owners required deadline for all revegetation work.

The purpose of this paper is to outline the reclamation goals for the project and then discuss management decisions made to not only complete the reclamation successfully but overcome project challenges.

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## **Introduction**

In March 2010 Western States Reclamation, Inc. was invited to bid on a pipeline project north of Salt Lake City, UT by Barnard Pipeline. The Apex Expansion project was only a 28-mile run of new 36-inch diameter natural gas pipeline, but held many challenges including the use of union workers, navigation through several Wasatch Mountain canyons, high altitudes, aggressive schedules and limited access. WSRI's scope of work would entail completing 390 acres of revegetation, which consisted of 850,000 square yards (175 acres) of erosion control blanket and 215 acres of seeding with straw mulch. The purpose of this paper is to outline the reclamation goals for the project and then discuss the management decisions that were made to not only complete the reclamation successfully, but overcome project challenges.

### **Project Description**

The Apex Expansion Project is located in the Wasatch Mountains in Morgan, Davis and Salt Lake counties of northern Utah, Fig. 1. The Wasatch mountains can be described as steeply sloping mountains (slopes typically between 0 and 50 percent) dissected by east to west facing canyons characterized by small rock outcroppings. The climate in the area can be classified as semi-arid with an annual precipitation rate of 16.5 inches and an average snowfall of 61 inches. The area has four distinct seasons with the majority of the precipitation occurring during the spring rainy season (Kern River Gas Transmission Company (KRGTC), 2009). High altitudes along the Right-of-Way (ROW) (8,000 feet and higher) bring extreme temperature swings and high winds.

The new pipeline is an expansion off of an existing 1,680 mile pipeline that stretches from southwestern Wyoming to California. The expansion begins in the neighborhoods of North Salt Lake and stretches 28 miles, reaching altitudes of 8,677 feet. The project spans several canyons and dissects multiple recreational trails and parks. Generally, the ROW for pipeline construction was 100 to 150 feet wide with additional temporary work spaces staggered along the 28 miles. The construction of the pipeline was scheduled to begin in October of 2010 with facilities placed in service by November 1<sup>st</sup>, 2011.

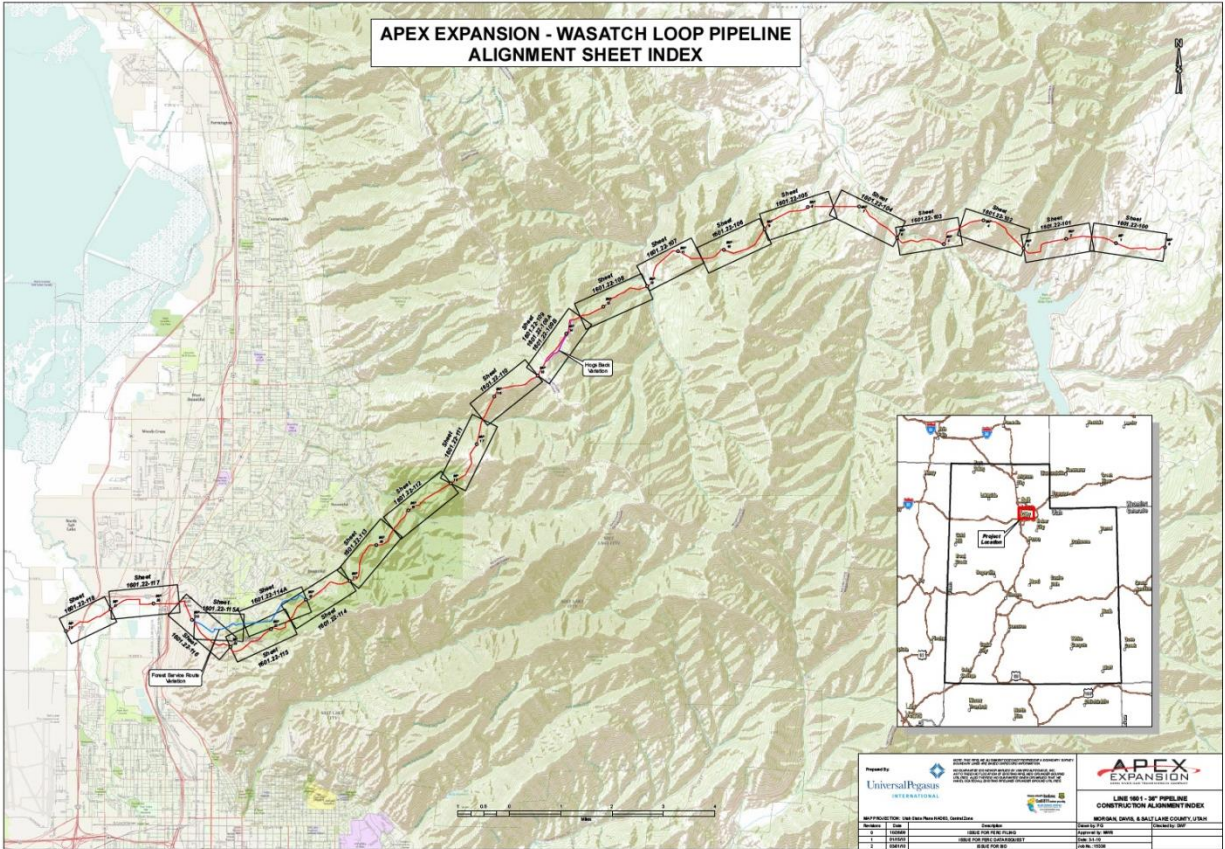


Figure 1 – Project Alignment (Kern River Gas Transmission 2009)

The project goals for the expansion project according to the project owner, Kern River Gas Transmission Company, were fivefold according to project specifications.

- The provided increased reliability and operational flexibility on the Kern River system through the additional looping and added compression.
- Added 266 million cubic feet per day of capacity to safely and efficiently transport natural gas.
- Increased the availability of an abundant clean fuel for the generation of electricity.
- Provided much needed take-away capacity for the increasing natural gas supplies in the Rocky Mountain producing areas.
- Generated payroll, sales, ad valorem and excise tax revenues to state, county and local governments along the pipeline system both during and after construction.

In addition to the functional goals of the pipeline, Kern River was keenly aware of the visual and environmental impact of the pipeline ROW and established a set of goals for the re-establishment and stabilization of the ROW.

### Reclamation Plan

A reclamation plan was developed by Kern River and multiple agencies to address disturbances to the current site conditions by the construction of the Apex Expansion Loop. The reclamation plan incorporated standard erosion, sediment control and restoration procedures or criteria that had been proven effective by the natural gas industry. The reclamation plan had also been developed with the knowledge of past reclamation efforts in the area. Outlined in the reclamation plan for the project was a list of reclamation goals.

The overall short term and long term goals for the project were as follows:

1. Re-establishing pre-construction contours and hydrologic patterns
2. Minimization of on-site erosion
3. Minimization of off-site sedimentation
4. Re-establishment of the pre-construction vegetative communities, as appropriate
5. Where possible, replacement and/or enhancement to wildlife habitats crossed
6. Establishment of post-construction vegetative monitoring stations

Kern River's long-term goals include:

1. Soil stabilization
2. Establishment of a sustainable vegetative cover
3. Annual post-construction restoration monitoring for a minimum of three years
4. Maintenance and repair of permanent erosion and sediment controls
5. A commitment to the restoration and protection of water resources
6. A return to pre-existing land uses to the extent practical and consistent with Kern River's Operations and monitoring needs.

The reclamation process outlined in the specifications began with general cleanup and soil placement processes and then went into detail about the various methods of revegetation and stabilization that would occur along the pipeline ROW. The specifications were outlined as follows for site stabilization.

1. Backfilling
2. De-compaction
3. Re-contouring
4. Rock Mulch
5. Imprinting
6. Water Bars
7. Revegetation - Seed Bed Preparation, Seeding Mixtures and Rates, Seeding Methods, Reclamation Treatments for Steep Slopes and Erodible Soils

Items one through six would be completed by the pipeline general contractor with equipment that they would already have on site, item seven would be the responsibility of Western States Reclamation, Inc.

The specifications for soil preparation and seeding were standard in description and outlined a fairly descript method of seed bed preparation, seeding and straw mulching. The specifications went into even greater detail as it discussed seed mixtures and the three vegetation communities (Albee et al. 1988), that the pipeline would cross over, these include: Great Basin Sagebrush; Mountain Mahogany – Oak Scrub and Douglas Fir Forest.

A sub-section titled “Reclamation Treatment for Steep Slopes and Erodible Soils” discussed additional reclamation efforts on the pipeline ROW. This sub-section identified that approximately 90 percent of the proposed project facilities have moderate to high erosion, shallow bedrock, or poor revegetation potentials. The specifications then went on to classify the soils that were to be reclaimed on the pipeline right of way.

- Soils with high water erosion potential: 341 acres
- Soils with high wind erosion potential: 28 acres
- Soils with shallow bedrock: 221 acres

Within the steep slope sub-section were detailed descriptions of reclamation methods including slope percentages that defined whether a slope would receive straw mulch or erosion control blanket.

#### Specified Materials for Reclamation

There were essentially three different types of work scopes for the Kern River Pipeline Expansion. They included:

1. Soil preparation, drill seeding and straw mulch and crimping of slopes less than 30 percent. Straw mulch would be applied in two one and one half ton lifts. The first lift would be crimped into the ground prior to seeding and the second lift of one and one half tons would be spread across the top of the seeded area.
2. Hand broadcast seed, hand raking, and installation of straw erosion control blanket with photodegradable netting erosion control on slopes between 30 and 50 percent. The blankets were to be installed with six inch staples.
3. Hand broadcast seeding, hand raking, and installation of straw coconut erosion control blanket with photodegradable netting on slopes greater than 50 percent. The blankets were to be installed with six inch staples.
4. Four different seed mixes would be utilized on the project ROW. The mixes coordinated with the different vegetation communities encountered during the initial survey.
  - UT-1 Seed Mixture for the Great Basin Sagebrush Community
  - UT-2 Seed Mixture for the Riparian and Canyon Woodlands Community
  - UT-3 Seed Mixture for the Wet Meadow Community
  - UT-4 Seed Mixture for the Douglas Fir Community

### **Construction of the Kern River Expansion Pipeline**

#### **Project Estimation**

Project estimation occurred in March of 2010. WSRI was supplied with a full set of construction documents, specifications, bid tabs and Google Earth files from the general contractor. It was agreed upon, before estimating commenced, that WSRI would join the Pipeline Union at the onset of contract negotiations if awarded the project.

Union wage rates had to be utilized on the project. Union wages are unique to the region of the country that the work is taking place in and are even negotiated further at a job level once the contract agreements are in place. WSRI estimating team requested and received current union rates from the local Salt Lake Union Hall and incorporated the wages into the estimate.

Bid quantities were supplied by Barnard Pipeline that broke out areas into those with slopes less than 30 percent to receive standard tillage, drilling, straw mulch and crimping and those areas over 30 percent to receive broadcast seeding, hand raking and erosion control fabric.

WSRI was directed to use the supplied quantities for bidding the project. With intentions of setting up a unit based contract WSRI followed form and bid the project according to directives given by the general contractor.

A critical piece to estimating reclamation on pipeline projects revolves around equipment and crew access to and along the pipeline ROW. Often times pipeline projects are located in rural areas and have only a few access points. Natural site conditions including slopes, streams canyons and existing infrastructure add to the difficulty of getting equipment and crews to areas along a pipeline. Therefore, it is critical to understand what equipment will be needed and how much time should be accounted for to access the pipeline ROW.

WSRI's initial review of the project plan set revealed access routes that were well defined and spaced evenly across the pipeline ROW. It was assumed during the estimation of the project that equipment and crews could be delivered to these points and from these locations access the entire project ROW to complete the reclamation process. It was also assumed that the majority of the mild slopes, less than thirty percent, would be located in areas that could be accessed by standard agricultural equipment and straw delivery trucks.

WSRI realized that there would be many challenges with the project schedule but if the project reclamation was able to occur in the fall of 2010, spring of 2011 and fall of 2011 that the project could be completed with standard crew sizes and could be managed by a general superintendent who would also be operating on the job.

During project estimation and negotiations Barnard Pipeline maintained open communication. Barnard allowed WSRI to re-evaluate pricing after initial submission and confirm pricing. After final numbers were submitted it took three months before Barnard Pipeline knew they were awarded the project and in turn before WSRI was informed that they would be awarded the revegetation portion of the project.

#### Contract Negotiations

In the summer of 2010 WSRI began the contract process with Barnard Pipeline for the Kern River Apex Expansion project. As promised, WSRI created a union based sister company, WSRII, in which the project would be performed under. Several months of contract negotiation ensued some of the main negotiation items were, project schedule/liquidated damages and unit based pricing.

The project general contractor was responsible for getting the line in service by November of 2011 or face liquidated damages of \$115,000.00 a day. WSR II negotiated an agreement where WSR II would only be responsible for up to 20 percent of the final revegetation contract only if they were responsible for contract delays and exceeded a set number of scheduled days per each section of pipeline.

### **Initial Project Approach**

WSR II anticipated a mobilization in the fall of 2010 to complete pipeline revegetation and stabilization on six sections of the pipelines ROW with a total acreage of 168 acres. In the original schedule WSR II was to complete the 168 acres between November of 2010 and January of 2011. The schedule then had WSR II re-mobilizing in June of 2011 to complete reclamation on the remaining 390 acres behind the pipeline installation and cleanup crew. It was anticipated that a 24-man blanket crew and a four-man tractor crew could keep pace with pipeline construction.

WSR II was planning on mobilizing one project superintendent, two project foremen (one labor union and one operator union), six laborers and one teamster from the Frederick, Colorado office. The project superintendent then would hire six laborers and one operator from the local union to fill out the initial reclamation crews. It was expected that crew sizes would grow as the project progressed and that additional employees from the main office would be added over time.

WSR II anticipated moving equipment and laborers across the pipeline with lowboy semis, four-wheel drive pickups and a two six wheeled Utility Terrain Vehicles. WSR II was anticipating hard to access areas and also mobilized a tracked ARGO vehicle to help transport crews and materials to the sites.

It was determined on the onset of the project that a full time employee would manage the project from the Salt Lake City office and keep communication between the field office and the main office in Frederick, Colorado. WSR II staffed the project with a project superintendent who had a limited amount of pipeline experience but extensive land reclamation experience. It was initially planned that individually he could oversee the project to completion.

Several WSR II staff joined the union to help train and manage union workers hired from the local hall. It was expected that WSR II would maintaining a one to one ratio with hired union



labor and operators and to meet the ratio. WSRII planned on using seasonal workers for labor on the project.

### **Modified Project Approach**

In the fall of 2010, Salt Lake City received large amounts of precipitation that delayed the construction of the pipeline and in turn delayed the mobilization of WSRII crews. In late November, a reclamation crew was mobilized to Salt Lake City to start the fall revegetation and stabilization, already two weeks behind schedule. Once WSRII was mobilized to the site crews were only able to complete 1.2 acres of the originally scheduled 168 acres of reclamation because of site conditions and delays in the construction schedule. WSRII pulled crews from the pipeline for the season once it realized that the project ROW would not be accessible until the spring.

The general contractor revised the schedule and compressed the project timeline into the summer and fall of 2011. WSRII's contract was based off of a schedule of days to complete each of the 13 sections of pipeline. By incorporating this language into the contract WSRII's intention was to protect itself from project delays and to guarantee a fixed amount of time for each section of pipeline. In turn, the compressed schedule still allowed for the number of days requested, but it meant that WSRII would have to complete several sections of pipeline simultaneously. As a result crew sizes on the project would have to increase and the management of the project became more of a challenge.

It was after the first mobilization in November of 2010 and then a subsequent trip in March 2011 to inventory site conditions that WSRII realized that the original project approach would not be possible because of site access and slopes (e. g, Fig. 2 and Fig. 3).

On the March 2011 site visit, WSRII was informed by the general contractor that pipe crews and materials were being flown into work areas by helicopters because of site slopes and lack of approved access roads which were previously anticipated for use. WSRII, based off of the new information, began making adjustments to the equipment fleet assigned to the project. It was decided by the WSRII team that UTVs should be utilized to mobilize crews and materials to the work sites daily.



Figure 2 – 2:1 Project Slopes (Colby Reid, 2011)



Figure 3 – 2:1 Project Slope (Colby Reid, 2011)

Crews were mobilized for the second time to the project ROW in late June of 2011. At this time WSRII had one non-union general superintendent, one union teamster, one union operator and one union laborer. Once on site 20 union laborers were hired for the project. As part of the union agreement and limited parking at the staging area crews had to meet at the Barnard Pipeline office each morning and be shuttled into the project area. Parking at the job site staging area/helicopter pad was limited to no more than two WSRII vehicles at a time. WSRII brought in two nine-passenger vans and one crew-cab truck in order to transport crews daily from the office to the staging area.

Once installation activities commenced, WSRII crews were struggling to meet estimated production rates and schedules safely because of site access and conditions. Two Polaris UTVs were utilized by WSRII crews initially in an attempt to transport eight laborers and supplies to work sites on the pipeline where erosion blankets were to be installed. The laborers that were not transported by the UTVs were tasked with hiking into the project area. It was quickly discovered that the Polaris UTVs simply could not negotiate the steep slopes with loose and rocky surfaces and laborers that were hiking into the project area, often time in 95 degree temperatures, were simply exhausted. It was calculated that in one day, WSRII had lost \$16,000 due to lack of production caused by delays in getting crews and erosion blankets to the work sites in a timely manner. It was obvious to the WSRII management team that changes had to be made promptly to avoid losing thousands of dollars daily and falling further behind on the schedule. WSRII approached Barnard Pipeline about sharing the cost and daily use of helicopters in order to fly crews, erosion blankets, water, food, fuel and even portable toilets into

work sites. An agreement was reached in which WSRII would share the two helicopters, a Bell 206 and 212, which Barnard Pipeline utilized on the project. The problem with sharing the helicopters was that Barnard's crews and supplies took precedence over WSRII's needs. Thus, WSRII did not have access to the helicopters until about 9:00 a.m. each morning and had to be off the mountain by 6:00 p.m. each night.

It was determined that the Polaris UTV's could be used to move crews and erosion blankets within sections of the pipeline where slopes were not extreme but still required erosion control blanket. The helicopters were used to air lift the UTVs into areas of the pipeline where they could safely negotiate lesser slopes. With this approach WSRII was able to bring its cost for daily production back into an acceptable range.

By late July, it became obvious that daily production, in terms of lineal distances of erosion control blanket completed each day, was falling further behind pipeline grading and cleanup crews. WSRII re-approached Barnard regarding flight times and was able to secure a 6:30 a.m. departure from the helicopter pad while maintaining the 6:00 p.m. departure time. At this time approximately 20 additional laborers were added to the team along with two additional (newly purchased) UTVs to shuttle crews on less steep areas.

It was not until about the end of July that WSRII crews encountered slopes less than 30 percent that required drill seeding and straw mulching. The very first area that WSRII encountered requiring these methods created a major access problem for agricultural tractors with implements. The lesser slopes requiring tractor access happened to be located in between two steep segments of pipeline ROW. Steep slopes prohibited tractors from traversing through these areas and accessing the lesser slopes. Furthermore, there were no usable permitted access roads that dissected the drill seed and straw mulch areas. It was determined by the WSRII team the only way to meet the required specifications on this area was to fly in smaller equipment and implements. WSRII used an UTV with small fabricated implements to complete the seeding in this section. Soil preparation was completed with a four foot wide custom made ripper. Drill seeding was accomplished with a DEW Drop Seed Drill, which is like a four foot wide Truax drill. WSRI was then faced with the challenge of delivering and applying the straw mulch cover according to specification. WSRII's intended method of applying the straw mulch was to use a big bale mulcher that required a tractor to operate it. Since there was no reasonable access into

the site straw was airlifted by helicopter and dropped out of a net. Hand spreading of straw had to be used after the helicopter air drops to meet the requirement of uniform straw coverage. Crimping was completed with a four foot wide fabricated crimper that was attached on the back side of the ripper.

By late August, WSRII was still not meeting the daily production necessary to stay directly behind Barnard’s pipeline grading and clean-up crews. Even though the percentage of erosion blanket completed seemed to match the anticipated schedule for the project, significant acres of erosion blanket installation still remained. WSRII crews began measuring and calculating the balance of erosion blanket required to cover all specified steep slope areas. It was discovered at this time that the side slopes along the ROW were not accounted for in the original blanket bid quantities and the square yardage of blanket was now double the original bid tabs that were given to WSRI for estimating (e.g., Fig. 4 and Fig. 5)

It was now approaching the end of August, WSRII was facing a condensed schedule, increased quantities of erosion control blanket (a very labor intensive process) and limited access into the project right of way. The ability to complete the balance of the 100 percent over run in erosion blanket by October 24<sup>th</sup> with anticipated snow in the high country seemed virtually impossible. The company’s reputation was built on offering quality work and meeting client’s expectations for project deadlines. The WSRII team set out to meet the challenge.



Figure 4 – Blanketed Slope (Colby Reid, 2011)



Figure 5 – 2.5:1 Side Slopes (Colby Reid, 2011)

By the end of August, WSRII more than doubled its workforce and equipment in order to meet the project schedule. One 20 passenger school bus, one 36 passenger full size school bus, two nine-passenger vans, and one crew-cab truck were required to haul crews to various portions of the pipeline. In addition, helicopters were still being used to transport some of the crews to inaccessible areas.

There was never a day that would go without more production and project budget issues. As the project progressed eastward the issue that developed was that the staging area/helicopter pad was too far away from the east end of the pipeline for timely and cost effective delivery of erosion control blanket. The decision was made to have semi-trucks deliver the erosion blanket at a small staging area on the east end of the pipeline. The erosion blanket was then loaded on to gooseneck trailers and hauled on approved access roads as close to the work areas as possible. A John Deere 650 wide track dozer was brought in with a fabricated rake on the back end which could be used to haul blanket up and down steep slopes areas. Also, a Morooka track dump truck which had been successfully used by Barnard work crews was rented to haul blanket material to crews on other parts of the pipeline.

WSRII's success story is that it completed the project, even with substantial quantity increases, five days ahead of schedule. This included losing nearly a week due to a snow storm in October. The following is a list of resources that were utilized from late August until the project was completed:

- 1 Division Manager
- 3 Foreman
- 4 Straw Bosses ( laborer supervisors)
- 4 Equipment Operators
- 4 Teamsters- Consisting of 1 semi driver,  
2 school bus drivers, 1 one-ton truck
- 100 Laborers
- 1 Semi-Tractor Trailer
- 2 9 Passenger Vans
- 2 School Buses
- 1 One Ton Trucks
- 6 ¾ Ton Trucks
- 4 Polaris UTV,s
- 1 Agro Tracked UTV
- 4 John Deere Ag Tractors
- 2 Rangeland Seed Drills
- 2 Rippers
- 2 Straw Crimpers
- 3 Helicopters 1 Huey 205, 1 Bell Ranger ,  
and 1 212
- 1 John Deere 650 Dozer
- 1 Morooka Track Dump Truck

### Project Outcomes

After the management shift on the pipeline and the modification of the project approach WSRII was able to complete the project five days ahead of schedule and avoid any liquidated damages, an accomplishment that many individuals didn't think could be done. The project ended up being one of the most difficult revegetation projects that WSRI/WSRII completed in its 29-year history.

Both ownership and the general contractor were impressed by WSRII's ability to complete the reclamation goals safely and on time. WSRII is eager to watch the establishment of the vegetation communities on the pipeline ROW and track the project over time.

### Lessons Learned

There can never be enough time spent ground validating access along pipeline ROWs. The time spent flying, driving and walking a pipeline ROW especially when located in challenging terrain is worth all of the upfront investment and should never be overlooked.

Staffing a union project takes a large administration team and individuals experienced in union work. Now that WSRII has executed a large scale union project the proper framework is in place to streamline the process of utilizing union employees.

Critical management decisions need to be made right away on a project of this complexity. Communication between management teams is critical to realize when help is needed and when project expectations and schedules are not being met.

As the vegetation establishes over the next several years it will be interesting to see the fruit of our efforts on the Kern River Expansion Project. WSRII gained invaluable experience from this experience and we are eager to apply our knowledge on the next project.

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