Section 6: Transmission Line Routing

SECTION 6: ROUTING & CONSTRAINT MAPPING

6.1 SECTION PURPOSE

The purpose of this section is to present the transmission line routing process, including the identification of constraints, GIS data acquisition, and mapping that was necessary to support the routing process. Also discussed are the efforts completed to avoid constraints where possible and the evaluation matrix used to score alternatives relative to their constraint impact in order to establish the most viable routes for permitting, right of way acquisition, and construction.

6.2 ROUTING APPROACH

The routing of transmission line projects is most efficiently developed in sequential phases beginning with many potential route possibilities and narrowing to a few options. A team approach that incorporates GIS mapping, environmental permitting knowledge, survey expertise with the terrain, routing experience and knowledge of the region, transmission line design and construction, and consideration of political and current issues is critical. The unique issues of each region, area and route segment are used at each phase to help guide decisions to arrive at the preferred route.

Transmission line routing involves trade-offs among a variety of factors. The route options that are most promising balance environmental considerations with project need, constructability, current and future identified land use, project costs and specific electric system needs.

The Tri Sage team has brought specific team members together that bring this regional expertise to obtain the best possible outcome of the routing and siting process; i.e. “professional routing”. The intent and benefit of professional routing of transmission lines is that, from the beginning of a project, crossings through overly difficult, potentially sensitive, and/or known “closed” areas can be eliminated. As a result, focus is put toward routing an alignment through areas that are known to be feasible, which ultimately reduces the burdens of permitting and acquiring of easements and/or rights-of-way later in the project. As a result, the preferred routes presented herein are intended to lead to a better overall project that is more acceptable to those who may be most impacted. Additionally, by taking into consideration the input received from key stakeholders, regulating agencies, and key utility and grid operators throughout the process, we be believe that we have arrived at project routes that are appropriate for the region, compliant with environmental regulations, and constructible.

6.2.1 Routing Process Overview

Upon identification of the project scope, an electric grid evaluation was performed, as discussed in Section 5, to establish termination points and line voltages. Line voltage in turn is a primary variable in selecting structure types. Once line voltage and structure type(s) were determined, a right-of-way (ROW) width could be assumed. Structure types and required ROW will ultimately drive line route possibilities. Generally speaking, there is more flexibility in routing transmission lines for voltages < 120kV than there is in routing higher voltage lines.

With termination points, voltages, preliminary structure types and required ROW widths determined, the next step was to identify study areas between the chosen termination points on base GIS mapping.

A straight line alignment between termination points rarely results in an acceptable route. Therefore, the study area delineated should be large enough in size to contain all possible route alternatives. Typically, longer project lengths (100 miles or more in length) will require large study areas; shorter project lengths may require smaller study areas. For longer project lengths, study area delineation and preliminary line routing is typically done on mapping at a 1:500,000 (1" = ~7.891 miles) scale. For shorter length projects, one could begin with 1:24,000 (1" = ~0.378 miles) scale mapping to begin route selection studies. For this project, 1:100,000 scale mapping was used for this stage of the routing development.

Once all possible route alternatives are identified, larger scale mapping (1:250,000 and possibly 1:24,000 scale) is used to fine-tune preferred routes. For this project, 1:24,000 scale maps were used to fine tune the proposed line routes. Most routing efforts are considered complete at this stage of the process.

After fine-tuning of preferred routes was completed at the 1:24,000 map scale, the project team chose to further refine the routes by reviewing them against digital aerial photography in an attempt to identify any 'fatal flaws' that may exist along the chosen routes. This is a beneficial step particularly if the aerial photography is more up-to-date than the 1:24,000 scale paper mapping that was used.

Helicopter reconnaissance was then performed in areas of significant concern (i.e. areas congested by terrain, other facilities, potential environmental constraints, etc.) to even further refine the proposed routes that had been laid out on paper. In this step, GPS technology was used to better locate specific elements, such as angle points, along the alignment. For this project, each proposed angle point has a GPS coordinate. After helicopter reconnaissance, on-ground staking of the preferred route(s) would be the next step, which is beyond the current scope of this project.

6.2.2 GIS Methodology

In order to support the routing process, extensive mapping was necessary to provide both preliminary information for routing avoidance, as well as follow-up mapping to capture the land and environmental constraints. Specific Geographic Information Systems (GIS) mapping was created and used to identify specific constrains of avoidance.

The first step in the mapping methodology was to establish baseline maps based on the establishment of the preliminary corridors. The methodology used was to identify the key factors or GIS layers to be considered as constraints (or opportunities) throughout the routing process. The project team focused on the key factors that would influence the "routability" of the lines through particular lands such as federally managed or private land, or the presence of limiting environmental conditions such as wetlands, wildlife, etc.

The factors used to develop the constraint maps, which are discussed in greater detail herein, included:

- Land Status / Ownership (Public vs Private)
- Topography and Slopes
- Roadways and Roadway Crossings
- Stream Crossings
- Railroad Crossings
- Wetlands
- Areas of Critical Environmental Concern
- Desert Tortoise and Sage Grouse Habitat
- Herd Management Areas
- Existing Utilities and Utility Crossings
- Wilderness Areas and Wilderness Study Areas
- Vegetation

The GIS digital data coverage for each constraint was merged together and edited to create a set of homogeneous items between the three state offices of the various agencies from which data was used. Elevation data was also researched and collected. This elevation data was converted to grid. A grid is a representation of the area as a series of equally sized cells or pixels. The GIS data and the elevation grids were then combined in the GIS software to create composite maps to aid in the evaluation of viable routing segments.

Initially, maps with constraints were developed at the 1:100,000 scale. This information was used to develop preliminary routes. Once preliminary route segments were established, maps were then narrowed to reflect the specific segments with the constraint overlays applied to layers. From this point, a weighted matrix evaluation was completed to narrow the segments even further to allow final preferred route selection. This matrix is further discussed in Section 6.5. It should be noted that this analysis was performed at the planning level and does not include localized site specific factors that could influence final design level engineering and permitting. Nor does this analysis account for private land owner's willingness to allow easement crossings.

6.3 GIS CONSTRAINT MAPPING

The specific preliminary corridor alignment details were input into a GIS database. This allowed the GIS constraint mapping and analysis to begin. Multiple layers of constraints were researched and overlaid onto the routing maps. These layers were overlaid together through the GIS mapping software, but required quality control with regard to completeness. Due to the multiple sources of information pertaining to each constraint, multiple databases were researched, agency contacts were made, and quality review of the data was completed. Much data was eliminated due to level of completeness or receipt from non-qualified resources. Each resource that was mapped as a routing constraint is discussed below.

6.3.1 Land Status / Ownership

Land status mapping is one of the critical elements of the mapping and provides the basis for how routing proceeds. In general, it is desirable to route transmission lines on Public Lands to avoid the economic and social impact of locating transmission lines on private land, thus reducing the potential for expensive and time consuming condemnation proceedings. It is critical at this point to understand that condemnation is a legal right given to utilities operating in the respective regions to ensure that a given private land owner cannot hold the utility hostage during the routing of transmission and distribution lines that benefit the public. As the industry has changed over the past years to include merchant transmission lines, this right of condemnation has become an issue for consideration. General merchant line owners are not afforded the same right of condemnation. As such, many privately owned transmission lines are partnered with local utilities to bring condemnation rights into the project. This issue is discussed in next steps but is also critical at this point to understand that the evaluation of constraints has assumed that these projects will have the benefit of condemnation. However, routing has still been completed to avoid private lands. This is necessary due to the history of many projects that are held up in time and cost even with condemnation rights. It is not always possible to totally avoid private land ownership, but avoidance is one key to line routing. Note

that there are times when private land is desirable as is the case on small lines where the private land owner(s) are willing participations. That is not the case here.

To identify private from public lands, this level of mapping shows all the land managed by public land agencies: Bureau of Land Management (BLM), US forest Service (USFS), State Lands, National Parks, Bureau of Indian Affairs (BIA), along with other federal and state ownerships. This also includes privately held land ownerships, but does not go to the level of specific private parcel ownership determination as that will be conducted following final line routing.

The BLM land status coverage is managed through individual BLM state offices. For this reason, much of the available mapping from this agency is unique to each state, often resulting in different types of land categories that are tracked. For example, California BLM does not track privately owned parcels but instead, categorizes these parcels and others into one ownership classification of "unclassified", but Nevada and Utah do track private parcel ownership. The result is a different set of items in both type and naming nomenclature for each state. This was addressed in the mapping process by creating similar categories in each database to be label and color coded to allow for common identification throughout the maps. Land ownership was then mapped at a 1:100,000 scale, providing planning sheets that included land status, topography and jurisdictional boundaries (military bases, fee lands, etc.). From these sheets, covering vast areas of land, the routing was initiated and multiple route segments were identified.

Included within this land mapping was ownership by the Bureau of Indian Affairs. This land is owned by tribal communities that typically involve cultural, religious or other sensitive criteria and are typically avoided where possible. Specific to the northern route within this report, BIA land is crossed as one of the viable route segments. In this case, there is belief that the BIA may have interest in development of its own renewable energy resource on this land. The addition of transmission infrastructure may pose a beneficial opportunity in this case and was considered as a viable route.

6.3.2 Topography and Slopes

Topography is a fundamental component to transmission line routing. This, along with evaluation of slopes is necessary to optimize both the line route and structure placement. In order to support both routing and conceptual design, the team utilized the National Elevation Dataset (NED). This is a grid set of three dimensional gridlines that details topography from the USGS 1:24,000 quadrangle mapping. This data was then used with ESRI's ArcMap spatial analysis software management to create digital elevation models and allow for integration of the specific route segments. This integrated topographic overlay with the routing allowed for the reporting of specific slope ranges from 0 to 9%, 10% to 18%, and above 18% (18% to be

considered extreme sloping) and applied this to the routing to allow for evaluation of extreme conditions and modifications of the routing where necessary. Once finalized, mileages and acreages of potential right of way of routes within specific slope ranges were calculated and applied to the weighted matrix. Slopes are important to identify flat low land verses hillsides which may require transmission line structure modifications. For example, flat lands with alluvial fanning may indicate drainage concerns while steep areas can be technically difficult to develop or construct. In most cases, extreme slopes will indicate a need for extensive roadway cutting in order to reach those transmission structures. For most of the routing on this project, extreme terrain was avoided. This topography and slope information was used, along with the land status mapping, as the basis of the land database from which all other constraints were applied.

6.3.3 Roadways, Trails and Roadway Crossings

Roadways and access ways are a critical component in routing transmission lines. Typically, agencies wish to utilize existing roadways where possible. Some public land management agencies even regulate the use of existing dirt two track roadways. As such, it was critical to identify all the roadways including highways, US interstates, paved public local roads, two track trails and access ways. This information, when identified up front on the corridor mapping, assists in the routing of lines adjacent to, or close to, these existing roads. To accomplish this, the US Census Bureau Tiger Database was used to identify roadways in the vicinity of viable route segments. Roadways identified within this database were at the USGS 1:24,000 quadrangle series mapping level. This included any identifiable roadway down to a two track dirt road. Roadways were classified as ones viable for use for construction. If the access was identified within 100 feet of the proposed route, the weighting was established as excellent; between 100 feet and one half mile (2640 feet) the weighting was established as good; and greater than one half mile the weighting was established as poor.

Issues that were accounted for in both the routing and evaluation matrix weighting includes distance from an existing roadway, requirements for new roadways, possibility of overland travel during construction, requirements for spur roadways for structure construction and roadway upgrades.

Roadway crossings were also mapped and weighted in the evaluation as such crossings will require additional structural design to accommodate wire clearances and specific crossing permits will also likely be required. This was all accounted for to arrive at the preferred routing evaluation and costing data.

6.3.4 Stream Crossings

The Federal Clean Water Act requires regulation of water bodies and stream water quality. As such, stream impacts must be either avoided or closely managed during transmission line construction. In order to assist in the avoidance of stream impacts, GIS datasets from the Tiger Files were obtained and mapped. The initial information was sourced from the USGS 1:24,000 series quadrangles.

While impacts to large drainage areas were avoided, some stream crossings will be required. These were identified to allow for the conceptual design and estimating necessary to account for such crossings. Crossing permits will also be required and were therefore documented and weighted.

6.3.5 Railroad Crossings

Railroad crossings were also mapped and weighted in the evaluation as such crossings will require additional structural design to accommodate wire clearances and specific crossing permits will also be required. This is all accounted for to arrive at the preferred routing evaluation and costing data. Specific to the three routes identified, there are only two railroad crossings, both of which are located on the northern route. While it is beneficial to avoid railroad crossings, it should be noted that railroads also offer a benefit to projects when it comes to material deliveries. In the case of the north route, this will provide both a constraint for design and permitting, but will also offer additional flexibility for material deliveries.

6.3.6 Wetlands

Wetlands are managed through the US Fish and Wildlife Service, and information specific to the identification and classification of these resources is managed under the National Wetland Inventory database. The Army Corps of Engineers manages the impacts to wetlands and how mitigation will be applied to protect these resources.

The mapping team obtained the set of GIS data from the National Wetland Inventory specific to the routing corridors. This information was downloaded into a GIS layer of the routing to allow for avoidance where possible. In addition to the potential environmental impacts, wetlands affect the foundation design and constructability of transmission lines and are avoided wherever possible. Two wetlands, however, will be impacted by this project. Specifically, the Owens Valley and the Humboldt River will have crossings of the power lines which will require diligent design, significant permitting, and careful construction to complete.

6.3.7 Areas of Critical Environmental Concern

This criterion is a summary of resource areas managed by the Bureau of Land Management that are considered environmentally sensitive areas. Management of this "collective" resource began as the 1976 Federal Land Policy and Management Act (FLPMA). This act directs the BLM to protect the riparian corridors, threatened and endangered species, cultural and archeological resources, and unique scenic landscape. Management of these resources is at the BLM's discretion and are identified, mapped and controlled solely within each State's BLM agency. This information is available in GIS format and was obtained for reference in the NEAC mapping process. It was included as a constraint level in the mapping; was avoided were possible; and weighted in the evaluation where not avoided completely.

6.3.8 Desert Tortoise and Sage Grouse Habitat

These two species have been identified as special management resources within Nevada and require special attention with regard to impacts. While not established as a Threatened and Endangered Species, both resources are highly monitored and protected with special status in Nevada. As such, the US Fish and Wildlife Service provides the tracking necessary to support the Nevada directive of special status monitoring. The data bases managed by the USFWS were referenced during the mapping and constraints determination process. It should be noted that in addition to the USFWS database, review was completed of the Nevada Department of Wildlife (NDOW) database as well.

The Desert Tortoise Habitat is primarily found in Southern Nevada. As a result, routing was completed to avoid these habitat areas for the southern route segments. The Eastern and Northern routes did not come near the tortuous habitat.

The Sage Grouse is located primarily in the Northern Nevada, Western Utah and Sierra Nevada Mountain Ranges. As a result, all three routes (North, South and East) came into contact with this habitat area. Much was avoided, but due to the large expanse of habitat, total avoidance was not feasible. The Greater Sage-Grouse is a sensitive Nevada resource that will require attention in the next phases of this project.

In August 2008, the NDOW contracted Resource Concepts, Inc to study the potential impacts of energy development on greater sage-grouse (Centrocercus urophasianus) and their habitat. In an effort to determine the possible extent and location of potential impact areas, they conducted an inventory of renewable and non-renewable energy development in Nevada in relation to sage-grouse distributions and known strutting grounds (leks). The results were presented in a final report dated August 2008. Information contained in that report was referenced during the routing of these projects but was not detailed for confidentiality

purposes and in conformance with protection of this resource. This report acknowledges that the Greater Sage-Grouse is critical to the State and moving forward, the project proponent will actively work with BLM and NDOW during the application phase of this project to establish the lek and habitat sites and associated mitigation.

It should be noted that while these two critical habitats were specifically mapped and avoided where possible, there are multiple other habitats that will require investigation. However these two are specifically tracked by the governmental agencies while the majority of the others will be field identified during the NEPA and CEQA environmental field investigations.

6.3.9 Herd Management Areas

The Wild Horse and Bureau Act of 1971 dedicated large expanses of land within both Nevada and California as Herd Management Areas. Each one of these areas has designated criteria that define the size of herd, as well as sensitivity of the habitat and environment. As such, these areas were critical to identify and avoid if possible. These areas are managed by BLM and are mapped within their database. Information was downloaded into the GIS layers and for routing that could not avoid this land classification, a calculation was completed to identify the area of disturbance within each segment of line route. This acreage was then given a weighting based on the amount of habitat impacted.

6.3.10 Existing Utilities and Utility Crossings

Existing utilities are critical to review during the routing of transmission lines for a twofold purpose; first it is important to identify existing utilities as an opportunity to utilize existing utility corridors where possible, and second it is critical to avoid utility crossings if possible.

Established utility corridors are areas designated by federal, state, and/or local planning agencies as appropriate or suitable for existing and future utility infrastructure. While there are thousands of miles of existing utility corridors that lend themselves well to new transmission line construction, much of these are either limited by land constraints such as terrain, or they are electrically constrained and do not allow the new grid connections that are required to complete necessary new grid expansions.

Specific to this project, existing utility corridors were paralleled where possible. However, many of the existing corridors did not lend themselves to the new routing that is required as discussed in Section 4 of this report. The identification of new utility corridors and infrastructure on federal land will be an important element in allowing Nevada to continue to economically and reliably develop the transmission infrastructure necessary to support the export of renewable energy. Note that due to the extensive nature of existing utilities, and the

multiple impacts and benefits to paralleling these facilities, existing utilities were not included in the evaluation matrix.

Mapping of the known Nevada, California and other western states corridors were obtained from the specific state's BLM Master Title Platts (MTPs). This information was then digitized to obtain every utility right of way found. This information not only assisted in the routing within or near corridors, but also allowed for the determination of line crossings that will be required and ultimately the determination of utility crossing permits that will be necessary. These crossings were accounted for in the evaluation matrix.

6.3.11 Wilderness Areas and Wilderness Study Areas

Mapping of Wilderness Areas (WA's) and Wilderness Study Areas (WSA's) was obtained from each State's respective BLM office. Due to the environmental sensitivity of these areas, routing of the transmission line alternatives was completed to avoid them. Because they are highly sensitive, however, they were also included in the weighting if the line route came within one half mile of a WA or WSA.

6.3.12 Vegetation

Vegetation mapping was obtained from ESRI's DCW data. While the majority of the route segments cross rangeland with little or no mapped vegetation, some instances of shrub and scrub lands are crossed that could impede travel and/or construction activities and could require tree trimming. These areas were included in the evaluation matrix. Much of the growth in these areas is juniper and pinion. In some instances, the lines traverse near Joshua trees which are threatened and endangered species. All threatened and endangered vegetation will be identified during the field investigations by biologists during the NEPA and CEQA permitting process.

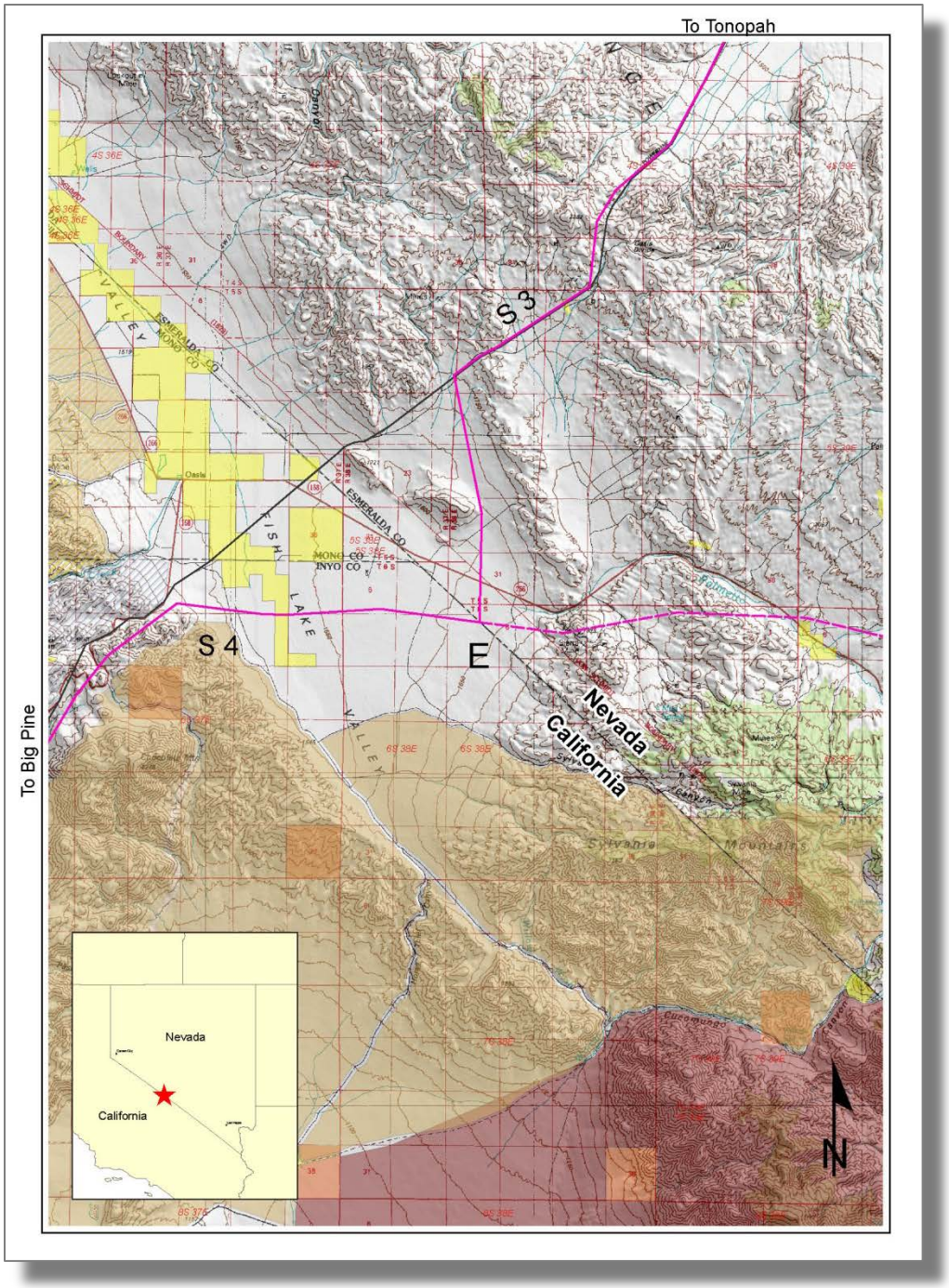

Figure 6.1 – Representation of a Constraints Map (example of South Project at Border)

The following presents the routing analysis that was completed, including considerations and issues that were addressed resulting in the three proposed transmission export projects; and the evaluation matrix that was used to narrow the segment alternatives into the preferred routes.

6.4 ROUTING ANALYSIS

The process of locating transmission access for renewable energy export from the Nevada to the California electric grid began with the identification of all known constraints along the approximately 617-mile border between the two states. The effort required to perform this work is extensive and was discussed in greater detail in Section 6.3, GIS Constraint Mapping. The team's research into the location of available transmission line export corridors along the Nevada-California state line identified several significant constraint issues, which effectively limit the location of transmission export lines. The following *Figure 6.2 – Nevada-California Border Constraints Map*, is a compilation of all the constraints identified within Nevada and California and along the state border that could pose potential impacts to the ultimate routing and permitting of the transmission export projects.

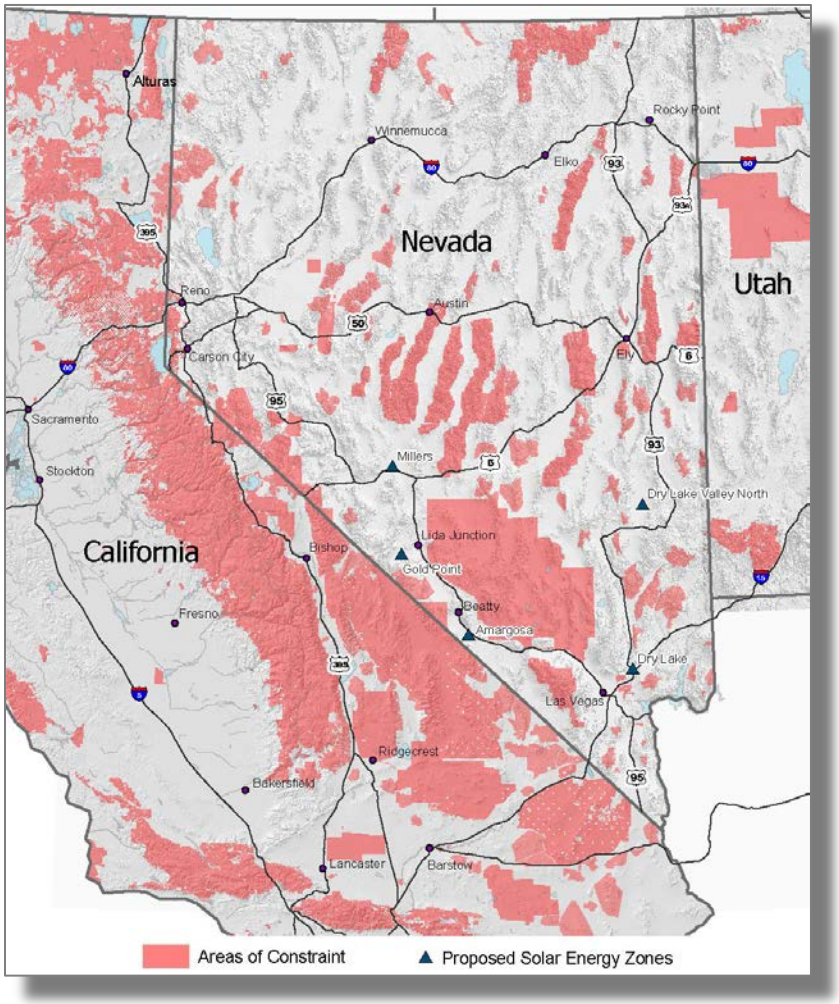

Figure 6.2 – Nevada-California Border Constraints Map

The constraints identified along the Nevada-California border consist of:

- Twelve (12) national forests, resulting in approximately 505 miles of length along the state line, several with contiguous borders.
- Sixteen (16) wilderness/wilderness study areas, resulting in approximately 270 miles of length along the state line.
- Nine (9) national parks/national monuments, which result in approximately 240 miles of length along the state line. The Lake Tahoe Basin is not identified as a national park or monument; however, the 'Basin' is a significant environmental and recreation resource.
- Five (5) military reservations, which result in approximately 145 miles of length along the state line. Three of these are of significant size and are located in the Mohave Desert area of Southern California.
- Eight (8) state game refuges, with approximately 60 miles of length along the state line.
- Eighteen (18) significant mountains and mountain ranges, primarily located on the California side of the state line. A linear mileage count of mountains and mountain ranges that exist along the state line is near impossible to determine by way of mapping. One can see their significance however on the above Figure 17, and on other topographical figures, maps and exhibits throughout the report.

In the initial process of identifying feasible and constructible transmission export routes from Nevada to California, all known possible crossings over the state border from Nevada into California were analyzed. From this evaluation, the team arrived at nine (9) possible ways to route from Nevada to California, one of which does not cross the Nevada-California state border; each is indicated on *Figure 6.3 – Nevada-to-California Preliminary Routes*. These routes were evaluated against the identified constraints – physical, environmental, political, and/or social, as well as the electric grid limitations and opportunities discussed previously in Section 5.

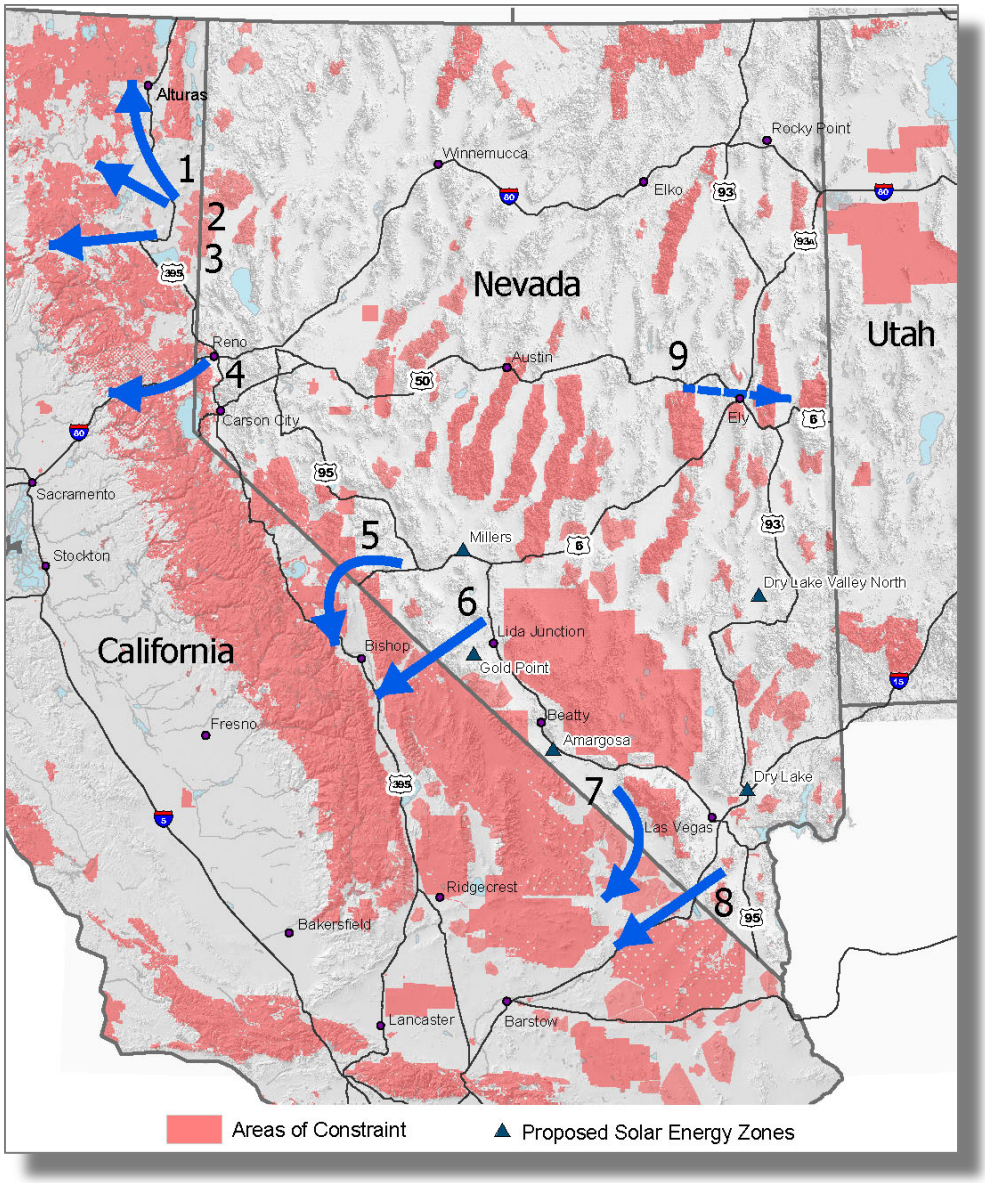

Figure 6.3 – Nevada-to-California Preliminary Routes

Following are the nine (9) route opportunities that were considered and evaluated:

1. The first crossing possibility would utilize the existing NVE 345kV 'Alturas' transmission line that originates at Tracy Power Plant, located east of Reno, Nevada, and terminates at Hilltop Substation, just north of Alturas in northern California. The Alturas Line, and therefore the corridor in which it is located, already connects the NVE system with Bonneville Power Administration in the Modoc County, California area. However, constructing another parallel transmission line within this corridor would not relieve congestion into the Central California grid, due to capacity limitations at Hilltop Substation.

2. The second crossing possibility would also utilize the existing NVE Alturas Line corridor, beginning at a previously proposed new substation, Raven, continuing westward to Round Mountain, California, approximately 30 miles northeast of Redding, California. In 2008 the TANC (Transmission Agency of Northern California) Transmission Plan, consisting of the development of four major high-voltage transmission projects in northern California, was introduced. The backbone of the overall project included two new 500 kV lines (Zeta North and Zeta South) to be constructed, beginning at the proposed Raven Substation and terminating south at Tracy, California. Due to significant opposition from the residents primarily located in Shasta and Tehama Counties, California, the whole project was halted in 2009. As a result, this area is viewed as a limited-viable corridor for new transmission, due to the very strong political and social constraints.
3. The third crossing possibility takes advantage of LMUD's (Lassen Municipal Utility District) planned double-circuit 230kV project, intended to provide an east / west interconnection to accommodate various proposed renewable energy generation projects within LMUD's service territory. The project begins at the proposed Viewland Substation, located approximately 10 miles north of Wendel, California, and terminates in Westwood, California, approximately 20 miles west of Susanville. This route was identified as viable but contingent largely on the LMUD progress with their project.
4. The fourth possibility, the proposed Great Basin underground HVDC project, follows the existing Interstate 80 (I-80) transportation and utility corridor, from the NVE Tracy Power Plant east of Reno, Nevada, through Reno, Truckee, Auburn, Sacramento and Davis, California to the WAPA (Western Area Power Administration) O'Banion Substation, located southwest of Yuba City. This crossing is associated with many difficult environmental constraints, such as the 'scenic corridor' status of Interstate 80, and the protections in place for the Tahoe National Forests. This route could potentially be considered for a future overhead transmission project in the event of the HVDC project not proceeding. In order to not replicate the intended use of the planned HVDC underground project, and in compliance with the contract directive to not duplicate effort, this route was not considered at this time.
5. The fifth possibility for crossing from southern Nevada into California is at Montgomery Pass. This is a crossing near US Highway 6 that makes its way between, though does not cross through, Toiyabe National Forest to the north and Inyo National Forest to the south. This was identified as a strong opportunity for new routing into California.
6. The sixth routing possibility into California traverses the southern Nevada-California border via Fish Lake Valley and Deep Springs Valley. Upon entering California, the

opportunity continues in a southeasterly direction to Big Pine, California. This crossing was also considered a strong opportunity for this project.

7. Crossing possibility seven which begins in Pahrump, Nevada and terminates in southern California was found to be constrained by a number of established BLM Wilderness and Wilderness Study Areas. For this reason, this crossing and route was determined to have limited feasibility.
8. The eighth crossing possibility that was identified during this project would utilize the AC/DC power line corridor, beginning at the Eldorado Substation located south of Boulder City, Nevada. This crossing/route possibility is already greatly constrained in terms of available electrical capacity, and therefore was not determined to be a feasible opportunity for this project.
9. The ninth and final possibility evaluated for getting from Nevada to California utilizes an existing transmission corridor from eastern Nevada to the Intermountain Power Project (IPP) in central Utah. From this point, Southern California is accessed by way of the existing AC/DC power line corridor. While this route is constrained as discussed in opportunity 8 above, there was consideration in that by heading east to reach this AC/DC corridor, a route could be established that would avoid all the physical congestion in and around the Eldorado Substation, but could potentially take advantage of available capacity that is freed up from reduced sales of coal generated power. Therefore, this option was established as viable.

From the preliminary evaluation, the team narrowed the focus to crossings at locations 3, 5, 6 and 9 from the above discussion. The following discussion details these route evaluations as the East Route, North Route, and South Route. As discussed in Section 5, these three routes were also evaluated in regard to potential impacts to these projects both with and without the NVE RTI effort. These routes, along with all associated route alternatives, and supplemental routing required in the absence of the NVE RTI are presented in *Figure 6.4 – Routing Alternatives and Line Segments*. Each route is broken into line segments which were used for the ultimate matrix evaluation of the route options and selection of the final preferred route.

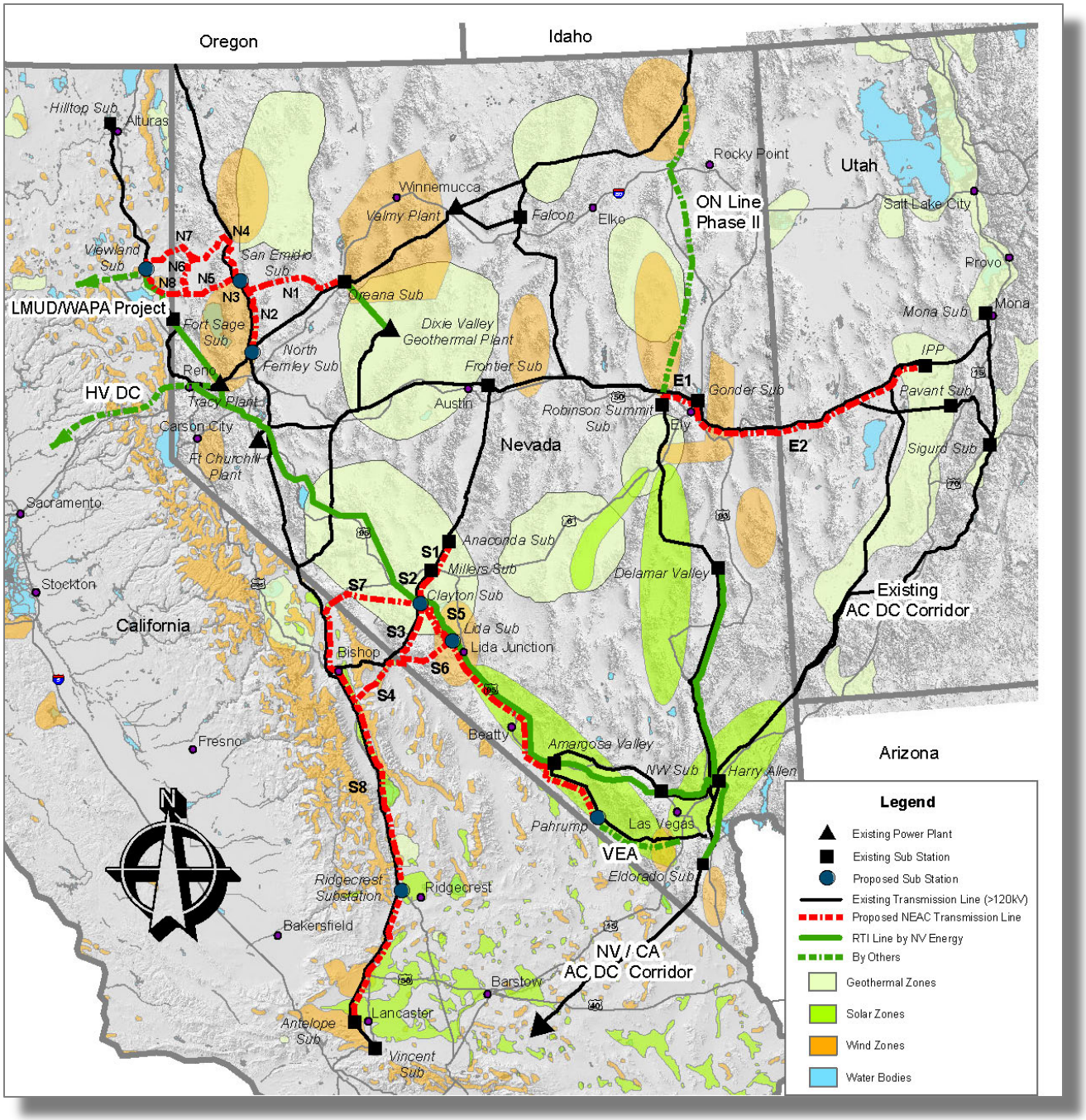

Figure 6.4 – Routing Alternatives and Line Segments

6.5 ROUTE SUMMARIES

6.5.1 North Route Details

The North Route provides interconnection into California by way of a 345kV line from NV Energy's Oreana Substation or a new substation at North Fernley to a new substation north of the Sierra Army Depot in Herlong, California.

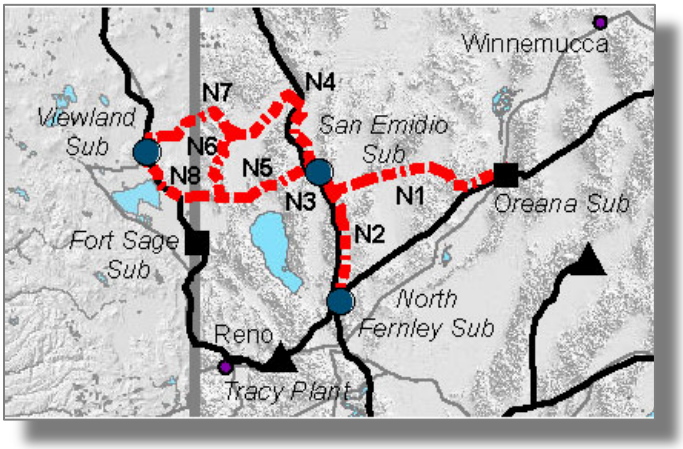

Figure 6.5 – North Route with Line Segments

6.5.2 East Route Details

The East Route, which could be either 345kV or 500kV, provides interconnection into the California market by connecting NV Energy's Robinson Summit Substation to IPP, thereby connecting into the AC/DC north-south corridor to southern California.

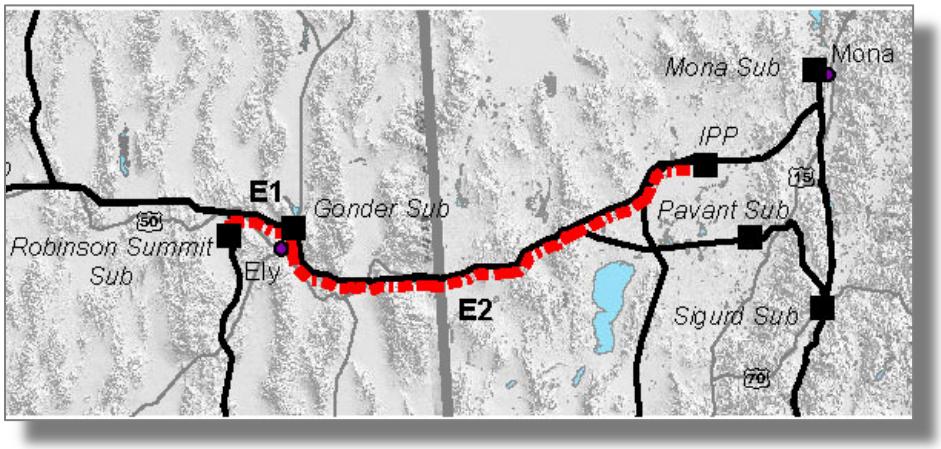

Figure 6.6 – East Route with Line Segments

6.5.3 South Route Details

The South Route, proposed to be 500kV, provides interconnection into the California Market at the CAISO operated Antelope Substation, located in Lancaster, Southern California. This route has several identified alternatives and is shown in *Figure 6.7 – South Route with Line Segments*.

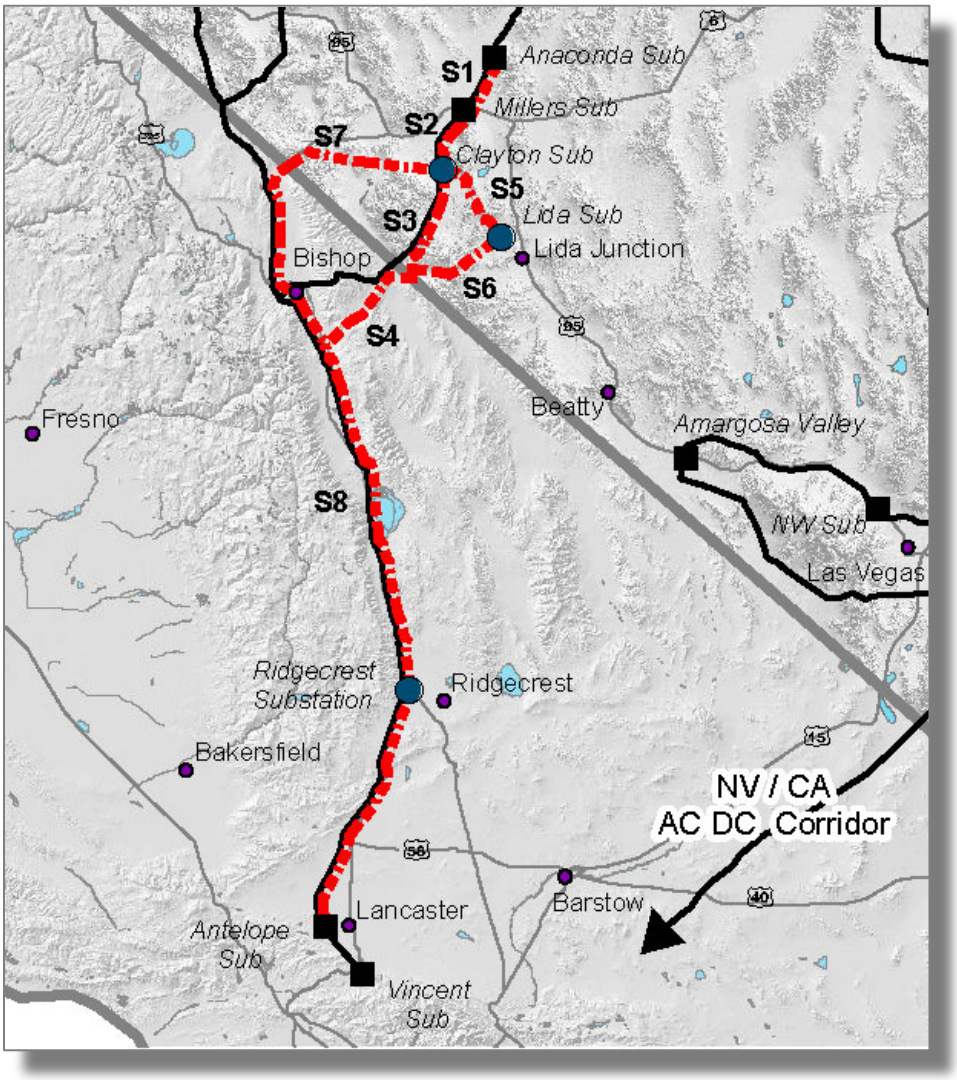

Figure 6.7 – South Route with Line Segments

6.6 EVALUATION MATRIX

Each of the constraints listed in Section 6.2 are critical for transmission line routing. To capture each of these constraints, they were quantified from the GIS database and input to an evaluation matrix as discussed in Section 6.3. The various line segments were combined into route options for evaluation against each other in order to select the preferred route.

The score derived for each route option indicates the level of difficulty associated with completing the project. A normal weighted score of 100 was assigned and based on the associated constraints; the score for a specific route was calculated. For example, a line route alternative that crosses a section of wetlands would receive a lower score than one that does not cross a wetland. Every effort was made to make the scores objective rather than subjective such that they are all based on quantifiable data and calculations.

The evaluation matrix was weighted by three major criteria (Permitting, Right of Way Acquisition, and Constructability) and each route alternative was scored based on the GIS data in accordance with the following discussion.

6.6.1 Permitting

Permitting is considered the most critical component for evaluating the viability of a project. A project that cannot be permitted cannot be built. For this reason, permitting was given 50% of the weight in the constraint evaluation matrix. The line routes were selected such that they are all considered permitable, but some impact various constraints more than others and the matrix provides a quantifiable method of comparing the various alternatives.

The constraints that make up the permitting criteria are Wilderness Areas and Wilderness Study Areas, Fish & Game Critical Habitat, Herd Management Areas, Wetlands, and Areas of Critical Environmental Concern. Each of these constraints was given equal weighting (considered equally important) and their raw score was based on the area (acres) impacted by the line route. An additional factor for CEQA permitting was also included in this category but was given a smaller weighting in recognition that many of the same environmental issues drive the NEPA and CEQA permitting processes.

6.6.2 Right-of-Way Acquisition

Right of Way Acquisition was given a lower weighting than Permitting (30%) given that issues associated with right of way acquisition can be resolved through negotiation, minor reroutes or design modifications, or, as a last resort, condemnation if the right of eminent domain is available to the ultimate project owner.

The constraints associated with right of way acquisition are based on land status. Private land and Bureau of Indian Affairs (BIA) land were given the highest weighting in recognition that they are normally the most difficult to negotiate. State and Military land were given a lesser weighting and Crossings (the acquisition of crossing permits) were given the least weighting. Scoring was based on the area (acres) of land impacted.

6.6.3 Constructability

Constructability was given the lowest weighting (20%) in recognition that the routing was completed such that all of the routes were chosen with constructability in mind and any issues encountered can be dealt with through thoughtful engineering.

The constraints associated with Constructability are physical in nature. Existing Access and Slope were given the highest weightings based on potential long term impacts to the environment. Wetlands were also given a higher weighting to account for any special construction techniques that may be required in these areas. Vegetation and Stream Crossings were assigned a slightly lesser rating given that impacts will be mitigated during construction and restoration activities would be required.

6.6.4 Matrix Evaluation Results

The evaluation matrix results for the preferred route options are summarized in *Table 6.1 –* Evaluation *Matrix Preferred Routes Summary*. Detailed results for each of the route options considered are included in subsequent Tables 6.2 to 6.6. These Tables can be found at the end of the Section. As previously discussed, the route option receiving the highest score for the project alternative being considered became the preferred option.

For the North Project, the preferred route is Option 3 with Oreana as the beginning terminus, as discussed in Section 5. This route is made up of Segments N1+N3+N5+N8 as shown in Figure 6.8 – Preferred North Route (Project).

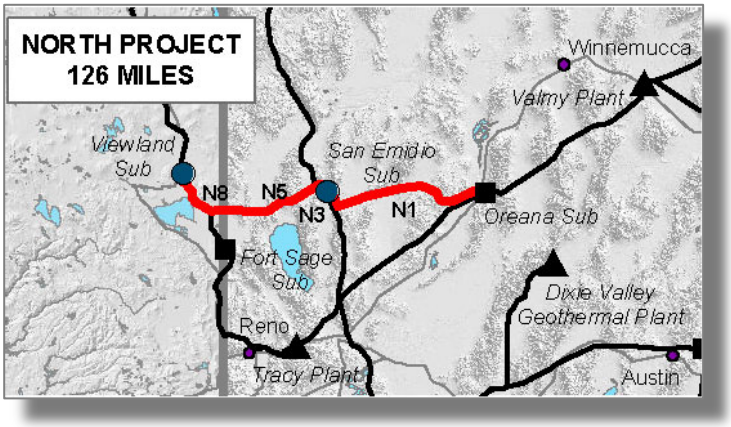

Figure 6.8 – Preferred North Route (Project)

If North Fernley had been the preferred beginning terminus, Option 7 would have been the preferred route. This route is made up of Segments N2+N3+N5+N8 (not shown).

For the East Project, the preferred alternative is either Option 9 or Option 10, depending on the voltage of the line, as discussed in Section 5. Both of these Options are made up of Segments E1+E2, as shown in *Figure 6.9 – Preferred East Route (Project)*.

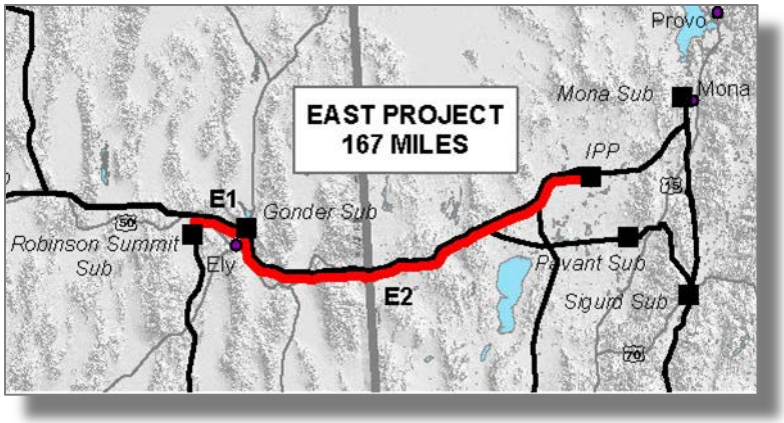

Figure 6.9 – Preferred East Route (Project)

Without the RTI, the South Project would begin at Anaconda Substation with a 230 kV extension to Clayton Substation and then continue to Antelope Substation at 500 kV. As such, Options 12 and 13 combine to make up the preferred South Project. This route is made up of Segments S1+S2+S3+S4+S8, as shown in Figure *6.10 – Preferred South Route (Project)*.

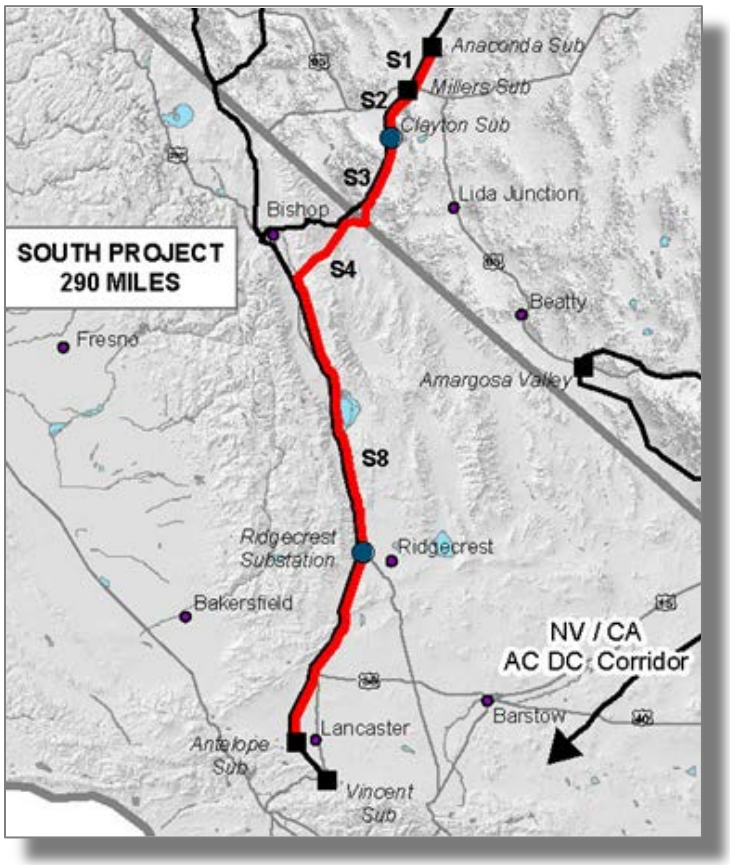

Figure 6.10 – Preferred South Route (Project)

If the RTI is built, the South Project would extend from either Clayton (Option 13) or Lida Substation (Option 17) to Antelope Substation at 500 kV. Note that, with the RTI in place, Options 18 and 19 are eliminated from consideration as Segment S5 would be unnecessary. From a transmission only point of view, Options 13 (Segments S3+S4+S8, from Clayton to Antelope) and 17 (Segments S6+S4+S8, from Lida to Antelope) are essentially the same cost; though Option 13 would be preferred from an evaluation matrix weighting standpoint. However, when the substation costs are added in, as discussed in Section 5, Option 17 is much less expensive and Lida Substation was chosen as the preferred starting point for this project alternative, as shown in *Figure 6.11 – South Route Alternative without RTI but with VEA Project*. Once this project moves forward and into the NEPA process, coordination with NV Energy would be critical in establishing the beginning terminus of the line, and Option 13 would remain in consideration as an alternative requiring further investigation.

For the South Alternate Project, Clayton Substation to Pahrump, also discussed in Section 5, Option 16 is the preferred route. This route is shown on *Figure 6.11* as well.

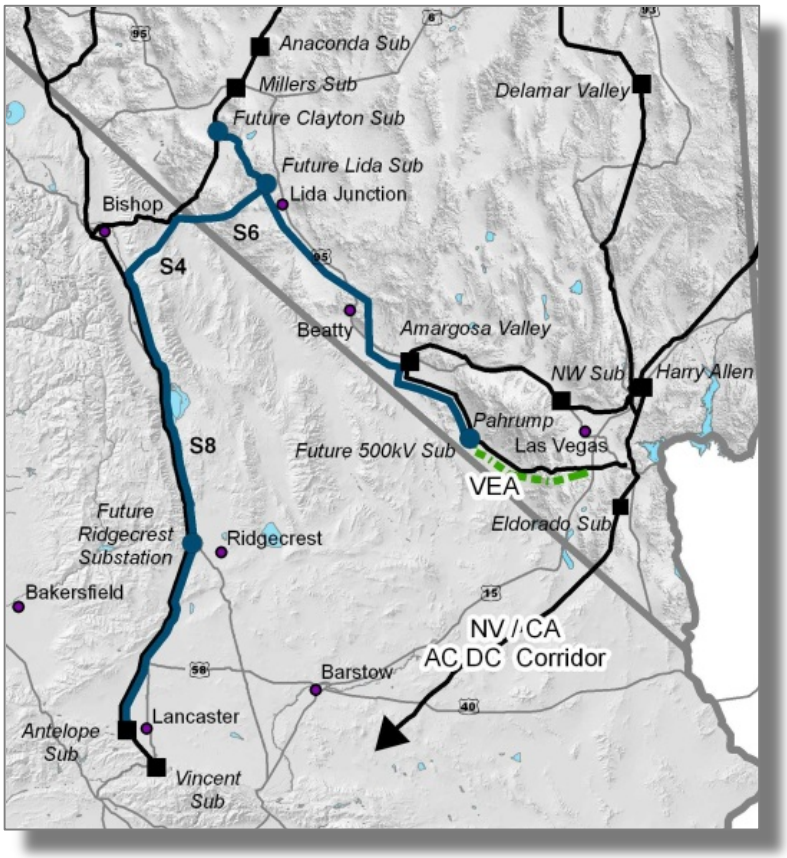

Figure 6.11 – South Route Alternative without RTI but with VEA Project

Option	Voltage	Route Segments	Line Terminals	Total Mileage	Total Transmission Cost[1]	Total Transmission Cost/Mile[1]	Weighted Score
North Project:							
3	345 kV	N1+N3+N5+N8	Oreana - Viewland	126	$172,880,000	$1,372,000	66.4
7	345 kV	N2+N3+N5+N8	Fernley - Viewland	101	$140,940,000	$1,395,000	68.7
East Project:							
9	345 kV	E1+E2 (345)	Robinson - IPP	167	$207,870,000	$1,245,000	84.1
10	500 kV	E1+E2 (500)	Robinson - IPP	167	$303,840,000	$1,819,000	78.1
South Project - Without RTI:							
12	230 kV	S1+S2	Anaconda - Clayton	37	$20,840,000	$563,000	99.0
13	500 kV	S3+S4+S8	Clayton - Antelope	253	$476,120,000	$1,882,000	52.1
South Project - Alternate:							
16	500 kV	S5+SE	Clayton - Pahrump	174	$299,790,000	$1,723,000	86.6
South Project - With RTI:							
17	500 kV	S4+S6+S8	Lida - Anelope	251	$476,230,000	$1,897,000	45.0

[1] *Costs are rounded*

Table 6.1 – Evaluation Matrix Preferred Routes Summary

Scoring Criteria	Scoring Methodology	Weight Max	North Project Option Scores - From Oreana							
			1		2		3		4	
			N1+N3+N4+N7		*N1+N3+N4+N6+N8*		*N1+N3+N5+N8*		*N1+N3+N5+N6+N7*	
			Raw	Weighted	Raw	Weighted	Raw	Weighted	Raw	Weighted
Permitting	Sum of the following five criteria scores:	50%	42.0	21.0	44.3	22.2	77.9	39.0	57.2	28.6
WA's and WSA's	Raw Score = Max Score * (1 - (Route Length within 1/2 mile of WA's or WSA's) / (Maximum Route Length within 1/2 mile of WA's or WSA's))	18	0.0	0.0	2.4	1.2	13.3	6.7	6.0	3.0
Fish & Game Critical Habitat	Raw Score = Max Score * (1 - (Route Area crossing Fish and Game Habitat) / (Maximum Route Area crossing Fish and Game Habitat))	18	12.4	6.2	12.7	6.3	14.7	7.3	9.8	4.9
Herd Management Areas	Raw Score = Max Score * (1 - (Route Area crossing Herd Management Areas) / (Maximum Route Area crossing Herd Management Areas))	18	2.3	1.2	2.6	1.3	8.1	4.1	0.6	0.3
Wetlands	Raw Score = Max Score * (1 - (Route Area crossing Wetlands) / (Maximum Route Area crossing Wetlands))	18	0.0	0.0	0.3	0.2	14.6	7.3	14.3	7.2
ACEC - Area of Critical Environmental Concern	Raw Score = Max Score * (1 - (Route Area crossing Areas of Critical Env. Concern) / (Maximum Route Area crossing Areas of Critical Env. Concern))	18	18.0	9.0	17.2	8.6	18.0	9.0	17.2	8.6
Additional CEQA Considerations	Raw Score = Max Score * (1 - (Route Length in California) / (Maximum Route Length in California))	10	9.3	4.6	9.1	4.6	9.1	4.6	9.3	4.6
R/W Acquisition	Sum of the following five criteria scores:	30%	90.0	27.0	70.4	21.1	41.9	12.6	58.9	17.7
Private Land	Raw Score = Max Score * (1 - (Route Area crossing Private Land) / (Maximum Route Area crossing Private Land))	35	26.6	8.0	22.2	6.7	23.5	7.1	25.5	7.6
State & Local Land	Raw Score = Max Score * (1 - (Route Area crossing State Land) / (Maximum Route Area crossing State Land))	15	15.0	4.5	14.9	4.5	14.9	4.5	15.0	4.5
Military Land	Raw Score = Max Score * (1 - (Route Area crossing Military Land) / (Maximum Route Area crossing Military Land))	15	15.0	4.5	0.0	0.0	0.0	0.0	15.0	4.5
BIA Land	Raw Score = Max Score * (1 - (Route Area crossing BIA Land) / (Maximum Route Area crossing BIA Land))	30	30.0	9.0	30.0	9.0	0.0	0.0	0.0	0.0
Crossings	Raw Score = Max Score * (1- (Route # of Crossings) / (Maximum Route # of Crossings))	5	3.4	1.0	3.3	1.0	3.5	1.0	3.4	1.0
Constructability	Sum of the following five criteria scores:	20%	53.9	10.8	51.7	10.3	74.4	14.9	69.6	13.9
Existing Access	Raw Score = Max Score * (1 - (Route Length @ Poor + 0.5 * Route Length @ Good) / (Max Route Length @ Poor + 0.5 * Route Length @ Good))	30	14.1	2.8	11.4	2.3	15.2	3.0	13.5	2.7
Slope	Raw Score = Max Score * (1 - (Route Area > 9% Slope) / (Maximum Route Area > 9% Slope))	25	17.3	3.5	16.2	3.2	19.2	3.8	17.7	3.5
Stream Crossings	Raw Score = Max Score * (1- (Route # of Stream Crossings) / Maximum # of Stream Crossings))	10	7.5	1.5	8.8	1.8	8.8	1.8	7.5	1.5
Vegetation	Raw Score = Max Score * (1 - (Route Area crossing Forest Vegetation) / (Maximum Route Area crossing Forest Vegetation))	15	15.0	3.0	15.0	3.0	15.0	3.0	15.0	3.0
Wetlands	Raw Score = Max Score * (1 - (Route Area crossing Wetlands) / (Maximum Route Area crossing Wetlands))	20	0.0	0.0	0.3	0.1	16.3	3.3	15.9	3.2
Total Score		300	186.0	58.8	166.5	53.6	194.2	66.4	185.7	60.2

Table 6.2 – Evaluation Matrix – North Project Options – From Oreana

Scoring Criteria	Scoring Methodology	Weight Max	North Project Option Scores - From Fernley							
			5		6		7		8	
			N2+N3+N4+N7		*N2+N3+N4+N6+N8*		*N2+N3+N5+N8*		*N2+N3+N5+N6+N7*	
			Raw	Weighted	Raw	Weighted	Raw	Weighted	Raw	Weighted
Permitting	Sum of the following five criteria scores:	50%	41.1	20.6	43.4	21.7	77.0	38.5	56.3	28.1
WA's and WSA's	Raw Score = Max Score * (1 - (Route Length within 1/2 mile of WA's or WSA's) / (Maximum Route Length within 1/2 mile of WA's or WSA's))	18	0.0	0.0	2.4	1.2	13.3	6.7	6.0	3.0
Fish & Game Critical Habitat	Raw Score = Max Score * (1 - (Route Area crossing Fish and Game Habitat) / (Maximum Route Area crossing Fish and Game Habitat))	18	11.3	5.6	11.5	5.8	13.5	6.8	8.6	4.3
Herd Management Areas	Raw Score = Max Score * (1 - (Route Area crossing Herd Management Areas) / (Maximum Route Area crossing Herd Management Areas))	18	1.8	0.9	2.0	1.0	7.6	3.8	0.0	0.0
Wetlands	Raw Score = Max Score * (1 - (Route Area crossing Wetlands) / (Maximum Route Area crossing Wetlands))	18	0.8	0.4	1.1	0.6	15.5	7.7	15.2	7.6
ACEC - Area of Critical Environmental Concern	Raw Score = Max Score * (1 - (Route Area crossing Areas of Critical Env. Concern) / (Maximum Route Area crossing Areas of Critical Env. Concern))	18	18.0	9.0	17.2	8.6	18.0	9.0	17.2	8.6
Additional CEQA Considerations	Raw Score = Max Score * (1 - (Route Length in California) / (Maximum Route Length in California))	10	9.3	4.6	9.1	4.6	9.1	4.6	9.3	4.6
R/W Acquisition	Sum of the following five criteria scores:	30%	94.2	28.3	74.6	22.4	46.0	13.8	63.0	18.9
Private Land	Raw Score = Max Score * (1 - (Route Area crossing Private Land) / (Maximum Route Area crossing Private Land))	35	30.4	9.1	26.0	7.8	27.3	8.2	29.2	8.8
State & Local Land	Raw Score = Max Score * (1 - (Route Area crossing State Land) / (Maximum Route Area crossing State Land))	15	15.0	4.5	14.9	4.5	14.9	4.5	15.0	4.5
Military Land	Raw Score = Max Score * (1 - (Route Area crossing Military Land) / (Maximum Route Area crossing Military Land))	15	15.0	4.5	0.0	0.0	0.0	0.0	15.0	4.5
BIA Land	Raw Score = Max Score * (1 - (Route Area crossing BIA Land) / (Maximum Route Area crossing BIA Land))	30	30.0	9.0	30.0	9.0	0.0	0.0	0.0	0.0
Crossings	Raw Score = Max Score * (1- (Route # of Crossings) / (Maximum Route # of Crossings))	5	3.8	1.1	3.8	1.1	3.9	1.2	3.8	1.1
Constructability	Sum of the following five criteria scores:	20%	61.4	12.3	59.2	11.8	81.9	16.4	77.1	15.4
Existing Access	Raw Score = Max Score * (1 - (Route Length @ Poor + 0.5 * Route Length @ Good) / (Max Route Length @ Poor + 0.5 * Route Length @ Good))	30	17.8	3.6	15.1	3.0	18.8	3.8	17.2	3.4
Slope	Raw Score = Max Score * (1 - (Route Area > 9% Slope) / (Maximum Route Area > 9% Slope))	25	19.0	3.8	17.9	3.6	20.9	4.2	19.3	3.9
Stream Crossings	Raw Score = Max Score * (1- (Route # of Stream Crossings) / Maximum # of Stream Crossings))	10	8.8	1.8	10.0	2.0	10.0	2.0	8.8	1.8
Vegetation	Raw Score = Max Score * (1 - (Route Area crossing Forest Vegetation) / (Maximum Route Area crossing Forest Vegetation))	15	15.0	3.0	15.0	3.0	15.0	3.0	15.0	3.0
Wetlands	Raw Score = Max Score * (1 - (Route Area crossing Wetlands) / (Maximum Route Area crossing Wetlands))	20	0.9	0.2	1.2	0.2	17.2	3.4	16.8	3.4
Total Score		300	196.7	61.1	177.2	55.9	204.9	68.7	196.4	62.5

Table 6.3 – Evaluation Matrix – North Project Options – From North Fernley

Scoring Criteria	Scoring Methodology	Weight Max	East Project Option Scores - From Robinson				IPP - Mona	
			9		10		11	
			E1+E2 (345)		*E1+E2 (500)*		*E3 (345)*	
			Raw	Weighted	Raw	Weighted	Raw	Weighted
Permitting	Sum of the following five criteria scores:	50%	86.4	43.2	79.9	40.0	99.2	49.6
WA's and WSA's	Raw Score = Max Score * (1 - (Route Length within 1/2 mile of WA's or WSA's) / (Maximum Route Length within 1/2 mile of WA's or WSA's))	18	15.9	8.0	15.9	8.0	18.0	9.0
Fish & Game Critical Habitat	Raw Score = Max Score * (1 - (Route Area crossing Fish and Game Habitat) / (Maximum Route Area crossing Fish and Game Habitat))	18	6.5	3.2	0.0	0.0	17.2	8.6
Herd Management Areas	Raw Score = Max Score * (1 - (Route Area crossing Herd Management Areas) / (Maximum Route Area crossing Herd Management Areas))	18	18.0	9.0	18.0	9.0	18.0	9.0
Wetlands	Raw Score = Max Score * (1 - (Route Area crossing Wetlands) / (Maximum Route Area crossing Wetlands))	18	18.0	9.0	18.0	9.0	18.0	9.0
ACEC - Area of Critical Environmental Concern	Raw Score = Max Score * (1 - (Route Area crossing Areas of Critical Env. Concern) / (Maximum Route Area crossing Areas of Critical Env. Concern))	18	18.0	9.0	18.0	9.0	18.0	9.0
Additional CEQA Considerations	Raw Score = Max Score * (1 - (Route Length in California) / (Maximum Route Length in California))	10	10.0	5.0	10.0	5.0	10.0	5.0
R/W Acquisition	Sum of the following five criteria scores:	30%	93.2	28.0	90.6	27.2	88.9	26.7
Private Land	Raw Score = Max Score * (1 - (Route Area crossing Private Land) / (Maximum Route Area crossing Private Land))	35	32.1	9.6	30.4	9.1	26.4	7.9
State & Local Land	Raw Score = Max Score * (1 - (Route Area crossing State Land) / (Maximum Route Area crossing State Land))	15	13.2	4.0	12.2	3.7	13.6	4.1
Military Land	Raw Score = Max Score * (1 - (Route Area crossing Military Land) / (Maximum Route Area crossing Military Land))	15	15.0	4.5	15.0	4.5	15.0	4.5
BIA Land	Raw Score = Max Score * (1 - (Route Area crossing BIA Land) / (Maximum Route Area crossing BIA Land))	30	30.0	9.0	30.0	9.0	30.0	9.0
Crossings	Raw Score = Max Score * (1- (Route # of Crossings) / (Maximum Route # of Crossings))	5	3.0	0.9	3.0	0.9	4.0	1.2
Constructability	Sum of the following five criteria scores:	20%	64.5	12.9	54.6	10.9	86.6	17.3
Existing Access	Raw Score = Max Score * (1 - (Route Length @ Poor + 0.5 * Route Length @ Good) / (Max Route Length @ Poor + 0.5 * Route Length @ Good))	30	16.7	3.3	16.7	3.3	25.3	5.1
Slope	Raw Score = Max Score * (1 - (Route Area > 9% Slope) / (Maximum Route Area > 9% Slope))	25	17.0	3.4	12.5	2.5	22.5	4.5
Stream Crossings	Raw Score = Max Score * (1- (Route # of Stream Crossings) / Maximum # of Stream Crossings))	10	5.4	1.1	5.4	1.1	8.8	1.8
Vegetation	Raw Score = Max Score * (1 - (Route Area crossing Forest Vegetation) / (Maximum Route Area crossing Forest Vegetation))	15	5.4	1.1	0.0	0.0	10.1	2.0
Wetlands	Raw Score = Max Score * (1 - (Route Area crossing Wetlands) / (Maximum Route Area crossing Wetlands))	20	20.0	4.0	20.0	4.0	20.0	4.0
Total Score		300	244.2	84.1	225.2	78.1	274.8	93.6

Table 6.4 – Evaluation Matrix – East Project Options

Scoring Criteria	Scoring Methodology	Weight Max	Anaconda - Clayton		South Project Option Scores - From Clayton					
			12		13		14		15	
			S1+S2		*S3+S4+S8*		*S4+S5+S6+S8*		*S7+S8*	
			Raw	Weighted	Raw	Weighted	Raw	Weighted	Raw	Weighted
Permitting	Sum of the following five criteria scores:	50%	99.9	49.9	59.8	29.9	50.2	25.1	52.3	26.1
WA's and WSA's	Raw Score = Max Score * (1 - (Route Length within 1/2 mile of WA's or WSA's) / (Maximum Route Length within 1/2 mile of WA's or WSA's))	18	18.0	9.0	14.8	7.4	14.8	7.4	16.7	8.4
Fish & Game Critical Habitat	Raw Score = Max Score * (1 - (Route Area crossing Fish and Game Habitat) / (Maximum Route Area crossing Fish and Game Habitat))	18	18.0	9.0	17.4	8.7	13.6	6.8	9.5	4.8
Herd Management Areas	Raw Score = Max Score * (1 - (Route Area crossing Herd Management Areas) / (Maximum Route Area crossing Herd Management Areas))	18	17.9	8.9	12.8	6.4	7.1	3.5	13.6	6.8
Wetlands	Raw Score = Max Score * (1 - (Route Area crossing Wetlands) / (Maximum Route Area crossing Wetlands))	18	18.0	9.0	13.0	6.5	13.0	6.5	12.4	6.2
ACEC - Area of Critical Environmental Concern	Raw Score = Max Score * (1 - (Route Area crossing Areas of Critical Env. Concern) / (Maximum Route Area crossing Areas of Critical Env. Concern))	18	18.0	9.0	0.7	0.4	0.7	0.4	0.0	0.0
Additional CEQA Considerations	Raw Score = Max Score * (1 - (Route Length in California) / (Maximum Route Length in California))	10	10.0	5.0	1.1	0.5	1.1	0.5	0.0	0.0
R/W Acquisition	Sum of the following five criteria scores:	30%	99.4	29.8	47.5	14.2	39.0	11.7	44.0	13.2
Private Land	Raw Score = Max Score * (1 - (Route Area crossing Private Land) / (Maximum Route Area crossing Private Land))	35	34.7	10.4	0.0	0.0	0.5	0.1	1.0	0.3
State & Local Land	Raw Score = Max Score * (1 - (Route Area crossing State Land) / (Maximum Route Area crossing State Land))	15	15.0	4.5	4.3	1.3	4.3	1.3	0.0	0.0
Military Land	Raw Score = Max Score * (1 - (Route Area crossing Military Land) / (Maximum Route Area crossing Military Land))	15	15.0	4.5	12.9	3.9	12.9	3.9	12.9	3.9
BIA Land	Raw Score = Max Score * (1 - (Route Area crossing BIA Land) / (Maximum Route Area crossing BIA Land))	30	30.0	9.0	30.0	9.0	20.5	6.2	30.0	9.0
Crossings	Raw Score = Max Score * (1- (Route # of Crossings) / (Maximum Route # of Crossings))	5	4.7	1.4	0.3	0.1	0.8	0.3	0.1	0.0
Constructability	Sum of the following five criteria scores:	20%	96.2	19.2	40.0	8.0	27.7	5.5	27.4	5.5
Existing Access	Raw Score = Max Score * (1 - (Route Length @ Poor + 0.5 * Route Length @ Good) / (Max Route Length @ Poor + 0.5 * Route Length @ Good))	30	27.2	5.4	7.3	1.5	4.8	1.0	2.7	0.5
Slope	Raw Score = Max Score * (1 - (Route Area > 9% Slope) / (Maximum Route Area > 9% Slope))	25	24.0	4.8	4.4	0.9	3.5	0.7	2.0	0.4
Stream Crossings	Raw Score = Max Score * (1- (Route # of Stream Crossings) / Maximum # of Stream Crossings))	10	10.0	2.0	2.1	0.4	2.1	0.4	0.0	0.0
Vegetation	Raw Score = Max Score * (1 - (Route Area crossing Forest Vegetation) / (Maximum Route Area crossing Forest Vegetation))	15	15.0	3.0	11.8	2.4	2.9	0.6	8.9	1.8
Wetlands	Raw Score = Max Score * (1 - (Route Area crossing Wetlands) / (Maximum Route Area crossing Wetlands))	20	20.0	4.0	14.4	2.9	14.4	2.9	13.8	2.8
Total Score		300	295.5	99.0	147.3	52.1	116.9	42.3	123.6	44.8

Table 6.5 – Evaluation Matrix – South Project Options – From Clayton

Scoring Criteria	Scoring Methodology	Weight Max	Alternate 16 S5+SE		South Project Option Scores - From Lida 17 S4+S6+S8		18 S3+S4+S5+S8		19 S5+S7+S8	
			Raw	Weighted	Raw	Weighted	Raw	Weighted	Raw	Weighted
Permitting	Sum of the following five criteria scores:	50%	96.5	48.3	53.7	26.8	56.3	28.2	48.8	24.4
WA's and WSA's	Raw Score = Max Score * (1 - (Route Length within 1/2 mile of WA's or WSA's) / (Maximum Route Length within 1/2 mile of WA's or WSA's))	18	18.0	9.0	14.8	7.4	14.8	7.4	16.7	8.4
Fish & Game Critical Habitat	Raw Score = Max Score * (1 - (Route Area crossing Fish and Game Habitat) / (Maximum Route Area crossing Fish and Game Habitat))	18	18.0	9.0	13.6	6.8	17.4	8.7	9.5	4.8
Herd Management Areas	Raw Score = Max Score * (1 - (Route Area crossing Herd Management Areas) / (Maximum Route Area crossing Herd Management Areas))	18	14.5	7.3	10.5	5.3	9.4	4.7	10.1	5.0
Wetlands	Raw Score = Max Score * (1 - (Route Area crossing Wetlands) / (Maximum Route Area crossing Wetlands))	18	18.0	9.0	13.0	6.5	13.0	6.5	12.4	6.2
ACEC - Area of Critical Environmental Concern	Raw Score = Max Score * (1 - (Route Area crossing Areas of Critical Env. Concern) / (Maximum Route Area crossing Areas of Critical Env. Concern))	18	18.0	9.0	0.7	0.4	0.7	0.4	0.0	0.0
Additional CEQA Considerations	Raw Score = Max Score * (1 - (Route Length in California) / (Maximum Route Length in California))	10	10.0	5.0	1.1	0.5	1.1	0.5	0.0	0.0
R/W Acquisition	Sum of the following five criteria scores:	30%	86.9	26.1	39.1	11.7	47.4	14.2	43.9	13.2
Private Land	Raw Score = Max Score * (1 - (Route Area crossing Private Land) / (Maximum Route Area crossing Private Land))	35	29.8	8.9	0.5	0.1	0.0	0.0	1.0	0.3
State & Local Land	Raw Score = Max Score * (1 - (Route Area crossing State Land) / (Maximum Route Area crossing State Land))	15	15.0	4.5	4.3	1.3	4.3	1.3	0.0	0.0
Military Land	Raw Score = Max Score * (1 - (Route Area crossing Military Land) / (Maximum Route Area crossing Military Land))	15	15.0	4.5	12.9	3.9	12.9	3.9	12.9	3.9
BIA Land	Raw Score = Max Score * (1 - (Route Area crossing BIA Land) / (Maximum Route Area crossing BIA Land))	30	24.8	7.4	20.5	6.2	30.0	9.0	30.0	9.0
Crossings	Raw Score = Max Score * (1- (Route # of Crossings) / (Maximum Route # of Crossings))	5	2.4	0.7	0.9	0.3	0.2	0.1	0.0	0.0
Constructability	Sum of the following five criteria scores:	20%	61.2	12.2	32.4	6.5	35.3	7.1	22.7	4.5
Existing Access	Raw Score = Max Score * (1 - (Route Length @ Poor + 0.5 * Route Length @ Good) / (Max Route Length @ Poor + 0.5 * Route Length @ Good))	30	11.4	2.3	7.5	1.5	4.6	0.9	0.0	0.0
Slope	Raw Score = Max Score * (1 - (Route Area > 9% Slope) / (Maximum Route Area > 9% Slope))	25	9.4	1.9	5.5	1.1	2.5	0.5	0.0	0.0
Stream Crossings	Raw Score = Max Score * (1- (Route # of Stream Crossings) / Maximum # of Stream Crossings))	10	5.4	1.1	2.1	0.4	2.1	0.4	0.0	0.0
Vegetation	Raw Score = Max Score * (1 - (Route Area crossing Forest Vegetation) / (Maximum Route Area crossing Forest Vegetation))	15	15.0	3.0	2.9	0.6	11.8	2.4	8.9	1.8
Wetlands	Raw Score = Max Score * (1 - (Route Area crossing Wetlands) / (Maximum Route Area crossing Wetlands))	20	20.0	4.0	14.4	2.9	14.4	2.9	13.8	2.8
Total Score		300	244.6	86.6	125.1	45.0	139.1	49.5	115.4	42.1

Table 6.6 – Evaluation Matrix – South Project Options – From Lida