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PRELIMINARY RAIL ACCESS STUDY

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JANUARY 1990

UNITED STATES DEPARTMENT OF ENERGY
NEVADA OPERATIONS OFFICE/YUCCA MOUNTAIN PROJECT OFFICE

PRELIMINARY RAIL ACCESS STUDY

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PRELIMINARY RAIL ACCESS STUDY

EXECUTIVE SUMMARY

The Yucca Mountain site, located on the southwestern edge of the Nevada Test Site (NTS), is an undeveloped area under investigation as a potential site for nuclear waste disposal by the U.S. Department of Energy (DOE). The site currently lacks rail service or an existing right-of-way. If the site is suitable and selected for development as a disposal site, rail service is desirable to the Office of Civilian Radioactive Waste Management (OCRWM) Program because of the potential of rail transportation to reduce costs relative to highway transportation (DOE, 1986, Appendix A).

Routes described here do not represent the DOE selection of routes. The DOE recognizes that transportation issues, including routing, will need a full and open treatment under requirements of the National Environmental Policy Act. This means that the issue of transportation will be included in public hearings to support development of an Environmental Impact Statement for the Yucca Mountain Project. This study was completed as part of DOE activities to evaluate options for addressing, as appropriate, the effects of waste transportation.

Ten rail options were identified in DOE rail access investigations to date. Alternatives within each major option were also developed wherever possible. These options were developed to conform to standard railroad engineering practices and avoidance of obvious land use conflicts. Each option was then evaluated further for other potential land use conflicts and potential access to regional rail carriers. Three Routes with few potential land use conflicts and access to regional carries are recommended for further investigation. Figure 1 shows the location of the ten rail options.

All of the ten options provided access to one or more regional rail carriers. The major options are named for the area at which they connect to the mainline railroad. They are identified as the Valley, Arden, Jean, Caliente, Crucero, Dike, Ludlow, Mina, Cherry Creek, and Carlin, options. The first six options would be spurs from the Union Pacific (UP) Railroad; the Ludlow option would connect to the Santa Fe (SF) and UP mainlines; the Mina option would originate from the Southern Pacific (SP) Railroad. The Cherry Creek and Carlin options would originate from the UP and the SP railroads. The Jean option could also access the SF Railroad through an existing agreement with the UP.

Each of the options were reviewed to identify land-use compatibility issues. They were categorized as either having existing conflicts that are not likely to change prior to DOE needing access, having potential conflicts, or having no identified conflicts. Caliente and Jean options were found to have no significant land-use conflicts.

Land-use conflicts were identified for the Arden, Crucero/Ludlow, and Dike options. The Arden route appears incompatible with existing private development activities and uncertainties associated with future private use. Development of the Crucero/Ludlow options would present an apparent conflict with lands in California designated by the Bureau of Land Management (BLM) as limited-use areas. The Dike route appears incompatible with the Nellis Air Force Base operations.

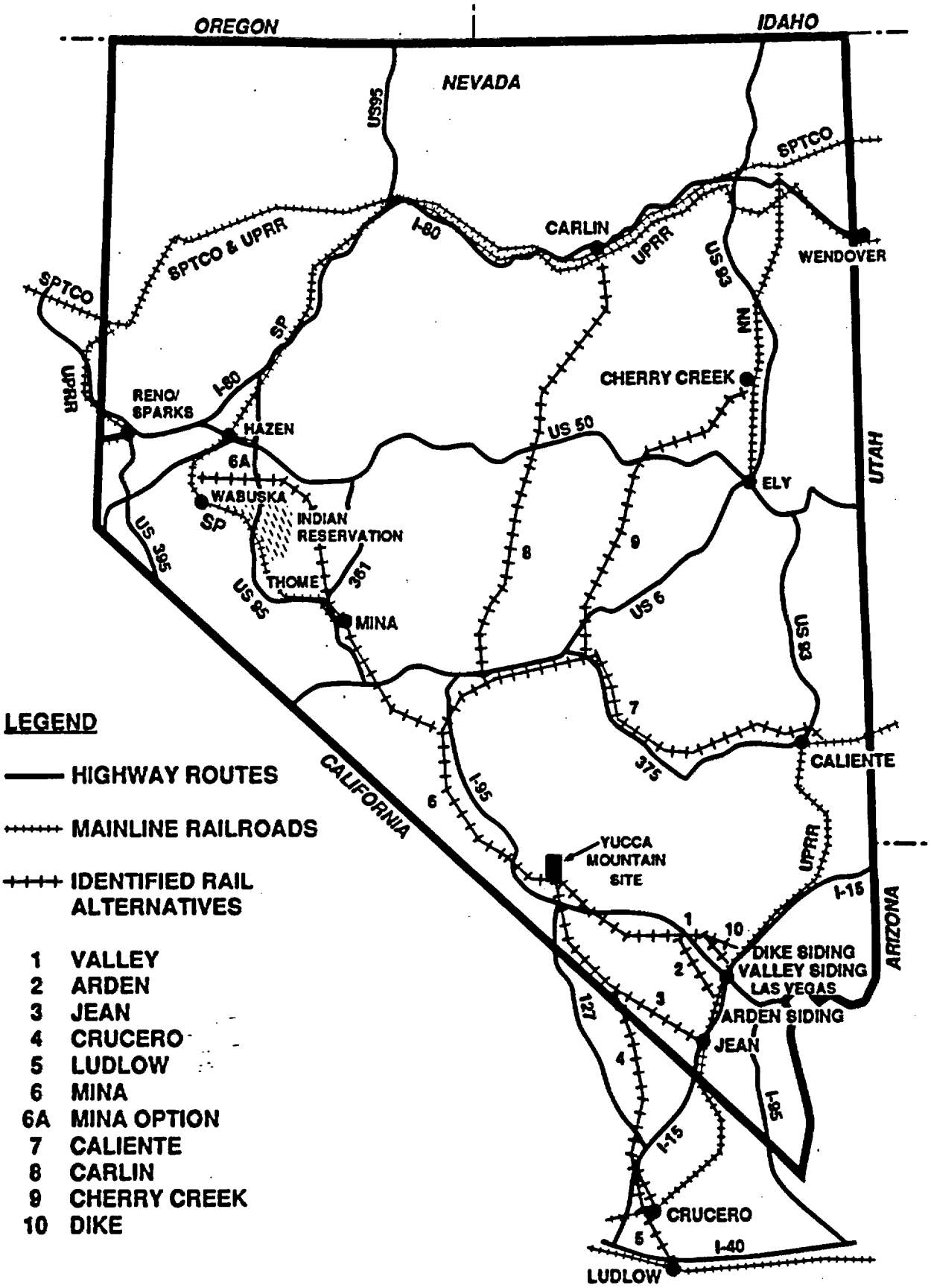

Figure 1. Department of Energy Identified Rail Options and Nevada State Rail Network, 1989.

The Mina, Valley, Carlin, and Cherry Creek options were also found to have potential land-use conflicts, primarily relating to private activities/use. Carlin was judged to have the least potential for serious conflicts of the routes connecting to the SP line based on a detailed review of current ownership patterns and development status.

Subsequent to the identification of these ten rail options, three additional alternative alignments were identified by Lincoln County and the City of Caliente, Nevada. Although different criteria were used in the selection of these alternatives, each of the proposed alternatives were evaluated on the basis of potential land use conflicts and potential access to regional rail carriers. Two of the proposed alternatives were found to have land use conflicts and the third does not provide direct access to the site.

The three routes recommended for further engineering evaluations were those routes with the least land use conflicts with the objective of not excluding access to any of the three regional rail carriers. These routes are Jean, Caliente, and Carlin. These recommendations are preliminary and could be revised based on new information becoming available that affects the potential feasibility of the identified routes or the identification of additional route options.

The final routes selected for consideration as potential rail access alignments to the Project site will be identified and discussed as part of the Environmental Impact Statement (EIS) scoping process. The physical and operations characteristics of each alignment, as well as the associated potential impacts will be addressed in the EIS. Development activities on the selected alignment are not expected to begin until the site is approved. It is anticipated that rail access to the site will be available within 2 years of site approval in order to support site development activities.

1.0 INTRODUCTION

The Yucca Mountain site, located on the southwestern edge of the Nevada Test Site (NTS), is an undeveloped area under investigation as a potential site for nuclear waste disposal by the U.S. Department of Energy (DOE). The site currently lacks rail service and an existing rail right-of-way. If the site is suitable and selected for development as a disposal site, rail service is desirable to the Office of Civilian Radioactive Waste Management (OCRWM) Program because of the potential of rail to reduce number of shipments and costs relative to highway transportation (DOE, 1986, Appendix A). This preliminary report is a summary of progress to date for activities to identify and evaluate potential rail options from major rail carriers in the region to the Yucca Mountain site. It is currently anticipated that the rail spur will be operational after the year 2000.

Routes described here do not represent the DOE selection of routes. The DOE recognizes that transportation issues, including routing, will need a full and open treatment under requirements of the National Environmental Policy Act. This means that the issue of transportation will be included in public hearings to support development of an Environmental Impact Statement for the Yucca Mountain Project. This study was completed as part of DOE activities to evaluate options for addressing, as appropriate, the effects of waste transportation.

1.1 BACKGROUND

The U.S. Government plans to begin operating the first geologic repository for permanent disposal of commercial spent nuclear fuel and high-level radioactive waste (HLW) soon after the turn of the century. In order to meet this goal, the OCRWM of the DOE must carry out the responsibilities assigned to the DOE by the Nuclear Waste Policy Act of 1982 (NWPA, 1982) and revised in 1987, Nuclear Waste Policy Amendment Act (NWPAA, 1987).

In 1987, the NWPA was amended and Yucca Mountain, Nevada, was named as the only site to be characterized. Activities at the other candidate sites at Hanford, Washington and Deaf Smith County, Texas were terminated. The NWPAA also provided for public participation by establishing a process by which the State of Nevada and affected units of local government could receive grants to support review, monitoring, testing, evaluation and informational activities, as well as the preparation of requests for impact assistance.

The evaluation of site suitability for the Yucca Mountain site will be documented in a draft Environmental Impact Statement (EIS) to be presented for public review. If the site is found suitable for development as a HLW repository, a final EIS will be prepared and submitted to the President, with the Secretary of Energy's recommendation regarding the construction of a repository for approval (NWPAA, 1987). If the President's decision is to construct the repository at Yucca Mountain, the Secretary will submit an application to the U.S. Nuclear Regulatory Commission (NRC) for construction authorization for a repository and an application for licenses which will authorize the DOE to receive HLW.

In the event that Yucca Mountain is found unsuitable for use as a site for the repository, site-specific activities are to be terminated by the DOE, disturbed areas will be reclaimed to pre-existing conditions, and a report will be made to Congress.

1.2 OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT TRANSPORTATION ACTIVITIES

The Office of Civilian Radioactive Waste Management (OCRWM), under the responsibilities delegated to the DOE under the NWPAA, will design, develop, and implement a system for the transportation of high-level waste from commercial reactors and DOE facilities to the repository, or other facilities in the waste management system. These responsibilities include the development of equipment and hardware, procurement of services to transport the waste, and the design and implementation of an institutional program that will assist in the development and operation of a transportation system. To meet these responsibilities, the DOE will use private industry to the greatest extent possible.

The base for the transportation system required under the NWPAA currently exists. The transportation procedures and technologies used by the DOE, the electrical utilities and the transportation industry provide the foundation for a system designed specifically for the handling of radioactive waste. This system will be designed to meet the increased requirements for transportation activities as stated in the NWPAA.

In developing and operating this system, the OCRWM will, in accordance with the NWPAA, develop new transportation equipment, procedures and infrastructure as necessary. Cask development will include engineering design and development, prototype fabrication, and testing and certification of the casks. Operational procedures will be developed and will include the physical transport of the waste from the source to the repository, maintenance of casks and equipment and the training of operations personnel. In addition, the OCRWM will coordinate and implement a program of public information and interaction to assure that interested citizens are fully informed of program activities.

Transportation activities in Nevada focus on development of rail access to the Yucca Mountain site, evaluations of potential transportation impacts in Nevada, coordination with other DOE transportation activities, and response to transportation issues raised in Nevada. These activities will be described in more detail in the Nevada Transportation Studies Plan presently under development.

1.3 REPORT OVERVIEW

The remainder of this report is divided into discussions of the study scope (Section 2), description of the routes (Section 3), evaluation of the routes for carrier access and land-use compatibility (Section 4), and recommendations for further evaluations (Section 5).

2.0 PRELIMINARY RAIL ACCESS STUDY

This report describes ten rail spur options to the Yucca Mountain site that have been identified by the DOE in rail access investigations to date. A preliminary evaluation of these options against existing (known) or potential land-use conflicts and access to regional rail carriers was completed. Three routes with few potential land use conflicts and access to regional carriers are recommended for further investigation. The recommended routes are preliminary and do not preclude the identification of additional viable routes or additional consideration of current options should new information become available that affects their potential feasibility. A route for detailed design and construction will be identified through National Environmental Policy Act process for the Yucca Mountain site, if it is selected as a disposal site for high-level radioactive waste.

The option at Dike Siding was previously identified in the Environmental Assessment (DOE, 1986) for Yucca Mountain. Dike Siding is approximately 11 miles northeast of Las Vegas. This option is considered in this study even though a review of land-use considerations indicated that it would require access to land withdrawn from public use by Nellis Air Force Base.

Three potential rail options, identified by Lincoln County and the City of Caliente, have been included (ETS Pacific, 1989). Although different criteria were used in the identification of these alternatives, the three alternatives were evaluated on the basis of potential land use conflicts and access to regional carriers. These options are considered in this study even though one does not provide direct site access and review of the other options indicate that they would require access to land withdrawn from public use by the DOE and the U.S. Air Force.

2.1 IDENTIFICATION OF ROUTES

Locations of existing and now-abandoned railroads, areas of obvious land-use incompatibility, and areas of favorable topography throughout Nevada were reviewed in order to develop potential options. Options were chosen to maximize the use of Federal lands, provide access to any of three regional rail carriers, avoid obvious land use conflicts and meet current railroad engineering practices. Lands withdrawn from public use by Federal actions were avoided.

Several of the options traverse the same general corridors as traveled by the now-abandoned railroads built in the early 1900s. Occasionally, the options deviate considerably from the earlier railroad routes to avoid developed, or environmentally sensitive areas. Other options traverse terrain not previously used for railroads. The terrain for these options is often much more rugged than those previously followed. Although feasible from an engineering viewpoint, routes over rugged terrain would generally require large amounts of earthwork, and may result in a relatively higher level of environmental impact and operational difficulties than the others.

Design standards employed by DOE at this preliminary stage include limiting grades to a 2 percent desirable maximum and a 2.5 percent absolute maximum. Horizontal curves are limited to 8 degrees (minimum 717-ft radius). Crossings at all primary and State highways are assumed to require grade separations. However, crossings of secondary and county high-

ways, and minor roads were assumed to require only automatic gates for protection. Provision for turnouts and/or passing tracks will be made in subsequent design work, but locations for these were not specifically identified.

The design criteria for those alternatives proposed by Lincoln County and the City of Caliente are presented in Evaluate Alternative Rail Corridor Routes through Lincoln County, NV to Yucca Mountain, NV, (ETS Pacific, 1989). These routes generally considered less restrictive design criteria, assumed access to land withdrawn from public use and routes with only partial site access.

2.2 LAND USE COMPATIBILITY

For the purpose of this report, all of the rail access options were examined to determine the degree of compatibility with existing and projected private development activities as well as existing and potential Federal and/or State agency land-use designations.

Land-use compatibility is defined as the presence or absence of a land-use conflict, and the potential for abatement of that conflict if one exists. The rail access spur options were evaluated for land-use conflicts, based on the following conditions:

- *Known*: There is definite conflict with existing or planned land-use activities or classification; high degree of uncertainty as to the resolution of the conflict; low probability that the conflict could be abated.
- *Potential*: Conflict with current or planned land use activities or classification is likely, however, the extent of the conflict is unknown; the probability exists that the conflict could be abated by DOE actions or resolved due to external, non-DOE activities.
- *None*: No conflicts with existing or planned land use activities or classification have been identified at this time. Right-of-way would need to be granted by the U.S. Department of the Interior (DOI).

Most, if not all, of the land traversed by the potential rail routes is under public ownership in order to minimize land use conflicts. For those routes where lands are not exclusively under public ownership, the DOI, Bureau of Land Management (BLM) would expect the applicant for a Right-of-Way on publicly owned lands to have negotiated an easement with the owner of the private lands. Processing of the application for a Right of Way, by the BLM, would not begin until it was demonstrated that such easements could be obtained. At a minimum, this means that the land owner acknowledge, in writing, his/her intent to provide an easement.

2.3 ACCESS TO REGIONAL RAIL CARRIERS

Details of transportation operations for the rail shipment of HLW to Yucca Mountain are presently uncertain. However, current guidance requires the use of private industry to the fullest extent possible. Plans for operating policies are currently being developed. Because of this uncertainty on the final form of these policies, routes that access regional carriers are recommended for further investigation. Access to more than one carrier by an option would permit greater flexibility in operations planning.

Currently, the state of Nevada is primarily serviced by three regional railroads: the Union Pacific Railroad (UP), the Southern Pacific Transportation Company (SP), and the Santa Fe Railroad (SF). The UP is the only rail line in southern Nevada and maintains trackage between Caliente, Nevada and Barstow, California. The SF railroad can use the UP trackage under an existing agreement. Both the UP and the SP service northern Nevada between Flanagan, Nevada, and Montello and Wendover, Nevada. For the most part, the lines run as parallel trackage or as shared (common) trackage.

2.4 DEPARTMENT OF ENERGY SPONSORED PUBLIC AND AGENCY FORUMS

The DOE intends to provide wide exposure of rail access route information to ensure that the proposed routes are well known and that any questions and comments concerning the routes are addressed. Copies of this report and subsequent ones that may follow will be available for public review and comment.

Through a process of soliciting public comments, the DOE will seek the public's involvement as the DOE identifies and evaluates the feasibility of proposed right-of-ways to be used for a rail spur to the Yucca Mountain site. The process of identification and evaluation of options will be included in the EIS scoping process, and will conclude with the release of the final EIS that includes the analysis and selection of a rail spur option, as well as analyses of potential regional and national transportation impacts.

3.0 RAIL ACCESS OPTIONS

Ten major options have been identified under the DOE program and are named for the area where they would connect to the mainline railroad. These options are identified as the Valley, Arden, Jean, Crucero, Caliente, Ludlow, Mina, Cherry Creek, Carlin, and Dike options.

The following sections describe each of the ten options in more detail, including their primary engineering features and generalized maps are provided. For the sake of simplicity, the maps do not provide all of the details described in the text. These locations shown for options are preliminary and indicate only the general location of the potential track. Construction and operating costs are described in Section 3.2.

Three additional alternatives, proposed by Lincoln County and the City of Caliente, are identified as Options A, B and C. Detailed discussion of these options are presented in ETS Pacific (1989). Summarized descriptions of the Lincoln County proposed alternatives are also presented for completeness.

3.1 DESCRIPTION OF OPTIONS

OPTION 1 - VALLEY

As shown on Figure 3-1, this option would begin at the Valley Siding of the Union Pacific Railroad about 6 miles northeast of Las Vegas. This siding was selected as an alternative to the Dike Siding, Option 10, discussed in the EA (DOE, 1986), because the land adjacent to Dike Siding is withdrawn from public use for the Nellis Air Force Base.

From the Valley Siding, the option would run northerly, away from Las Vegas, for approximately 4 miles and would turn west to skirt the Floyd Lamb State Park, the Nellis Bombing and Gunnery Range, and the Quail Springs Wilderness Study Area (Figure 3-2). The proposed option would cross over U.S. Highway 95 on an elevated structure about 13 miles west of Valley Siding. The route would continue west for about 3 to 4 miles to pass a Paiute Indian reservation before turning north and crossing over or under Kyle Canyon Road (Nevada Highway 157). The irregular pattern of privately and publicly owned land along this westerly portion of the route would require acquisition of private land currently under development.

Valley Siding option would proceed north on the south side of U.S. Highway 95. The route would run close to U.S. Highway 95 where it approaches the Desert View Nature Area to minimize visual impacts. North of the Desert View Nature Area, the option would continue on the south side of U.S. Highway 95. The route around Indian Springs would rise northwesterly across the slope to pass behind the first row of hills south of Indian Springs, returning to U.S. Highway 95 about 15 miles west of Indian Springs. This option would negotiate more rugged terrain than is found on the north side of U.S. Highway 95 to avoid conflict with Nellis Bombing and Gunnery Range, the U.S. Air Force Indian Springs Auxiliary Field and the town of Indian Springs.

An identified alternative, alternative 1A, shown in Figure 3-1, would cross through the mountains south of Indian Springs to provide a separation of over 5 miles from the runway at Indian Springs Auxiliary Field. Alternative 1A would add over 20 miles of additional

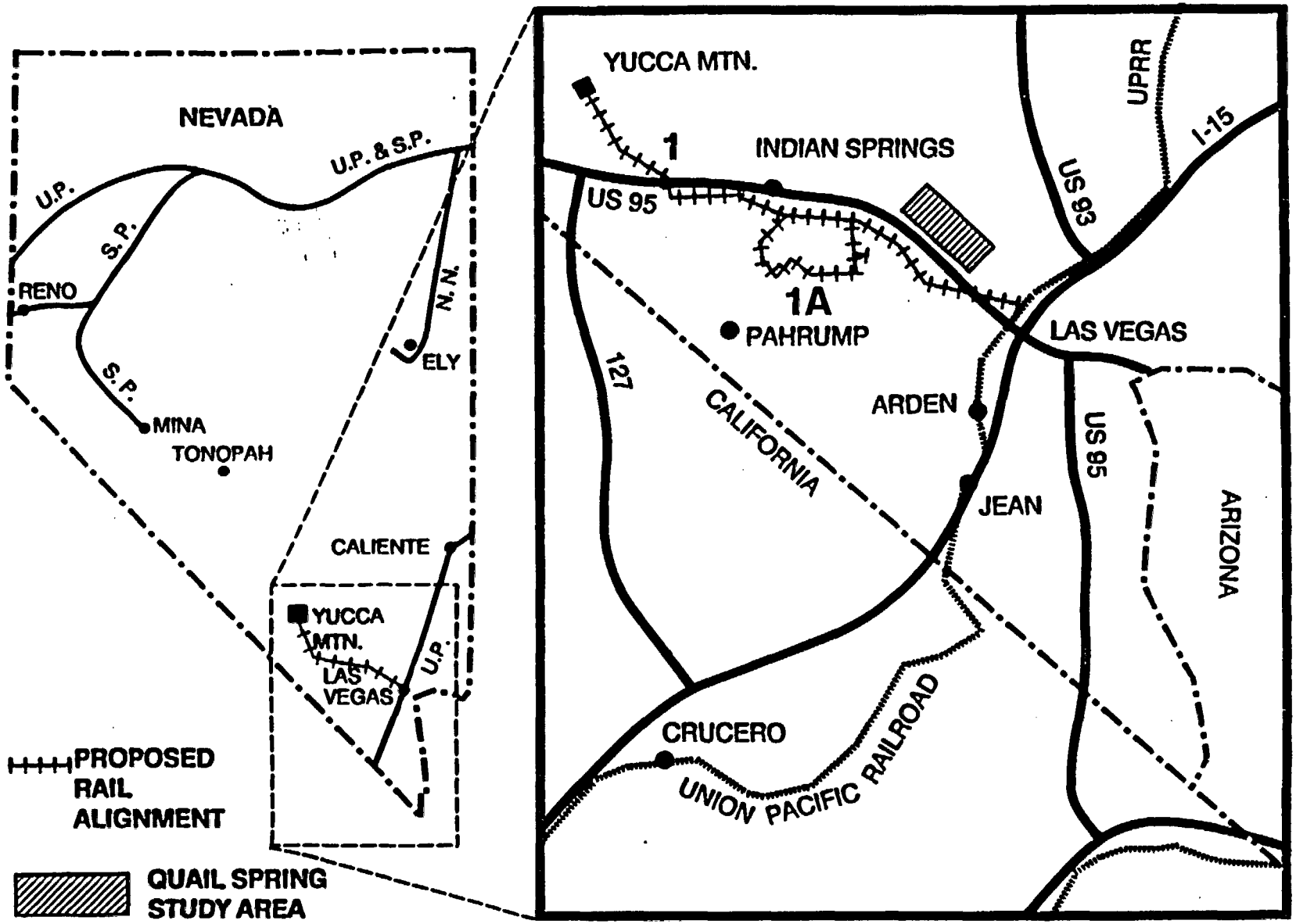

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Figure 3-1. Option 1: Valley.

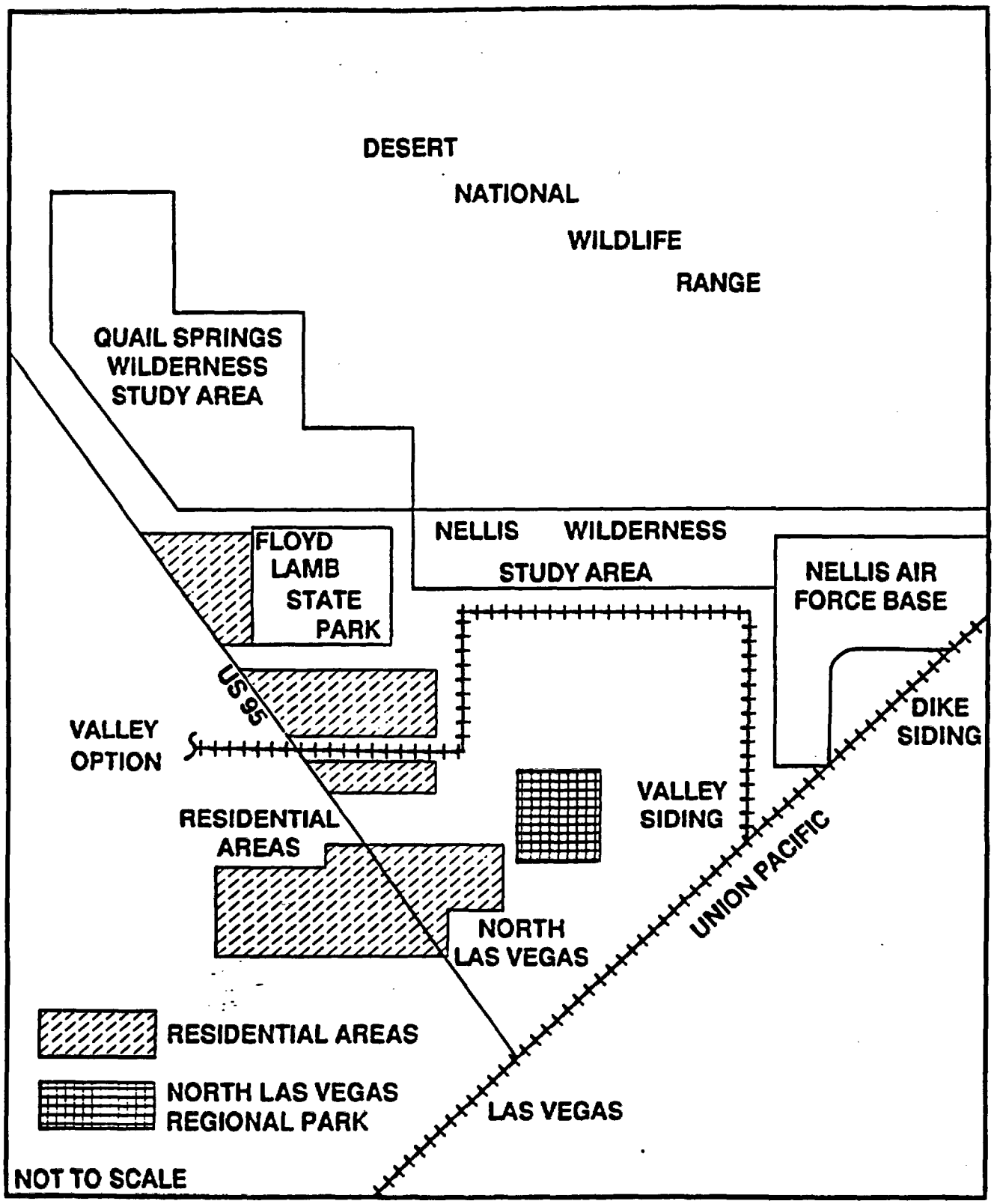

Figure 3-2. Valley Option Land Use Considerations Near Las Vegas.

track length in mountainous terrain. The increased length adds both significant capital cost increases ($41 million), and potential railroad operational problems due to the additional rise and fall and track curvature.

For the remainder of the route along U.S. Highway 95, the Valley option would cross over to the north side of U.S. Highway 95 and passes within 1.25 miles of the end of the Desert Rock Air Strip runway. The option would enter the site by bridging over Fortymile Wash. The counties that could be impacted by the selection of this route are Clark and Nye counties.

Total track length for the Valley option is 99 miles. Major engineering features for the route include a bridge over Fortymile Wash, and a total of three grade separations of which two are major structures over U.S. Highway 95.

The Valley option discussed here could significantly change if the Quail Springs and Nellis Wilderness Study Areas (WSAs) are not designated as wilderness areas by Congress. At this time, the President is required to report his recommendations for wilderness areas to Congress by October 1993. These recommendations will be based on recommendations of the Secretary of the Interior. The Bureau of Land Management (BLM) has not recommended either the Quail Springs or the Nellis WSA's for wilderness area status (DOI, 1988). However, until the Presidential recommendations are made and Congress acts on these recommendations, the BLM is required to maintain the WSA's suitability for wilderness as a designation. Hence, no new right-of-ways could be issued.

OPTION 2 - ARDEN

As illustrated in Figure 3-3, this option would begin close to the end of the UP spur, approximately 8 track miles northwest of the Arden siding. The track would proceed northerly through the eastern edge of the hills to the west of Las Vegas, curving, to avoid as much as possible, the areas likely to be utilized for future urban expansion. However, there would be unavoidable conflicts with private lands slated for future development. At its closest point, the track would pass within 5 miles of the Red Rock Canyon Recreation Area. The counties that could be impacted by the selection of this route are Clark and Nye counties.

The option would cross three minor roads, including the access road to the recreation area and Nevada Highway 157. Traffic volumes are anticipated to be low enough (an average daily traffic count below 2,000 vehicles) to permit automatic-gate protection instead of requiring grade separations on at least two of the three crossings. This alignment would merge with Alignment 1 just north of Nevada Highway 157 for a total length of 99 miles. If a grade separation was required for Nevada Highway 157, the option would have a total of two grade separations, including a major structure over U.S. Highway 95, and a major bridge across Fortymile Wash.

OPTION 3 - JEAN

As shown in Figure 3-4, this option would begin near Jean, along the Union Pacific (UP) mainline, about 20 miles southwest of Arden Siding. The track would cross U.S. Interstate 15 via a grade separation about 1 mile south of the Jean Landing Strip. West of U.S. Interstate 15, the track would turn toward the northwest and then run parallel to Nevada Highway 161 about 1 mile to the south, passing about 1 mile south of the town of Goodsprings. The track would reach the maximum 2.5 percent grade while ascending the Spring Mountains.

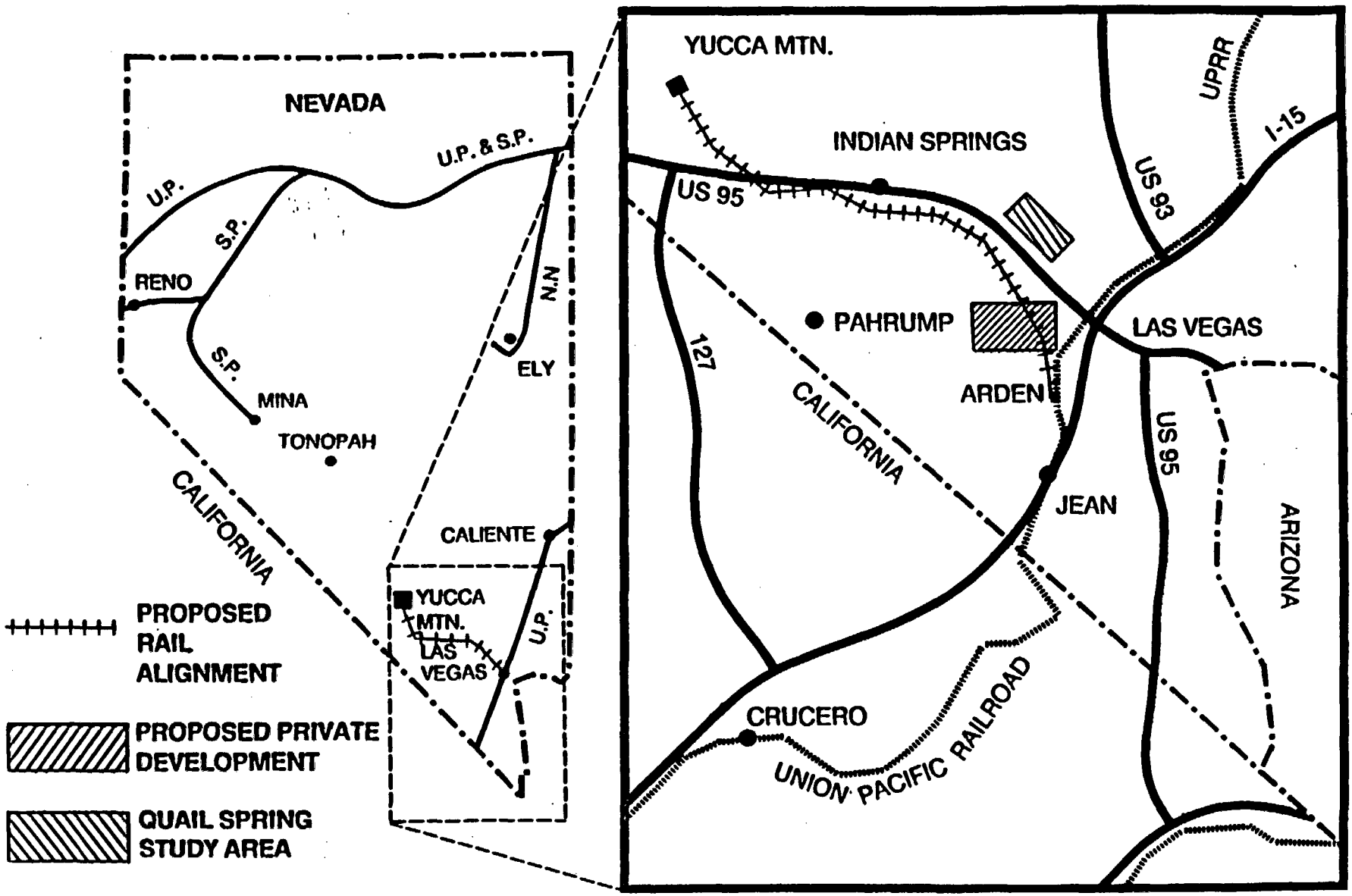

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Figure 3-3. Option 2: Arden.

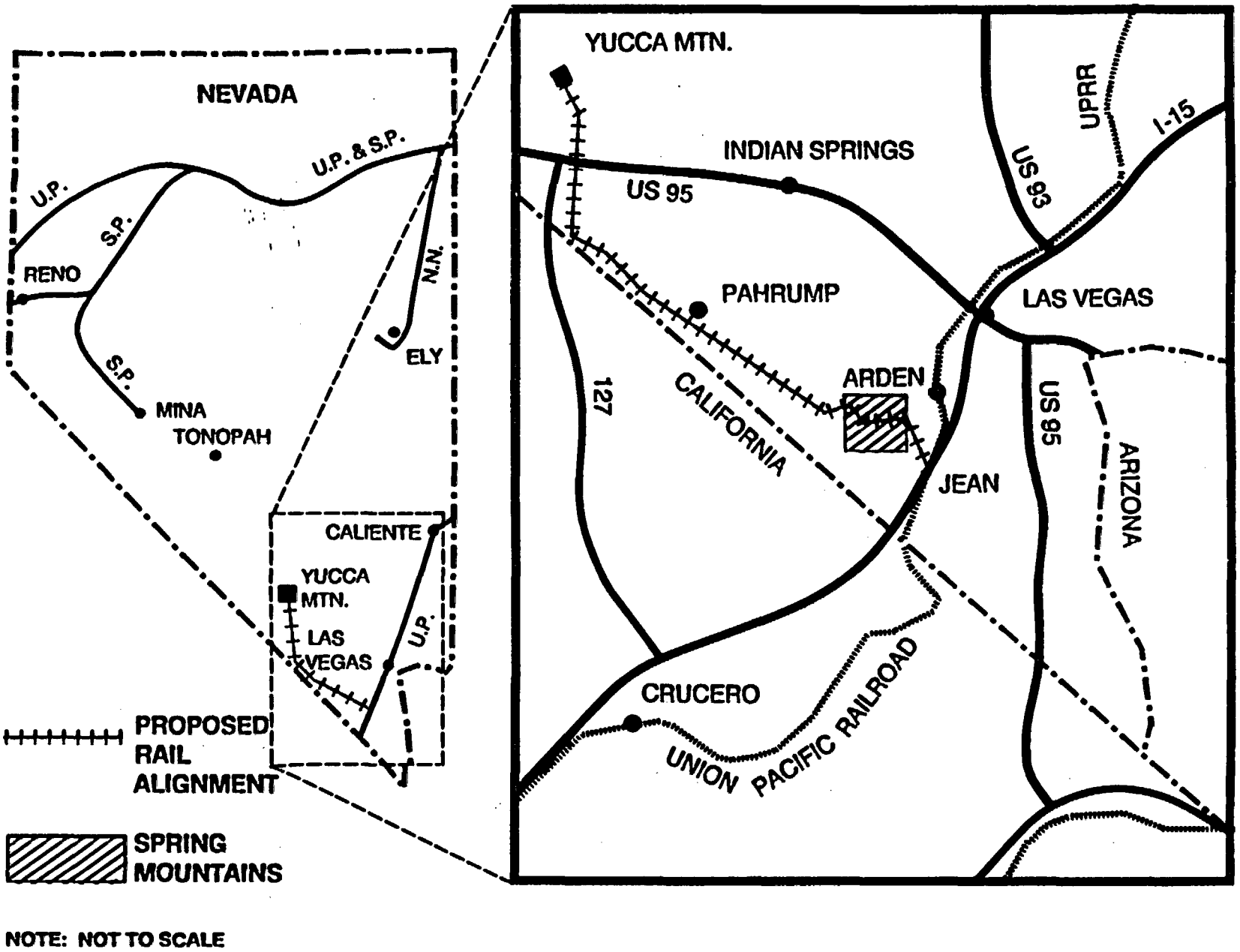

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Figure 3-4. Option 3: Jean.

North of the crest, the option would negotiate a cross slope of about 13 percent, requiring significant earth and drainage work on the steep cross slope. As illustrated in Figure 3-4, the track for the Jean option would follow the eastern slope of the Pahrump Valley northwesterly along the Nevada-California border. It would pass to the southwest of the town of Pahrump. Toward the north end of the Pahrump Valley, the track would cross Nevada Highway 372, a secondary road, via a grade separation.

At the end of Pahrump Valley, the option would cross through a ridge of hills into the Stewart Valley dry lake. Depending on the degree of cross slope on the eastern side of the Pahrump and Stewart Valleys, some special provision for drainage may have to be made, such as ditches on the uphill side of the track to divert storm water sheet flow into culverts under the roadbed. This option would continue northwesterly for approximately 16 miles before turning northerly toward the site. The Jean option would pass approximately 6 miles south of Devil's Hole, an isolated portion of Death Valley National Monument, and within 2 miles of the community of Ash Meadows.

The Jean option would proceed northerly across the Ash Meadows basin, ascending a gradient of less than 2 percent before crossing over U.S. Highway 95 some 13 miles to the north. The Jean option would join the Valley option (described previously) about 10 miles north of Lathrop Wells (Amargosa Valley). The counties that are potentially impacted by the selection of this route are Clark and Nye counties.

From beginning to end, the Jean option would cover 121 track miles, making it 22 miles longer than the alignments beginning closer to Las Vegas. The route would require one minor and two major grade separations and the bridge over Fortymile Wash.

OPTION 4 - CRUCERO

This Option begins at the Union Pacific tracks in the vicinity of Crucero, California (Figure 3-5). Because the Fort Soda area, which was traversed by the original Tonopah and Tidewater (T&T) Railroad trackage in the early 1900s, has been designated as an Area of Critical Environmental Concern (ACEC) by the Bureau of Land Management, the proposed alignment would climb northerly through the Soda Mountains west of Fort Soda and closely follow the alignment of U.S. Interstate 15 easterly through the hills. Depending on the drainage in the area of U.S. Interstate 15, a bridge or levees and a culvert could be required to channel storm water run-off.

Once through this area, this option would swing northerly and cross over U.S. Interstate 15 on a skew-grade separation about 3 miles to the north. The tracks would then ascend northwesterly through the Soda Mountains, away from the Silver Lake area, approaching a 2.5 percent maximum grade, and then reversing back to the northeast and descending into the Silurian Valley and crossing Route 127 via a grade separation about 3 miles north of Silver Lake.

From this point, this option would follow the old T&T grade northerly past the Silurian Hills. The proposed route is primarily level, following the 1,000-ft elevation contour line. At the foot of the Silurian Hills, about 8 miles to the north, this route would depart from the T&T grade to climb northerly over the Aljean and Alexander Hills into the California Valley, reaching a maximum gradient of 2.5 percent. The proposed route would skirt the eastern edge of the Nopah Range and continue through the northern end of the Pahrump Valley and on to a junction with the route of Option 3 in the Stewart Valley. Route 178 would be crossed via

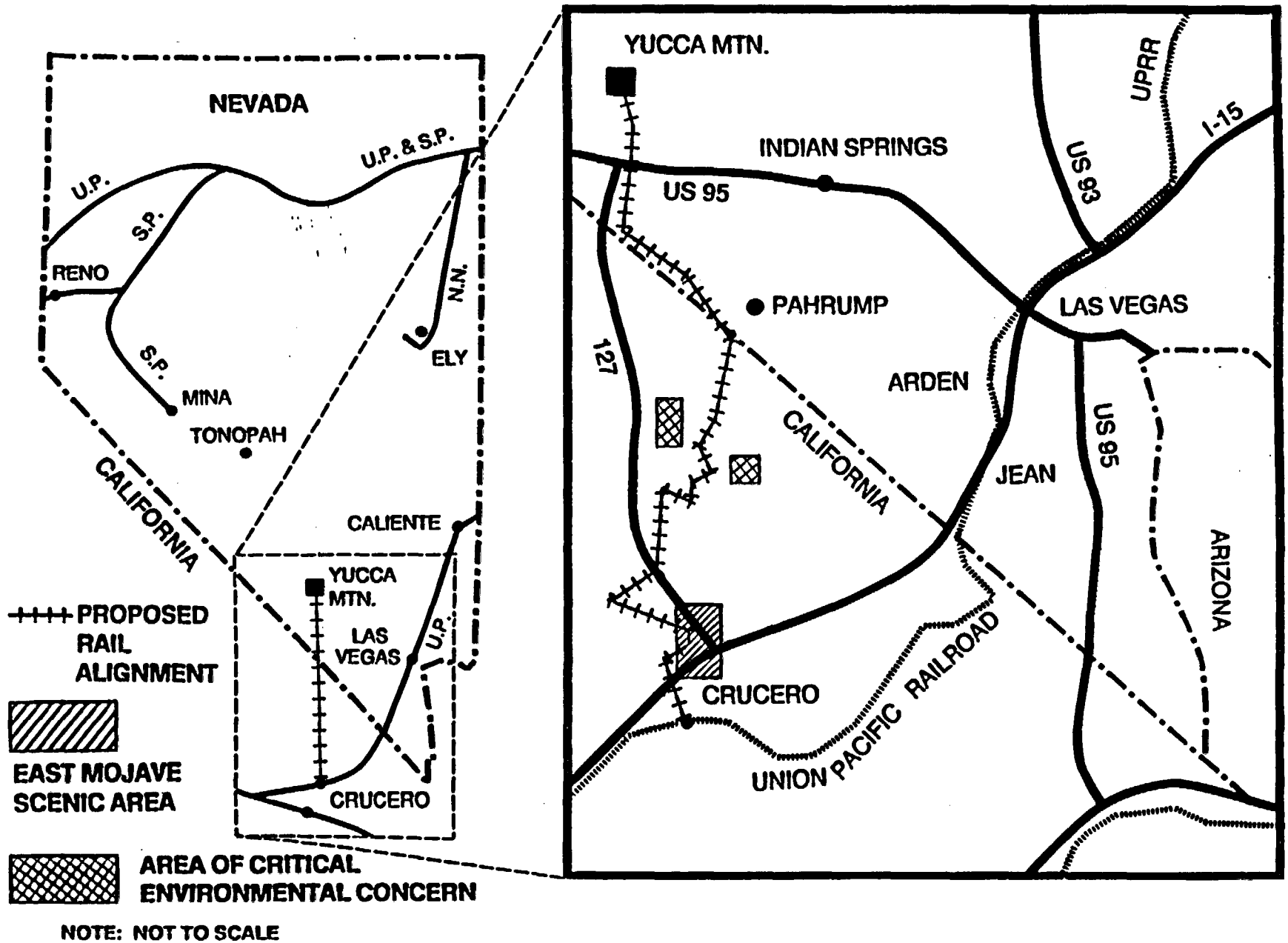

Figure 3-5. Option 4: Crucero.

a grade separation. The junction of the Pahrump and Stewart Valleys contains a dry lake bed and wash that would have to be skirted and/or perhaps crossed to proceed into Nevada. The counties in Nevada that could be impacted by use of this route are Clark and Nye counties.

The Crucero option is a total of 147 track miles long. It would have four grade separations with highways, the most major being with U.S. Interstate 15. Additionally, this option would require a bridge over Fortymile Wash.

OPTION 5 - LUDLOW

The Ludlow option is identical with the Crucero route, north of Crucero. The addition is a connection running from the Santa Fe (SF) tracks around Ludlow northerly across the 25 miles of desert to Crucero (Figure 3-6). The trackage would closely parallel the old T&T route and would not present any unique engineering problems. The only additional structures required are bridges over U.S. Interstate 40 to the west of Ludlow and over the Union Pacific (UP) tracks in the vicinity of Crucero. The total length of this option would be 170 track miles. It would have six grade separations with highways, plus the bridge over Fortymile Wash. The counties in Nevada potentially impacted by use of this option are Clark and Nye counties.

OPTION 6 - MINA

This option totals 209 miles for the base case. It begins about 5 miles north of Mina on the Southern Pacific (SP) branch line to Mina. After bypassing Mina to the east, it roughly parallels the routes of the old Tonopah & Goldfield Railroad (T&G) on the northern end and the Las Vegas and Tonopah (LV&T) on the southern end. The proposed option from Mina follows the U.S. Highway 95 corridor to the south past the Columbus Salt Marsh and the town of Coaldale.

The proposed option would cross over U.S. Highway 95 on the approximate alignment of the previous railroad before turning southwesterly away from the old railroad grade in order to pass to the west of the Goldfield area, and provide a more direct route to Yucca Mountain (Figure 3-7). The proposed option would follow the old grade along Nevada Highway 265, then cross Nevada Highway 265 via a grade separation and pass to the west of the town of Silverpeak and the salt evaporation area. The track ascends the Montezuma Mountains through Railroad Pass. Because Railroad Pass has an average grade of 4.7 percent, considerable development would be necessary to keep the maximum grade at 2.5 percent.

From the Montezuma Mountains, the proposed track would descend to follow the south side of U.S. Highway 95 past the town of Scotty's Junction. The option would cross Nevada Highways 266 and 267 via grade separations before bridging over U.S. Highway 95 to the north side, about 12 miles southwest of Scotty's Junction. On the north side of the highway, the track would be located fairly close to the road because of rough terrain, particularly as it swings southeasterly around Bare Mountain. The counties potentially impacted by this route are Nye, Esmeralda and Mineral.

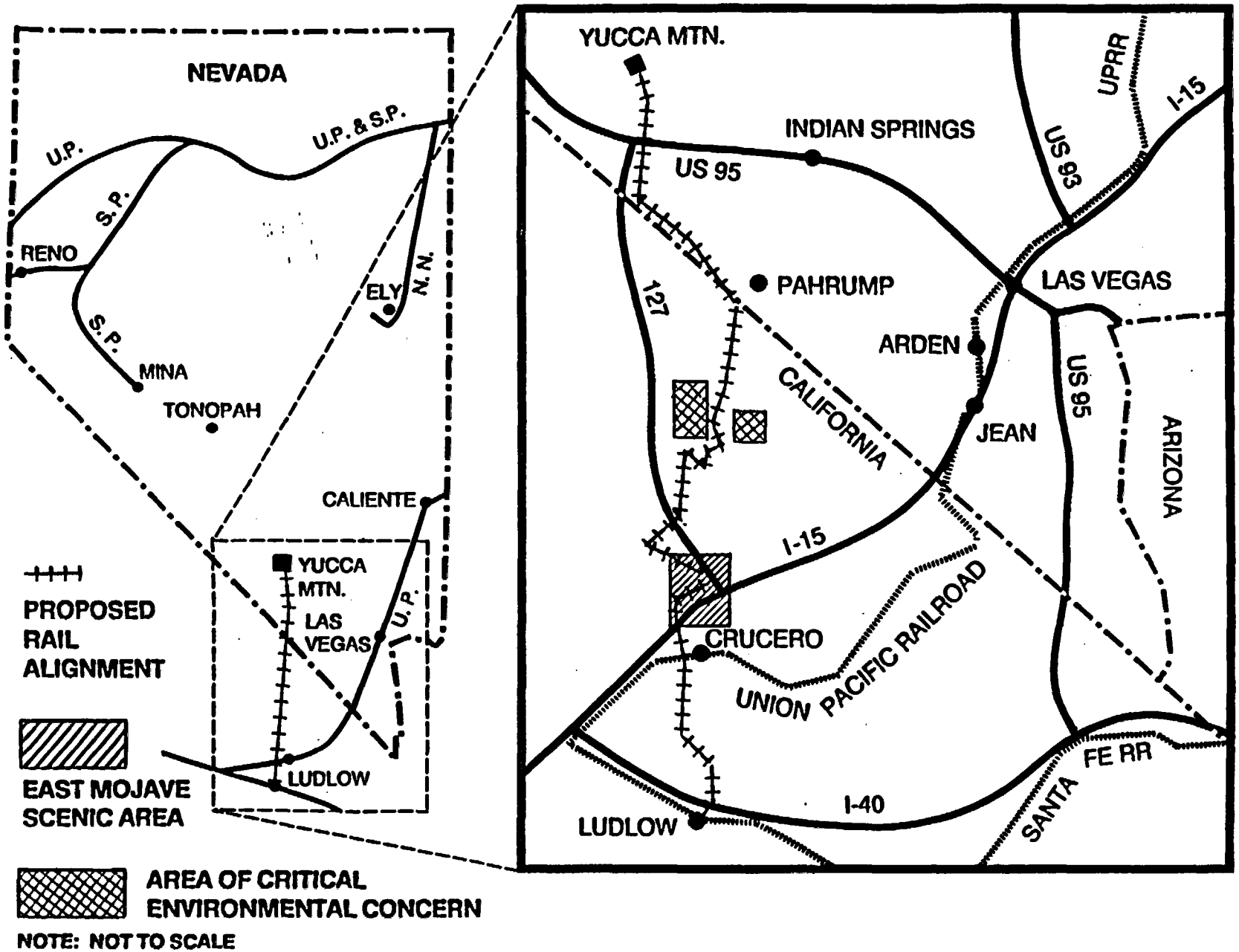

Figure 3-6. Option 5: Ludlow.

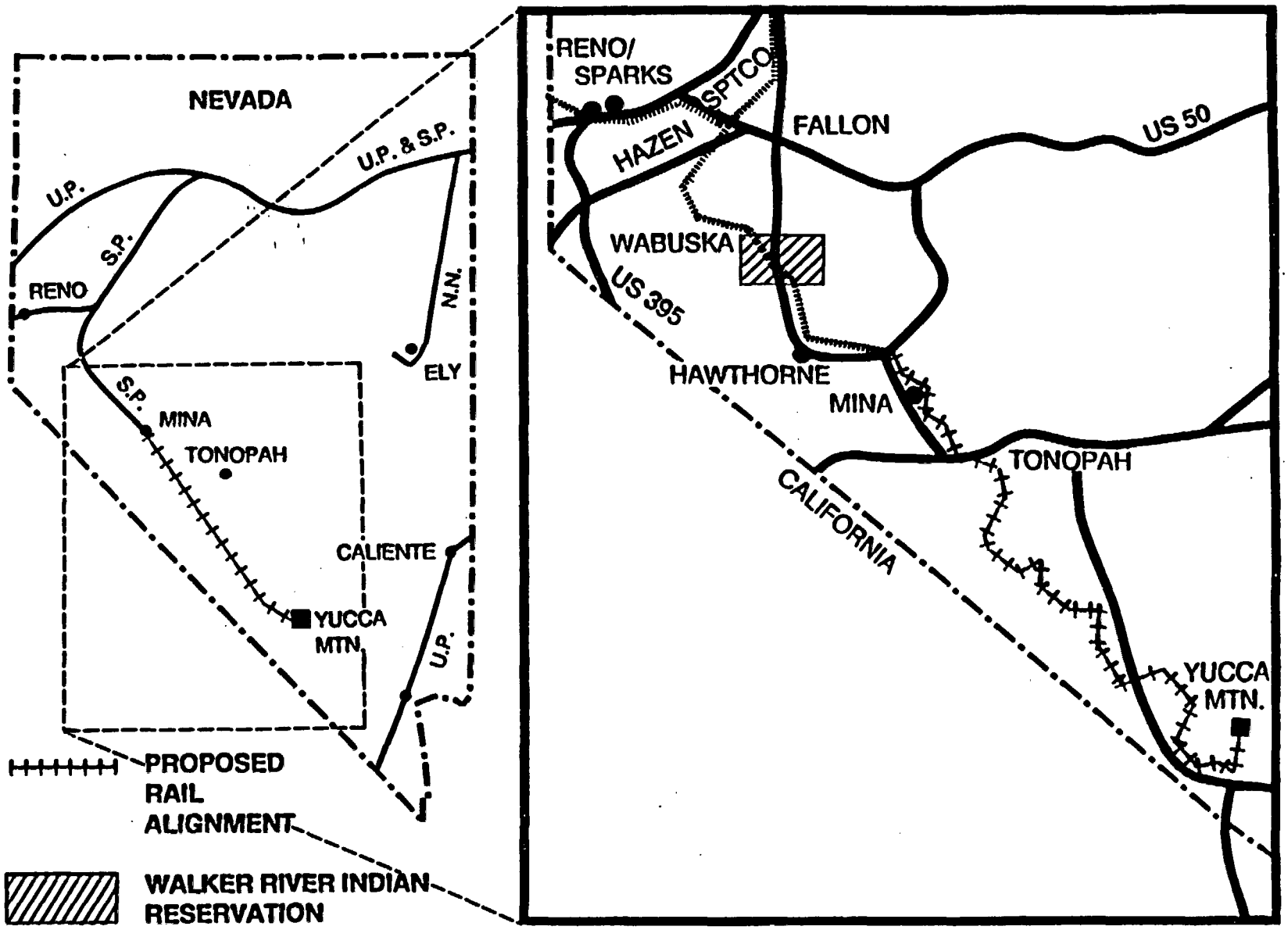

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Figure 3-7. Option 6: Mina.

An engineering advantage of this option is that it could approach the site from the west and avoid bridging the main part of Fortymile Wash. However, a major culvert or smaller bridge would be required to cross an arm of the wash on the way into the site. This option would require that about 84 miles of the existing SP Mina branch from Wabuska south to the beginning of the spur connection be upgraded. The remaining 41 miles of the branch line from Wabuska north to the SP mainline at Hazen is in relatively good condition. An important land-use consideration of this option is that it would avoid use of private land except for the SP right-of-way because of the remoteness of the location. However, a potential land use conflict does exist with this option. Currently, the Walker Lake Indian Reservation is disputing the SP's ownership of the right-of-way through reservation lands.

In August 1989, the Interstate Commerce Commission (ICC) published an Environmental Assessment on the Notice of Exemption filed by the Southern Pacific Transportation Company (SP), (ICC, 1989). In the Notice of Exemption, the SP proposed to abandon the rail line between Thorne and Mina, Nevada. The SP intends to abandon the line, salvaging tracks, ties, and related materials. In the review of the proposed action, the ICC concurred with the SP that abandonment would not affect, significantly, the quality of the human environment and requested public comment. To date, the ICC has received a Petition for Reconsideration and is evaluating the petition.

Alternative To avoid potential conflicts with the Walker Lake Indian Reservation and the issue of disputed ownership of the right-of-way, the Mina option has one major sub-option that is designated Route 6A (Figure 3-8). It consists of the base Mina route, plus the addition of a detour departing from the SP Mina branch line at Fort Churchill (10 miles north of Wabuska). It detours easterly, and then southerly around the Walker Lake Indian Reservation to connect with the SP branch line just north of Mina. The length of new construction with Route 6A is 368 miles. Of this total, 209 miles are from the base route and 159 miles comprise the new bypass. The bypass would avoid all but 5 miles of the 84-mile portion of the Mina branch line that would have to be upgraded. It would not require any private land beyond use of the SP right-of-way. The option, east of U.S. Highway 95, would pass between the U.S. Navy bombing ranges which the Navy plans to expand. The counties potentially impacted by use of this alternative are Nye, Esmeralda, Mineral, Lyon and Churchill.

The terrain which would be traversed by the Mina bypass is generally very rugged. This would lead to higher construction costs, and increased risk of washout or slope failure. The expense of constructing the bypass would be an estimated $275 million more than rehabilitating the existing branch line.

OPTION 7 - CALIENTE

An option was selected from the Caliente area in order to avoid land use impacts encountered in most of the southern areas of Nevada, and is shown in Figure 3-9. The Caliente option consists of a base route with five alternatives. The base route has the most favorable land-use compatibility, but would incur significant costs due to the complex engineering and construction required to traverse rough terrain.

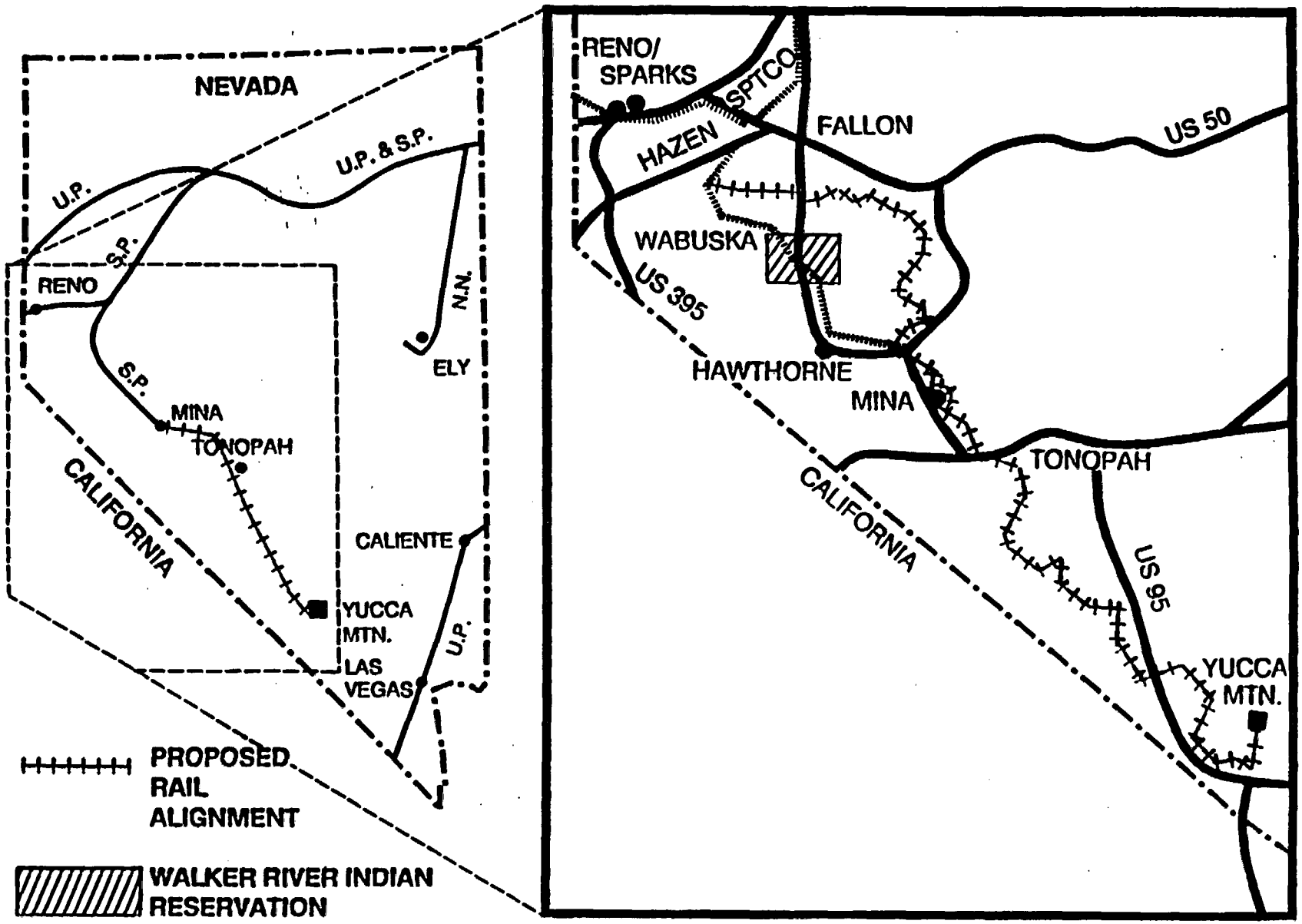

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Figure 3-8. Option 6A: Mina Alternative.

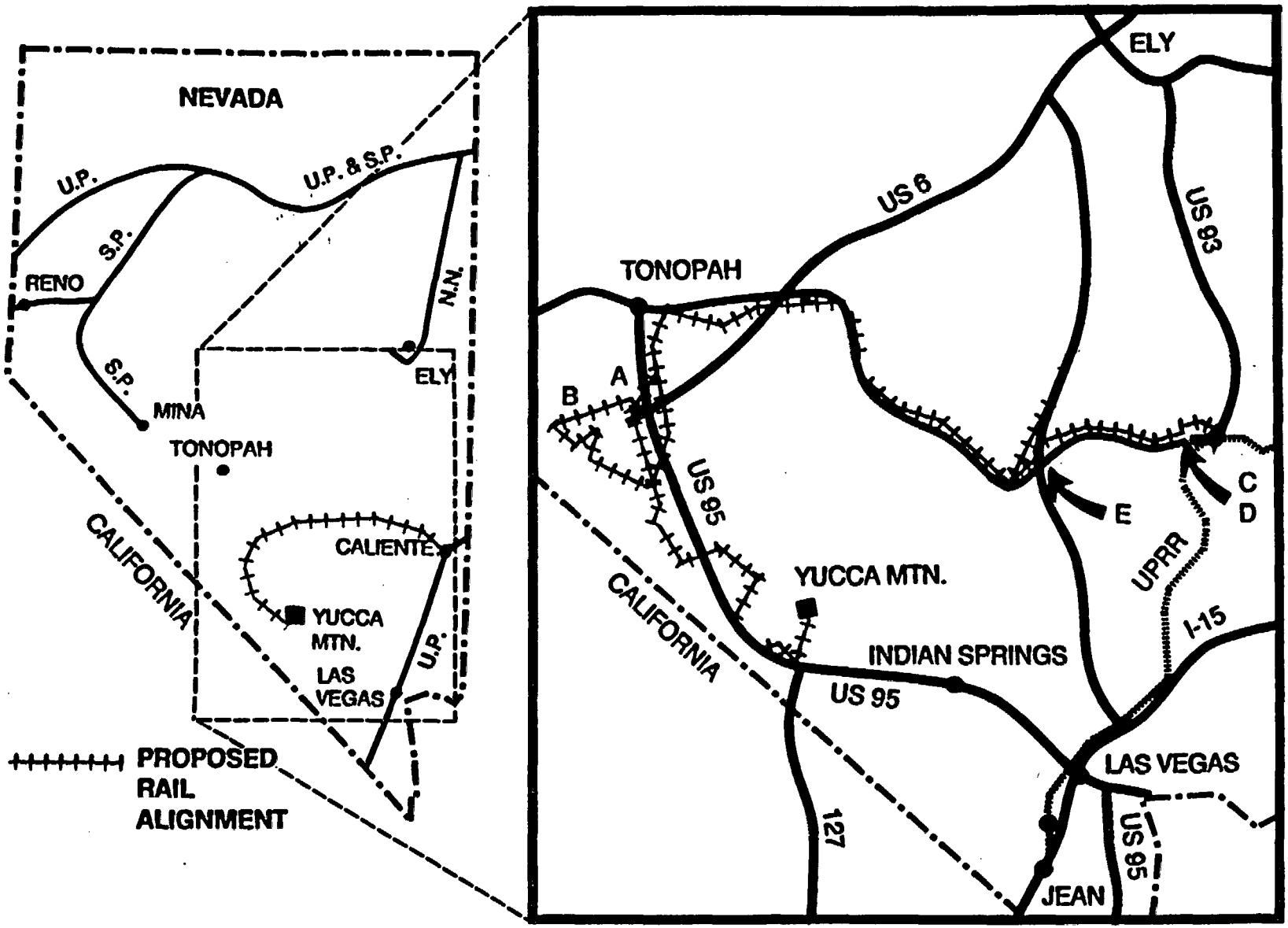

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Figure 3-9. Option 7: Caliente and Alternatives.

The Caliente option is 406 miles long. It would begin on the UP mainline 4 miles east of Caliente to avoid impacts to the town and proceeds north-westerly across the mountain ridges, crossing U.S. Highway 93 on a long trestle at Indian Cove about 2 miles north of Caliente. The route would then wind southerly through the mountains until reaching U.S. Highway 93. From the highway, the option would travel westward toward the Pahranagat Valley. After a detour around private land holdings in the Pahranagat Valley, the option would roughly follow Nevada Highway 375 and U.S. Highway 6 across central Nevada to the north of the Nevada Test Site and the Nellis Bombing and Gunnery Range. Counties potentially impacted by use of this route are Lincoln and Nye.

Much of the terrain for this option is very rugged, and would require complex engineering and extensive earthwork. This is particularly true on the bypasses around Caliente and the Pahranagat Valley. Because much of the difficulty would be caused by attempting to avoid all contact with private land, Alternatives 7C, 7D, and 7E were developed, and are discussed subsequently.

The base option would turn southwesterly about 8 miles east of Tonopah and pass through the Goldfield area. The base option would thread east of Goldfield between the private land holdings to the west, and the Nellis Bombing and Gunnery Range to the east. Option 7 would join Option 6, the Mina route, about 22 miles south of Goldfield.

Alternatives There are a total of five alternatives to the base option in the vicinity of Goldfield and on the eastern end of the route. The options around Goldfield were selected to give more flexibility in crossing the adjacent mountain ranges. The base route would pass east of Goldfield between the Nellis Air Force Range and the many private land holdings around Goldfield. Alternative 7A would pass just west of Goldfield, crossing the route of the historic Las Vegas & Tonopah Railroad. However, the old railroad grade is much steeper than the 2.5 percent grade chosen as the maximum on the Yucca Mountain rail access route, and would require significant earth work.

Alternative 7B would cross to the north of Goldfield and join the Mina route sooner than the other two alternatives. Alternative 7B would be easier to construct, but would go an additional 50 miles in comparison to the other options. The counties potentially impacted by use of either alternative are Lincoln, Esmeralda and Nye. These two options would add $6 to $50 million to construction costs, respectively.

As alternatives to the use of very rugged terrain to avoid private land on the eastern end of the base route, Alternatives 7C, 7D, and 7E, which pass through Caliente and the Pahranagat Valley, are included. Since all of the alternatives are within Lincoln County, the counties potentially impacted are Lincoln and Nye counties. Alternative 7C leaves the UP mainline northeast of the main part of town at the junction with the now-abandoned UP Pioche-Prince branchline. It would traverse a generally undeveloped area to join the base route along U.S. Highway 93. Alternative 7D would leave the UP mainline southwest of the town and proceed northwesterly along U.S. Highway 93. Both alternatives would cross to the north side of U.S. Highway 93 via a grade separation. The alternatives eliminate 17 to 18 miles from the base route, all of it in very rugged, mountainous terrain. Construction cost would be $52 to $56 million less with one of these options.

Alternative 7E would go directly across the Pahranagat Valley on the north side of U.S. Highway 93 and Nevada Highway 375, crossing Nevada Highway 318 via a grade separation. This alternative would avoid 26 miles of very difficult mountainous terrain and $60 million in construction expense. Combining Alternatives 7C and 7E would create the most direct route and would save 44 miles of track in mountainous terrain and $113 million in construction costs.

OPTION 8 - CARLIN

Several areas were explored for this option in order to obtain access to Yucca Mountain from the paired trackage of the SP and UP between Wells and Winnemucca in northern Nevada. However, the checkerboard pattern of private and public land ownership surrounding the railroads across northern Nevada makes the complete avoidance of private land difficult. The minimum impact departure point is a location about 5 miles west of Carlin. The terrain in this area is so rugged that private developers were uninterested in the land, and as as a result, the greater portions of the terrain were left in BLM ownership.

The proposed option would depart from the UP/SP paired trackage and proceeds parallel to Nevada Highway 278 along the border of Eureka and Elko Counties, as shown in Figure 3-10. To minimize contact with private land, the base route would traverse a rugged ridge east of the highway. Option 8A provides an alternative route for a 5-mile portion of this route that would present much less engineering difficulty, but would require use of private land closer to Nevada Highway 278.

About 40 miles south of mainline railroads, the proposed route would leave the vicinity of Nevada Highway 278 and pass southwesterly into the Monitor Valley and crosses U.S. Highway 50 into Lander County. It would follow the Monitor Valley into Nye County, and continue on through the Ralston Valley to a junction with the Caliente route south of U.S. Highway 6, about 12 miles east of Tonopah, Nevada. The counties potentially impacted by the use of this route or its alternative are Nye, Esmeralda, Eureka, Lander and Elko counties.

The base Carlin route is 365 miles long. Because the mountain ranges in Nevada are predominantly north and south, this route generally would have more favorable topography than other east-west routes.

OPTION 9 - CHERRY CREEK

The Cherry Creek option, as shown in Figure 3-11, is 370 miles in length, and connects with the abandoned Nevada Northern (NN) right-of-way, presently owned by the Department of Water & Power, City of Los Angeles, in the vicinity of Cherry Creek. The NN right-of-way was purchased to ensure rail access to a coal fired power plant planned for the Cherry Creek Valley sometime after 1991 (Nevada, 1986). Although about 92 miles of the Nevada Northern trackage would have to be rehabilitated, this linkage with the NN, would give a direct connection to both the Union Pacific Railroad (UPRR) and the Southern Pacific Transportation Co. (SPTCo.), about 20 miles west of the Utah border. The use of this right-of-way by coal trains supplying the power plant will require upgrading of the existing track.

From Cherry Creek, the proposed option would wind southwesterly across the mountain ridges and valleys of White Pine County, crossing U.S. Highway 50 about 50 miles west of Ely, and continuing into Nye County. In Nye County, the route would follow a southerly course to U.S. Highway 6, and then join with the Caliente route 3 miles east of Warm

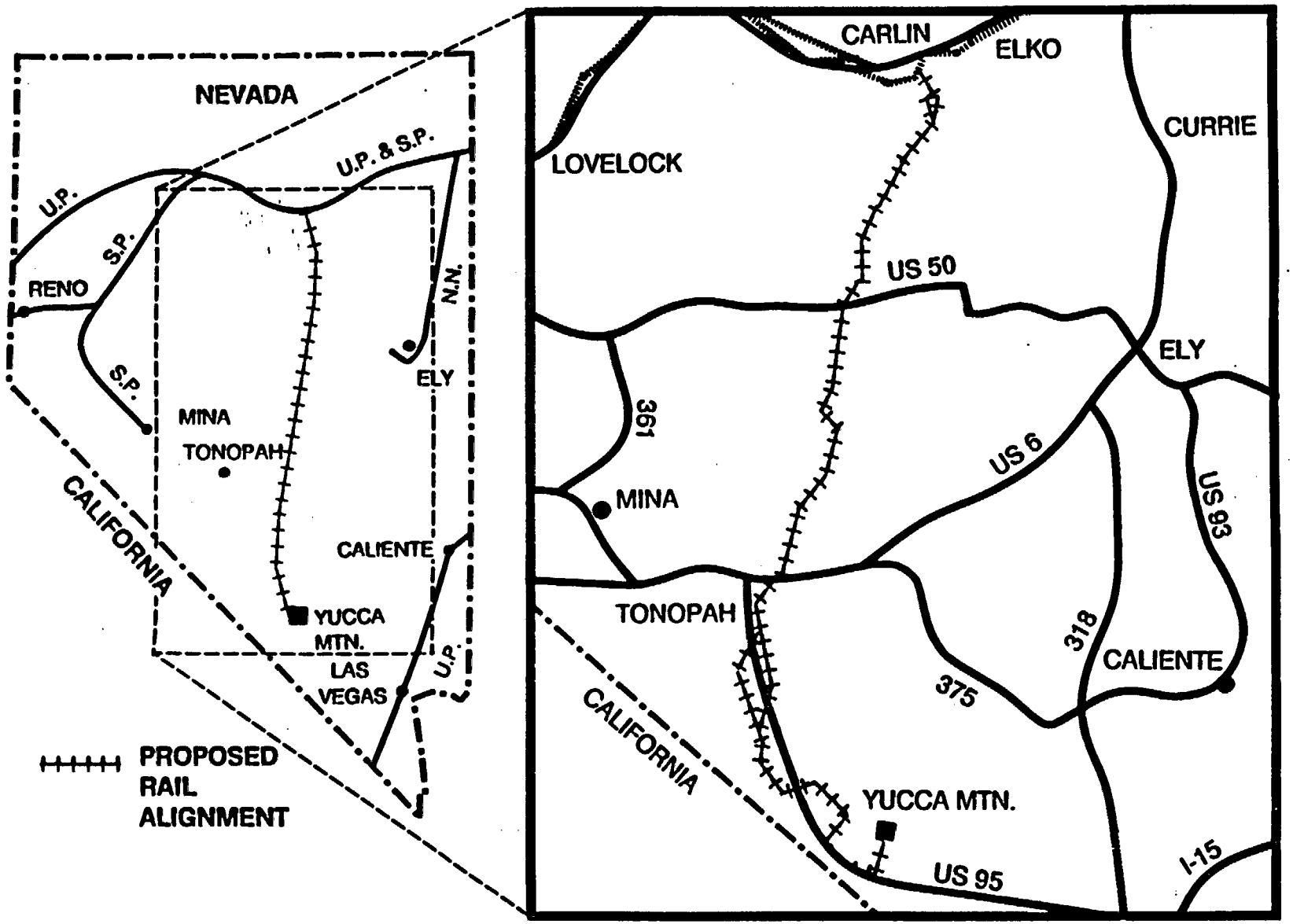

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Figure 3-10. Option 8: Carlin.

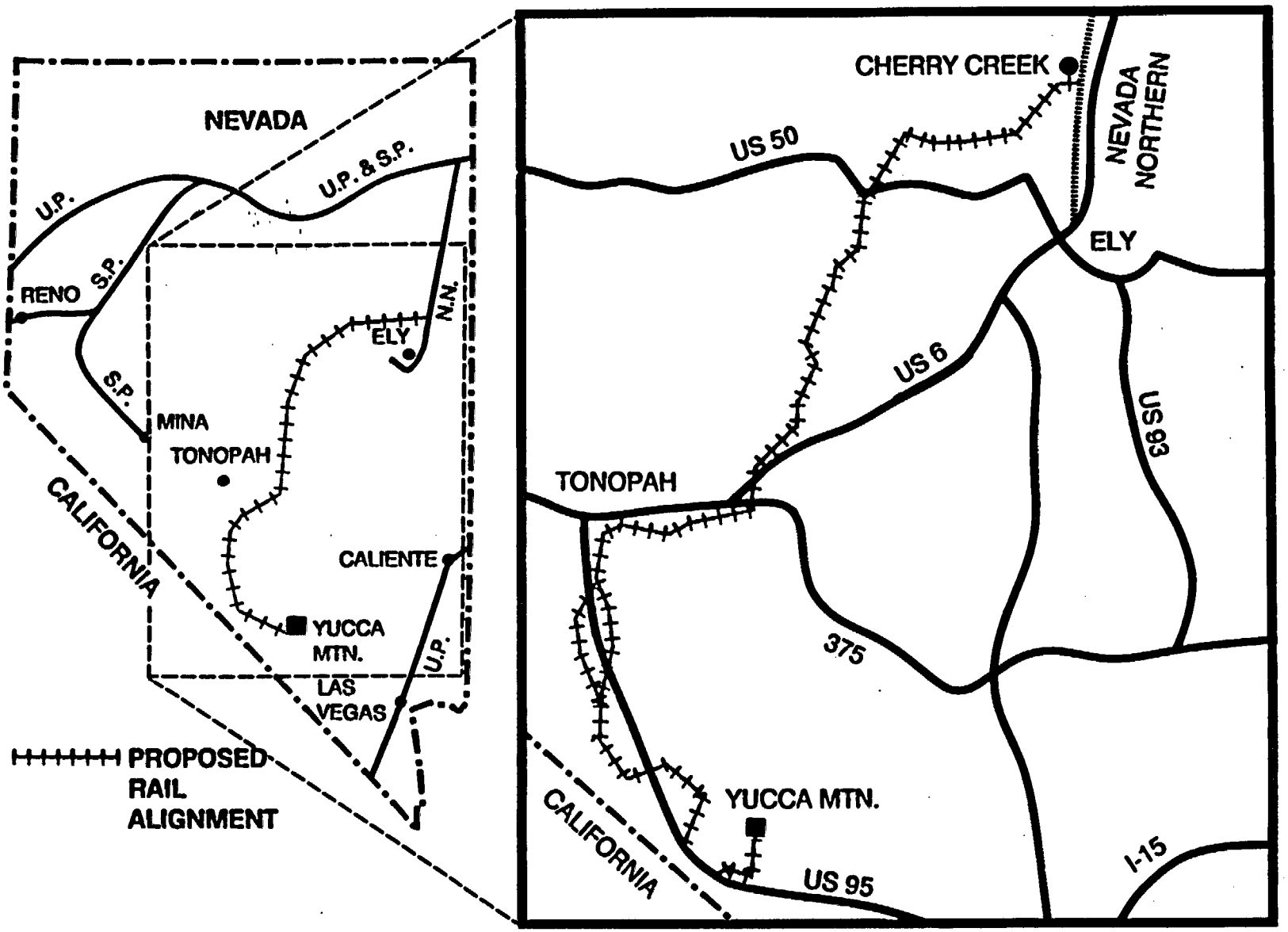

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Figure 3-11. Option 9: Cherry Creek.

Springs along Nevada Highway 375. Because Cherry Creek is about 80 miles east and about 120 miles north of the junction with the Caliente route, this option would have to cross a series of north-south mountain ridges, which would add significant engineering difficulty. However, no private land would be required for the right-of-way. The counties potentially impacted by use of this option are White Pine and Nye counties.

OPTION 10 - DIKE

This option originally identified in the Environmental Assessment for the Yucca Mountain site (DOE, 1986), is approximately 100 miles in length and originates off the Union Pacific Railroad mainline approximately 11 miles northeast of Las Vegas. From this siding, the route heads east-northeast for approximately 10 miles where it bears to the NE, skirting the Las Vegas and Sheep Ranges. This alignment would pass through the Nellis Air Force Base and the Quail Springs Study Area. From that point the option closely parallels the alignment of U.S. 95 to Indian Springs where it passes through the Indian Springs Air Force Auxiliary Field. The option continues west of Indian Springs a few miles where it diverges from U.S. 95 and heads toward Mercury and on to the Yucca Mountain site (Figure 3-12). The counties potentially impacted by this option are Clark and Nye counties.

Lincoln County Option - Route A

The 206 mile Alternative Route A begins in Caliente, Nevada, and heads north to Pioche on the abandoned Union Pacific Railroad right-of-way. The line continues up Lake Valley to Bristol Wells and turns westerly down through Dry Lake Valley south of Burnt Peak to cross Nevada Highway 318. The line continues to Timber Mountain Pass then descends into Coal Valley through Water Gap, into Garden Valley, then into San Spring Valley. The line then runs southwest to Chalk Mountain crossing Nevada Highway 375 and going into Nellis Air Force Range. The line continues down Emigrant Valley around the toe of Rhyolite Hills to Groom Pass. From Groom Pass, the line descends to Yucca Flats then up along Mine Mountain into Mid Valley, then westerly to Yucca Mountain.

Lincoln County Option - Route B

The 203 mile Alternative Route B begins at Crestline, heads up Sheep Spring Draw, then descends just east of Panaca Hills in Meadow Valley and connects to Route A just north of Condor Canyon. From here it follows Route A.

Lincoln County Option - Route C

The 116 mile Alternative Route C begins west of Caliente at Elgin, Nevada. The line climbs out of Meadow Valley Wash and follows Kane Spring Valley and Coyote Spring Valley to U.S. Highway 93, then parallels Highway 93 north to Lower Pahrangat Lake. The line then climbs southwest up through Sheep Range into Desert National Wildlife Refuge passing Desert Lake on the east side. The line continues south, crossing into Clark County and heads southwestern just east of Banded Ridge. The line continues downhill in a southwesterly direction and ends near U.S. Highway 95.

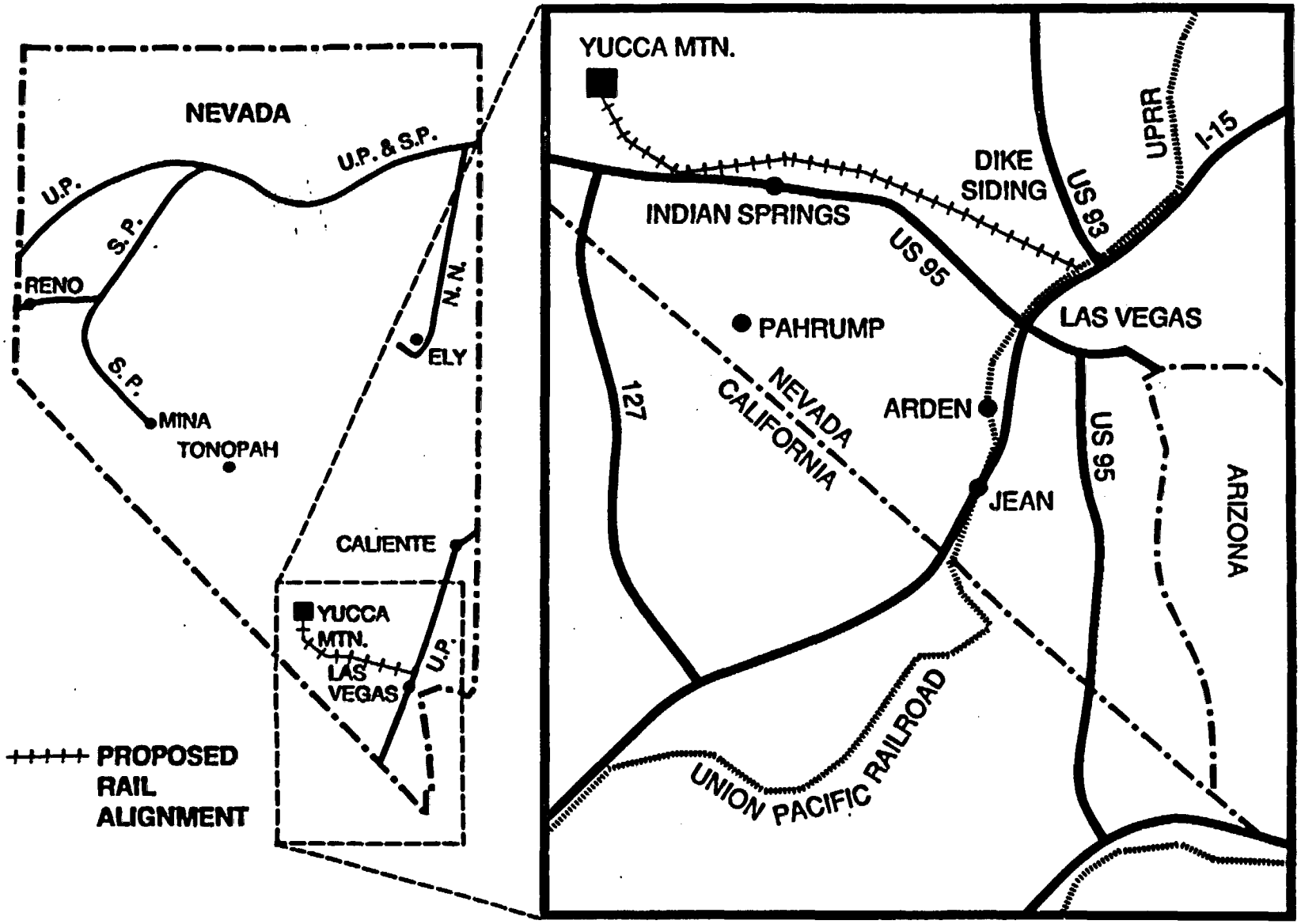

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Figure 3-12. Option 10: Dike.

3.2 CAPITAL, OPERATING, AND MAINTENANCE COSTS

The following section discusses the preliminary estimates of capital, and operating and maintenance (O&M) costs for each of the options. Routes suggested by Lincoln county did not have equivalent cost information and are not addressed in this section. The capital costs which include track work, grading, and drainage, and operating and maintenance costs were estimated using standard railroad industry methods. Right-of-way (ROW) costs for BLM land was assumed to be zero, while ROW costs for private land were estimated to range between 2 to 10 percent of construction costs, depending on the degree to which the land was developed. These costs were developed in order to identify order of magnitude costs for estimating proposes.

3.2.1 CAPITAL COST ESTIMATES

For the purpose of this preliminary study, railroad construction costs were assumed to be $1 million per mile in flat to rolling terrain, $2 million per mile in mountainous terrain, and $2.2 million per mile in very rugged mountainous terrain. These figures include the cost of trackwork at approximately $500,000 per mile and grading, drainage, fencing, and appurtenances totaling slightly over $500,000 per mile in flat to rolling terrain. In mountainous terrain, an additional $1 million to $1.2 million per mile is allotted for increasing grading and drainage. Subsequent rail access studies are expected to refine these costs.

The costs of grade separations and major bridges were estimated separately to range from $600,000 to $2 million. The cost of a rail bridge over Fortymile Wash is estimated to cost $2 million. A high bridge or trestle over U.S. Highway 93 at Indian Cove north of Caliente was estimated to cost $12 million. All cost estimates are in 1988 dollars.

Right-of-way costs were estimated for private parcels of land that could expect to be required mainly in the vicinity of Las Vegas. Some private land would also be required around Carlin, along the Ludlow/Crucero options, at one point on the Cherry Creek route, and along alternatives of the Caliente route. None of the likely right-of-way for private parcels of land is known to be developed. Only BLM land, which is assumed to be available at minimal cost, would be required for the right-of-way elsewhere. The cost of the private land is expected to be relatively minor, raising the cost of the railroad construction by 2 percent per mile in rural areas and 10 percent per mile in undeveloped urban areas.

Additional costs were included for upgrading existing branch and spur railroad utilized by the Mina, Arden, and Cherry Creek options. Although condition of the existing track is not known for the Arden route, the upgrade estimates cover the cost of installing new ballast and rails, and performing tie replacement that would probably be required to ensure safety and permit utilization of 130-ton cars. A similar estimate was made for the Mina route, where the 84 miles south of Fort Churchill will have to be upgraded, and for the 92 miles of the Nevada Northern to Cherry Creek.

No costs were included for rolling stock, which can be expected to be the same for all alternatives. Nominal capital costs were included for possible purchase of the Mina branchline and the Nevada Northern. Current information indicates the SPTCo may seek to abandon or sell the branchline in the 1990s. Therefore purchase of the branchline may be necessary.

3.2.2 OPERATING AND MAINTENANCE COST ESTIMATES

Expected operating costs were based on work by W. W. Hay (1982) in addition to baseline estimates of railroad operating costs. Increases to typical mainline operating costs because of relatively low tonnage were balanced out by expected efficiencies of operating a short-line railroad. These calculations resulted in an estimated operating cost of $16.70 per 1,000 gross ton miles (gtm).

Track maintenance costs were estimated to be $5,140 per track mile per year, equivalent to an additional operating cost of $50.15 per 1,000 gtm. This value is based on data from studies which include maintenance costs reported to the California Public Utilities Commission for short-line railroads. The unit costs per gtm reflect the relatively low total tonnage, heavy (130- to 150-ton) cars, and high concern about safety. Because the track would need to be maintained during the period between waste emplacement and repository closure for possible waste retrieval, O&M costs after the expected end of operations and up to decommissioning would continue at a rate of 70 to 75 percent of the O&M costs during operation.

For the purpose of this preliminary study, all operating cost figures are based on a projected tonnage of 102,500 gross tons per year, corresponding to an average of 112 one-way trains per year (Roberts, 1988). Each train consists of five 131-ton HLW cars and a 30-ton caboose with four 30-ton gondola cars for buffers, two on each end of the HLW cars. Although different cost and tonnage estimates will lead to different absolute costs, there would be minor comparative differences among the alternatives.

Additional financial outlays were projected for the costs of operating over rise and fall, curvature, and the incremental distance compared with the shortest alternative. The additional costs of rise and fall and curvature are not significant factors in the total O&M costs, comprising less than 2 percent of the average O&M costs.

Table 3-1 summarizes the lengths of, and costs associated with, each of the options and their alternatives. It should be noted that some of the proposed options share common alignments, and in some cases, common alternatives. The length of, and capital costs, ranged from a low of 99 miles at $142 million for the Valley option to a maximum of 448 miles at $735 million for the Caliente option utilized in alternative 7B alignment.

Table 3-1. Summary of option costs

Options[a]		Length (miles)		Cost ($ millions)	
	Alternative	New const.	Total incl. Rehabilitation	Capital	Annual O&M
(1)	Valley	99	99	142	0.74
	1A	119	119	183	0.87
(2)	Arden	99	108	144	0.80
	w/1A	119	128	185	0.93
(3)	Jean	121	121	183	0.89
(4)	Crucero	147	147	205	1.10
(5)	Ludlow	170	170	238	1.20
(6)	Mina	209	293	394	1.50
	6A	368	373	669	2.67
(7)	Caliente	406	406	692	2.90
	7A	413	413	698	2.90
	7B	448	448	735	3.30
	7C	389	389	639	2.80
	7D	388	388	636	2.80
	7E	380	380	631	2.70
	7CE	367	367	579	2.60
(8)	Carlin	365	365	661	2.90
	8A	365	365	659	2.50
(9)	Cherry Creek	370	462	642	3.30
	w/7A	377	469	649	3.30
	w/7B	412	504	685	3.70
(10)	Dike Siding	100	100	121	0.69

[a]Several of the options utilize common alignments; however, where applicable, costs for alternatives were included.

4.0 OPTION EVALUATION

The option evaluation discussed in the following section is based on a review of existing BLM maps, contact with agency/developer personnel, and preliminary review of county land ownership records.

4.1 LAND-USE COMPATIBILITY

The following is a discussion of the land-use compatibility of each of the identified rail access spur options. The extent of land-use conflicts associated with each of the routes is summarized in Table 4-1.

- *Valley Option*: The irregular pattern of privately- and publicly-owned land along the southern portion of the route and the passage of the route through the boundaries of North Las Vegas indicate that a high potential exists for land-use conflicts, although the exact development plans for these lands are currently unknown. The Valley option would pass within 5 miles of the Nellis Wilderness Study Area, Floyd Lamb State Park, and through the Desert View Nature Area. The possibility exists that the alignment of this option could be significantly changed pending resolution of the designation of the Wilderness Study Areas. Congress can consider changing the status of these areas in 1993. (DOI, 1988)
- *Jean Option*: This route, as presently aligned, has only minor potential for contact with private land (patented mining claims and the town of Jean), and it is highly probable that current tracts of private land could be avoided. This option has no significant conflicts with current BLM land-use plans.
- *Arden Option*: This option is in direct conflict with areas currently being developed privately on the west side of Las Vegas. In addition, the proposed route would also impact the Desert View Nature Area Viewshed. Finally, the route would pass within 5 miles of the Red Rock Canyon Recreation Area, and would intersect with existing access roads to the area. As a result, the option is considered to have known land-use conflicts.
- *Mina Option*: The base option would avoid private lands completely. However, the Southern Pacific branch line, which this option would access, does traverse the Walker Indian Reservation and ownership of this right-of-way is being contested. In addition, the SP has filed for permission to abandon the portion of the branchline between Thorne and Mina, Nevada (ICC, 1989). The alternative to this option, identified as Mina Bypass (6A), would avoid the potential conflict with the Walker Indian Reservation. However, the option would pass within 5 miles of the U.S. Navy (USN) Bombing Ranges. The USN is currently planning to expand these ranges. No conflicts with BLM or other agency land-use plans have been identified. Due to the uncertainty of the ownership of the right of way through the Reservation, the status of the abandonment proceedings, and the USN Bombing Range expansion plans, this route is considered to have a potential land-use conflict.

Table 4-1. Land-use conflicts

Option	Known[a]	Potential[b]	None[c]
Valley	X		
Jean			X
Mina		X	
Caliente			X
Ludlow	X		
Crucero	X		
Cherry Creek		X	
Carlin		X	
Arden	X		
Dike	X		
Option A	X		
Option B	X		
Option C	X		

[a]Known = There is a definite conflict with existing or planned land-use activities; high degree of uncertainty as to the resolution of the conflict; an extremely low probability that conflict would abate.
[b]Potential = A conflict with current or planned land-use activity or classification exists; however, the extent of conflict is unknown; the probability exists that conflict could be abated, or may be resolved, due to external, non-DOE, activities.
[c]None = There is no identified conflict with existing or planned-use activities.

- *Caliente Option*: The base route for Caliente and alternatives 7A and 7B avoid private lands completely. These options, which would bypass Caliente, would traverse mountains containing some archaeological sites and a deer habitat. However, no BLM land-use plan conflicts are currently identified. The alternatives to this base case, Caliente 7C, 7D, 7E, are estimated to cross about 2 miles of private land.

  Currently, due to the lack of any identified existing or planned land-use conflict, the base Caliente route and alternatives 7A and 7B are considered to have only minor potential conflicts.

- *Ludlow Option*: There are no known or potential private land-use conflicts associated with this route. However, this option would conflict with existing BLM land-use plans by requiring use of "limited use" lands which may not be available if a "feasible alternative" exists. In addition, the option passes in close proximity to Areas of Critical Environmental Concerns. As a result of these potential conflicts, the option is identified as having a known land-use conflict.

- *Crucero Option*: This option has the same land-use concerns as those identified for the Ludlow option and, hence, has a similar evaluation.

- *Cherry Creek Option*: This option would avoid private land completely, and therefore, does not have a conflict. However, the Nevada Northern Railroad right-of-way, which this option would access is currently owned by a private company, and the plans and schedules for developing this line are uncertain. Should this line be developed, operational conflicts in the area of usage and scheduling could occur as a result of private ownership. The probability exists that the line could be designated as an industrial spur requiring negotiation of access and usage fees. As a result, a potential conflict exists. With respect to BLM land-use plans, minimal conflicts exist.

  As a result of the uncertainty associated with the Nevada Northern Railroad right-of-way option, this option is considered to have a potential land-use conflict.

- *Carlin Option*: Due to the checkerboard pattern of land ownership in the vicinity of the railroads across northern Nevada, both the base option and the alternative, Carlin 8A, would require some private land, currently estimated at not more than 5 miles in length. As in the previous option, the Carlin option has some minimal conflict with BLM land-use plans. Due to the minimal private land required and the minimal BLM land-use conflicts, the option is currently considered to have only a minor potential land-use conflicts.

- *Dike Option*: As presently aligned, this route would traverse Department of the Air Force land that has been withdrawn. As a result the route is considered to have known land use conflicts.

- *Option A*: As aligned, this option would cross land withdrawn from public use by the DOE and the Department of Defense. As a result, this option is currently considered to have a known land use conflict.

- *Option B*: This option has the same land use conflict as that identified for Option A, and, hence, has a similar evaluation.

- *Option C*: This option would traverse the proposed Wilderness Study Area near the lower Pahrangat Lake and the Desert National Wildlife Refuge. This option, therefore, is considered to have known land use conflicts.

4.2 RAIL ACCESS TO REGIONAL CARRIERS

The ability to access more than one regional carrier is considered important since it permits increased flexibility in operations planning. Of the ten routes identified by DOE, two routes, Carlin and Cherry Creek, would have direct access to more than one regional carrier. Of the remaining routes, including those proposed by Lincoln County, all would have indirect access to more than one carrier except Lincoln County, Option C. Indirect access means that although the option has one origin point in a single line, access to that origin point can be accomplished by more than one regional carrier.

5.0 RECOMMENDATIONS

Two criteria for recommendation of routes for further investigation have been evaluated for the ten routes identified by DOE and the three routes proposed by Lincoln County. These criteria are avoidance of obvious land use conflicts and potential access to each of the three regional rail carriers.

Of the ten options identified by DOE in this report, the Arden, Valley, Crucero, Ludlow, and Dike options were identified as having known land-use conflicts that have a low probability of being resolved. Each of the three options proposed by Lincoln County were found to have similar land use conflicts. The Jean and Caliente options were shown to have no, or minimal, potential land-use conflicts. The remaining options, Cherry Creek, Mina, and Carlin, have a potential land-use conflict that may be resolved. This breakdown of land-use conflict was previously summarized in Table 4-1.

Recommendation of the Jean and Caliente options would avoid significant land use conflict, but would only allow access to two of the three regional rail carriers. For this reason, the Carlin, Cherry Creek, and Mina options were evaluated to recommend the option with the least potential for irreconcilable conflicts. Due to uncertainty facing both the Cherry Creek and Mina options in the areas of access and ownership, respectively, it was judged that the Carlin option had the least potential for significant conflict based on current information.

As a result of this preliminary study, the Jean, Caliente, and Carlin options are recommended to be the focus of further rail access development activities. These activities would include development of conceptual designs to support more detailed costs, engineering, land access and environmental evaluations. The remaining seven DOE options, Crucero, Ludlow, Arden, Valley, Mina, Cherry Creek, and Dike, and the three Lincoln County proposed options will continue to be monitored for changes in their status that could affect their potential feasibility.

Additional options may be considered in the future if additional routes with potential to meet the criteria developed in this report are identified. The focus of future rail development activities will also be evaluated periodically in order to continue to support the needs of the Yucca Mountain Project and in response to new information on the current options.

6.0 REFERENCES

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