Appendix D

- Technical Memorandum #4 - Candidate Alignments and Evaluation, Sep 2011

Hidden Waters Parkway North
Feasibility Study:
Interstate 10 to State Route 74

Final -Tech Memo 4
Candidate Alignments and Evaluation

Prepared For:

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Abbreviations

Arizona Department of Water Resources	ADWR
Arizona Game and Fish Department	AGFD
Arizona Public Service	APS
Arizona State Land Department	ASLD
Bureau of Land Management	BLM
Bureau of Reclamation	BOR
Capital Improvement Program	CIP
Central Arizona Project	CAP
Development Master Plan	DMP
Environmental Overview	EO
Flood Control District of Maricopa County	FCDMC
Geographic Information System	GIS
Maricopa Association of Governments	MAG
Maricopa County Department of Transportation	MCDOT
Municipal Planning Area	MPA
Master Planned Community	MPC
National Environmental Protection Agency	NEPA
National Registor of Historic Places	NRHP
Palo Verde Nuclear Generation Facility	PVNGF
Planned Area Development	PAD
Salt River Project	SRP
State Route	SR
Toyota Arizona Proving Grounds	TAPG
Technical Advisory Committee	TAC
Traffic Interchange	TI
Transportation Improvement Program	TIP
US Fish and Wildlife Service	USFWS
Western Area Power Authority	WAPA

1.0 Introduction

1.1 Background

The Interstate-10/Hassayampa Valley Roadway Framework Study (Hassayampa Framework Study) is a transportation planning document completed by the Maricopa Association of Governments (MAG) in 2007 that identified a comprehensive roadway network to meet future traffic demands in northwest Maricopa County. The roadway network recommended by the Hassayampa Framework Study is comprised of freeways, parkways and major arterial roads. The Hidden Waters Parkway was identified as a major link in the transportation framework.

The Hidden Waters Parkway North (Hidden Waters Parkway) Feasibility Study Area is located west of the Phoenix metropolitan area in Maricopa County, Arizona (Figure 1-1). The area west of the White Tank Mountains within the Hassayampa River Valley has been identified as an area where intense growth is anticipated to occur in the future. The Hidden Waters Parkway North Parkway Feasibility Study was commissioned by Maricopa County Department of Transportation (MCDOT) in response to this anticipated growth and the future need for a high-capacity roadway within this corridor.

The study area includes the northern section of the Hidden Waters Parkway, as shown on the Hassayampa Framework Study, from Interstate 10 (I-10) north to the future alignment of State Route 74 (SR74). The study area is approximately 28 miles long and two miles wide, primarily centered about the Hassayampa Framework Study proposed alignment for the Hidden Waters Parkway. Except in the area from Northern Avenue to Bell Road where the study area expands to two miles west of the Hassayampa Framework Study alignment and from the south end of Douglas Ranch to Patton Road where the study area expands to two miles east of the Framework Study alignment. This results in the study corridor being a total of three miles wide in these two areas (refer to Figure 1-1 for a graphic depiction of the study area).

The proposed Hidden Waters Parkway corridor passes adjacent to, or through, several entitled Master Plan Communities (MPC) including: Millennium Ranch, Hassayampa Ranch, Belmont, and Douglas Ranch. At build-out, it is estimated that these communities may contain over 187,000 dwelling units. The need for a parkway within the Hidden Waters corridor is based upon projected development and is linked directly to the development of the previously mentioned MPC's. It is important to identify a recommended alignment for the Hidden Waters Parkway during the planning stages of the proposed MPC's to ensure that adequate right-of-way will be preserved.

The purpose of the Hidden Waters Parkway study is to document conditions along the parkway corridor, identify potential fatal flaws and develop an alignment alternative that meets the future traffic needs identified in the Hassayampa Framework Study. The recommended alternative will establish a roadway footprint that may be used as a guide for local agencies and development within the corridor.

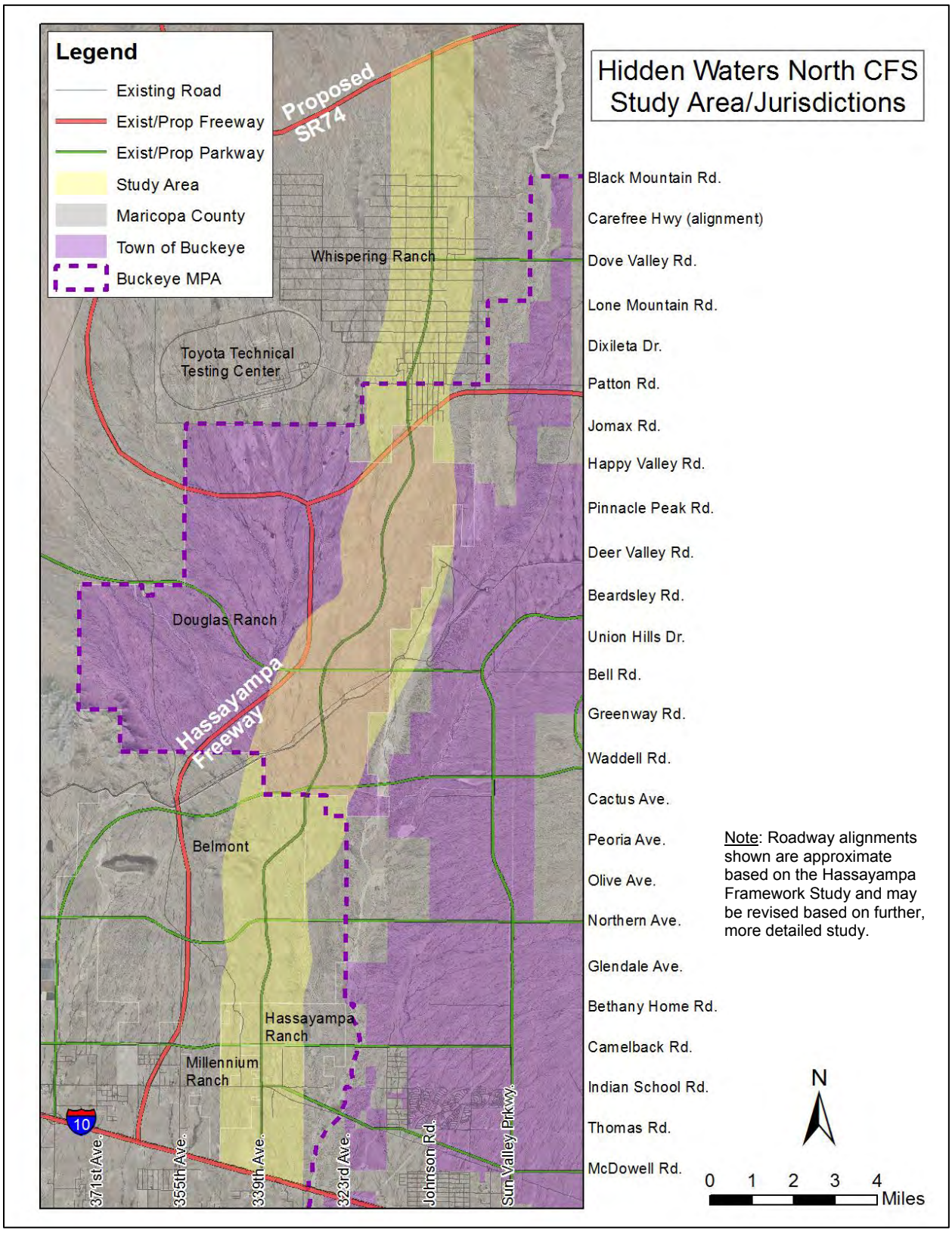


Figure 1-1 Hidden Waters Parkway Study Area

2.0 Development of Parkway Alignments

The candadate alignments for the Hidden Waters Parkway were developed using a tiered format. The purpose of this technical memo is to document the process used to develop and evaluate these candidate alignment alternatives.

2.1 Conceptual Parkway Alignments

Conceptual alignments for the Hidden Waters Parkway were intiially developed in response to the opportunities and constraints identified in Technical Memos 1, 2 and 3 which include:

- Existing/proposed residential communities
- Existing commercial and/or employment centers
- Current land ownership
- Environmental resources
- Existing/proposed utilities
- Existing drainage patterns

These conceptual alignments are presented in Figure 2-1. Each of the potential alignments was considered a viable option for a 200ft wide parkway corridor to address the transportation needs of the study area.

To determine which candidate alignments would be carried forward for further analysis members of the design team evaluated each conceptual alignment segment. These efforts refined the conceptual alignments down to the three candidate alignment alternatives identified and discussed in the following section.

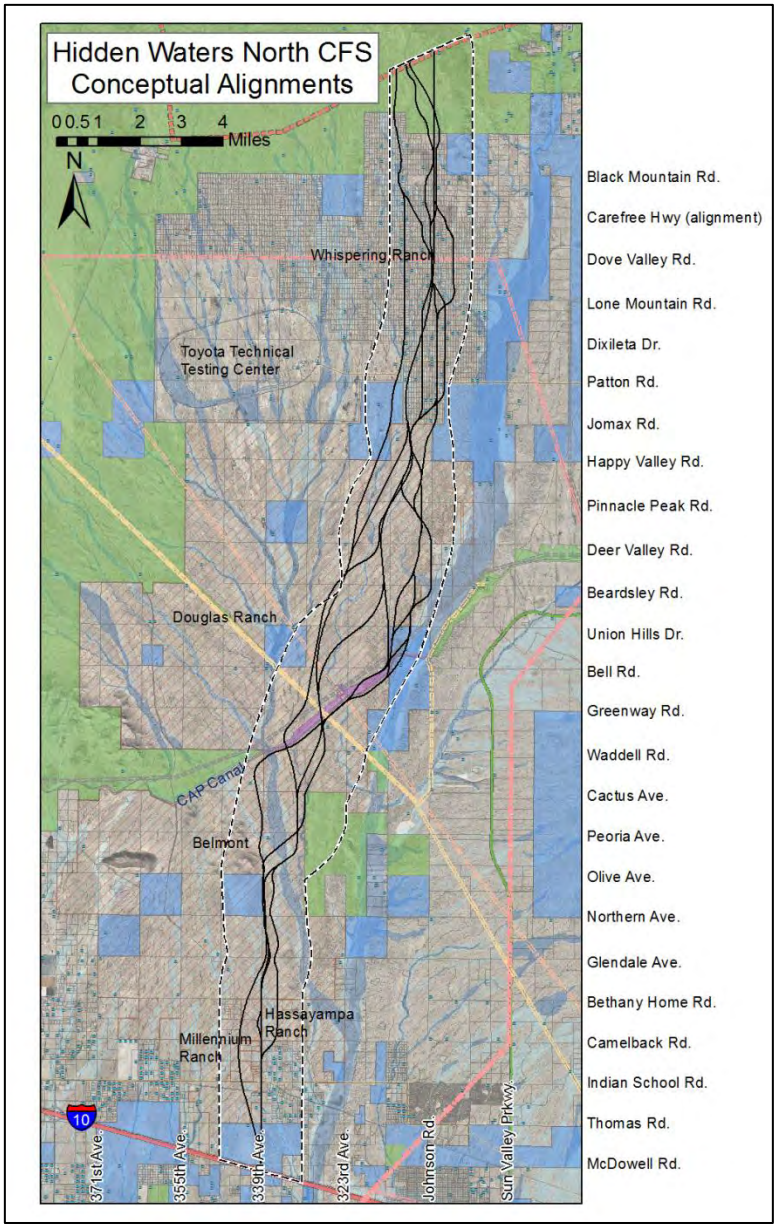


Figure 2-1 Conceptual Alignments for the Hidden Waters Parkway

2.2 Candidate Parkway Alignments

Three candidate parkway alignment alternatives, plus the no-build alternative, were carried forward into the next tier of development and analysis. The three candidate alignment alternatives are depicted in Figure 2-2. Schematic drawings of the candidate alternatives are presented in section 2.4.

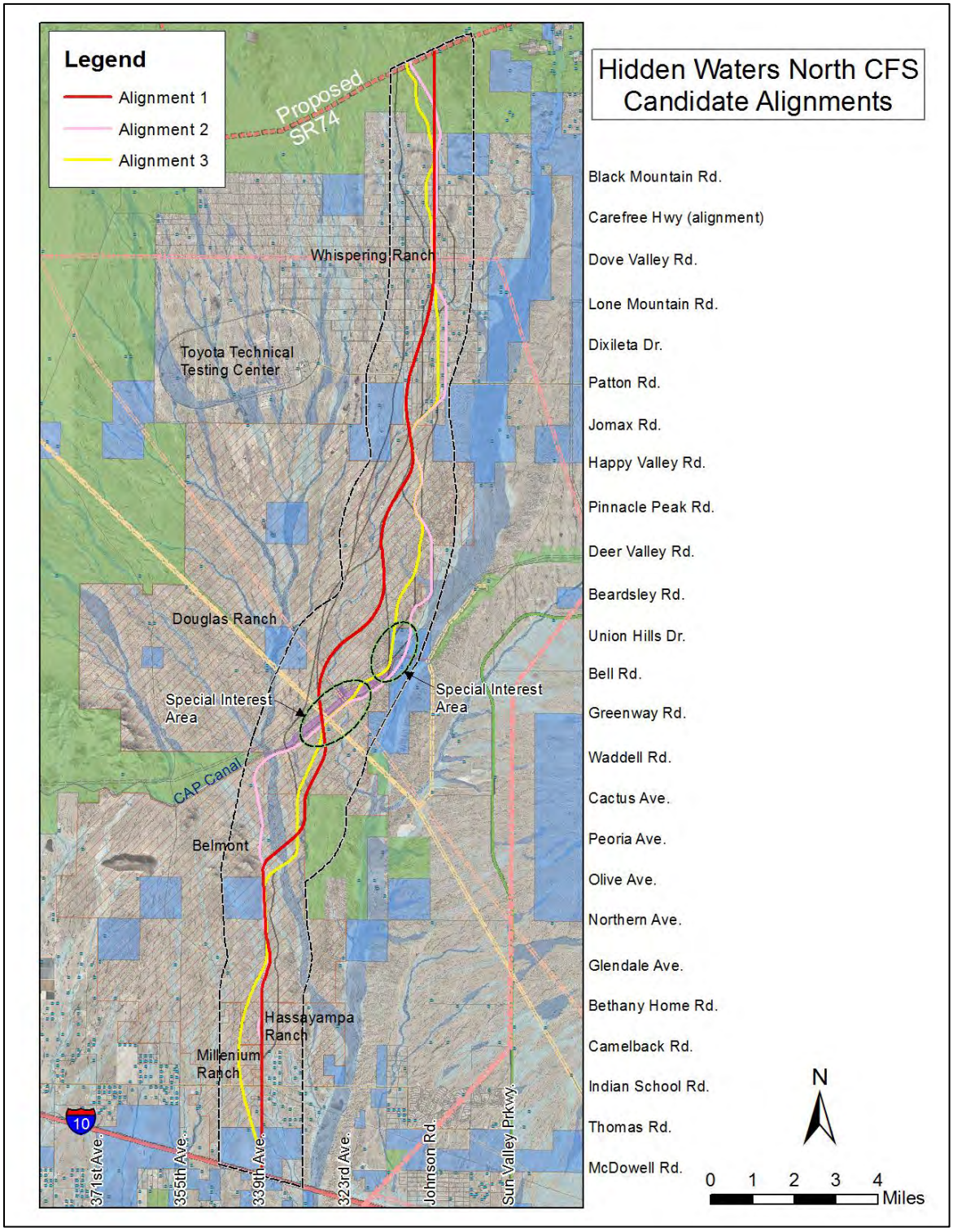


Figure 2-2 Candidate Alignments for the Hidden Waters Parkway

Alternative 1

The first alignment alternative carried forward for further analysis was developed during the Hassayampa Framework Study. Alternative 1 begins at the 339th Avenue/ I-10 Traffic Interchange (TI) and continues north for seven miles along the 339th Avenue alignment. North of Olive Avenue, Alternative 1 shifts east to the 331st Avenue alignment and follows a curvilinear path through the proposed Douglas Ranch development approximately along arterial roadway alignments identified in the Development Master Plan (DMP) circulation element (refer to figure 3-1). Alternative 1 follows the 302nd avenue alignment between Dove Valley Road and the northern boundary of the study area.

Alternative 2

Alternative 2 was developed in response to existing/approved land plans and the stakeholder feedback received during the planning phase of this study. It incorporates the proposed circulation elements of the Hassayampa Ranch, Belmont, and Douglas Ranch MPCs.

Similar to Alternative 1, Alternative 2 begins at the 339th Avenue/ I-10 TI and continues north to Camelback Road. It follows the proposed parkway alignment of Hassayampa Ranch between Camelback and Bethany Home Road, which curves approximately 500 feet to the west 339th Avenue. Alternative 2 runs along the west side of Jackrabbit Wash, through the proposed Belmont MPC, then turns east along the south side of the Central Arizona Project (CAP) canal. Alternative 2 crosses the CAP canal at the Hassayampa River siphon, and runs along the east side of the proposed Douglas Ranch development. The alternative then runs along 229th Avenue between Jomax Road and Lone Valley Road where it shifts west to the 302nd Avenue alignment until Carefree Highway alignment. At this point alternative 2 generally runs along the east side of an unnamed wash to the proposed alignment for SR 74.

Alternative 3

The third alignment alternative carried forward to the second tier of analysis begins at the 339th Avenue/ I-10 TI and then curves to the west along an existing ridgeline between McDowell Road and the Glendale Avenue alignment. This shift was added to minimize the number of wash crossings for the proposed parkway. Alternative 3 follows the same path as Alternative 1 between Glendale Avenue and Olive Avenue, then turns east to cross Jackrabbit Wash near its narrowest floodplain width. It then continues north along an existing ridgeline to the CAP canal where it crosses the canal approximately one mile west of Alternative 2. At this point Alternative 3 continues north along the west side of an Arizona State Land Department (ASLD) parcel and an existing ridgeline until it rejoins Alternative 2 north of the Deer Valley Road alignment. This alternative passes through the community of Whispering Ranch along/between 301st

Avenue and 302nd Avenue. Alternative 3 generally runs along the west side of an unnamed wash north of Black Mountain Road to the proposed alignment for SR 74.

No Build Alternative

The no-build alternative considers how the existing roadway network would function if this project were not constructed. This alternative provides a valuable baseline for comparison when evaluating other alignments.

2.3 Special Interest Areas

A special interest area was identified near the intersection of 323rd Avenue and Greenway Road. At the location, the candidate alignment alternatives converge on the CAP canal, existing and proposed overhead electrical transmission lines, a major drainage crossing, Bureau of Reclamation lands, and a potential cultural resource site. Additional analysis may be required to ensure that the candidate alignment alternative recommended for further evaluation appropriately addresses the potential constraints of this area.

A second special interest area was added to evaluate the CAP crossing of candidate alternatives near the Hassayampa Wash/CAP siphon.

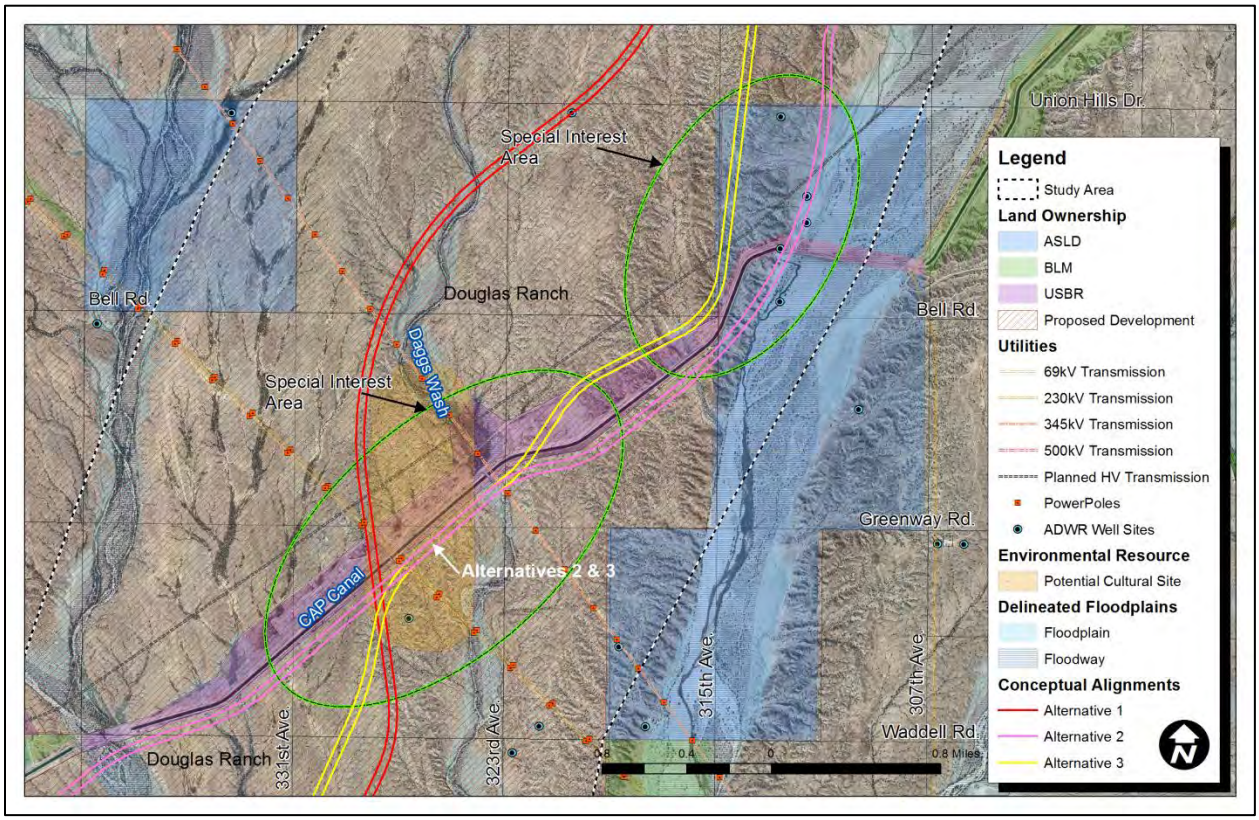


Figure 2-3 Special Interest Area

2.4 Schematic Drawings of the Candidate Alignment Alternatives

Figure 2-4 presents a sheet index for the schematic drawings of the Hidden Waters Parkway Candidate Alignments.

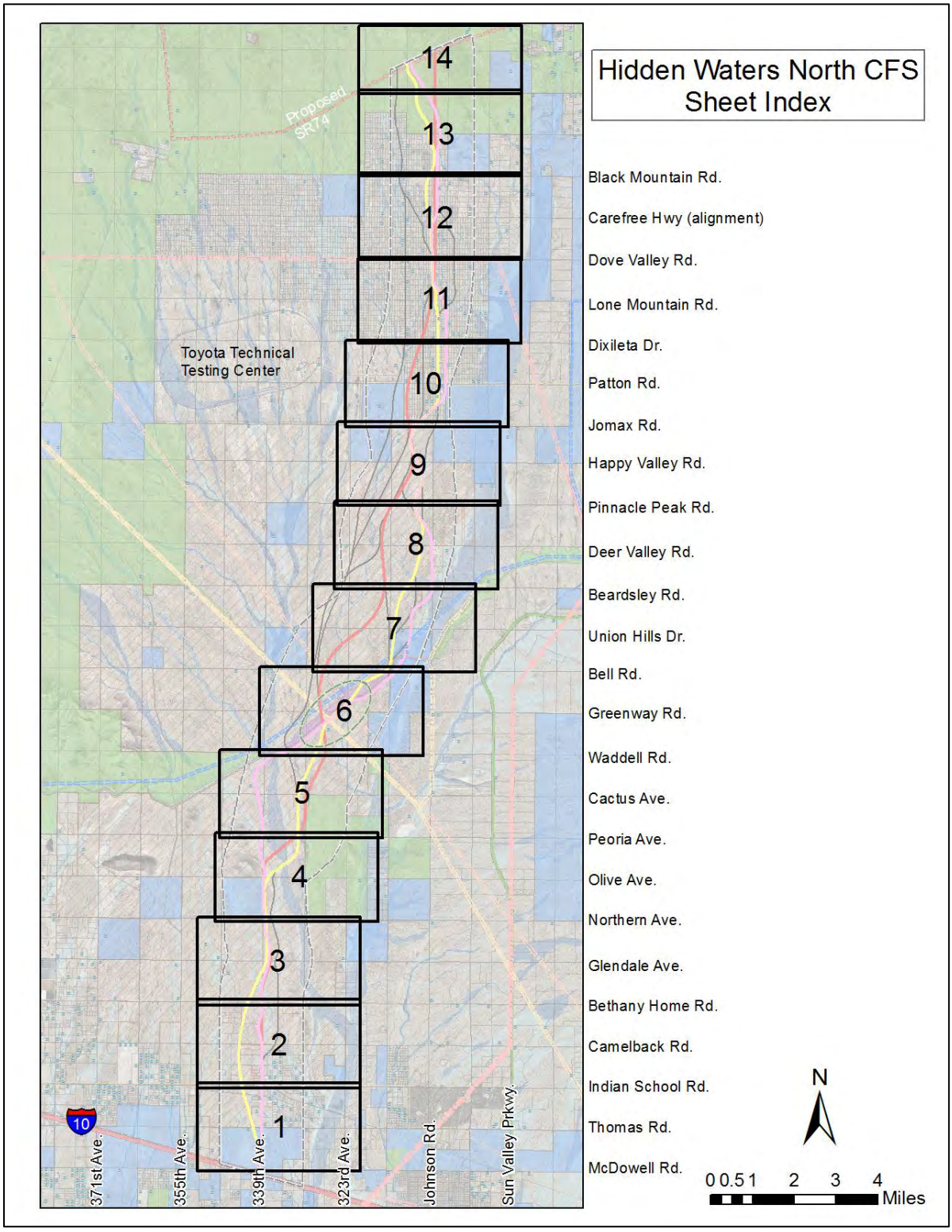


Figure 2-4 Sheet Index for the Schematic Drawings of the Candidate Alignments

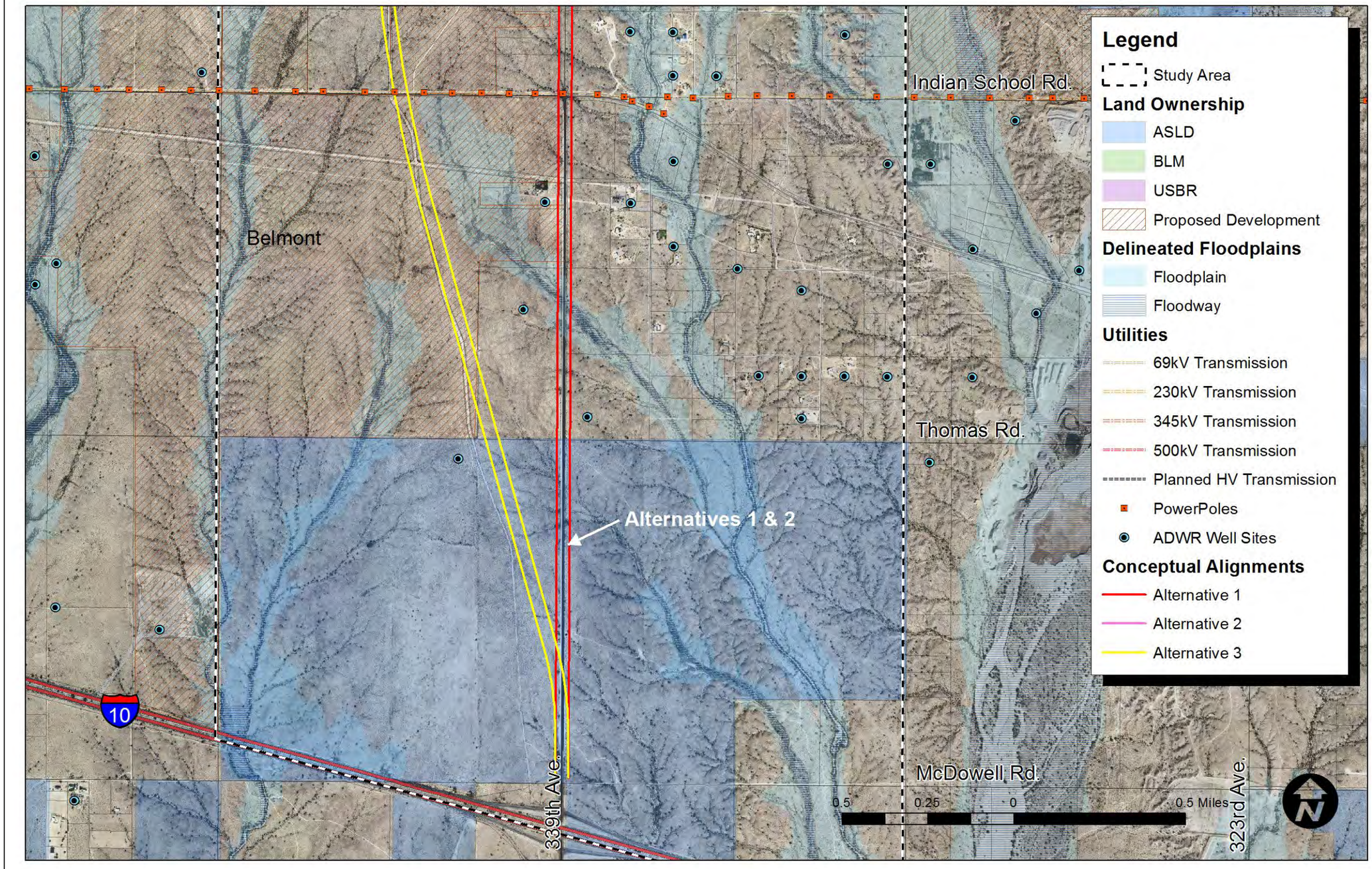


Figure 2-5 Schematic Drawing of Candidate Alternatives (1 of 14)

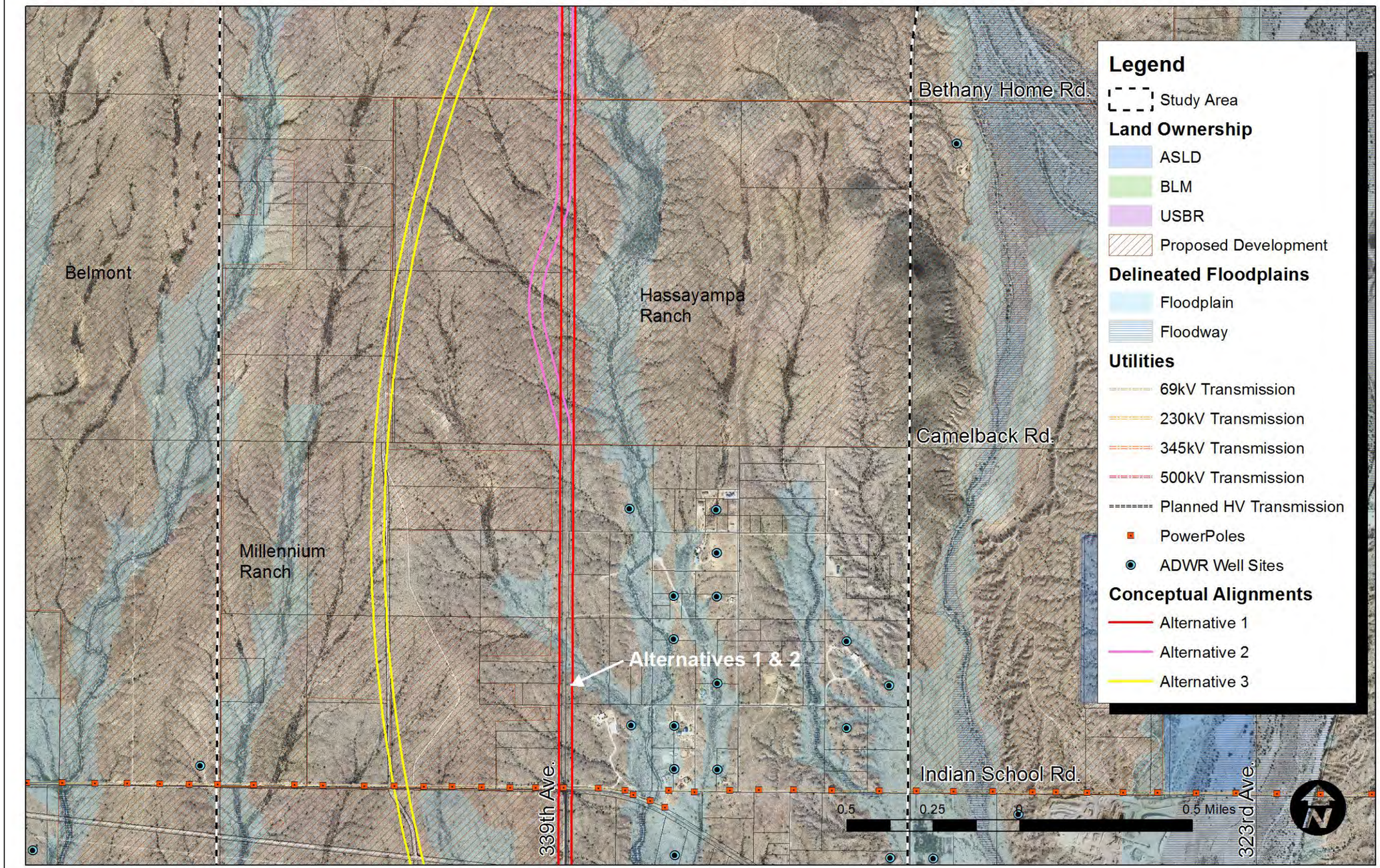


Figure 2-6 Schematic Drawing of Candidate Alternatives (2 of 14)

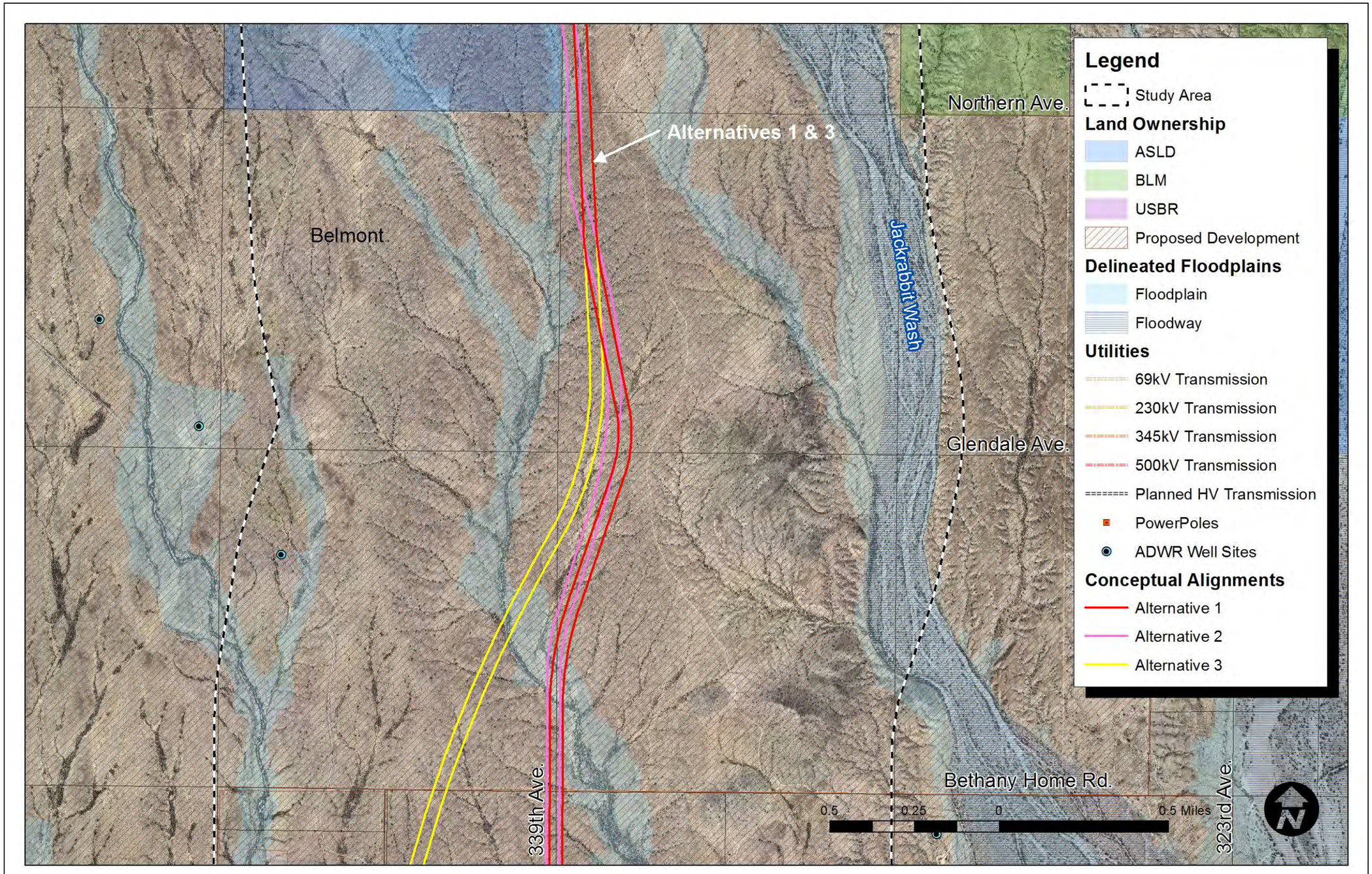


Figure 2-7 Schematic Drawing of Candidate Alternatives (3 of 14)

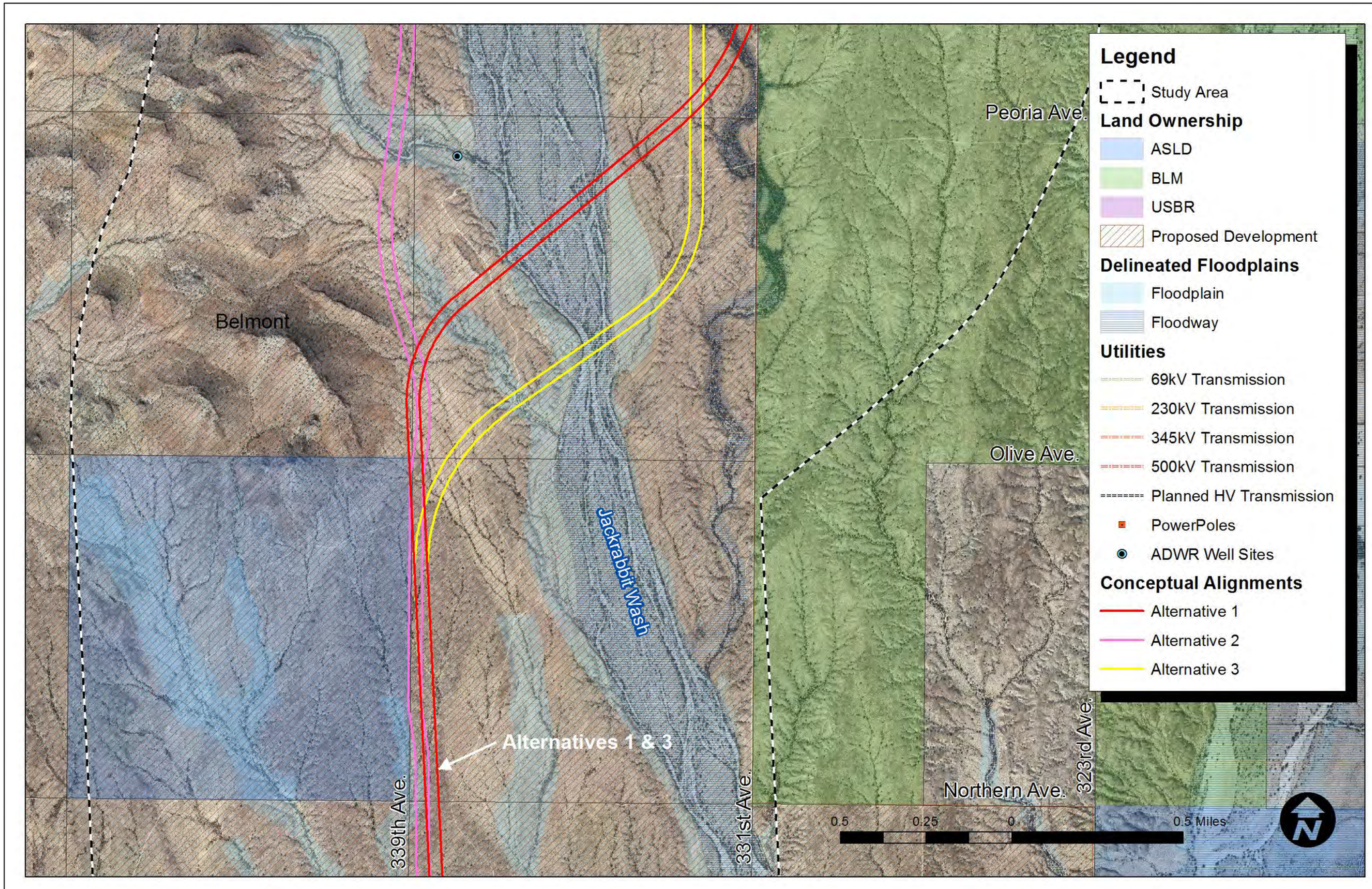


Figure 2-8 Schematic Drawing of Candidate Alternatives (4 of 14)

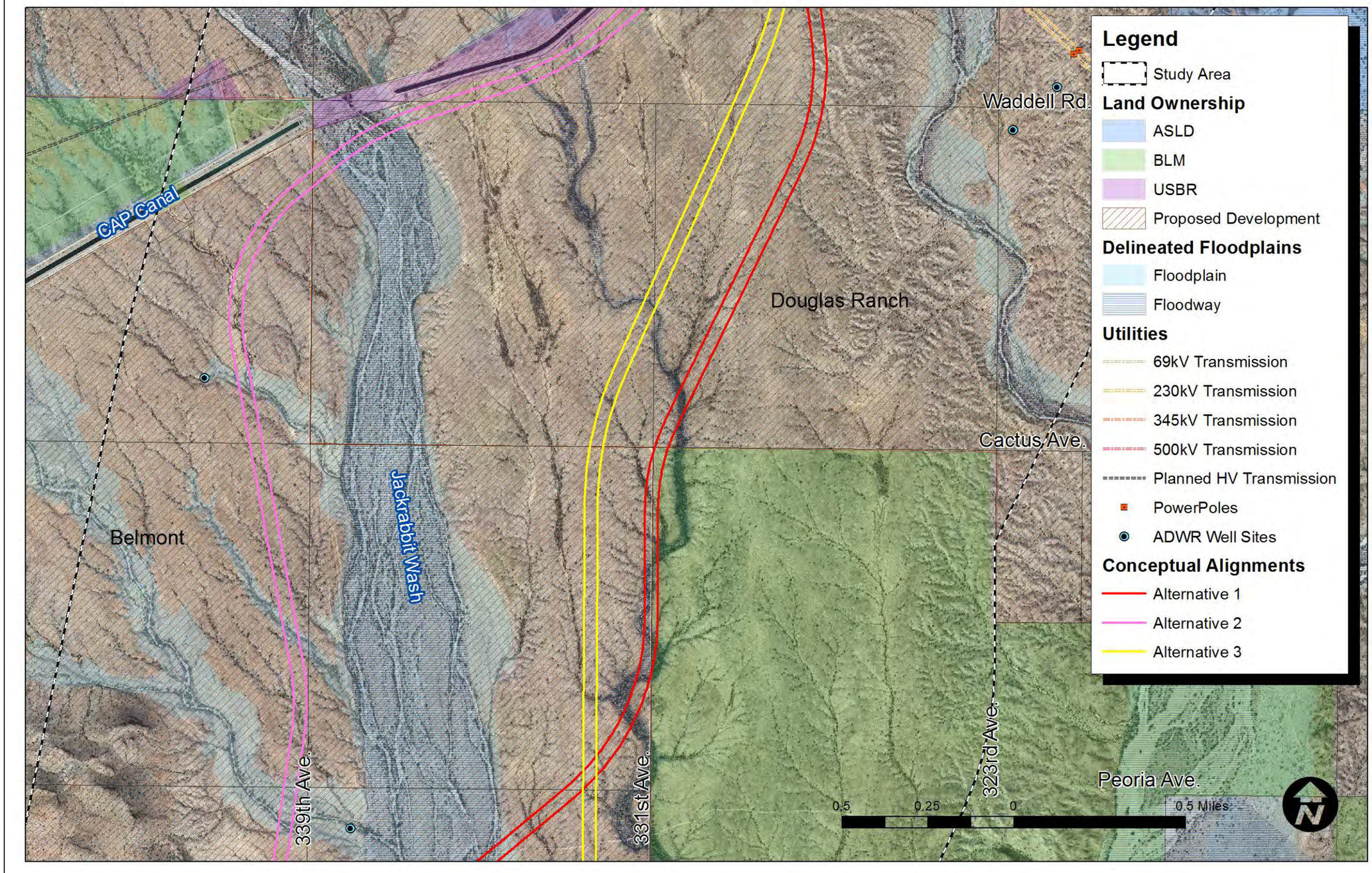


Figure 2-9 Schematic Drawing of Candidate Alternatives (5 of 14)

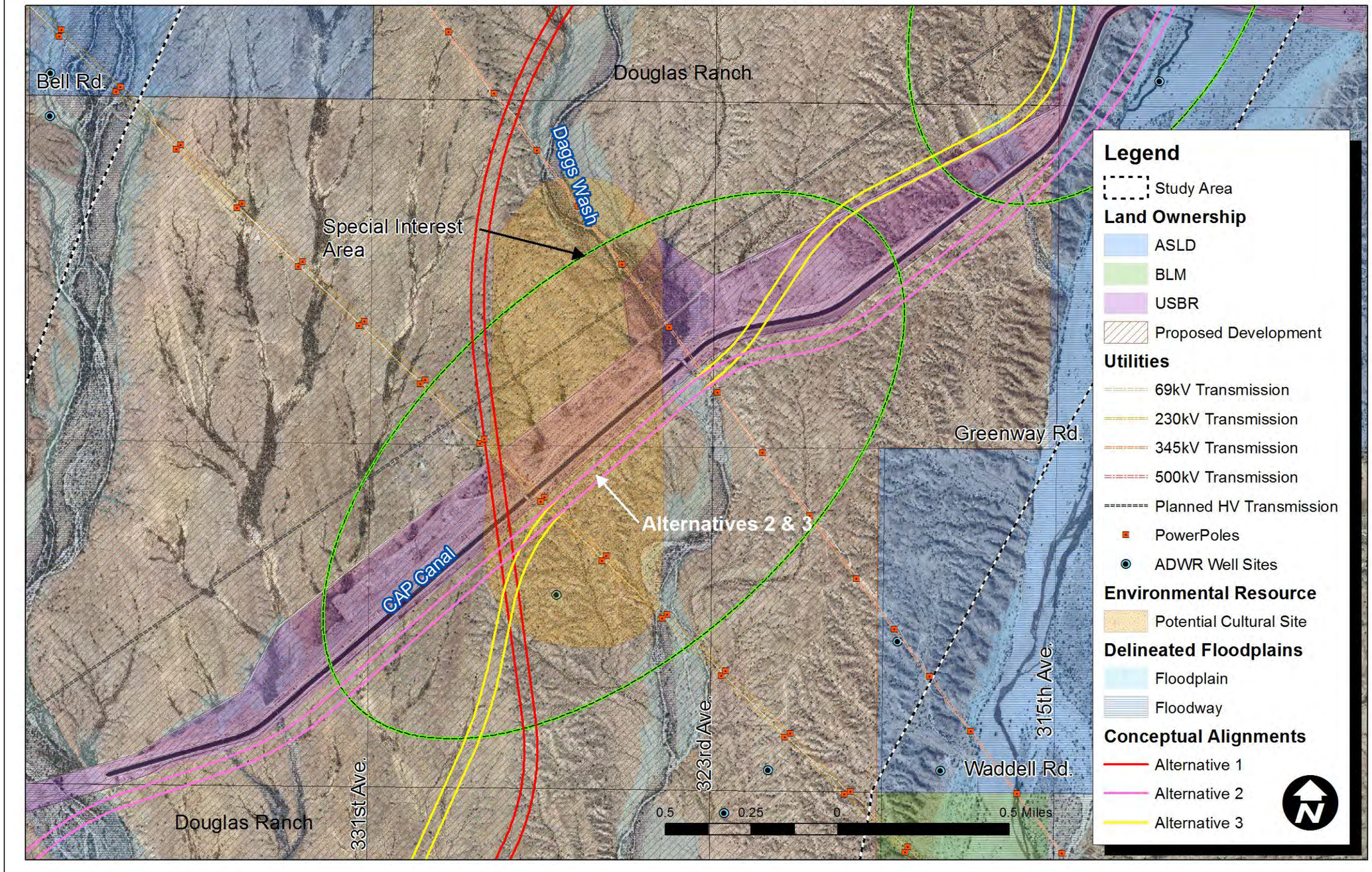


Figure 2-10 Schematic Drawing of Candidate Alternatives (6 of 14)

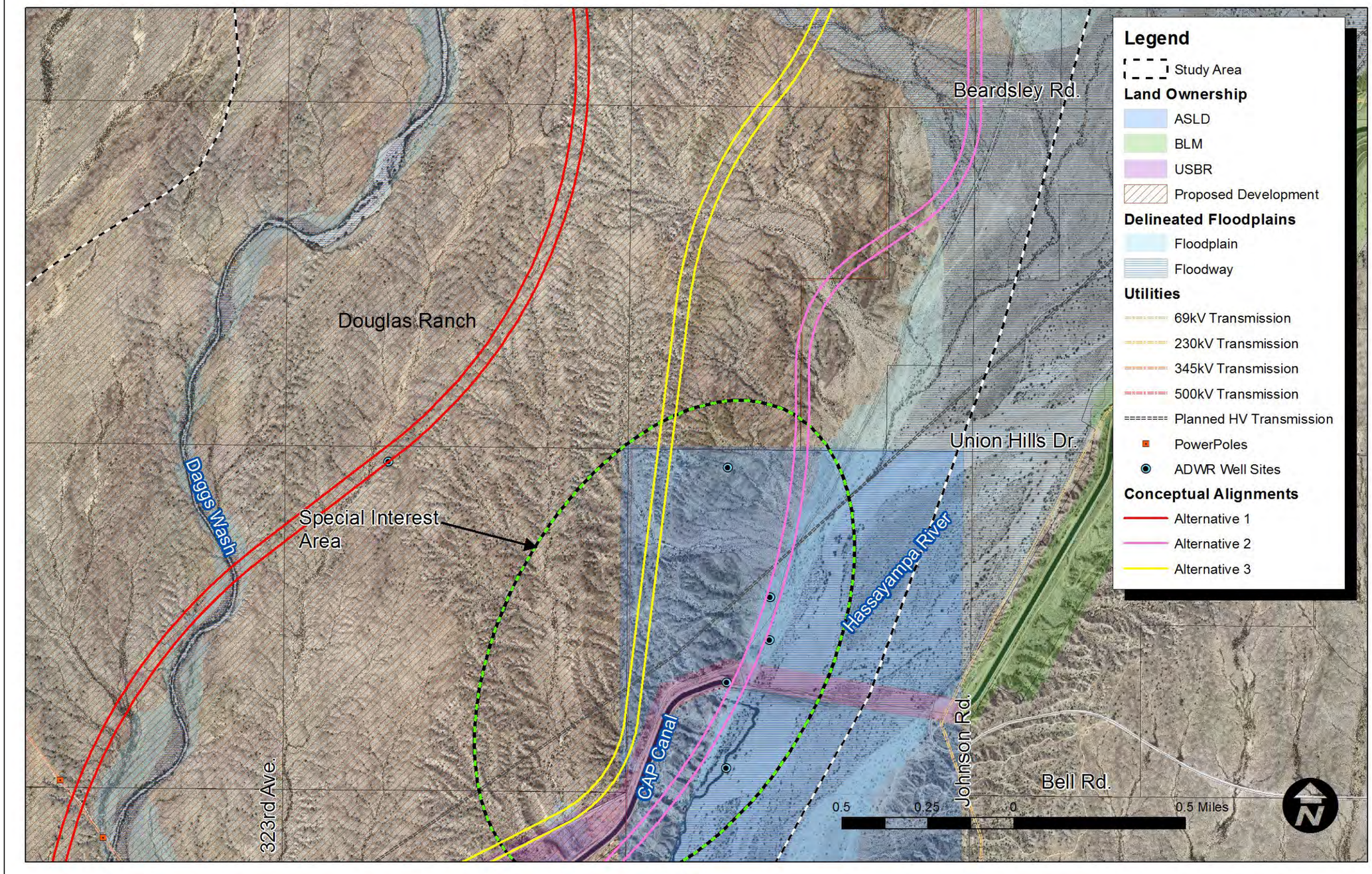


Figure 2-11 Schematic Drawing of Candidate Alternatives (7 of 14)

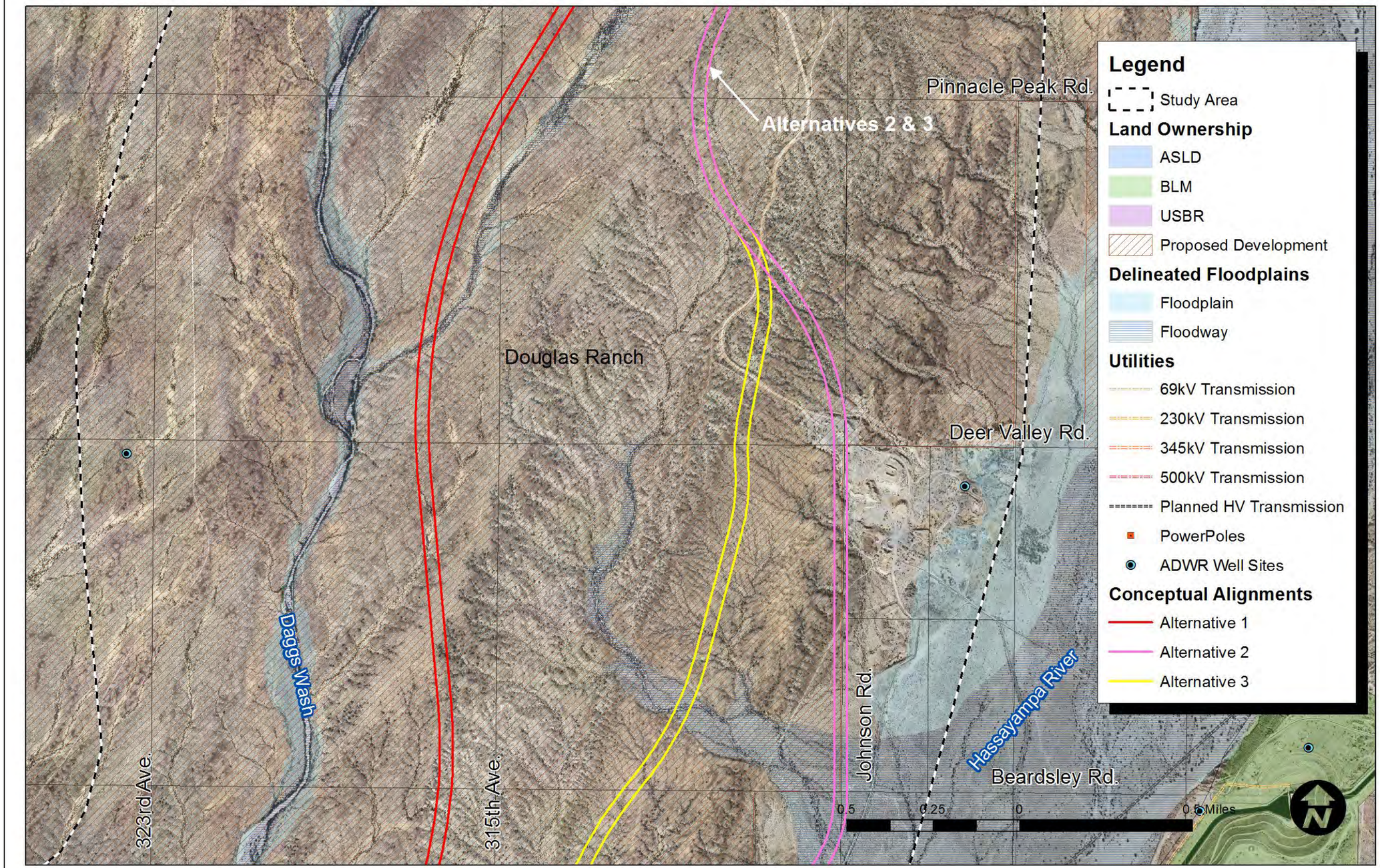


Figure 2-12 Schematic Drawing of Candidate Alternatives (8 of 14)

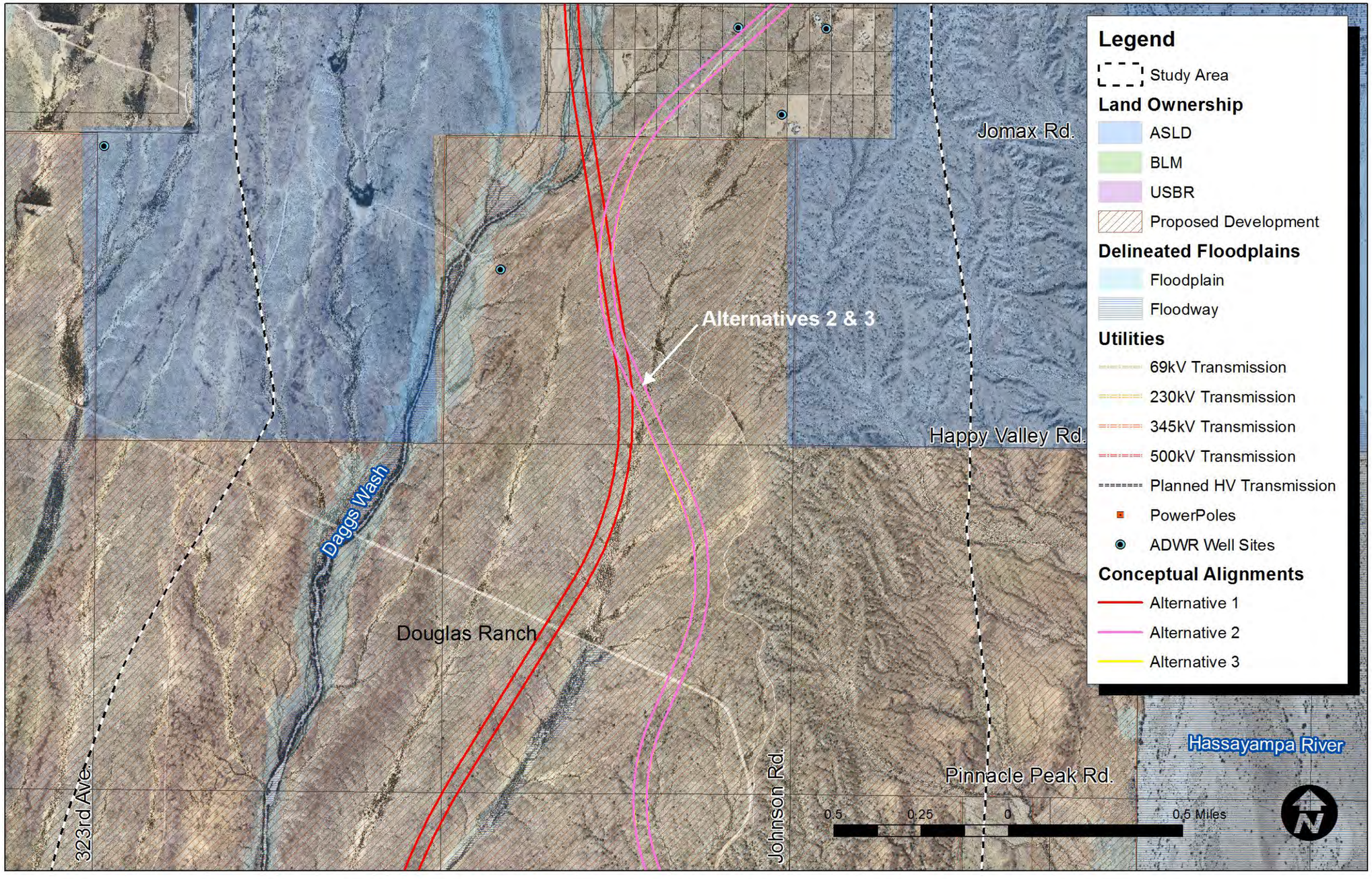


Figure 2-13 Schematic Drawing of Candidate Alternatives (9 of 14)

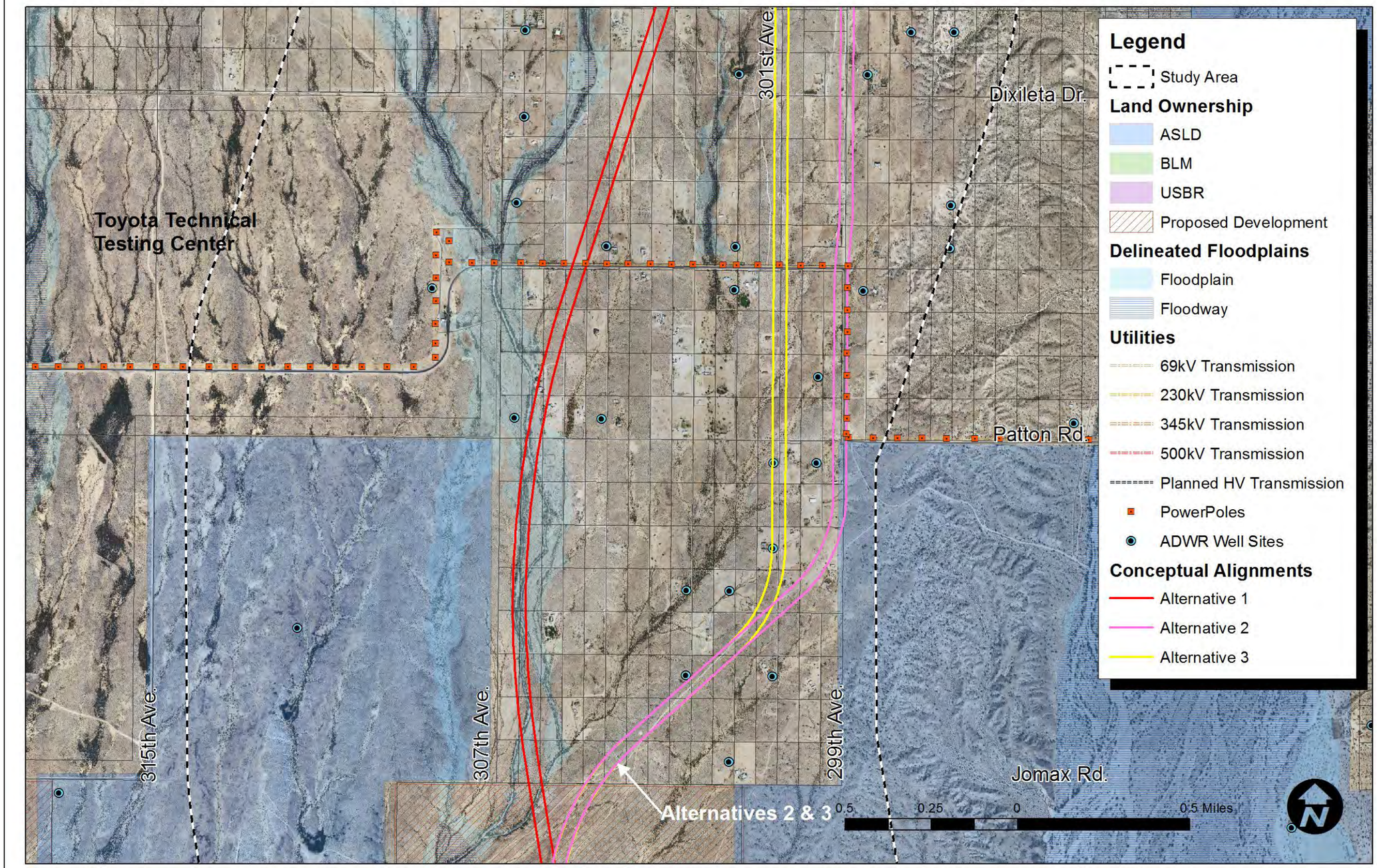


Figure 2-14 Schematic Drawing of Candidate Alternatives (10 of 14)

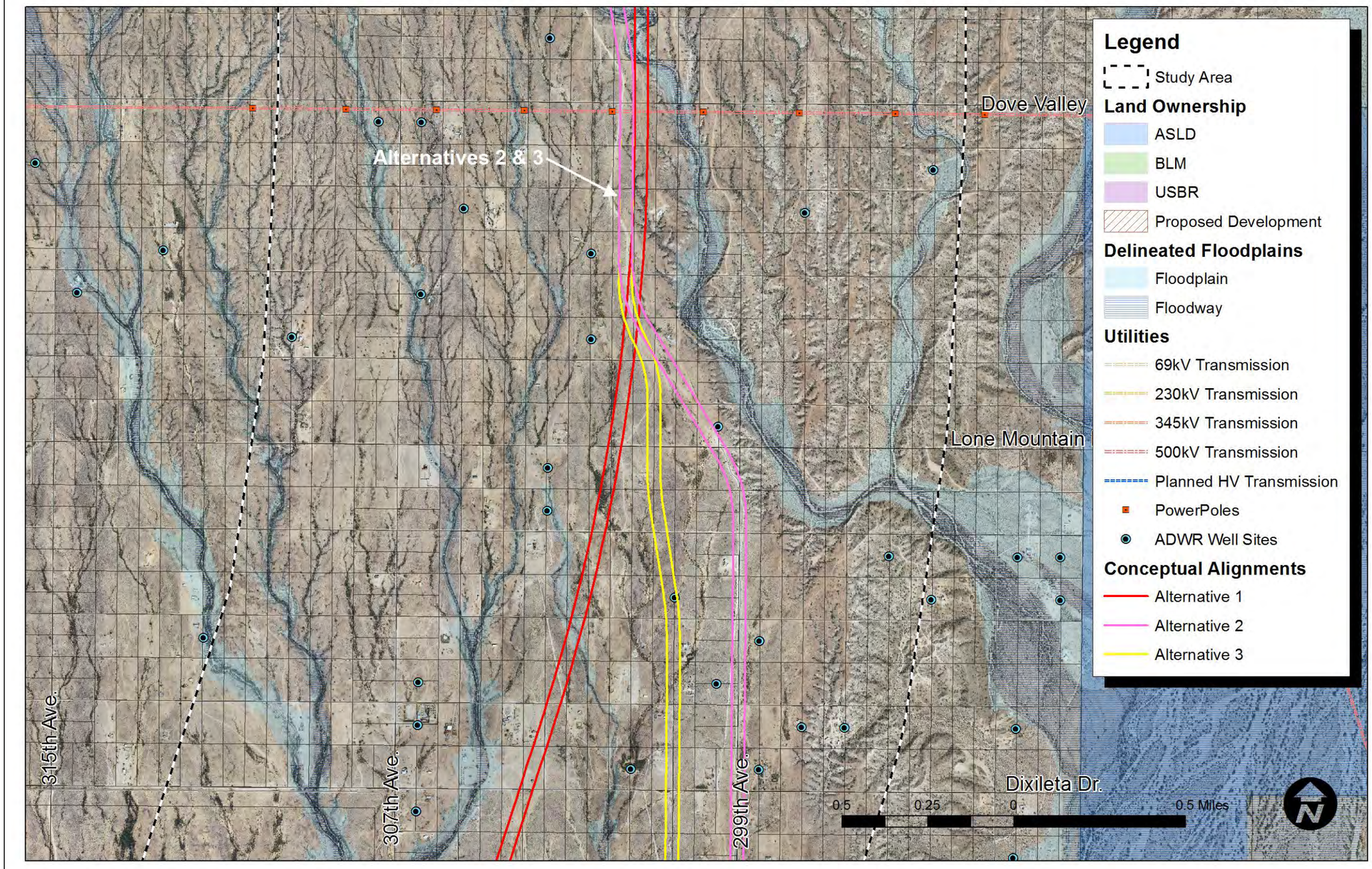


Figure 2-15 Schematic Drawing of Candidate Alternatives (11 of 14)

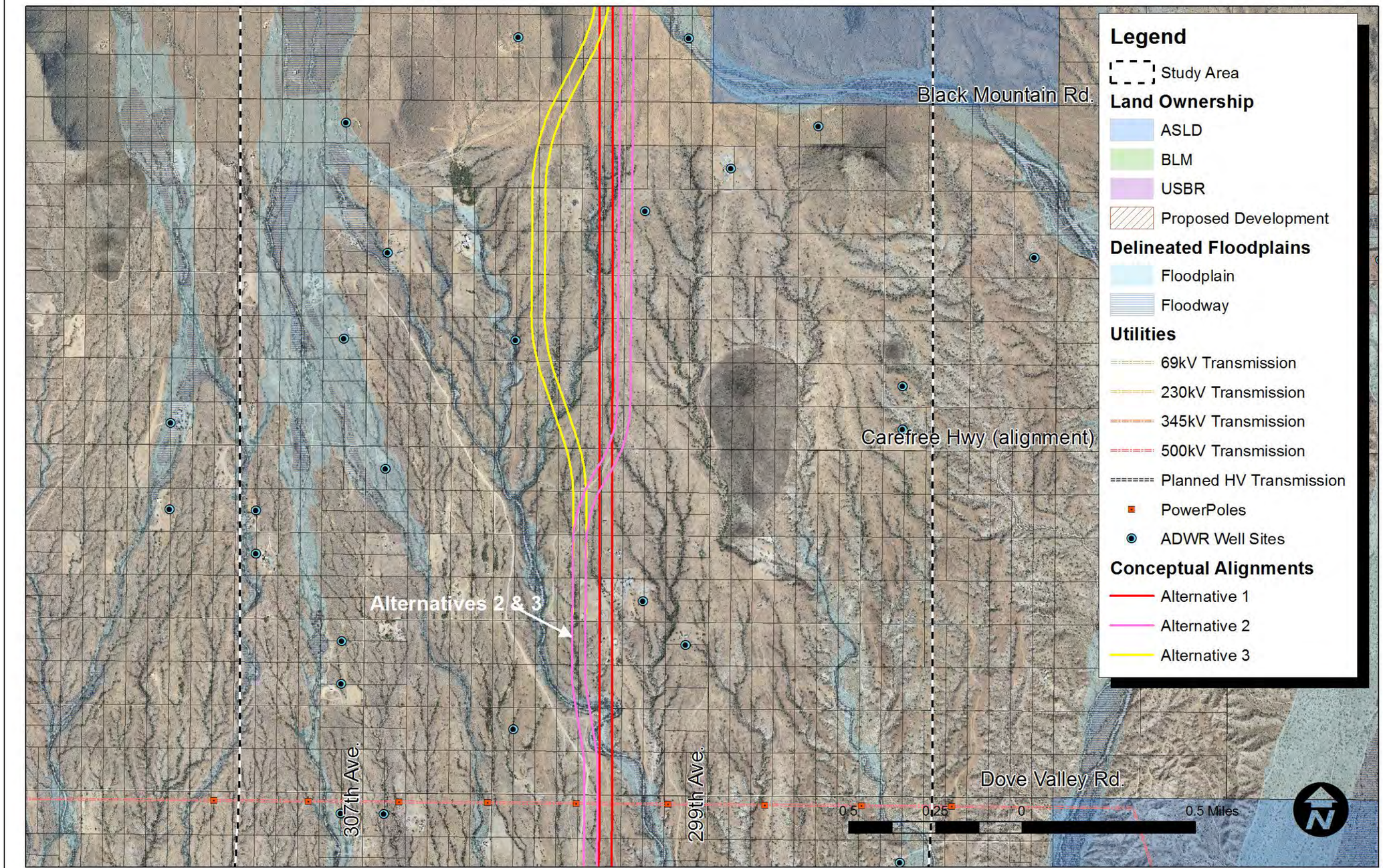


Figure 2-16 Schematic Drawing of Candidate Alternatives (12 of 14)

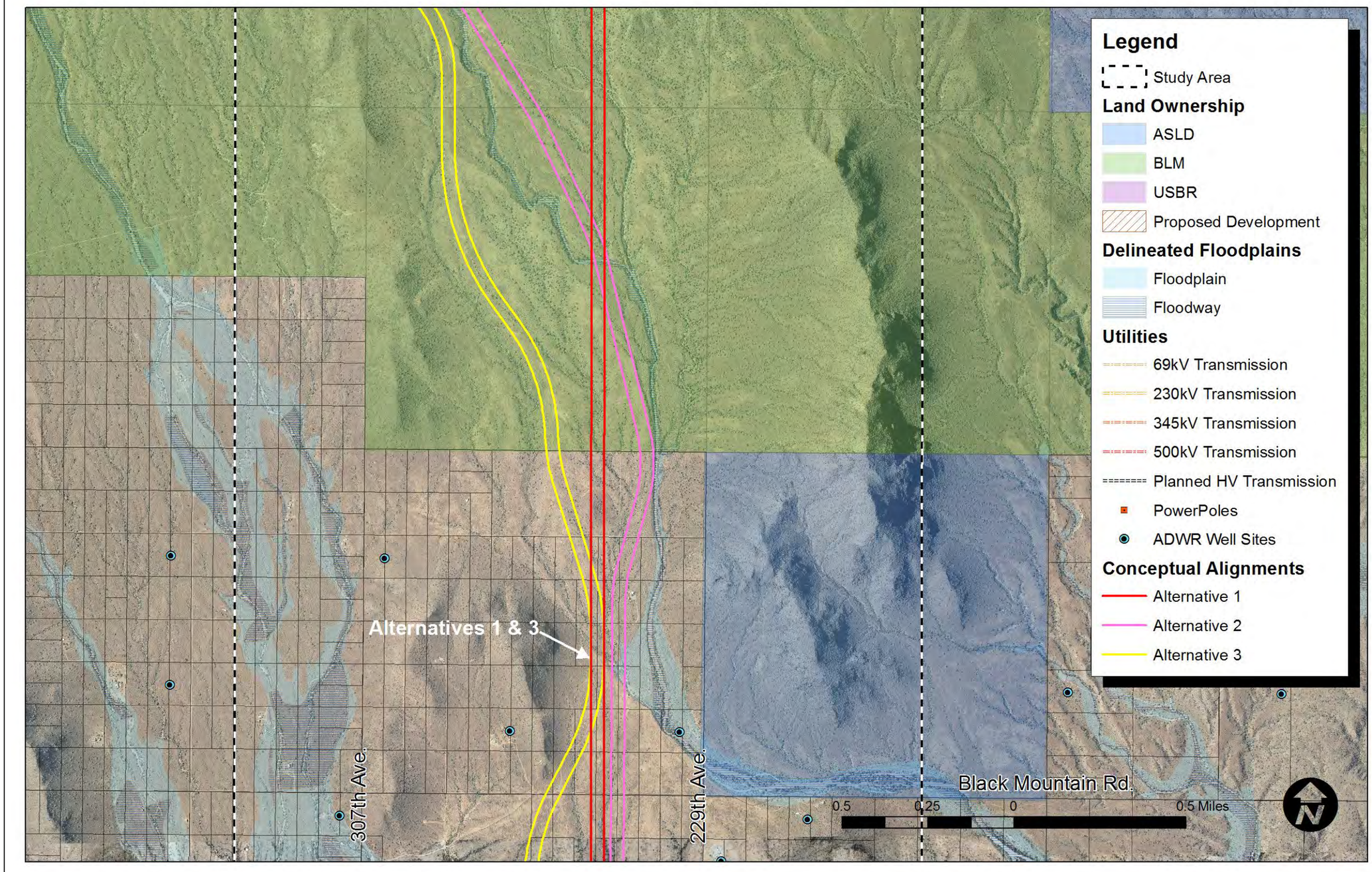


Figure 2-17 Schematic Drawing of Candidate Alternatives (13 of 14)

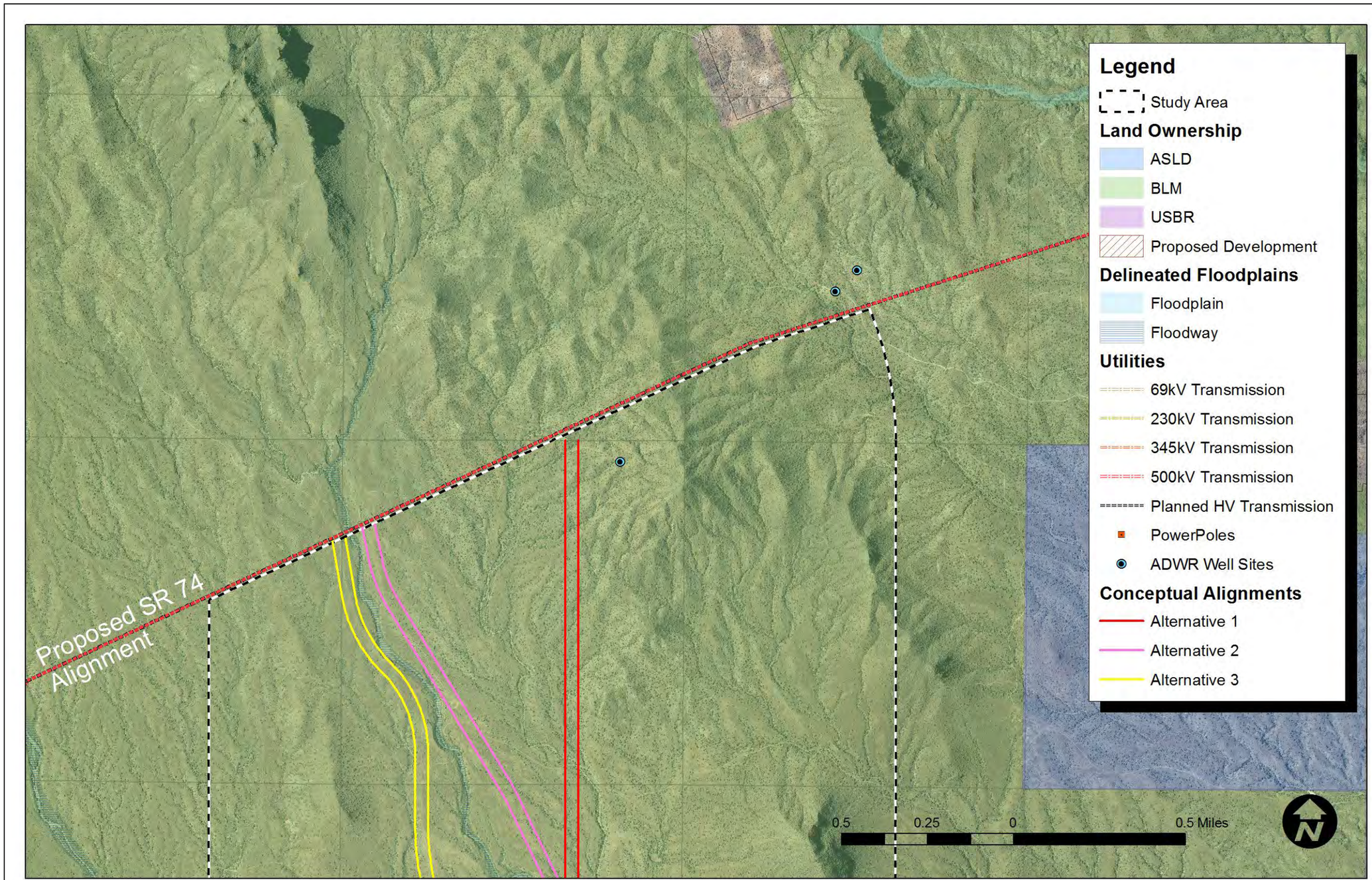


Figure 2-18 Schematic Drawing of Candidate Alternatives (14 of 14)

3.0 Evaluation of the Candidate Alternatives

A series of qualitative evaluation criteria were developed during the study scoping process, with input from MCDOT and the Technical Advisory Committee, in response to the issues, concerns and opportunities identified during the agency and public scoping meetings. The qualitative evaluation criteria identified for this feasibility study are as follows:

- Consistency with proposed development
- Environmental impacts
- Utility impacts
- Drainage impacts
- Engineering complexity
- System functionality
- Right of way requirements
- Buildings/property impacts
- Planning level cost estimate
- Stakeholder and community feedback

Corridor alternatives will be evaluated using one of five rankings based upon the perceived response to each evaluation criteria question. These rankings will be used to screen the initial corridor alternatives to determine which alternative will be shown as the preferred alignment. The ranking levels are as follows:

Strong Disadvantage	Disadvantage	Neutral	Advantage	Strong Advantage
●	◒	○	◒	●

3.1 Consistency with Proposed Development

The purpose of this criterion is to evaluate potential impacts to proposed master planned communities and to determine how well the candidate alternatives preserve the intent/concept of the approved circulation elements.

● ***Alternative 1***: Alternative 1 closely approximates the approved circulation element of Millennium Ranch, Hassayampa Ranch and the southern portion of Belmont. It is either coincident with, or within 500 feet of the proposed parkway corridors which would result in low impacts to the future development of these areas. Alternative 1 deviates from Belmont's proposed parkway alignment between Olive Avenue and Waddle Road (refer to Figure 3-1). Alternative 1 passes through parcels with similar land use to the Belmont proposed parkway alignment north of Olive Road and may in some cases result in larger contiguous sections of developable land. Alternative 1 was seen to have a moderate impact on the proposed developments south of the CAP canal. [disadvantage]

Alternative 1 is not concurrent with the approved circulation element of Douglas Ranch. This alternative would bisect two commercial centers and several

residential areas, including the first proposed phase of the development. Alternative 1 will require substantial revisions to the approved Douglas Ranch Planned Area Development. [strong disadvantage]

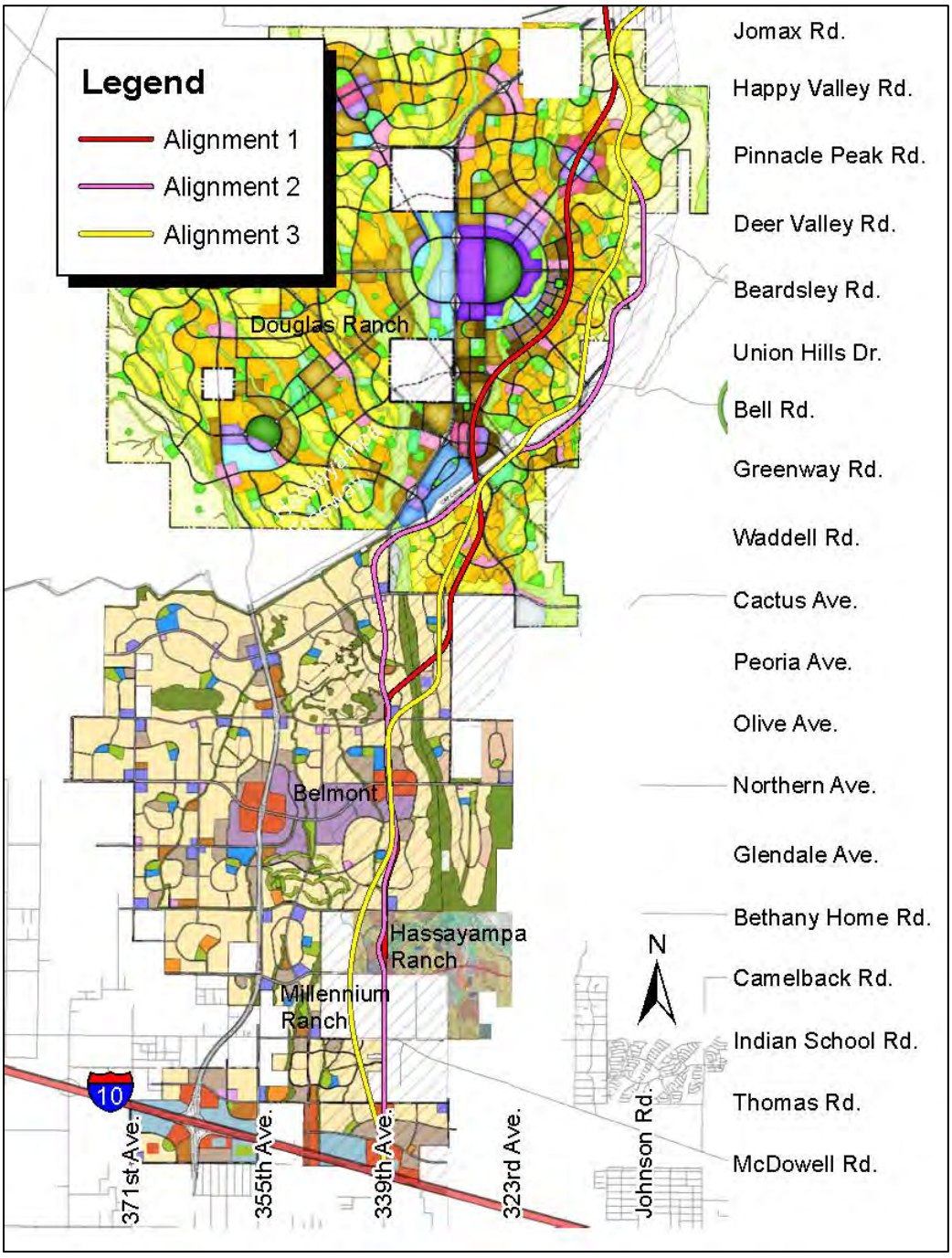


Figure 3-1 Impacts to Proposed Development

- ***Alternative 2:*** The approved circulation elements of Millennium Ranch, Hassayampa Ranch, Belmont and Douglas Ranch were used to develop Alternative 2 south of Jomax Road. As such, this alternative represents the least impact to the proposed developments within the study area. Alternative 2 has a strong advantage in this qualitative ranking in this category. [advantage]

- ***Alternative 3:*** Alternative 3 creates remnant parcels with limited development potential near the north end of Belmont (between Olive Avenue and Cactus Avenue) and within the proposed Millennium Ranch and Hassayampa Ranch communities. Alternative 3 also bisects Douglas Ranch south of the CAP canal. Although not consistent with Douglas Ranch's DMP, efforts were made to locate Alternative 3 on or near the proposed parkway and arterial roadway alignments north of the CAP canal. All four planned communities within the study area will have to amend their approved master plans if this alignment is carried forward as the recommended alternative. Alternative 3 was rated lowest for this evaluation criterion. [strong disadvantage]
- ***No-Build Alternative:*** The circulation elements of the proposed master planned communities assume that that there will be a continuous, improved roadway linking the northern and southern portions of the study area. Currently there are no improved, north-south roadways within the study area between Indian School Road and Jomax Road. The no-build alternative would not construct the transportation framework necessary to accommodate build-out conditions of the study area. For this reason, the no-build alternative was rated as having a slight disadvantage in this category because there is no guarantee that a continuous north-south roadway will be in place when needed. [disadvantage]

3.2 Environmental Impacts

This criterion evaluates how the three candidate alternatives impact the environmental resources identified in Technical Memoranda 2. Each alignment alternative will be assigned a qualitative ranking for this category based upon potential impacts to cultural resources, the physical and natural environment, and land use/socioeconomic factors. Figure 3-2 captures the main environmental features within the study area.

Only 15 percent of the study area has been surveyed for cultural resources. Within that surveyed area, three cultural resources were identified as being eligible for inclusion in the National Register of Historic Places. These sites include the in-use Indian School Road and the abandoned Wickenburg/Hassayampa Road, both historic roads, and one prehistoric lithic scatter near the CAP canal. Since all three candidate alignments equally/minimally impact both historic roads, their cultural resource evaluation will be based upon how well they mitigate impacts to the previously identified prehistoric lithic scatter site.

The Hidden Waters Study area is located within relatively undisturbed Desertscrub vegetation. Although this vegetation supports numerous species of plants and wildlife, no suitable habitat was identified for any threatened or endangered species. All three candidate alignments pass through suitable habitat for the Sonoran desert tortoise and the California leaf-nosed bat (both sensitive species) in the northern third of the study area. Encroachment on suitable habitat for these sensitive species was considered a moderate environmental impact for all three candidate alignments. Future surveys will be required separate from this study and prior to construction to assess if these sensitive species exist within the study area.

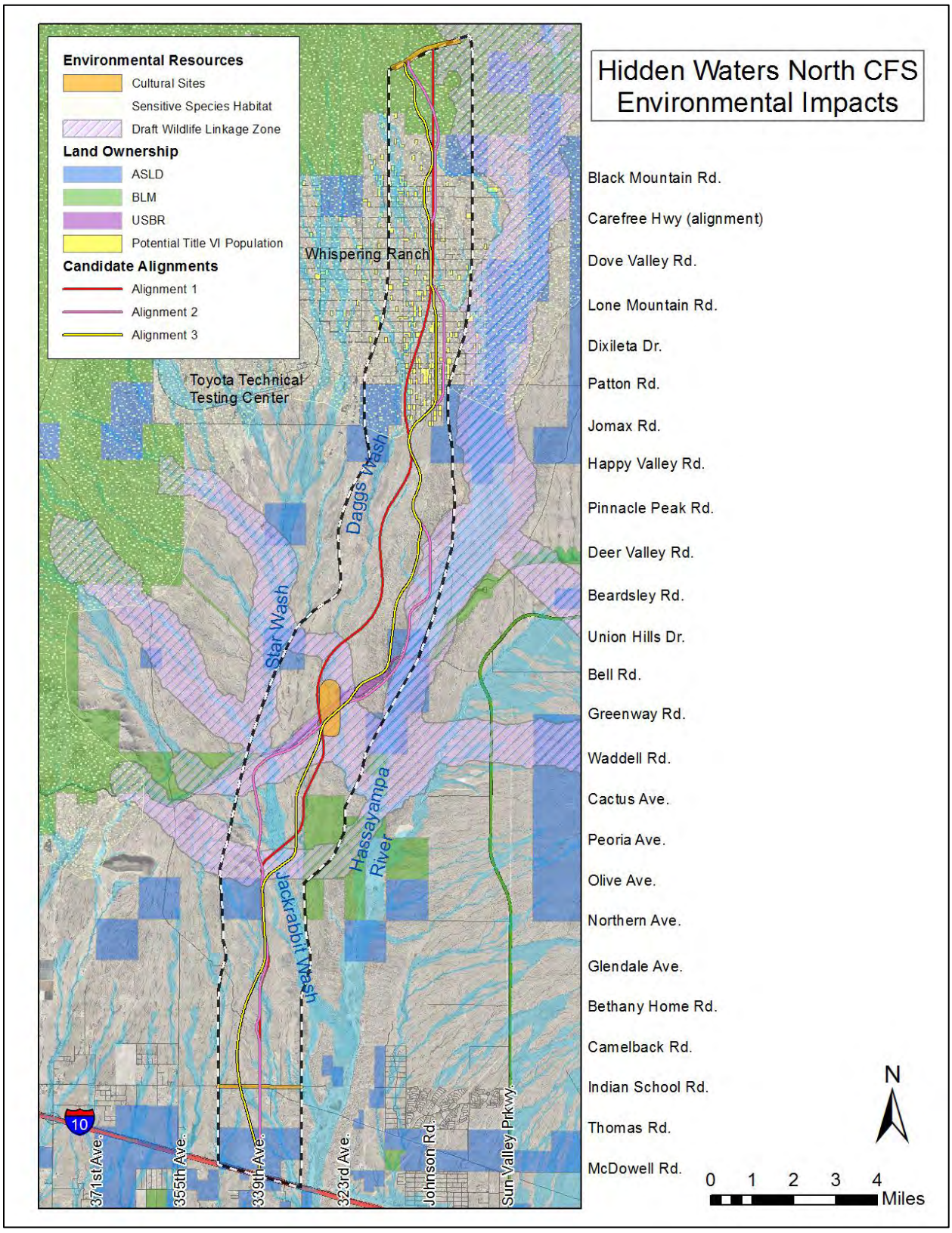


Figure 3-2 Environmental Resources

The United States Bureau of Reclamation (USBR) lands along the CAP canal, the Hassayampa River and other major washes within the study area, are all considered important wildlife linkage corridors. Potential impacts to these features were also considered when evaluating the environmental impacts to of the candidate alignment alternatives.

Arizona Game and Fish Department (AGFD) has also identified a proposed wildlife linkage corridor between the White Tank, Belmont/Bighorn and Vulture/Hieroglyphic mountains. This linkage corridor, illustrated in Figure 3-2, runs along the east side of the study area. It also crosses the study area at two locations; along the CAP canal and roughly along the Olive Avenue alignment. AGFD is concerned that alignment alternatives that closely parallel the CAP canal may restrict east-west wildlife movement through the study area. They expressed a preference in a letter (see Appendix A) for a hybrid alignment alternative through the study area to potentially minimize impacts to local wildlife.

Environmental justice/Title VI populations (elderly and disabled) occur in greater number within the northern half of the study area than in Maricopa County and the Town of Buckeye. It was assumed that all residential parcels/structures disturbed within the northern portion of the study area have the potential to qualify as a Title VI impact.

- ***Alternative 1***: Alternative 1 minimizes impacts to known cultural resources by passing to the east of the previously identified prehistoric lithic scatter near the CAP canal. [neutral impact]

  Alternative 1 impacts two washes that are likely considered waters of the US (Daggs Wash between Jomax and Patton Roads and a second unnamed ephemeral wash between Peoria and Cactus Avenues). It also runs through mountainous terrain in the northern two miles of the study area which has been identified by BLM as a wildlife linkage zone. While these conflicts may be overcome by either channelizing/rerouting washes around the proposed parkway alignment or by incorporating wildlife crossing treatments, they constitute a negative impact to the physical and natural environment for this alternative. [disadvantage]

  Alternative 1 follows a curvilinear path through the existing Whispering Ranch Community that impacts nine residential structures. Alternative 1 also passes within 500 feet of the Toyota Technical Testing Center, which has cited the need to preserve the privacy of their testing operations. [strong disadvantage]

- ***Alternative 2*** passes through the previously identified prehistoric cultural site on the south side of the CAP canal. Additional cultural surveys will be required prior to construction to preserve the history of this site. [disadvantage]

  Wildlife crossing treatments will be required at existing washes to facilitate wildlife movement across the proposed parkway. Alignment Alternative 2 was rated as having moderate impacts to the physical and natural resources of the study area. AGFD has also expressed the concern that the proximity of Alternative 2 to the south side of the CAP canal (approximately 300ft) will restrict future east-west wildlife movement through the study area. [disadvantage]

Alternative 2 follows a fairly direct north-south path through the Whispering Ranch Community generally along the edge of existing parcels. Efforts were made to avoid existing residential parcels and structures. This alignment was deemed to have minor socioeconomic impacts within the study area. [neutral]

- ***Alternative 3*** has environmental impacts comparable to alignment alternative 2. It crosses the known cultural site along the same alignment as Alternative 2 and will require similar, albeit fewer, wildlife crossing treatments across existing washes. AGFD has also expressed the concern that the proximity of Alternative 3 to the south side of the CAP canal (approximately 300ft) will restrict future east-west wildlife movement through the study area. [disadvantage]

  The socioeconomic impacts of Alternative 3 were minimized through the Whispering Ranch community by locating the alignment along existing parcel lines and avoiding residential structures whenever possible. [neutral]

- ***No-Build Alternative*** By definition, the No-Build alternative does not alter the environmental resources of the study area. It is therefore given a neutral rating for this category

3.3 Utility Impacts

Table 3-1 summarizes the utility impacts of the three candidate alignment alternatives. These utility impacts are concentrated in three areas of the study area 1) near Indian School Road 2) the CAP canal and 3) the Whispering Ranch Community.

Table 3-1 Utility Impacts

Utility Impact	Alternative 1	Alternative 2	Alternative 3
12 kV Power Poles	16	8	11
69 kV Power Poles	2	1	2
230 kV Transmission Towers	1	0	0
Angle of CAP Crossing	~60°	N/A	~45°
ADWR Well Sites	1	1	3

- ***Alternative 1*** The utility impacts of Alternative 1 were considered a strong disadvantage because of the potential conflict with the Western Area Power Authorities' (Western) 345 kV transmission towers north of the CAP canal (refer to Figure 2-10). This Alternative 1 also impacts one existing well site and the largest number of 12kV electrical poles within Whispering Ranch, many of which also support fiber optic telecommunication lines. It also will require the relocation of two 69kV electrical transmission poles (one near Indian School Road and the second on the north side of Peak View Road). [disadvantage]
- ***Alternative 2*** will require the fewest relocations of 12kV electrical power poles in the Whispering Ranch community and a single 69kV electrical pole near the intersection of Indian School Road and 339th Avenue. This alignment crosses the CAP canal at the Hassayampa River siphon. The CAP will still require a bridge over the siphon structure. Overall, the utility impacts of Alternative 2 are fairly minor. For this reason it was given a neutral rating in this category. [neutral]
- ***Alternative 3*** may impact three existing well sites within the Whispering Ranch community. It also will require the relocation of two 69kV electrical transmission poles (one near Indian School Road and the second on the north side of Peak View Road). The overall utility impacts of Alternative 3 are also fairly minor. [neutral]
- ***No-Build Alternative:*** The No-Build alternative does not impact nor improve the existing utilities of the study area. It is therefore given a neutral rating for this category.

3.4 Drainage Impacts

The candidate alternatives were evaluated to determine how they impact the existing drainage patterns/structures within the study area. Alignments that provide all-weather access through the study area with fewer impacts to the existing washes were rated more favorably.

Roadway drainage crossing locations were identified based on examination of high resolution digital aerial photographs, topographic maps, and delineated floodplains in the study area. The required structure sizes were estimated based upon relative size of the contributing drainage areas and existing drainage models. The proposed drainage structures were separated into three categories: Pipe Culverts, Box Culverts, and Bridges. The results of this analysis are summarized in Table 3-2 and presented graphically in Figure 3-3 (on the following page).

Table 3-2 Summary of Drainage Structures

Drainage Structure	Alternative 1	Alternative 2	Alternative 3
Pipe Culvert	51	61	31
Box Culvert	32	14	15
Bridge Structure	1 (2000ft structure)	1 (1200ft structure)	1 (700ft structure)
Total Crossings	84	76	47

*The values presented in table 3-2 represent the total number of culvert crossings.

All three candidate alternatives require a bridge to span Jackrabbit Wash. The size of the required bridge structures was estimated by evaluating the width and flow of the floodway where the alignments cross the wash.

- ***Alternative 1*** was rated lowest of the three candidate alternatives in the drainage category. It requires the greatest number of cross-drainage structures to provide all-weather access through the study area and crosses Jackrabbit Wash where the floodway is wide resulting in the need for a large bridge. Two segments of the alignment also run down the middle of complex braided floodplains (Daggs Wash between Jomax and Patton Roads and a second unnamed ephemeral wash between Peoria and Cactus Avenues). [strong disadvantage]
- ***Alternative 2:*** The drainage impacts of Alternatives 1 and 2 are essentially the same south of Olive Avenue. From that point, Alternative 2 continues north along the west side of Jackrabbit Wash to the CAP canal, crosses the floodway, and then continues east along the downstream side of the canal where flows are generally concentrated. This alignment clips the floodplain of the Hassayampa River near the near the Union Hills Drive alignment (see Figure 3-3). Alternative 2 also crosses a small, complex alluvial fan near the Beardsley Road alignment. [disadvantage]
- ***Alternative 3:*** One of the objectives when developing Alternative 3 was to reduce the number of required drainage crossings and minimize the drainage impacts of the proposed parkway by placing the alignment along natural ridgelines whenever feasible. Alternative 3 also minimizes the size of the Jackrabbit Wash bridge by crossing the wash at a narrow point. [advantage]

- ***No Build Alternative:*** While the no-build alternative does not impact any of the existing drainage patters, it fails to provide all-weather access through the study area. This lack of all-weather access was the reason the no-build alternative received a disadvantageous rating in this category. [disadvantage]

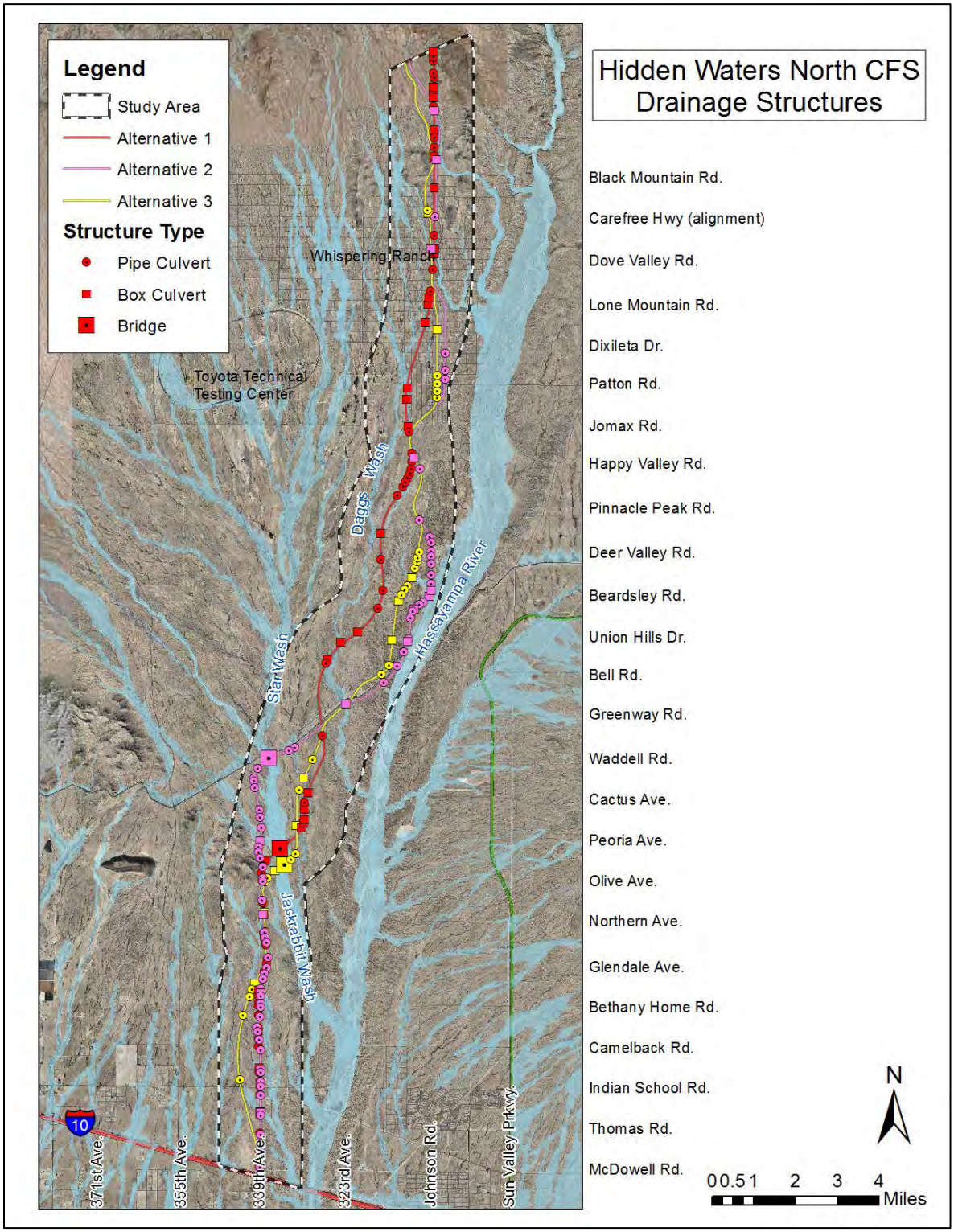


Figure 3-3 Proposed Drainage Structures

3.5 Engineering Complexity

Each candidate alignment was evaluated to determine if they contain elements that would lead to more complicated or costly designs.

- ***Alternative 1*** does not present any unique engineering challenges south of Olive Avenue. However, Alignment 1 crosses the Jackrabbit Wash north of Olive Avenue at a point where the floodplain is approximately 2000 feet wide. By crossing the wash at this location, this alternative will require a longer, more costly bridge structure. Alternative 1 also runs through the middle of two complex braided floodplains (described in the previous section) that will result in a more complicated drainage design, which may include multiple cross drainage culverts and/or channelization of the existing wash around the proposed parkway. [disadvantage]

  Alternative 1 crosses the CAP canal approximately 500 feet from Western's 345 kV electrical transmission lines and conflicts with Western's nearest electrical transmission tower (refer to Figure 2-10). This area will require extra attention during design to ensure that the appropriate clearance above the canal and below the transmission lines are achieved. It will also require at least one 345kV electrical transmission tower be relocated with this design. [disadvantage]

  Alternative 1 cuts through a mountainous area to the north of Black Mountain road en route to the future SR 74 alignment. This alignment will require extensive earthwork as well as wildlife crossing treatments to mitigate the impacts in this mountainous area. [disadvantage]

- ***Alternative 2***: This alternative does not present any special engineering challenges south of the CAP canal or north of Beardsley Road. [advantage]

  As discussed previously, Alternative 2 crosses a small alluvial fan near the Beardsley Road alignment. While distributary flows and excess sediment deposition are expected at this crossing, engineered drainage solutions should not be too onerous or costly given the smaller flows from this wash. [neutral]

- ***Alternative 3*** does not present any special engineering challenges within the study corridor. [advantage]

- ***No-Build Alternative:*** The No-Build alternative does not involve any engineering design and was therefore given a neutral rating for this category.

3.6 System Functionality

The "System Functionality" criterion evaluates how well the candidate alternatives address the need for a new north-south parkway as identified in the Hassayampa Framework Study. Figure 3-4 presents the candidate alternatives overlaid on the Hassayampa Framework Study roadway network.

- ***Alternative 1*** is located along the Hidden Waters Parkway alignment as proposed in the Hassayampa Framework Study. It provides a needed north-south parkway between I-10 and the future SR 74, achieves all of the major

connections in the roadway network and is aligned with the existing 339th Avenue traffic interchange. [strong advantage]

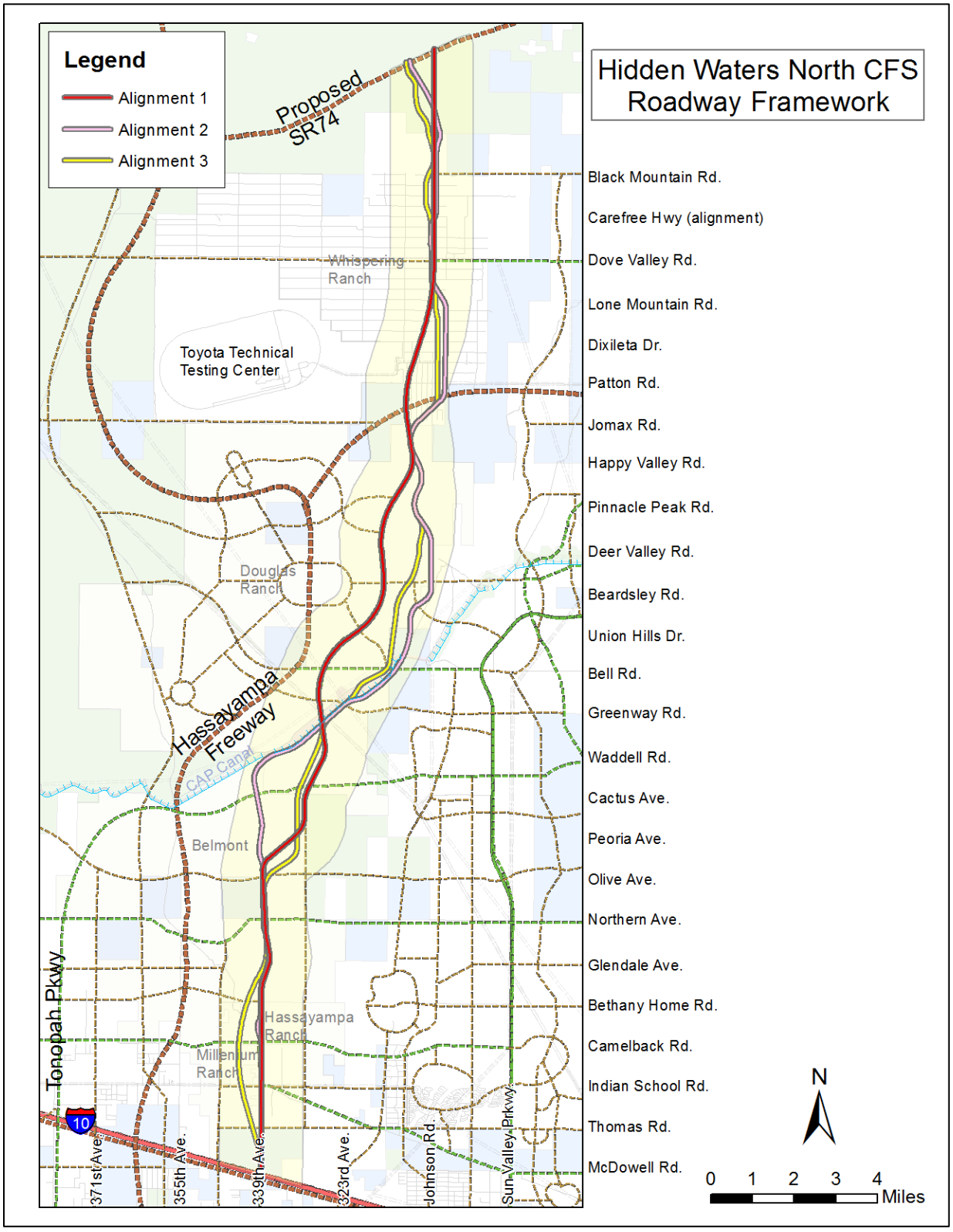


Figure 3-4 Candidate Alignments vs. Hassayampa Framework Roadway Network

- ***Alternative 2*** also meets the intent of the Hassayampa Framework Study by providing a needed north-south parkway between I-10 and the future SR 74. It also allows the existing 339th Avenue traffic interchange location to be preserved.

  While all of the desired roadway connections may be achieved, Alternative 2 places Hidden Waters Parkway within a quarter-mile of the developer's proposed alignment for the future Hassayampa Freeway, which may lead to more difficult system interchanges in the future. [neutral]

  Approximately seven miles the alignment is located adjacent to a physical barrier (i.e. the south side of the CAP canal and west edge of the Hassayampa River). This results in limited access to the roadway and inhibits the parkway's arterial-like functionality. [slight disadvantage]

- ***Alternative 3:*** This alignment provides a needed north-south parkway between I-10 and the future SR 74, achieves all of the major connections in the roadway network and is aligned with the existing 339th Avenue traffic interchange. [strong advantage]

- ***No-Build Alternative***: The no-build alternative does not address the need for a continuous north-south parkway between I-10 and the future SR 74. [strong disadvantage]

3.7 Buildings/Property Impacts

This evaluation criterion captures potential impacts to existing residential parcels and structures which are generally located within two regions of the study area. All three candidate alternatives avoid a small cluster of residential parcels located near the intersection of 339th Avenue and Indian School Road.

The second cluster of mostly five-acre residential parcels is located within the Whispering Ranch community (north of Jomax Road). Houses of varying size and type, including mobile and manufactured homes, are scattered throughout this community making potential conflicts between the candidate alternatives and existing residential structures nearly unavoidable. Some of the residential structures within this area have fallen into disrepair and seem to be no longer habitable. The county's GIS Land-use shapefile was used to differentiate which parcels were considered to have a residential land use.

- ***Alternative 1*** follows a curvilinear path through the existing Whispering Ranch Community. This meandering alignment impacts 107 parcels within this community including nine with a residential land use. Alternative 1 bisects many parcels which may lead to higher property acquisition costs (in excess of 30 full property acquisitions). This alignment will likely require the relocation or acquisition of nine residential structures within Whispering Ranch. [disadvantage]
- ***Alternative 2*** follows a north-south alignment through the Whispering Ranch community generally along existing parcel lines. This helps create a more equitable distribution of right-of-way acquisition and minimize impacts to existing residential parcels. Alignment 2 will require right-of-way acquisition from 115 parcels including seven residential parcels within the Whispering Ranch

community. Of these impacted parcels, up to 17 may require full property acquisition. This alignment will likely require the relocation or acquisition of two residential structures within Whispering Ranch. [neutral]

- ***Alternative 3*** also follows a north-south alignment through Whispering Ranch along existing parcel lines. It will require right-of-way acquisition from 112 parcels including nine residential parcels within the Whispering Ranch community. Of these impacted parcels, up to 23 may require full property acquisition. This alignment will likely require the relocation or acquisition of one residential structure within Whispering Ranch. [neutral]
- ***No Build Alternative:*** The no-build alternative does not involve any improvements through the Whispering Ranch Community and therefore does not impact any parcels. [advantage]

3.8 Stakeholder and Community Feedback

Building consensus between MCDOT, local agencies, jurisdictions, key stakeholders and the public is vital to the success of the Hidden Waters Parkway Study. For this reason the design team has held multiple technical advisory committee meetings, met individually with key stakeholders, and held a public open house to identify which issues are most important to the community. This criterion evaluates how well the candidate alignment alternatives agree with the feedback that had been received.

- ***Alternative 1:*** Two key stakeholders, LKY development (Belmont) and El Dorado Holdings (Douglas Ranch) have expressed strong opposition to Alignment 1 because it is inconsistent with their approved development master plans. [strong disadvantage]

  The Toyota Motor Corporation expressed concern about Alignment 1 because it passes within 500 feet of their testing facilities. They felt that this alignment would make it more difficult to preserve the confidentiality of their daily operations. [strong disadvantage]

  Alignment 1 also impacts the largest number of existing residential parcels/structures within the Whispering Ranch community. [disadvantage]

- ***Alternative 2*** most closely addresses the concerns expressed by key stakeholders and residents during the planning phase of this study. It preserves the approved circulation elements of the proposed developments within the study area, provides a one-mile buffer between the proposed parkway and Toyota's testing facilities, and attempts to mitigate impacts to existing residential parcels/structures. Several residents of the Whispering Ranch Community expressed a preference for Alignment Alternative 2 during the public open house held on August 30th, 2011. [strong advantage]
- ***Alternative 3*** is responsive to feedback received from Toyota Motor Corporation by providing a ¾ mile buffer between the proposed parkway and Toyota's testing facilities property line. It also attempts to mitigate impacts to existing residential parcels/structures within the Whispering Ranch Community. However, this alternative is not consistent with the approved MPC circulation elements. Stakeholder, El Dorado Holdings, has expressed strong opposition to this alternative. [strong disadvantage]

- ***No-Build Alternative:*** Many of the Whispering Ranch residents expressed the desire to have an all-weather roadway connecting their community to regional transportation facilities. The no-build alternative does not provide that needed roadway. [disadvantage]

3.9 Right of Way Requirements

The right-of-way requirements for the three candidate alternatives are summarized in Table 3-3. The right-of-way requirement metric is quantitative in nature. Therefore, qualitative rankings were not assigned for this evaluation criterion.

Table 3-3 Right-of-way Requirements for Candidate Alternatives

Land Owner	Alternative 1	Alternative 2	Alternative 3
ASLD	25 ac	61 ac	47 ac
BLM	55 ac	47 ac	45 ac
BOR	5 ac	2 ac	19 ac
Private	600 ac	607 ac	584 ac
Total RW	686 ac	717 ac	695 ac

The following observations were made about the right-of-way requirements of the candidate alternatives

- Alternative 1 provides the most direct route through the study area and therefore has the lowest right-of-way requirements of the candidate alternatives.
- Alternative 2 is generally located along the perimeter of the proposed Douglas Ranch development. This fact adds to the overall length of this alignment and drives up the overall right-of-way requirements.
- The no-build alternative by definition does not involve any improvements and there for has zero right-of-way requirements.

3.10 Cost

A planning level cost estimate for roadway construction and right-of-way acquisition was prepared for the candidate alternatives. Unit costs were taken directly from MCDOT's most recent Construction Costs Worksheet (Updated May 3, 2010). Appendix B presents a list of the cost items, unit costs, and quantities that were used to prepare the estimate. The following assumptions were made:

- A 6-lane Arizona Parkway shall be constructed throughout the entire study area.
- A signalized intersection was assumed at each one mile intersection.
- Signal conduit and pull boxes were provided at the half mile street intersections.
- Traffic signal interconnect facilities will be provided for the entire corridor length.
- Street lighting was not included in the cost estimate.
- Roadway excavation/fill was not included with this cost estimate

Table 3-4 presents the planning level cost estimates for the candidate alternatives. Design, construction management, and administration costs were added as a percentage of the construction cost items detailed in Appendix B. Estimates for right-of-way acquisition, utility relocations, and drainage structures were also included.

Table 3-4 Planning Level Cost Estimate

COST CATEGORIES	Factors	No Build	Alternative 1	Alternative 2	Alternative 3
Construction		$-	$69,300,000	$65,800,000	$63,200,000
Design (10% to 15%)	12%	$-	$8,300,000	$7,900,000	$7,600,000
Construction Management	15%	$-	$10,400,000	$9,900,000	$9,500,000
Right-of-Way		$-	$101,500,000	$103,000,000	$101,000,000
Structures		$-	$45,100,000	$30,800,000	$20,500,000
Utility Relocation		$-	$1,000,000	$100,000	$200,000
Administration (8% to 13%)	10%	$-	$6,900,000	$6,600,000	$6,300,000
Total		$-	$242,500,000	$224,100,000	$208,300,000

3.11 Summary of Qualitative Analysis

All three candidate alternatives were qualitatively evaluated based upon the evaluation criteria described in the previous section. The results of this initial screening of the candidate alternatives are summarized in Table 4-1.

Table 3-5 Summary of Qualitative Evaluation

Evaluation Criteria	***Alternative 1***	***Alternative 2***	***Alternative 3***	***No Build***
Proposed Development	●	◉	●	◒
Environmental Impacts	◒	◒	◒	○
Utility Impacts	◒	○	○	○
Drainage Impacts	●	◒	◓	◒
Engineering Complexity	◒	◓	◓	○
System Functionality	◉	○	◉	●
Buildings/Property Impacts	◒	○	○	◓
Stakeholder/Community Feedback	●	◉	●	◒
Right of Way Requirements	*686 ac*	*717 ac*	*695 ac*	*N/A*
Cost (in millions)	*$242.5*	*$224.1*	*$208.3*	*N/A*
Recommended for Further Evaluation	***No***	***Yes***	***No***	***No***

Appendix A

- Appendix A: Arizona Game and Fish Department Letter dated September 15, 2011

THE STATE OF ARIZONA
GAME AND FISH DEPARTMENT
5000 W. CAREFREE HIGHWAY
PHOENIX, AZ 85086-5000
(602) 942-3000 • WWW.AZGFD.GOV
REGION IV, 9140 E. 28TH ST., YUMA, AZ 85365

September 15, 2011

Matt Truitt
EPS Group, Inc.
2045 S. Vineyard Ave.
Suite 101
Mesa, Arizona 85201

Re: Hidden Waters Parkway North Corridor Feasibility Study: Draft-Tech Memo 4 Candidate Alignments and Evaluation

Dear Mr. Truitt:

The Arizona Game and Fish Department (Department) has reviewed the August 2011 Hidden Waters Parkway North Corridor Feasibility Study: Interstate 10 to Route 74. We have reviewed the Draft-Tech Memo 4 Candidate Alignments and Evaluation and have a few recommendations to minimize impacts to wildlife found within the area.

Due to the locations of alternative alignments, the Department has concerns about the potential impacts some may have on local wildlife. While the Department does not favorably view either alignment in its entirety, a combination of segments from Alignment 1 and Alignment 3 will help minimize impacts to local wildlife.

McDowell Rd to Waddell Rd.

From McDowell Road to just north of Waddell Road, the Department favors the construction of Alternative 3 because it minimizes the number of wash crossings and potential impacts to the associated wildlife and habitat. At approximately 0.2 miles south of the Central Arizona Project (CAP) canal we recommend switching to Alignment 1 because it will directly cross the CAP canal providing the opportunity to incorporate an appropiate wildlife crossing structure such as a bridge or other to accommodate existing wildlife movement along the canal. As mentioned in our May 10, 2011 letter, the canal is often a barrier to wildlife because of the limited ability different species have in crossing it. As a result, wildlife movement is incidentally directed along the canal, and the Department and other stakeholders have identified CAP-adjacent lands as potential wildlife linkages critical to preserve as natural habitat within the context of future urban, rural, transportation and energy development. In fact, Department researchers, using GPS tracking technology, have documented mountain lion using CAP crossing structures just west of the Hassayampa River to travel between the White Tank and Belmont mountains (pers D. Grandmaison, AGFD). Alignment 2 and Alignment 3 along the CAP canal will impact wildlife movement throughout the area. Both alignments will be within approximately 0.06 miles of the south side of the canal with Alignment 2 running parallel to it for approximately 4.9 miles. Alignment 3 will run parallel for approximately 1.1 miles south and 1.6 miles north of the canal after

and heading more directly north. Those segments of Alignment 2 and Alignment 3 will run through designated open space (Figure 1) identified in the Belmont Wildlife Mitigation Plan (attached) which is intended to help support local wildlife populations and their movement. Constructing either of those segments along the CAP canal will limit the effectiveness of the mitigation plan and hinder efforts to maintain wildlife movement though the area.

Waddell Rd. to Happy Valley Rd.

From the CAP canal to Happy Valley Road, we recommend the continuation of Alignment 1 because the construction of Alignment 2 and parts of Alignment 3 between Bell Road and Deer Valley Road will likely create a barrier to wildlife along the Hassayampa River. As mentioned in the May 10, 2011 letter, construction of the parkway within close proximity to the river will create a barrier to wildlife movement and reduce habitat availability due to an expected increase in human activity such as noise and ecological light pollution, and result in wildlife mortality due to vehicle collisions. Maintaining an appropriate distance to the river is important because noise has been identified as a barrier to movement by disturbing and repelling different species (Minton 1968; Liddle 1997). Also, the prevention of ecological light pollution along the river is important. Artificial lighting can alter the light-sensitive cycle of different species and impair an individual's ability to navigate through an area through disorientation from and attraction to that artificial light source (Beier 2006). The attraction of wildlife to artificial light sources varies by species, but it has been identified as a cause of decline in reptile populations (Perry and Fischer 2006).

Happy Valley Rd. to Black Mountain Rd.

We recommend switching back to Alignment 3 from Happy Valley Road to Black Mountain Road because it minimizes the number of wash crossings and is a further distance from the Hassayampa River, reducing the impacts to wildlife as stated above.

Black Mountain Rd. to Proposed SR74

At this time the Department is not ready to provide comments on the three alternative alignments north of Black Mountain Road. The Department is working on evaluating potential mine sites and/or caves within close proximity to the alignments. We believe there is potential for these sites to host bat colonies and species such as the California leaf-nosed bat (*Macrotus californicus*) which is listed as Wildlife of Special Concern in Arizona by the Department. We hope this information will be available later this year.

3.2 Environmental Impacts

The analysis of the alternative alignments fails to discuss the potential impacts to the proposed wildlife linkage between the White Tank, Belmont/Bighorn and Vulture/Hieroglyphic mountains. This linkage was previously discussed in Department correspondence dated May 10 and 20, 2011. Attached is a map of the final design for the White Tank – Belmont – Heiroglyphics linkage and the candidate alignments. The Department recommends including discussion of this linkage within this section of Technical Memo #4. A final linkage report will be released by the Department within the next couple of months. The shapefile of the linkage design can be provided to correctly illustrate the linkage in Fig 3-2 of the memo.

Thank you for the opportunity to provide comments on the Draft-Tech Memo 4 Candidate Alignments and Evaluation. If you have any questions, please contact me at 928-341-4069 or tbommarito@azgfd.gov.

Sincerely,

Tab Bommarito

Tab Bommarito
Habitat Specialist
Region IV, Yuma

cc: Pat Barber, Regional Supervisor, Region IV
Josh Avey, Chief, Habitat Branch
Troy Smith, Habitat Program Manager, Region IV
Leonard Ordway, Assistant Director, Field Operations

AGFD # M11-09091846

Beier, P. 2006. Effects of artificial night lighting on terrestrial mammals. In. Rich, C., and Longcore, T. (eds) Ecological consequences of artificial night lighting. Island Press, Covelo, CA, pp 19-42.

Liddle, M. 1997. Recreational ecology: The ecological impact of outdoor recreation and ecotourism. Chapman and Hall, New York, NY, pp 639.

Minton, Jr. S.A. 1968. The fate of amphibians and reptiles in a suburban area. Journal of Herpetology 2:113-116.

Perry, G., and R.N. Fisher. 2006. Night lights and reptiles: Observed and potential effects. In. Rich, C., and Longcore, T. (eds) Ecological consequences of artificial night lighting. Island Press, Covelo, CA, pp. 269-191.

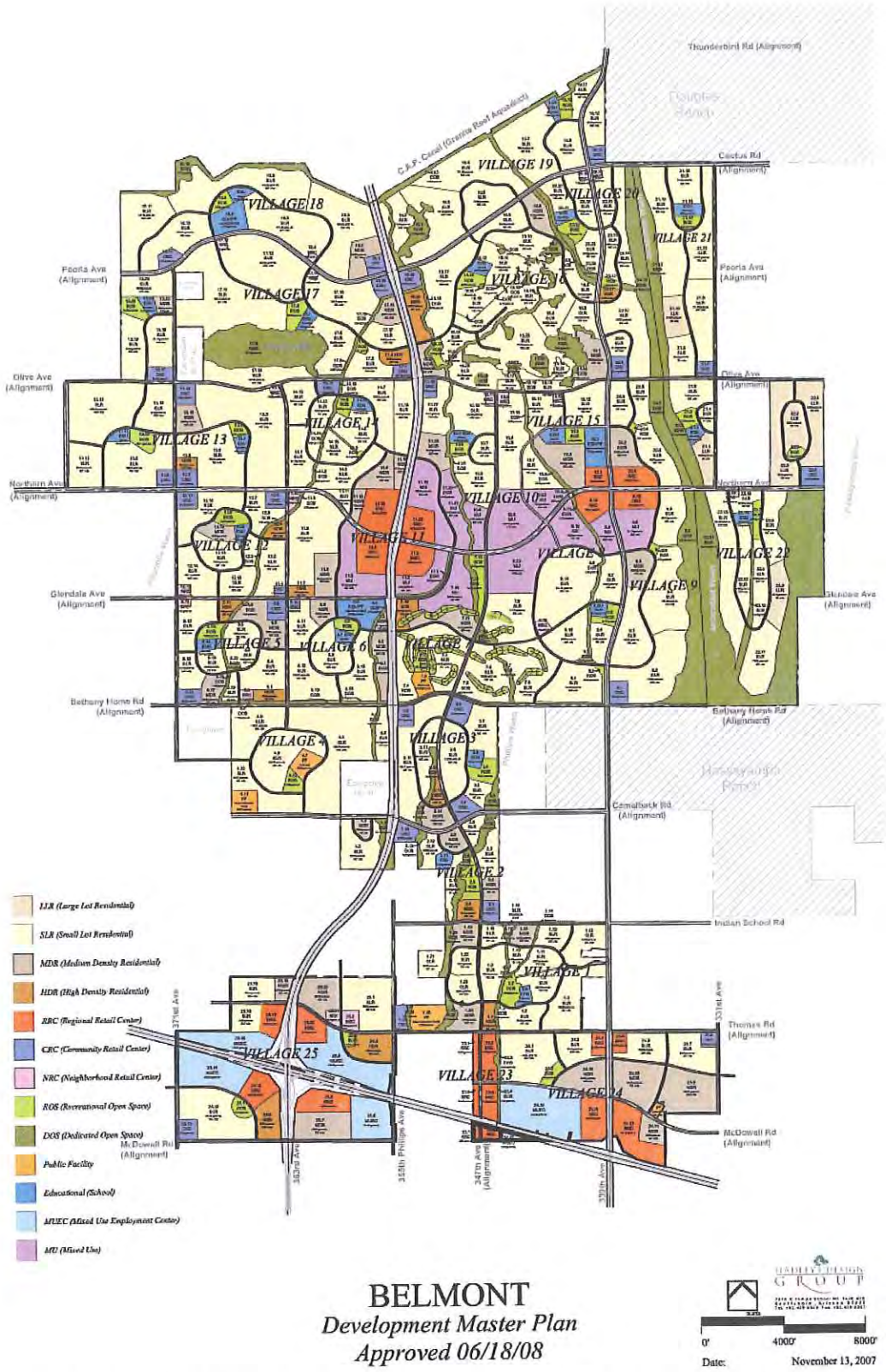
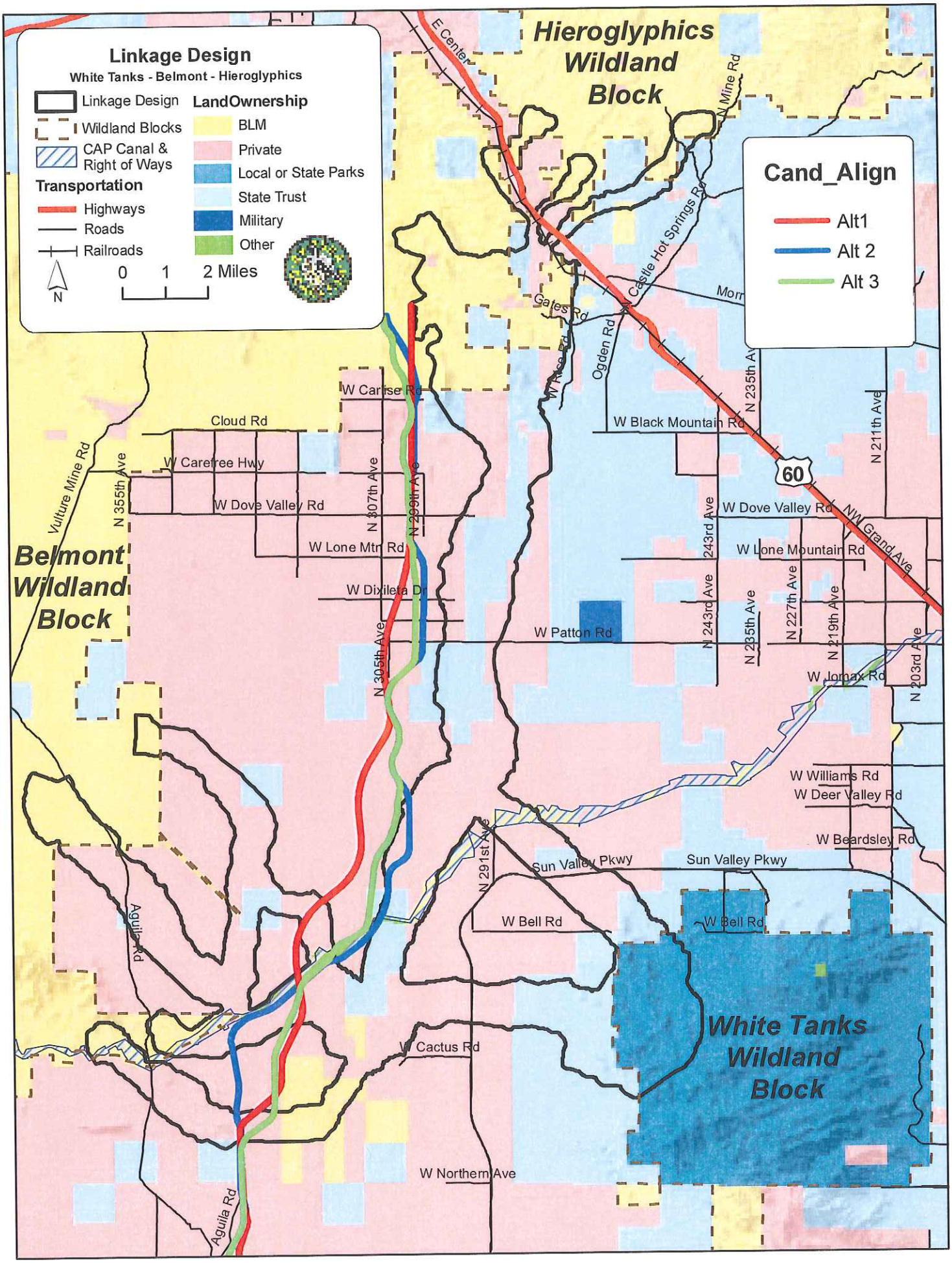


Figure 1. Graphical image of the Belmont development and dedicated open space (dark green).


Linkage Design
White Tanks - Belmont - Hieroglyphics
Linkage Design
Wildland Blocks
CAP Canal & Right of Ways
Transportation
Highways
Roads
Railroads
LandOwnership
BLM
Private
Local or State Parks
State Trust
Military
Other
N
0 1 2 Miles
Cand_Align
Alt1
Alt 2
Alt 3
Hieroglyphics Wildland Block
Belmont Wildland Block
White Tanks Wildland Block
E Center
N Mine Rd
N Castle Hot Springs Rd
Gates Rd
W Rose Rd
Ogden Rd
N 235th Ave
W Carefree Hwy
Cloud Rd
W Black Mountain Rd
N 211th Ave
60
NW Grand Ave
Vulture Mine Rd
N 355th Ave
W Dove Valley Rd
N 307th Ave
N 299th Ave
W Lone Mtn Rd
W Lone Mountain Rd
243rd Ave
W Dixileta Dr
W Patton Rd
N 243rd Ave
N 235th Ave
N 227th Ave
N 219th Ave
N 203rd Ave
N 305th Ave
W Jomax Rd
W Williams Rd
W Deer Valley Rd
W Beardsley Rd
N 291st Ave
Sun Valley Pkwy
Sun Valley Pkwy
Aguila Rd
W Bell Rd
W Bell Rd
W Cactus Rd
W Northern Ave
Aguila Rd

Appendix B

- Planning Level Cost Estimate

Alternative:			ALT 1		ALT 2		ALT 3	
Road Construction - Item Description	**Unit**	**Unit Cost**	**Quantity**	**Total**	**Quantity**	**Total**	**Quantity**	**Total**
N.P.D.E.S.	Lump Sum	$ 31,858.71	1	$ 31,858.71	1	$ 31,858.71	1	$ 31,858.71
Community Relations	Allowance	$ 12,790.30	1	$ 12,790.30	1	$ 12,790.30	1	$ 12,790.30
Engineer's Field Office	Lump Sum	$ 139,708.51	1	$ 139,708.51	1	$ 139,708.51	1	$ 139,708.51
Subgrade Preparation	SQ YD	$ 1.59	1,591,893	$ 2,538,918.07	1,663,691	$ 2,653,427.97	1,613,099	$ 2,572,738.56
New Asphalt Concrete Pavement (see Pavement sheet)	SQ YD	$ 13.85	1,591,893	$ 22,047,722.67	1,663,691	$ 23,042,115.73	1,613,099	$ 22,341,416.53
Concrete Single Curb	LF	$ 14.42	149,240	$ 2,151,980.73	155,971	$ 2,249,039.04	151,228	$ 2,180,646.89
Concrete Curb & Gutter	LF	$ 12.36	149,240	$ 1,844,415.37	155,971	$ 1,927,601.91	151,228	$ 1,868,984.50
Traffic Signing & Striping - 7 lanes	LF	$ 4.85	149,240	$ 723,449.38	155,971	$ 756,078.28	151,228	$ 733,086.32
Traffic Signal, Full Intersection	EA	$ 494,973.19	24	$ 11,879,356.67	24	$ 11,879,356.67	24	$ 11,879,356.67
Interconnect/Traffic Signals	LF	$ 9.47	149,240	$ 1,413,821.24	155,971	$ 1,477,587.19	151,228	$ 1,432,654.50
Traffic Signal, Future "Box-in"	EA	$ 6,049.47	24	$ 145,187.34	24	$ 145,187.34	24	$ 145,187.34
42" & 48" RGRCP, Class III	LF	$ 154.00	9,588	$ 1,476,552.00	11,468	$ 1,766,072.00	5,828	$ 897,512.00
Headwall (MAG details)	EA	$ 5,941.91	102	$ 606,074.66	122	$ 724,912.82	62	$ 368,398.32
Box Culvert (see Structure sheet)	LS	$ 250,000.00	32	$ 8,000,000.00	14	$ 3,500,000.00	15	$ 3,750,000.00
	Subtotal			$ 53,011,835.64		$ 50,305,736.49		$ 48,354,339.16
Removal of Existing Improvements @ 2%	Lump Sum		1	$ 1,060,237.00	1	$ 1,006,115.00	1	$ 967,087.00
Mobilization/Demobilization @ 4%	Lump Sum		1	$ 2,120,473.00	1	$ 2,012,229.00	1	$ 1,934,174.00
Traffic Control @ 3%	Lump Sum		1	$ 1,590,355.00	1	$ 1,509,172.00	1	$ 1,450,630.00
SUBTOTAL Construction				$ 57,782,900.64		$ 54,833,252.49		$ 52,706,230.16
	Contingency	20%		$ 11,556,580.13		$ 10,966,650.50		$ 10,541,246.03
	TOTAL			**$ 69,339,480.77**		**$ 65,799,902.99**		**$ 63,247,476.19**
Right-of-Way - Item Description	**Unit**	**Unit Cost**	**Quantity**	**Total**	**Quantity**	**Total**	**Quantity**	**Total**
Right-of-Way	Acres	$145,000.00	675	$ 97,875,000.00	705	$ 102,225,000.00	694	$ 100,630,000.00
Residental Structure	EA	$400,000.00	9	$ 3,600,000.00	2	$ 800,000.00	1	$ 400,000.00
	TOTAL			**$ 101,475,000.00**		**$ 103,025,000.00**		**$ 101,030,000.00**
Right-of-Way - Item Description	**Unit**	**Unit Cost**	**Quantity**	**Total**	**Quantity**	**Total**	**Quantity**	**Total**
Jackrabbit Wash Bridge	Sq Ft	$190.00	2000'x108'	**$ 41,040,000.00**	1200'x108'	**$ 24,624,000.00**	700'x108'	**$ 14,364,000.00**
CAP Canal Bridge	Sq Ft	$190.00	200'x108'	**$ 4,104,000.00**	300'x108'	**$ 6,156,000.00**	300'x108'	**$ 6,156,000.00**
	TOTAL			**$ 45,144,000.00**		**$ 30,780,000.00**		**$ 20,520,000.00**
Utility - Item Description	**Unit**	**Unit Cost**	**Quantity**	**Total**	**Quantity**	**Total**	**Quantity**	**Total**
Relocate 12 kv Wood Pole (Tangent)	EA	$5,000.00	16	$80,000.00	8	$40,000.00	11	$55,000.00
Relocate 69 kv Steel Pole (Tangent)	EA	$20,000.00	2	$40,000.00	1	$20,000.00	2	$40,000.00
Relocate 230 kv Tower	EA	$750,000.00	1	$750,000.00		$0.00		$0.00
Replace Well	EA	$30,000.00					3	$90,000.00
Subtotal Construction				$870,000.00		$60,000.00		$95,000.00
	Contingency	20%		$ 174,000.00		$ 34,800.00		$ 6,960.00
	TOTAL			**$1,044,000.00**		**$ 94,800.00**		**$ 191,960.00**