



APPENDIX 5

TECHNICAL MEMORANDUM 5 – DETAILED PREFERRED ALIGNMENT



Yuma Parkway Feasibility Study – Salome Highway to Palo Verde Road

Contract 2010-055
Project TT005

FINAL Technical Memorandum 5 **Detailed Preferred Alignment**

Prepared by:



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and Associates, Inc.

February 2012
091337133

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1. INTRODUCTION

Technical Memorandum 5 (TM 5), entitled *Detailed Preferred Alignment*, provides detailed information on the proposed alignment and design considerations of the preferred alternative for Yuma Parkway as part of the *Yuma Parkway: Salome Highway to Palo Verde Road Corridor Feasibility Study* (hereafter referred to as the *Yuma Parkway Feasibility Study*, or “the study”). Specifically, TM 5 provides a summary of the study background and study area; a description of the preferred alternative; standard cross-sections and design considerations for the preferred alignment of the parkway facility; and plan view drawings on aerial photographs showing the preferred alignment centerline and right-of-way limits at a scale of 1 inch = 200 feet.

The preferred alignment centerline and right-of-way limits are subject to more detailed design work that may necessitate some adjustments as roadway profiles, drainage requirements, and land development plans are further defined. Additional detailed information is included in the following companion documents: *Existing and Future Corridor Features* (TM 1), *Environmental Overview* (TM 2), *Conceptual Drainage Report* (TM 3), and *Candidate Alternative Alignments and Evaluation* (TM 4).

1.1 Background and Study Need

In July 2008, the Maricopa Association of Governments (MAG) completed the *Interstate 10/Hassayampa Valley Transportation Framework Study* (known as the *Hassayampa Framework Study*), which recommended a comprehensive roadway network to meet the future traffic demands that result when the area west of the White Tank Mountains is completely developed (hereafter referred to as buildout travel demand). This long-range regional transportation network includes the “Arizona Parkway” as a new facility type to supplement more traditional roadway classifications in meeting projected travel demand.

The Arizona Parkway, by design, is an enhanced arterial roadway which utilizes a distinct intersection treatment that prohibits left turns at major cross-street intersections and controls intersection traffic movements with two-phased traffic signal control. Left-turn movements are made indirectly using left-turn crossovers in the median immediately downstream of cross-street intersections. This design improves the functionality of the parkway, allowing traffic to flow more freely. The improved functionality increases capacity while maintaining local access and a posted speed of 45 miles per hour (mph). The typical right-of-way width for an Arizona Parkway is 200 feet.

The *Hassayampa Framework Study* recommended Yuma Parkway as an Arizona Parkway to meet buildout travel demands and provide a continuous parkway network. Although today’s land development and travel demands in the study area do not warrant a parkway in the short-term, the buildout forecast for future land development and travel demands does warrant a parkway in the long-term future. The potential for increased travel demand is evident in the approved development plans already underway converting the vacant lands within the study area to land uses that will generate future traffic.

This feasibility study will provide Maricopa County, the Town of Buckeye, area property owners, developers, and other stakeholders with guidelines to preserve a 200-foot wide right-of-way corridor to accommodate the typical Arizona Parkway design. This will require significant coordination with various governing bodies, other public agencies, development interests, and the general public.



1.2 Study Area

The Yuma Parkway study area is approximately 13 miles long and two miles wide and is generally centered on the Buckeye Road/Yuma Road section line, from one-half mile west of Salome Highway to one-half mile east of Palo Verde Road. The study area boundaries are shown in **Figure 1**.

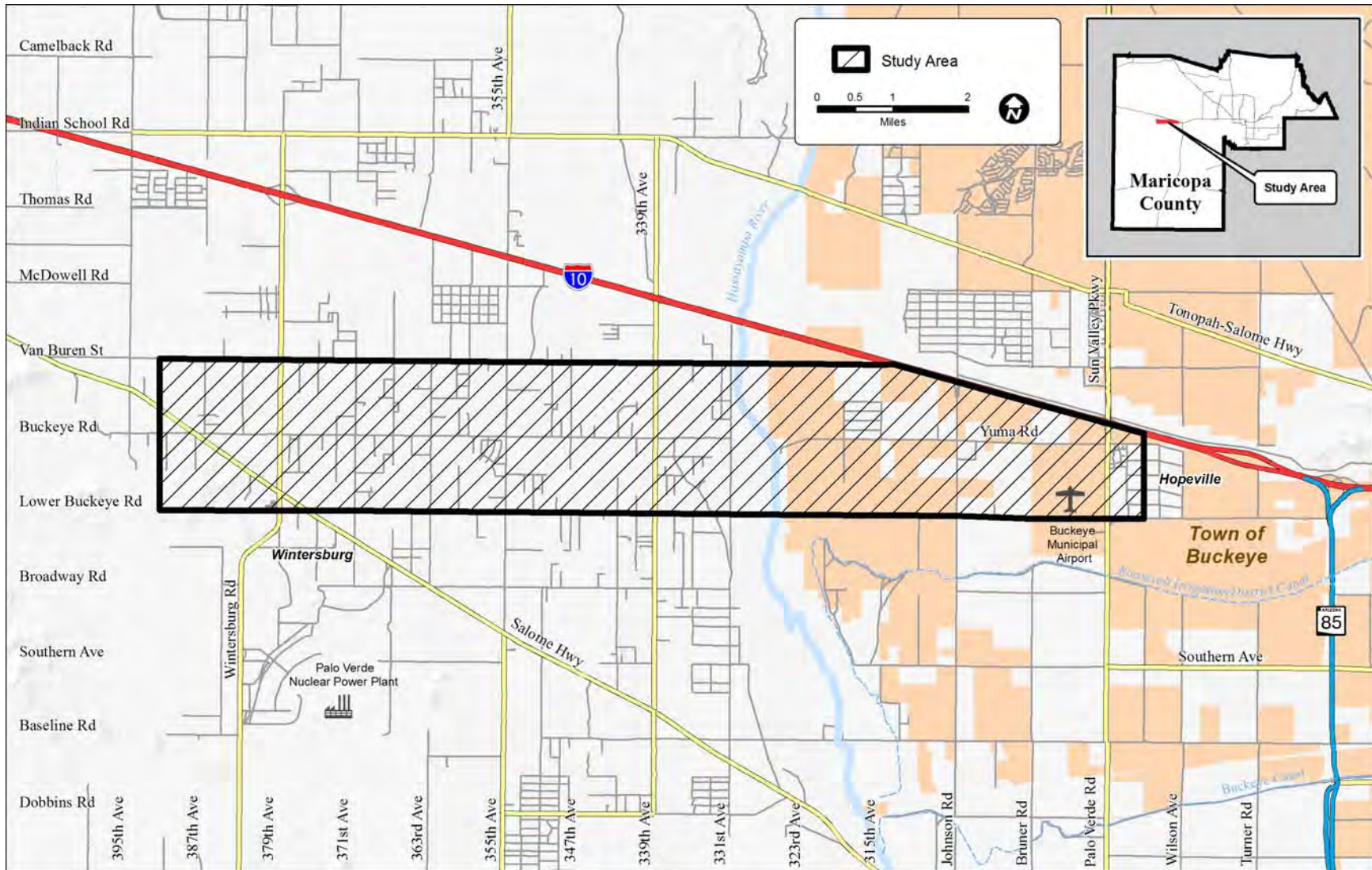


Figure 1 – Study Area

2. DEVELOPMENT OF THE PREFERRED ALTERNATIVE

2.1 Process for Selecting the Preferred Alternative

Selection of the preferred alternative was accomplished through a two-step process. The first step was to identify a series of conceptual alternatives that were subjected to a “fatal flaw” analysis. The conceptual alternatives were developed only to the extent necessary to conduct a meaningful comparative analysis that would produce up to three candidate alternatives which could be defined and evaluated in greater detail. As a result of this process, the following general recommendations were developed:

- The western terminus for all Yuma Parkway candidate alternatives should be Wintersburg Road rather than Salome Parkway. This recommendation was based on the relatively low buildout traffic projections west of Wintersburg Road, the established low density residential developments in the area, and topographic constraints that will limit development to the south and west of the study area;
- Between the Hassayampa River and Johnson Road, the Yuma Road alignment should be the only candidate alternative considered besides the no-build alternative. This recommendation is compatible with the approved Desert Creek and Cipriani community master plans (CMPs) that have been approved by the Town of Buckeye. The approved master plans include stipulations to reserve 200 feet of right-of-way along Yuma Road for the future Yuma Parkway facility; and
- East of Johnson Road, a special analysis area should be designated for more detailed study. Issues requiring closer examination include expansion plans for the Buckeye Municipal Airport, the Community of Hopeville, planned interchange and frontage road configurations along I-10, and the Town of Buckeye area plan for roadways between Palo Verde Road and State Route 85.

In accordance with these general recommendations, candidate alternatives were developed for more detailed evaluation for the following three segments within the study area.

Between Wintersburg Road and the Hassayampa River, three candidate alternatives were proposed as follows:

- Alternative A – A 200-foot-wide corridor located one-half mile north of the Buckeye Road alignment;
- Alternative B – A 200-foot-wide corridor located on the Buckeye Road alignment; and
- Alternative C – A 200-foot-wide corridor located one-half mile south of the Buckeye Road alignment.

These alternatives have the least impact on existing subdivided properties, are most compatible with planned developments, and converge at the same general crossing location at the Hassayampa River.

Between the Hassayampa River and Johnson Road, a single alternative, Alternative A, was designated for more detailed evaluation as a candidate alternative. This is the only alternative that is compatible with the approved CMPs in this segment.

Between Johnson Road and Palo Verde Road – which is the special analysis area – three candidate alternatives were developed. These candidate alternatives were developed after conducting more detailed analysis on constraints and opportunities in the special analysis area

and meeting with the Town of Buckeye, MAG, and the Federal Highway Administration (FHWA) to discuss the findings of the analysis and the feasibility of various conceptual alternatives. The three candidate alternatives developed for this segment of Yuma Parkway are as follows:

- Alternative A – A 200-foot-wide corridor that matches the preliminary alignment for Yuma Parkway shown in the *Hassayampa Framework Study*. This alternative was based on the assumption that the Buckeye Municipal Airport primary runway would be extended to the north of Yuma Road and that it would not be feasible to extend Yuma Parkway between Bruner Road and Palo Verde Road. As a result, this alternative terminates at a planned Bruner Road overpass on I-10;
- Alternative B – A 200-foot-wide corridor located on the Yuma Road alignment. This alternative is based on the Town of Buckeye current plan to extend the Buckeye Municipal Airport primary runway to the south rather than the north. This makes it possible to extend the Yuma Parkway between Bruner Road and Palo Verde Road. This alternative would shift the Yuma Parkway centerline sufficiently north to avoid encroaching on existing airport or Hopeville properties; and
- Alternative C – A 200-foot-wide corridor following a curvilinear alignment traversing north of Yuma Road and then south to connect with Palo Verde Road south of Hopeville. This alternative is intended to provide maximum flexibility for expanding the Buckeye Municipal Airport. It also provides greater separation from the I-10 interchange with Palo Verde Road/Sun Valley Parkway and from Hopeville.

The candidate alternatives are shown in **Figure 2**.

The second step was to perform a more in-depth evaluation of the candidate alternatives and identify a preferred alternative. This process is discussed in greater detail in *Technical Memorandum No. 4 – Candidate Alternative Alignments and Evaluation*. The conceptual alternatives, candidate alternatives, and evaluation criteria were all developed in consultation with the Technical Advisory Committee (TAC) and stakeholders and were presented for general public input at public open house meetings.

The candidate alternatives, along with a no-build alternative, were evaluated using the following evaluation criteria:

- System continuity and capacity;
- Building/property impacts;
- Future development compatibility;
- Utility impacts;
- Wildlife impacts;
- Cultural/archaeological impacts;
- Drainage impacts;
- Cost; and
- Public acceptability.

Most of the evaluation criteria do not lend themselves to numerical quantification, so the candidate alternatives evaluation was performed on a “qualitative” basis. Based on the evaluation results, a preliminary preferred alternative was identified for each Yuma Parkway segment.



The evaluation results and preliminary preferred alternatives were discussed with TAC members and stakeholders at their November 29, 2011 meeting and then presented for public comment at a December 6, 2011 open house. Based on the input received, the preliminary preferred alternatives were selected as the study's recommended preferred alternatives. The preferred alternative for each Yuma Parkway segment is:

- Between Wintersburg Road and the Hassayampa River – Alternative B (the Buckeye Road alignment);
- Between the Hassayampa River and Johnson Road – Alternative A (the Yuma Road alignment); and
- Between Johnson Road and Palo Verde Road – Alternative B (the Yuma Road alignment).

The overall preferred alternative for Yuma Parkway is shown in **Figure 3**. Also included in this figure are the proposed locations where other parkways and a freeway are expected (per the *Hassayampa Framework Study*) to intersect Yuma Parkway. These intersection/interchange locations are preliminary and subject to change.

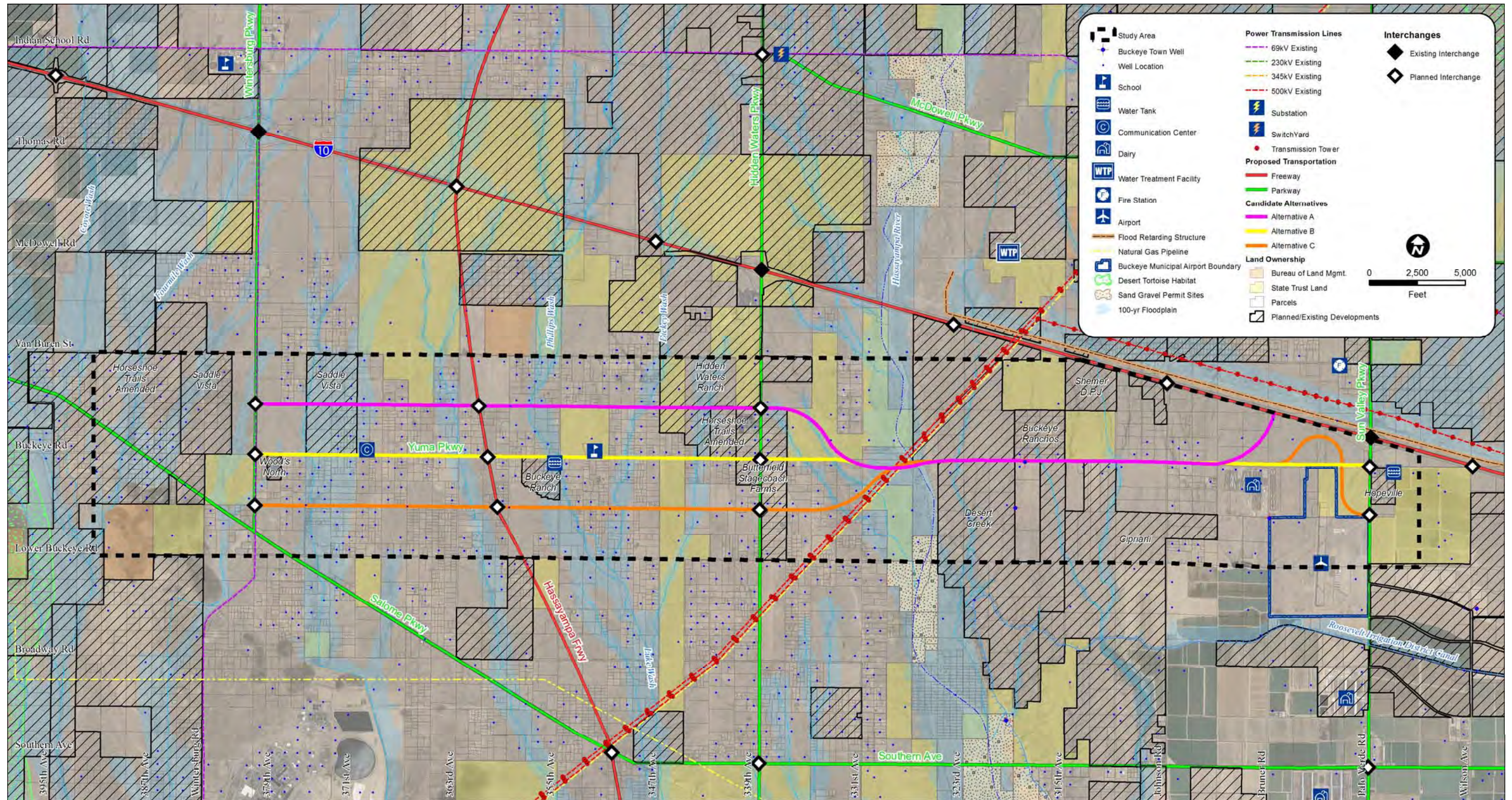


Figure 2 – Candidate Alternatives

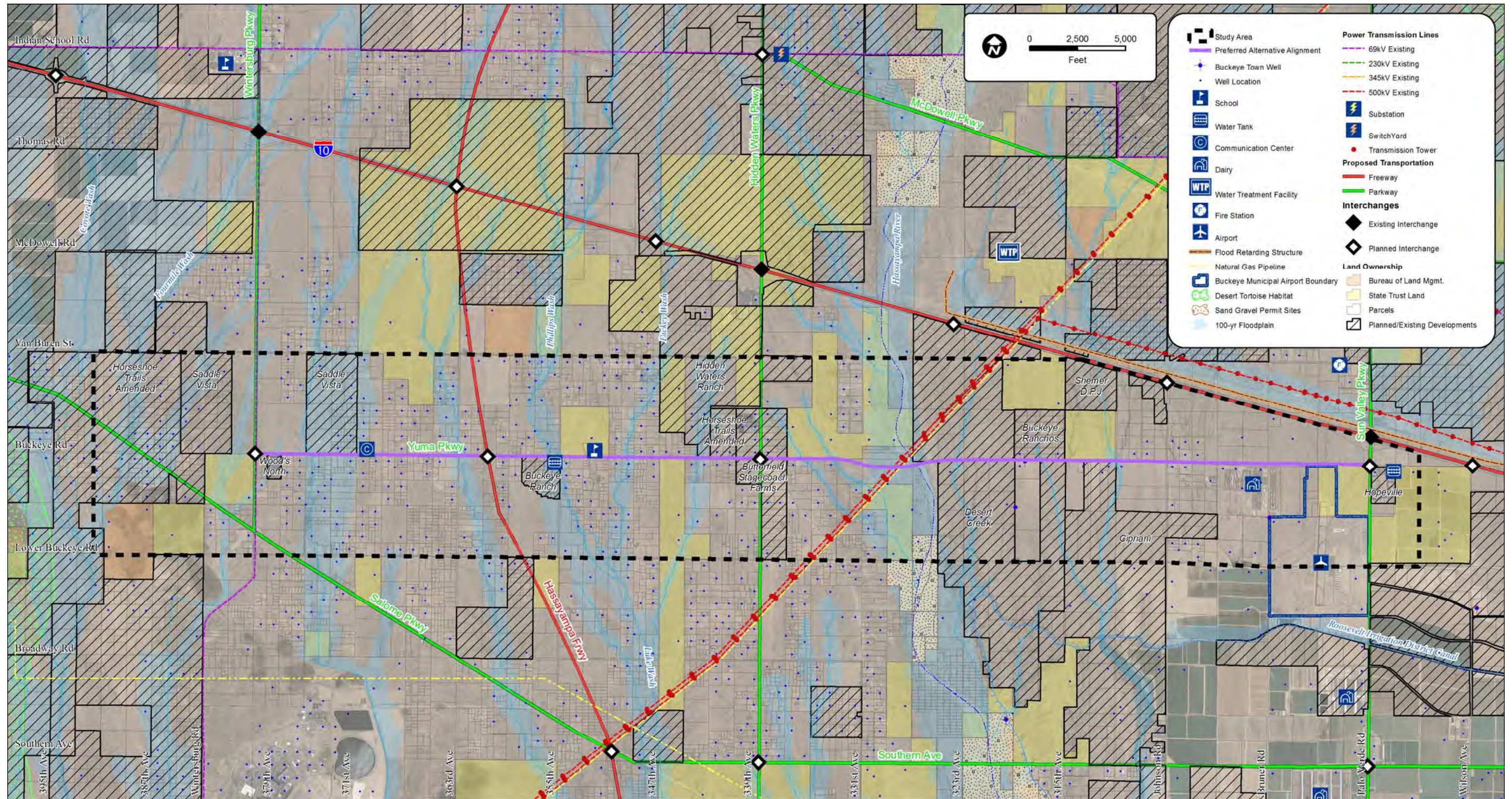


Figure 3 – Preferred Alternative

3. PREFERRED ALIGNMENT DESIGN CONSIDERATIONS

Once the preferred alternative was selected, the preferred alignment for Yuma Parkway was defined in greater detail in light of the following design considerations.

3.1 Parkway Design Guidelines and Typical Cross-Sections

Guidelines for implementation of an Arizona Parkway are documented in the MCDOT publications *Enhanced Parkway Study (August 2007)*, *Design Guideline Recommendations for the Arizona Parkway (August 2008)*, and *Arizona Parkway Intersection/Interchange Operational Analysis and Design Concepts Study (August 2009)*.

Typical urban parkway basic design guidelines and recommendations are summarized as follows:

- Minimum 200-foot-wide right-of-way. Additional right-of-way and/or easements may be needed for intersections, turn lanes, bus bays, drainage structures, drainage facilities, side slopes, utilities, and landscaping;
- Twelve-foot-wide outside travel lanes;
- Fourteen-foot-wide inside lanes (adjacent to the median);
- A six-foot-wide bicycle lane adjacent to the outside travel lane;
- Curb, gutter, and a detached six-foot-wide sidewalk;
- Median width varies based on the number of lanes;
- Minimum design speeds are 50 mph for rolling terrain and 55 mph for level terrain; and
- WB-50 is the design vehicle.

Parkway typical cross-sections from the *Design Guideline Recommendations for the Arizona Parkway* are shown in **Appendix TM5-01**. The basic Yuma Parkway design configuration is recommended as a six-lane parkway west of Hidden Waters Parkway and an eight-lane parkway east of Hidden Waters Parkway to accommodate projected traffic volumes per the *Arizona Parkway Intersection/Interchange Operational Analysis and Design Concepts Study* (see **Appendix TM5-02**).

3.2 Crossing Features

There are a number of locations where major roadways, utilities, drainage washes, and other features will cross the parkway. These crossings will require more detailed analyses during design. The following design considerations relate to the crossing features:

- Minimum right-of-way width for at-grade parkway-to-parkway intersections is 225 feet on each approach for a distance of 300 feet to accommodate dual right-turn lanes on both parkways;
- There are numerous washes throughout the study area that will require pipe culverts, box culverts, or bridges, which may result in the need for additional right-of-way. For purposes of this study, pipe culverts are assumed to be needed where the peak 100-year flood drainage flows are less than 350 cubic feet per second (cfs), box culverts are assumed to be needed for flows between 350 cfs and 1,400 cfs, and bridges are assumed to be needed for flows greater than 1,400 cfs;
- There are three anticipated at-grade parkway-to-parkway intersections within the study area:



- Yuma Parkway/Wintersburg Parkway,
- Yuma Parkway/Hidden Waters Parkway, and
- Yuma Parkway/Palo Verde Parkway;
- The Arizona Department of Transportation (ADOT) *Freeway-to-Parkway Interchange Templates* (October 2010) publication contains guidelines and ten potential design templates for grade-separated freeway-to-parkway interchanges. For purposes of this study, the four templates that support the Arizona Parkway concept and its two-phase signal cycle are considered appropriate potential solutions for the anticipated freeway-to-parkway interchange at Yuma Parkway and the planned Hassayampa Freeway. The four design templates, which are shown in **Appendix TM5-03**, are:
 - Diamond interchange with no direct left turns from the parkway to freeway ramps,
 - Single point urban interchange (SPUI) with no direct left turns from the parkway to the freeway ramps,
 - Diverging diamond interchange (DDI) with cross-overs that allow direct left turns from the parkway to the freeway ramps, and
 - Three-level diamond interchange that provides separate levels for the freeway, parkway, and ramp traffic, allowing for direct left turns on the ramp level only.

3.3 Access Management Guidelines

To preserve the operating efficiency of the parkway facilities, a higher level of access management than what is typically applied to arterial streets is recommended. Because MCDOT will not have operational control over all parkway facilities, it will be up to the agencies with jurisdiction over the roadway to apply and enforce access management policies. The following policies are recommended as minimum access management guidelines (per the *Design Guideline Recommendations for the Arizona Parkway*):

- Intersections (full median breaks) will preferably be restricted to one-mile spacing, with a minimum spacing of one-half mile, and are only recommended where intersecting with parkway, arterial, or major collector streets;
- Left turns in any direction are prohibited at all intersections;
- Left turns from a side-street or driveway onto the parkway are prohibited;
- Left turns from the parkway to a cross-street or driveway are discouraged due to conflicts between u-turns and right turns;
- U-turn directional crossovers are recommended to be restricted to a maximum of eight per mile; and
- Recommended minimum driveway spacing is 165 feet for low-volume segments and 330 feet for high-volume segments. The typical driveway will be limited to right-in/right-out maneuvers.

4. PREFERRED ALIGNMENT IMPLEMENTATION

4.1 Detailed Preferred Alignment Drawings

Detailed preferred alignment drawings were created that show the parkway centerline and right-of-way limits at a scale of 1 inch = 200 feet. The detailed preferred alignment drawings are provided in **Appendix TM5-04**. The preferred alignment centerline and right-of-way limits are subject to more detailed design work that may necessitate some adjustments as roadway profiles, drainage requirements, and land development plans are further defined.

In developing the detailed preferred alignment drawings, existing roadway centerlines, section lines, right-of-way lines, and property lines were reviewed to determine the feasibility of following some or all of these lines to the greatest extent possible. At major roadway and drainage wash crossings along the parkway, additional right-of-way will likely be required beyond the basic 200-foot-wide parkway footprint. Areas that may potentially require additional right-of-way are noted in the detailed preferred alignment drawings as being subject to further study as land development and roadway improvement plans are further defined.

4.2 Planning-Level Construction Cost Estimates

Planning-level construction cost estimates were developed for the preferred Yuma Parkway alignment. Because this study does not include preparation of an “engineered” roadway alignment and does not address detailed design issues for various features, the construction cost estimate was based on generalized unit costs. The planning-level unit cost estimates were applied to the Yuma Parkway preferred alignment characteristics and are summarized in **Table 1**.

The estimated construction cost for Yuma Parkway is \$157 million in 2012 dollars. This cost estimate excludes the construction costs of a freeway-to-parkway interchange at the planned Hassayampa Freeway, which is subject to further study and design. Right-of-way acquisition and relocation expenses are also excluded from the construction cost estimate because it is expected that much of the required right-of-way will be dedicated through the land development process.

A roadway construction unit cost estimate of \$9.6 million per mile in 2012 dollars was used for the six-lane segment of Yuma Parkway between Wintersburg Parkway and Hidden Waters Parkway. The unit cost for a six-lane parkway was developed for the *Turner Parkway Corridor Feasibility Study*, completed by MCDOT in 2010, and is utilized for this study with no inflation factors applied.

A roadway construction unit cost estimate of \$10.9 million per mile in 2012 dollars was used for the eight-lane parkway segment between Hidden Waters Parkway and Palo Verde Road. The unit cost for an eight-lane parkway was developed by calculating the per-lane-mile cost of the six-lane parkway unit cost, multiplying it by the number of lanes in the eight-lane parkway, and then applying a 15 percent decrease to account for the gained cost efficiency between a six-lane parkway and an eight-lane parkway.

Table 1 – Planning-Level Construction Cost Estimates

Facility Characteristic	Estimated Units and Costs
6-lane Parkway Segment Length (miles)	5
8-lane Parkway Segment Length (miles)	6
Roadway Construction Cost (in millions)	\$114
Major Structural Elements Bridge Construction Cost (in millions)	
-Phillips Wash Bridge	\$8
-Dickey Wash Bridge	\$8
-Hassayampa River Bridge	\$24
Total Estimated Construction Cost (in millions)	\$154
<p><i>Notes:</i></p> <p>1) <i>The estimated roadway construction unit cost for a 6-lane parkway is \$9.6 million per mile and for an 8-lane parkway is \$10.9 million per mile. Per the MCDOT Arizona Parkway Intersection/Interchange Operational Analysis and Design Concepts Study, a 6-lane parkway will ultimately be needed from Wintersburg Parkway to Hidden Waters Parkway and an 8-lane parkway will ultimately be needed from Hidden Waters Parkway to Palo Verde Road.</i></p> <p>2) <i>The estimated bridge construction unit cost is \$150 per square foot of bridge.</i></p> <p>3) <i>Major structural elements do not include a freeway-to-parkway interchange at the planned Hassayampa Freeway, which is subject to further study and design.</i></p> <p>4) <i>Estimated costs are rounded to the nearest \$5 million and are in 2012 dollars.</i></p>	

The roadway construction unit costs exclude major structural elements for crossing features but do include 20 percent contingencies for addressing drainage requirements. To give a sense of the amount of required drainage facilities anticipated in the study area, the number of anticipated drainage crossings in the study area, along with their relative size and type, were estimated based off aerial photography and required flow capacities and are summarized in **Table 2**.

The major structural elements in the study area are anticipated to include new all-weather bridges over Phillips Wash, Dickey Wash, and the Hassayampa River. Bridge costs were developed by multiplying the anticipated area of each bridge (in square feet) by a bridge construction unit cost estimate of \$150 per square foot. The unit cost for bridge construction was derived from typical bridge construction costs on other recently completed projects.



Table 2 – Anticipated Drainage Crossings

Crossing Size	Number
Small (pipe culverts)	3
Medium (box culverts)	8
Large (bridge)	3
Total Drainage Crossings	14
<i>Notes:</i> 1) Pipe culverts are assumed to be needed where the peak 100-year flood drainage flows are less than 350 cubic feet per second (cfs). 2) Box culverts are assumed to be needed for flows between 350 cfs and 1,400 cfs. 3) Bridges are assumed to be needed for flows greater than 1,400 cfs.	

4.3 Implementation Strategies

It is important to recognize that the *Yuma Parkway Feasibility Study* is a long-range transportation planning study and is therefore the earliest phase of project development. This study is intended to identify the feasibility of constructing a parkway facility at some future date to accommodate traffic demands that will be associated with future land development within and near the study area.

No public funding is currently allocated for design, right-of-way acquisition, or construction of any elements of Yuma Parkway. The recommended centerline and right-of-way limits will be used to guide future planning efforts and ensure that subsequent land development proposals and transportation system plans are compatible with future construction of Yuma Parkway. Some refinement and negotiation of the parkway centerline and right-of way requirements may occur as properties are developed and as transportation improvements are implemented.

The following are key issues captured during this study’s stakeholder and public involvement process that should be taken into consideration as the recommendations of this study are carried forward into design and construction:

- *Developer Participation* – It is anticipated that land developers will participate in dedicating right-of-way and participating in project design and construction costs;
- *Funding Strategies* – Long-term funding strategies need to be developed that will assist in positioning the parkway corridors to take advantage of future funding opportunities. When and how much funding is needed will be dependent on when and where development occurs, how much developer participation happens, and what the detailed designs call for;
- *Access Management Strategies* – Access management strategies that are consistent with the Arizona Parkway design guidelines should be implemented to ensure the parkways provide efficient traffic flow, safe operations, and reasonable local land access;
- *Environmental Impacts* – Specific impacts on environmental features, such as natural resources, wildlife habitats, cultural and archaeological resources, noise mitigation, and air quality will require further evaluation during future project development. Wildlife crossing features should be considered in the final project design where appropriate and feasible;



- *New Right-of-way Requirements* – Final roadway configurations will need to be developed through a more detailed design process to determine exactly how much land will need to be acquired to accommodate the future parkway;
- *Landscaping Plans* – Final project design should specify the type of landscaping to be used;
- *Drainage Structures* – Bridges and culverts along the new roadway should be designed during subsequent design efforts that ensure that the roadway is designed to provide all-weather crossings during major storm events. Opportunities to create drainage structures that also accommodate wildlife movements across the parkway should be considered where appropriate and feasible;
- *Bicycle, Pedestrian, and Transit Access* – Future projects should be designed to accommodate alternative modes of travel and provide access to planned trails and neighborhoods in the area;
- *Coordination with Other Planned Transportation Facilities* – Implementation of the parkway should be coordinated with the implementation of other planned transportation facilities that intersect or impact the parkway (e.g., intersecting freeways, parkways, and arterials);
- *Corridor Traffic Management* – Intelligent Transportation Systems (ITS) should be implemented in conjunction with roadway construction to promote efficient traffic operations and management along the parkway corridor; and
- *Jurisdictional Coordination* – Implementation of corridor improvement, traffic management, and access management concepts should be coordinated among the responsible jurisdictions to ensure safe, seamless, and efficient transportation facilities.

4.4 Next Steps

Agencies with primary responsibility for implementing the recommendations of this study are Maricopa County, Town of Buckeye, and ADOT. Among the critical long-range planning actions that need to commence are:

- Maricopa County and Town of Buckeye adoption/acceptance of the Arizona Parkway designation and general preferred alignment for Yuma Parkway;
- Right-of-way preservation in developing areas as needed to protect the long-term viability of the parkway facilities;
- Preparation of Design Concept Reports for consideration in project programming;
- Appropriation of funding for design, right-of-way acquisition, and construction as needed for joint participation with land developers; and
- Coordination among the jurisdictions and key stakeholders on planning, right-of-way preservation, and design.

While implementation timing of Yuma Parkway will be driven by land development, it is up to the public sector agencies to establish the transportation system planning framework now to be responsive to future land development interests while also protecting the broader long-term public interests.

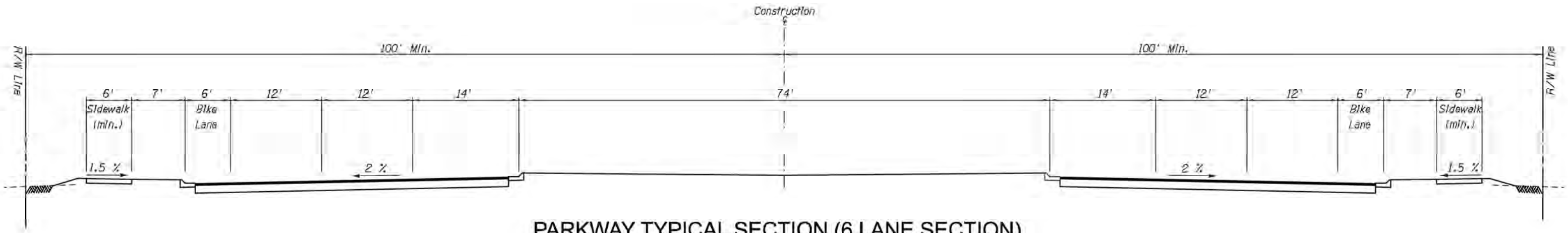


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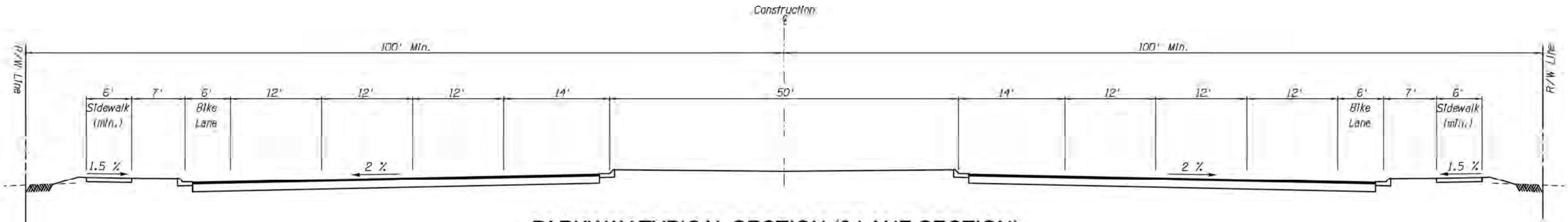


APPENDIX TM5-01

ARIZONA PARKWAY CROSS-SECTIONS AND LAYOUTS



PARKWAY TYPICAL SECTION (6 LANE SECTION)

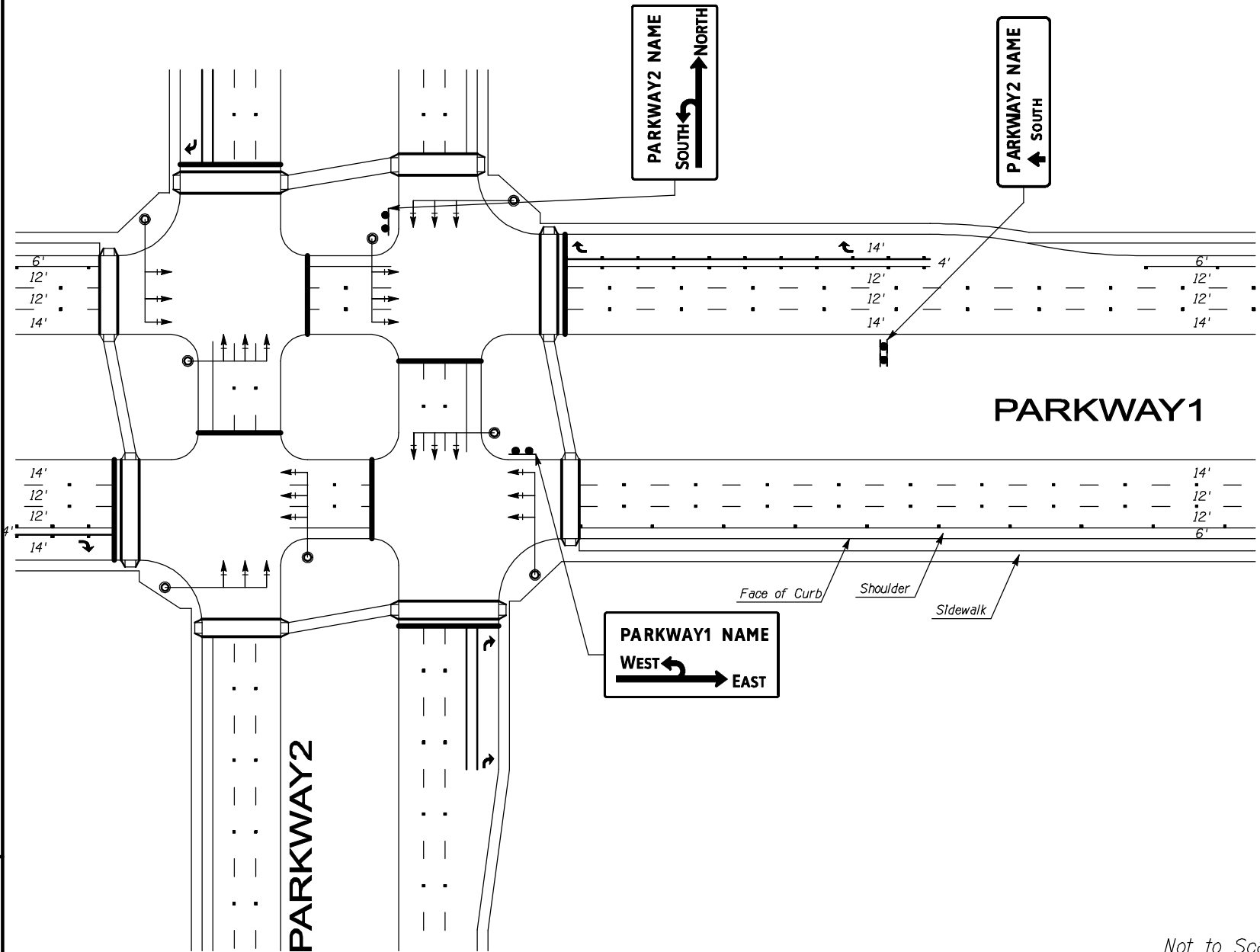


PARKWAY TYPICAL SECTION (8 LANE SECTION)

Notes:
When curb is present, dimensions are to face of curb

DESIGN FILE: m:\5204\49333\Project\Drawings\Fig18.dgn

FIGURE 18 - TYPICAL PARKWAY INTERSECTION



PARKWAY1

PARKWAY2

PARKWAY1 NAME
WEST ← → EAST

PARKWAY2 NAME
SOUTH ← → NORTH

PARKWAY2 NAME
← SOUTH

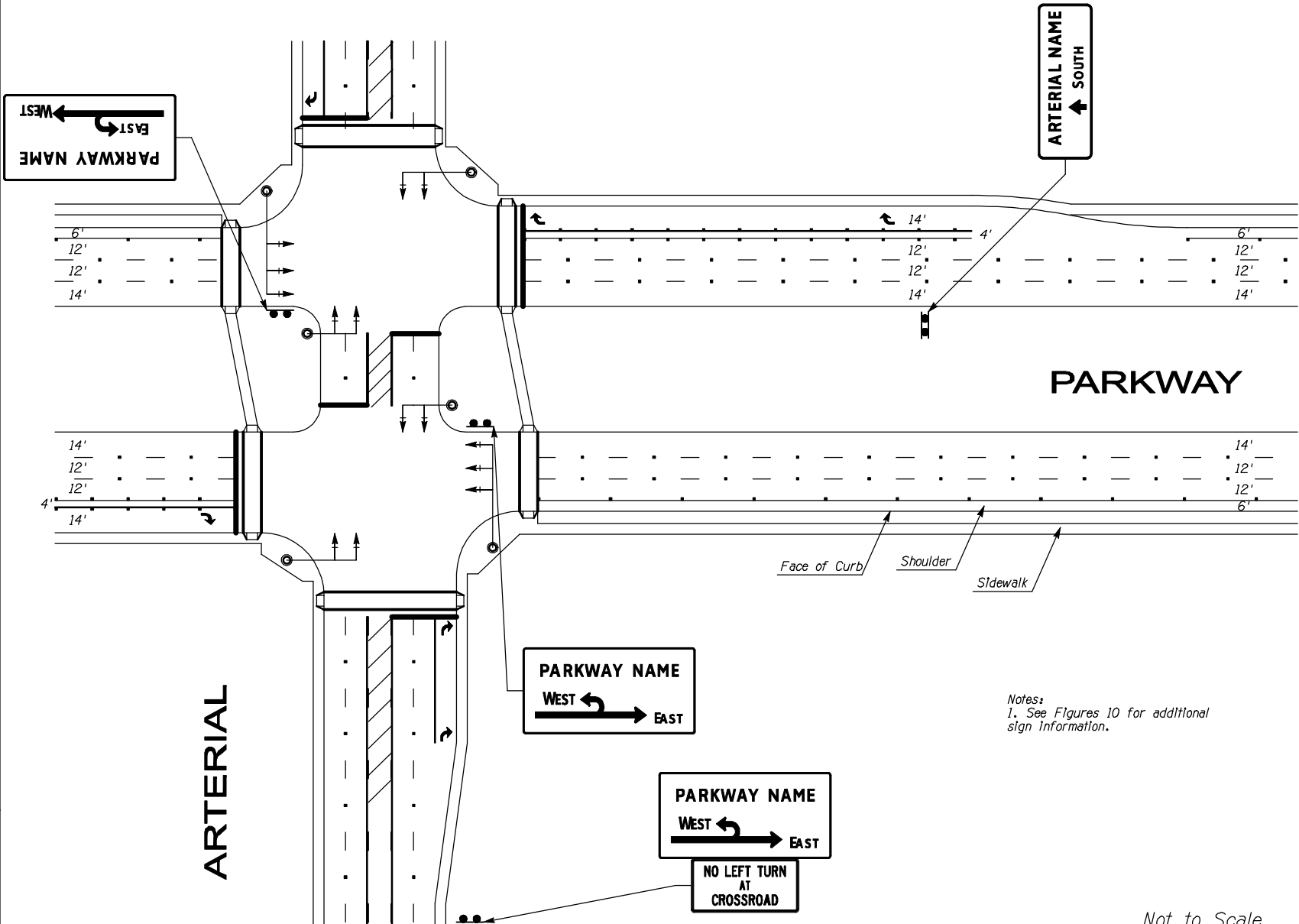
Face of Curb
Shoulder
Sidewalk

Not to Scale

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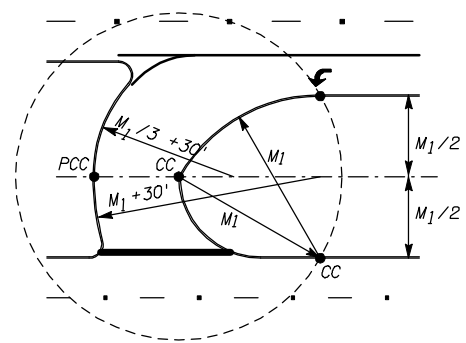
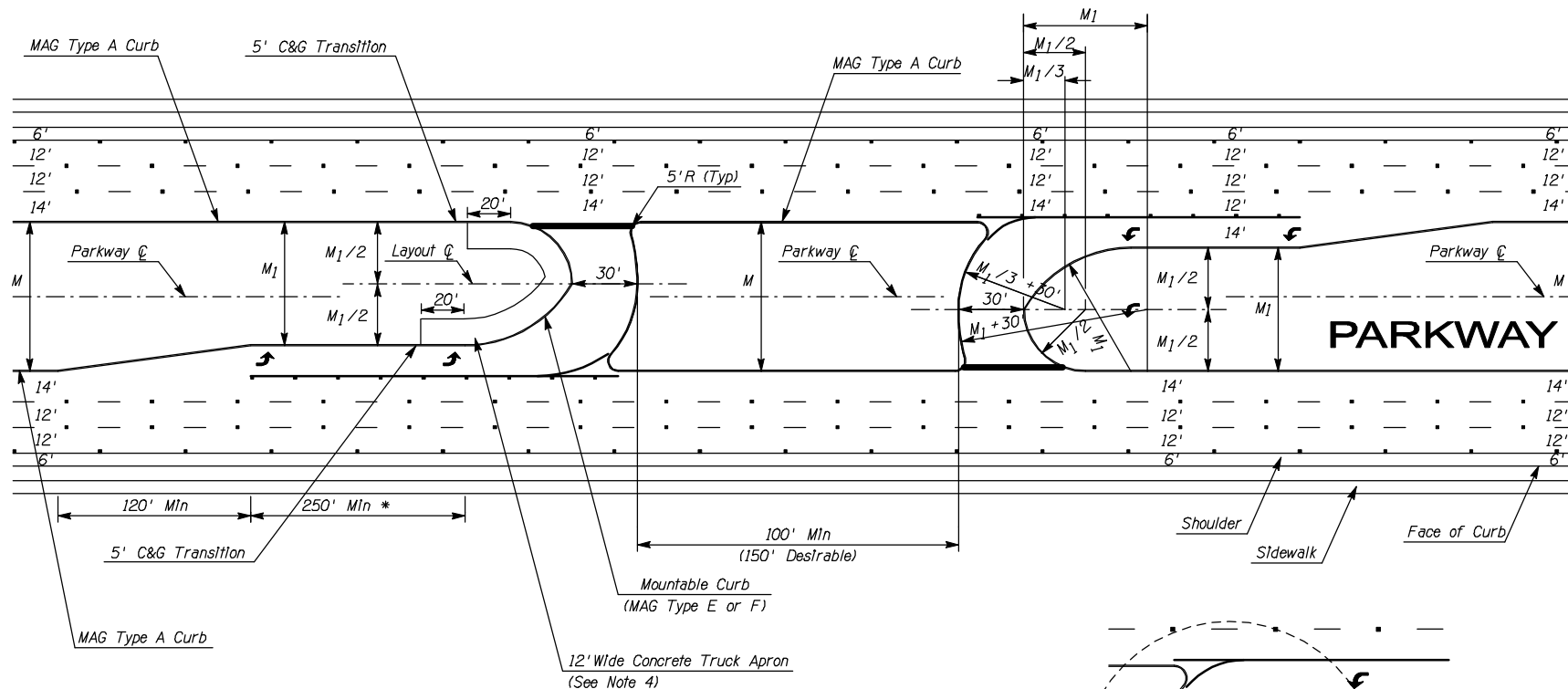
SURVEY NO.	FINISHED PLANS-	REVISIONS-	LOCATION-	DATE-	SURVEY NO.	FINISHED PLANS-	REVISIONS-	LOCATION-	DATE-
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FIGURE 17 - TYPICAL ARTERIAL INTERSECTION



Not to Scale

DATE: _____ LOCATION: _____ REVISIONS: _____ FINISHED PLUS: _____ SURVEY NO. _____ DATE: _____ LOCATION: _____ REVISIONS: _____ FINISHED PLUS: _____ SURVEY NO. _____



- Notes:**
1. Dimensions to Face of Curb
 2. See Figure 2 and Table 1-1 regarding "M"
 3. $M_1 = M - 12$
 4. Pavement section to be determined by Geotechnical/Pavement Engineer. 10" PCCP over 4" AB typical.

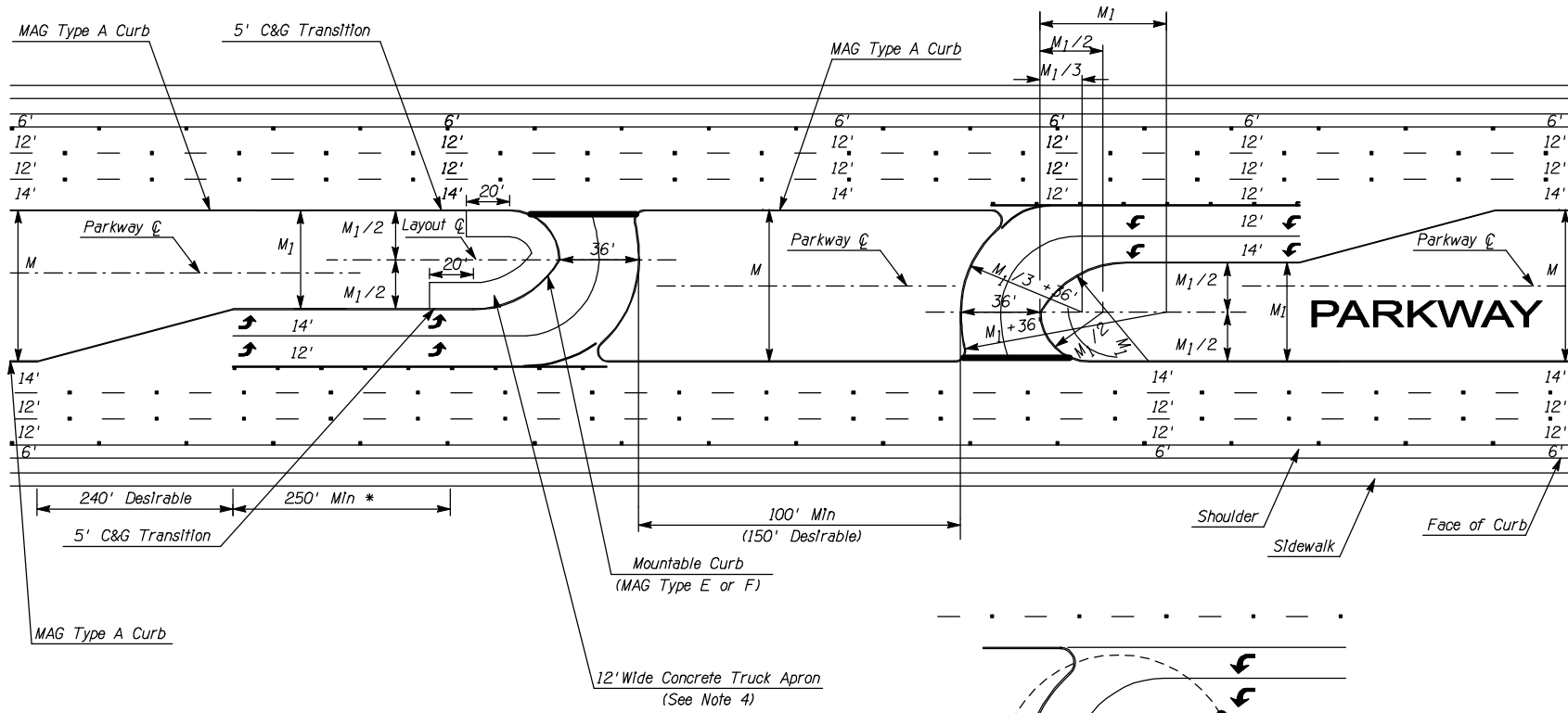
* - LENGTH TO BE DETERMINED BY TRAFFIC ANALYSIS

Not to Scale

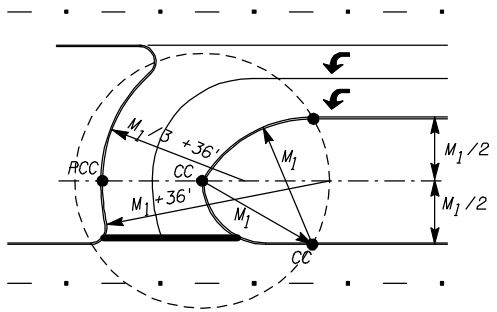
GEOMETRICS FOR TYPICAL SINGLE-LANE DIRECTIONAL CROSSOVERS

DATE: 08/08
SHEET NO: S-3

DATE: _____
 LOCATION: _____
 REVISIONS: _____
 FINISHED PLANS: _____
 SURVEY NO.: _____
 DATE: _____
 LOCATION: _____
 REVISIONS: _____
 FINISHED PLANS: _____
 SURVEY NO.: _____



- Note:**
1. Dimensions to Face of Curb
 2. See Figure 2 and Table 1-1 regarding "M"
 3. $M_1 = M - 24$
 4. Pavement section to be determined by Geotechnical/Pavement Engineer. 10" PCCP over 4" AB typical.



Not to Scale

GEOMETRICS FOR TYPICAL DUAL-LANE DIRECTIONAL CROSSOVERS

DATE: 08/08
SHEET NO: S-4



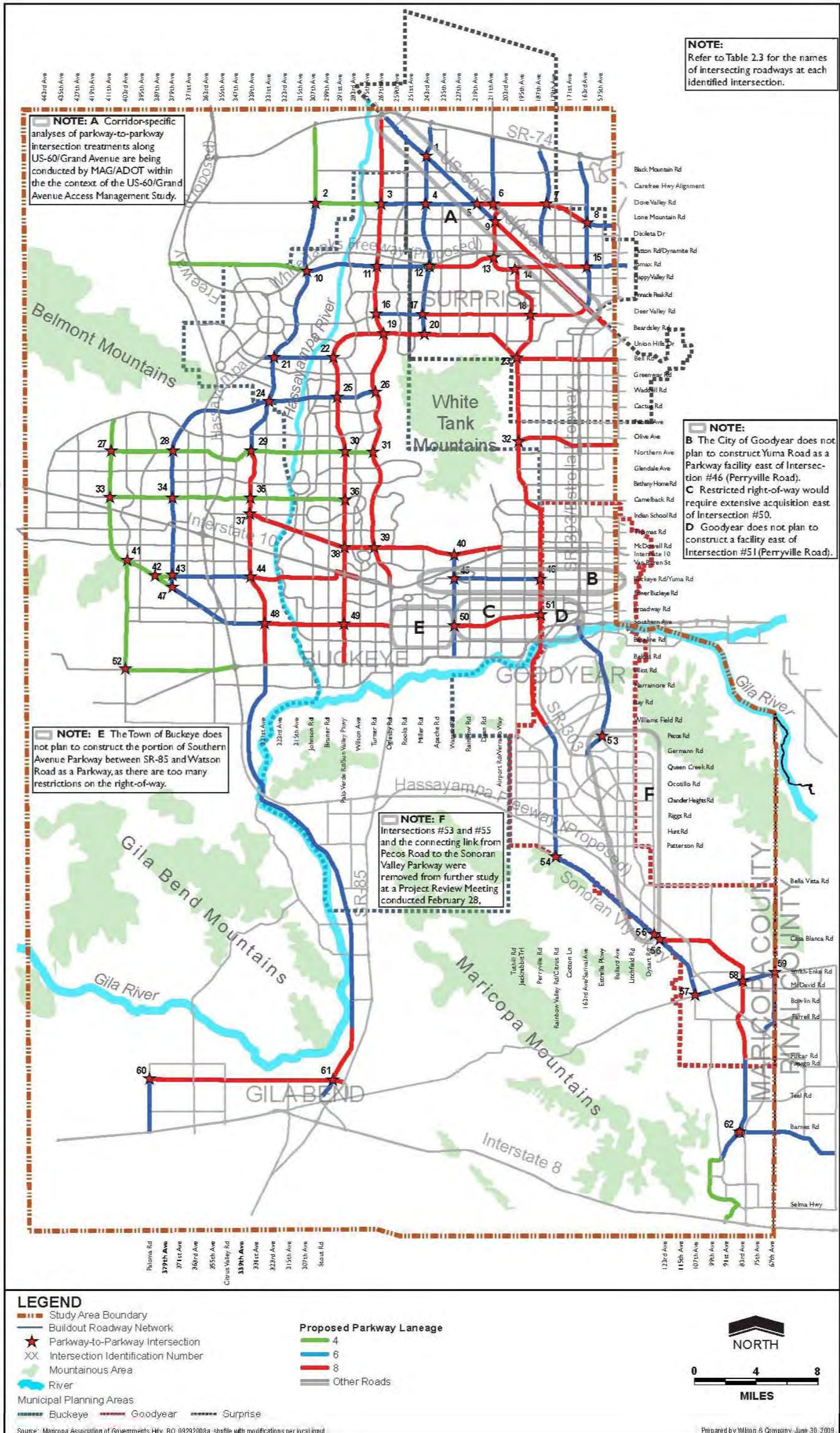
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APPENDIX TM5-02

PROPOSED LANEAGE FOR ARIZONA PARKWAY SEGMENTS

Figure 2.3
Recommended Number of Lanes for Buildout Parkway Network





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APPENDIX TM5-03

FREEWAY-TO-PARKWAY TEMPLATES

Figure 3.1 Interchange Template 1: Diamond Interchange - No Left Turn from Arizona Parkway

This template is based on the design of a standard diamond interchange. The short spacing between ramp terminals would make it classified as a *tight* or *compact* diamond interchange typical of urban areas. The ramp terminal spacing could be increased to a *spread* condition typical of rural areas.

This template differs from a standard diamond interchange at the ramp terminal intersections as left turns from the Arizona Parkway onto the freeway ramps have been restricted. This restriction allows the signals to operate as two-phase signals (as shown in the signal phasing diagram). Traffic exiting the freeway would be allowed to make a direct left or right turn onto the Arizona Parkway. This setup makes the interchange relatively normal when considering driver expectancy for the freeway and Arizona Parkway facilities. Additionally, traffic exiting the freeway would be able to negotiate the interchange and continue on the freeway in the same or opposite directions with no major obstruction.

Each of the interchange ramp terminals would be signalized. The median u-turns immediately adjacent to the interchange could either be stop-controlled or signal-controlled, as determined by traffic needs. Because traffic from the freeway is able to make all turns, the signing for the ramps and Arizona Parkway would be relatively standard for each facility.

Pedestrian flow would be allowed along and across the Arizona Parkway facility at the locations shown in the graphic. This crossing pattern would be similar to the many diamond interchanges that are in use throughout

Arizona. The movement across the Arizona Parkway could be enhanced by adding a right-turn island that would serve as a refuge for pedestrians and minimize the conflict with right-turning traffic.

The grade separation between the two facilities would require a single underpass bridge structure or two side-by-side overpass bridge structures. The underpass (as shown in the graphic) would be constructed as a two-span bridge while an overpass could be constructed as a single-span or two-span bridge.

The graphic depicts an ultimate eight-lane Arizona Parkway. In practice, the facility would likely be constructed in phases from four-lanes to eight-lanes. If the construction is implemented from the outside-in, this interchange template would not require major reconstruction. It would be recommended to construct the ultimate bridge structure(s). Reconstruction of the median u-turn would be required during the implementation phases.

This interchange template would require approximately 11.5 acres of additional right-of-way for the ramps and sideslopes. This right-of-way does not include any contingency for items such as drainage. The access control limits are shown on the figure. It is recommended that they be extended beyond the first adjacent median u-turn on both sides of the Arizona Parkway.

The approximate cost would be \$21 million which is the lowest among the interchange templates.

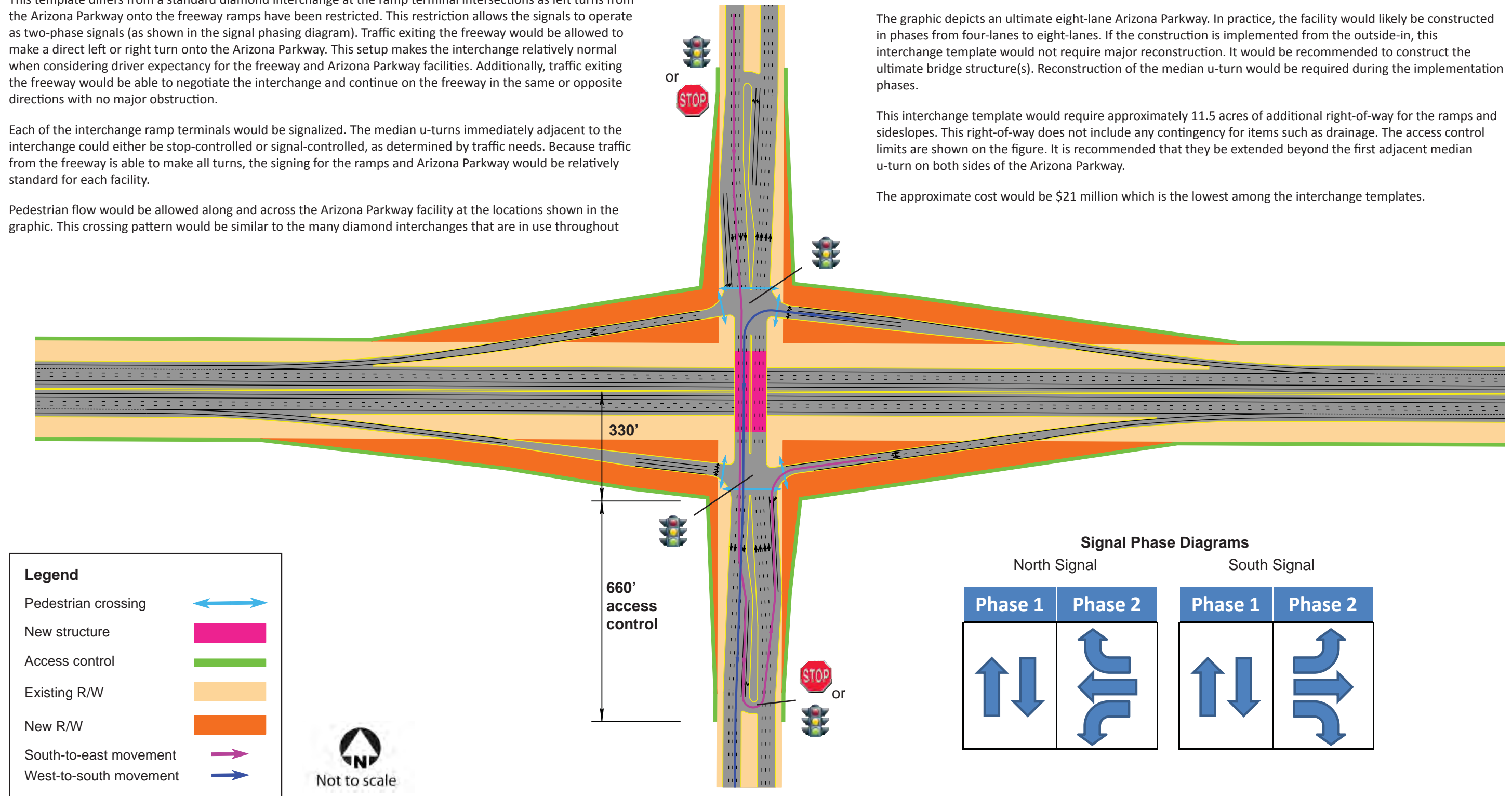


Figure 3.4 Interchange Template 4: SPUI - No Left Turn from Arizona Parkway

This template is based on the design of a standard SPUI. The ADOT *Roadway Design Guidelines* includes a section on the geometrics for the ramp and crossroad intersection associated with a SPUI that could be adapted to this configuration.

This template differs from a standard SPUI because the left turns from the Arizona Parkway onto the freeway ramps have been removed at the interchange. This restriction allows the signal to operate as a two-phase signal (as shown in the signal phasing diagram). Traffic exiting the freeway would be allowed to make a direct left or right turn onto the Arizona Parkway. However, it should be noted that the yield-controlled right-turn onto the Arizona Parkway would be in conflict with both phases of the signal. Therefore, turners would need to find gaps in the opposing traffic flow or use the outside lane (in the four-lane condition).

Overall, the interchange is relatively normal when considering driver expectancy for the freeway and Arizona Parkway facilities. Traffic exiting the freeway that wishes to continue along the freeway in the same direction would need to make a right-turn, followed by a u-turn to return to the interchange while traffic wishing to continue in the opposite direction would need to make a left turn, followed by a u-turn, to return to the interchange.

The interchange would be signalized. The median u-turns immediately adjacent to the interchange could either be stop-controlled or signal-controlled. Because traffic from the freeway is able to make all turns, the signing for the ramps and Arizona Parkway would be relatively standard for each facility.

Pedestrian flow would be allowed along the Arizona Parkway facility at the locations shown in the graphic. This template would require crossing fewer ramps than the standard SPUI. Because crossing the Arizona

Parkway is opposed by both phases at the interchange, a separate pedestrian phase of the signal would be needed to safely cross the Arizona Parkway at grade.

An underpass grade separation (as shown in the graphic) between the two facilities would require a single two-span bridge structure. This bridge structure would be relatively complex due to the asymmetrical ramps converging on the center of the interchange and the clear interchange area. With the freeway over the Arizona Parkway, a pair of single- or multi-span structures that clear the entire intersection would be needed. Additionally, the tight setup generally requires retaining walls between the freeway and the ramp.

The graphic depicts an ultimate eight-lane Arizona Parkway. In practice, the facility would likely be constructed in phases from four-lanes to eight-lanes. If the construction is implemented from the outside-in, this interchange template would not require major reconstruction. For underpasses, the ultimate bridge structure must be constructed due to the geometry of the intersection and the complexity of widening in the future.

This interchange template would require approximately 11.5 acres of additional right-of-way for the ramps and sideslopes. This right-of-way does not include any contingency for items such as drainage. The access control limits are shown on the figure. It is recommended that they be extended beyond the first adjacent median u-turn on both sides of the Arizona Parkway.

The approximate cost would be \$30 million which is relatively moderate among the interchange templates.

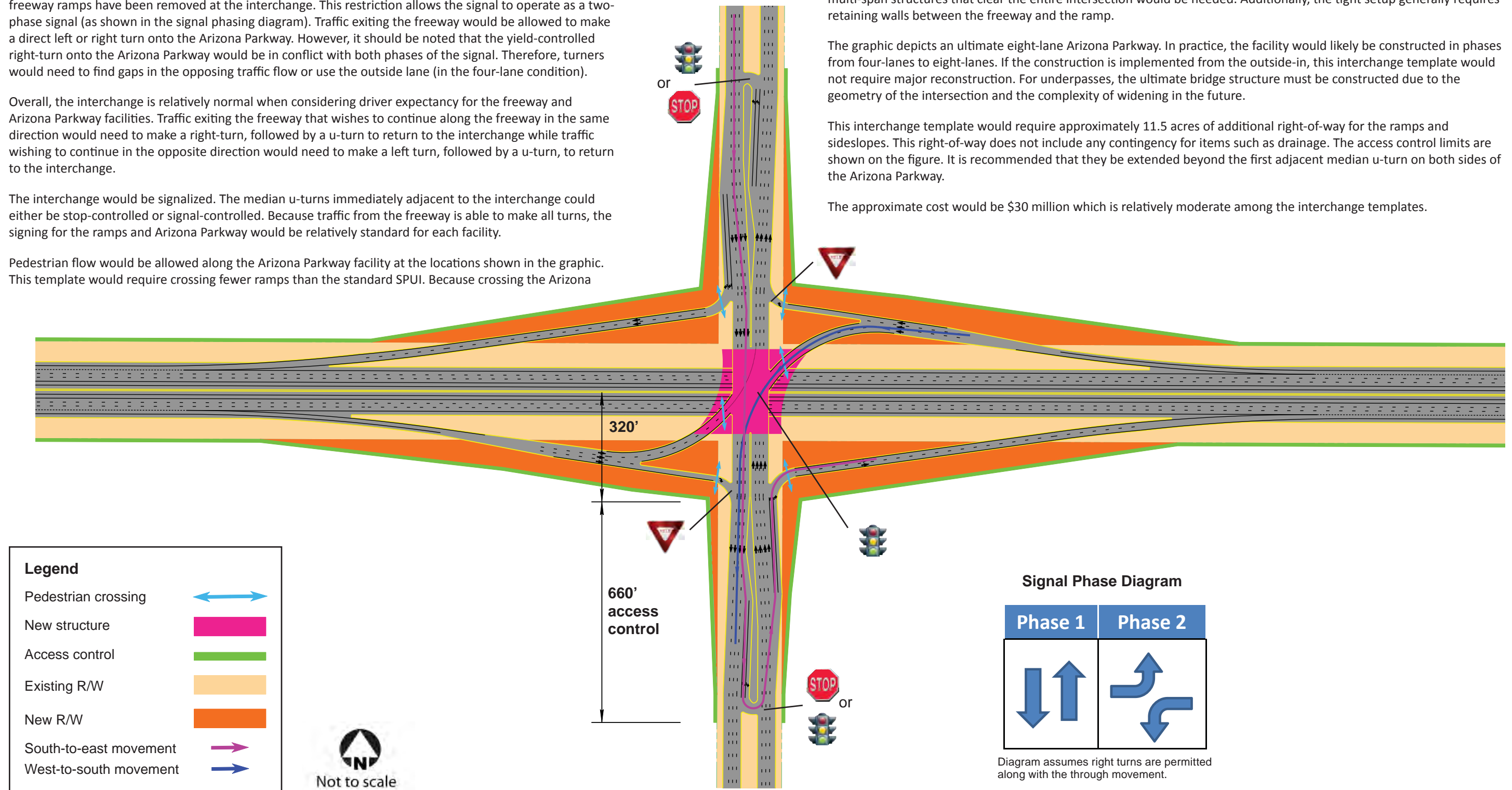


Figure 3.7 Interchange Template 7: Diverging Diamond Interchange

The diverging diamond interchange (DDI), also known as the double crossover diamond interchange, is a new interchange concept that includes a crossover on the Arizona Parkway facility in which the traffic moves to the left side of the road between the signalized ramp intersections. This allows drivers of vehicles on the Arizona Parkway who want to turn left onto the ramps the chance to continue to the ramps without conflicting with opposing through traffic and without stopping. The short spacing between ramp terminals would make it classified as a *tight* or *compact* interchange typical of urban areas. The first DDI interchange in operation in the United States is located in Springfield, Missouri, and there are several others in various stages of planning and construction. At this location, it has been observed that motorists generally use speeds 10 to 15 mph less than the speed limit as they travel through the crossover area.

The DDI design accommodates left-turning movements onto the freeway while eliminating the need for a left-turn signal phase at signalized ramp terminal intersections. The two signalized intersections at the crossover points operate with two phases (as shown in the signal phasing diagram), with each phase dedicated to the alternative opposing movements. The freeway ramp left-turn movements could be signal-controlled or yield-controlled at the intersection with the Arizona Parkway facility. If signalized, all four would be operated in a coordinated system.

Since all movements are provided at the interchange, median u-turns adjacent to the interchange are not required. The signing of the interchange would be unique to this interchange type. Similarly, the traffic operations would not be familiar to drivers because this is not a common interchange. Traffic exiting the freeway that wishes to continue along the freeway in the same direction would need to make a right-turn, followed by a u-turn to return to the interchange, while traffic wishing to continue in the opposite direction could make a u-turn within the interchange.

Pedestrian flow would be allowed along and across the Arizona Parkway facility at the locations shown in the graphic. The pedestrian flow along the Arizona Parkway could be accommodated in the median or on the outside of the travel lanes. The pedestrian flow across the Arizona Parkway would be made in stages as each through movement is stopped. Although some ramps would be signalized, thereby providing protection for pedestrian flow, most of them would be free-flow or yield-controlled. The proposed crossing pattern would be unique to this interchange type.

The underpass grade separation between the two facilities would require a single or two separated bridge structures depending on the planned use of the median area. Whether the freeway were to go under the Arizona Parkway (as shown in the graphic) or go over the Arizona Parkway, a standard two-span structure would be appropriate.

The graphic depicts an ultimate eight-lane Arizona Parkway. In practice, the facility would likely be constructed in phases from four-lanes to eight-lanes. If the construction is implemented from the outside-in, this interchange template would not require major reconstruction.

This interchange template would require approximately 17.6 acres of additional right-of-way for the ramps and sideslopes. This right-of-way does not include any contingency for items such as drainage. The access control limits are shown on the figure. It is recommended that they be extended 300 feet beyond the radius return for the right-turn lane entering and exiting the Arizona Parkway.

The approximate cost would be \$29 million which is relatively moderate among the interchange templates.

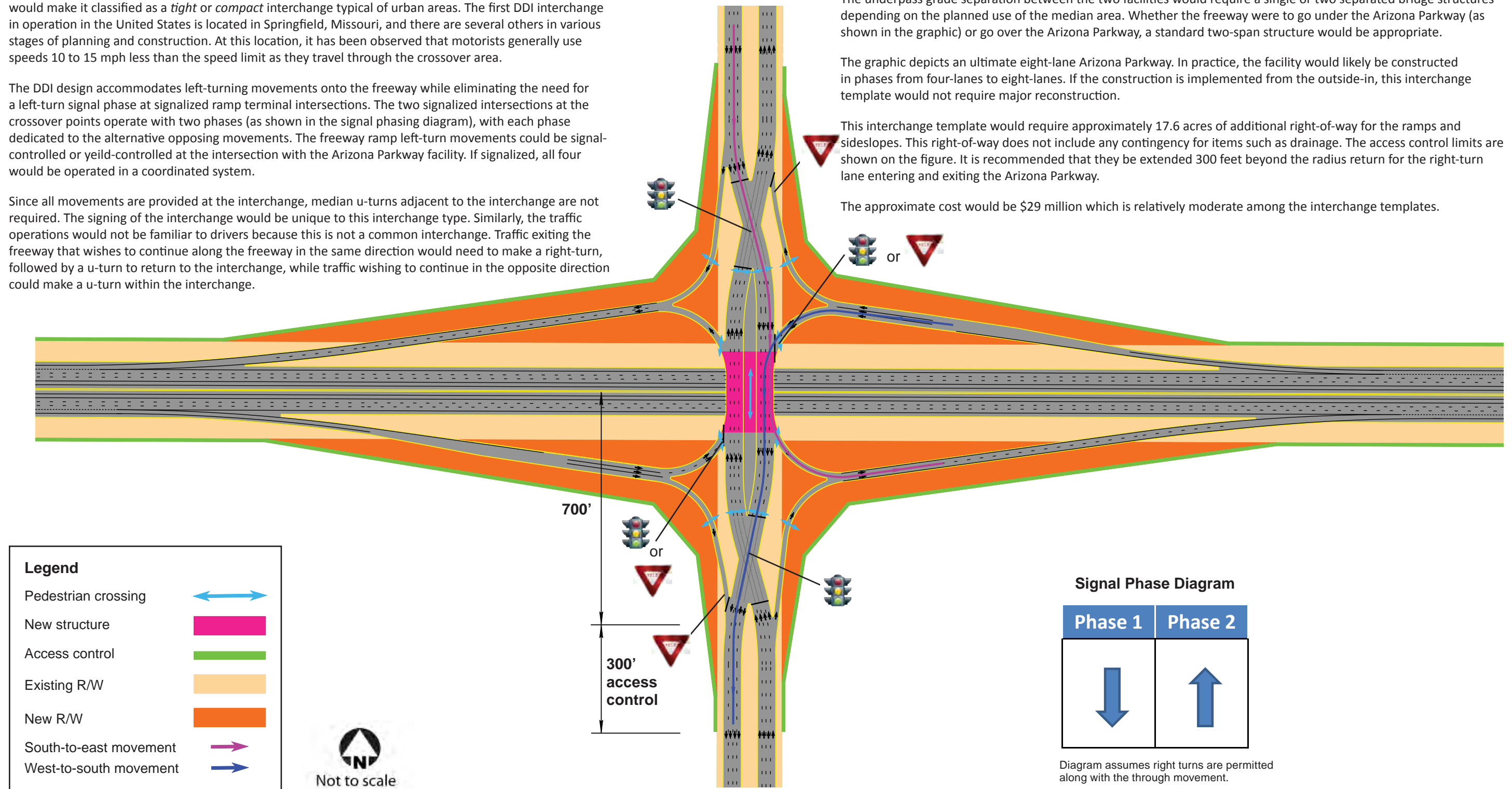


Figure 3.10 Interchange Template 10: Three-level Diamond Interchange

The three-level diamond interchange is an interchange concept that separates freeway, Arizona Parkway, and ramp traffic onto three grade separated levels. This allows the Arizona Parkway traffic to continue free-flow across the freeway. The traffic interacting between the Arizona Parkway and the freeway use ramps and a series of one-way platform roads to complete their movements. The size of the platform would be dependent on the storage lengths needed to meet the traffic demand.

The three levels can be ordered in any manner, but it is desirable to have the ramp traffic in the middle level to reduce the change in elevation between the platform roads and either the freeway or Arizona Parkway. There are variations or hybrids, such as a platform SPUI, that would operate in a similar manner.

The platform roads create four intersections. The four signalized intersections at the ramp terminals operate with two phases (as shown in the signal phasing diagram). All of the signals would be operated by a single controller.

Since all movements are provided at the interchange, median u-turns adjacent to the interchange are not required. The signing of the interchange would be unique to this interchange type, but would be similar to a diamond interchange. Traffic exiting the freeway that wishes to continue along the freeway in the same direction or the opposite direction could complete the movement using the platform roads.

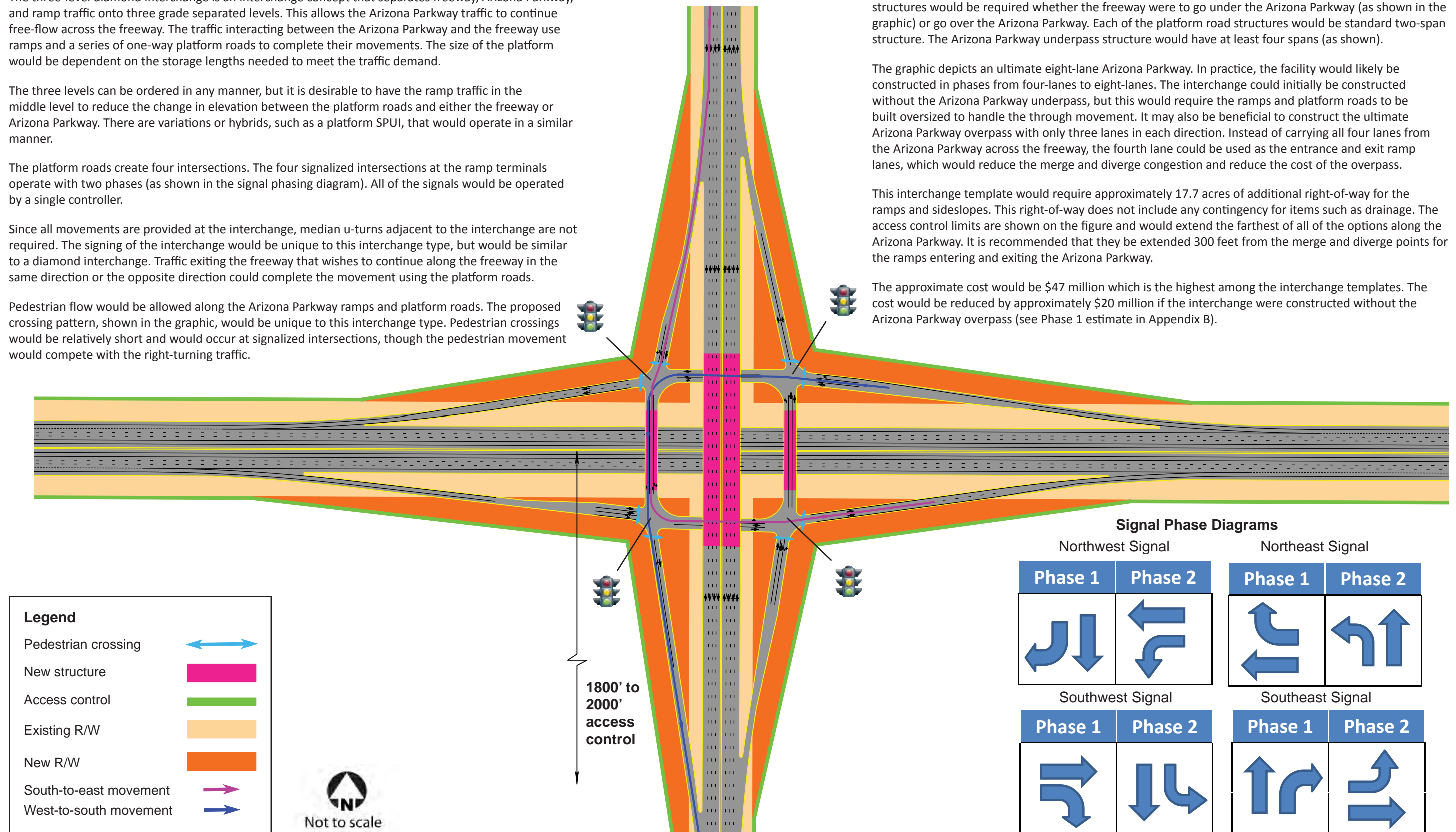
Pedestrian flow would be allowed along the Arizona Parkway ramps and platform roads. The proposed crossing pattern, shown in the graphic, would be unique to this interchange type. Pedestrian crossings would be relatively short and would occur at signalized intersections, though the pedestrian movement would compete with the right-turning traffic.

The interchange includes two structures to grade-separate the platform roads and the freeway and another structure to grade-separate the Arizona Parkway from the platform roads and the freeway. Three structures would be required whether the freeway were to go under the Arizona Parkway (as shown in the graphic) or go over the Arizona Parkway. Each of the platform road structures would be standard two-span structure. The Arizona Parkway underpass structure would have at least four spans (as shown).

The graphic depicts an ultimate eight-lane Arizona Parkway. In practice, the facility would likely be constructed in phases from four-lanes to eight-lanes. The interchange could initially be constructed without the Arizona Parkway underpass, but this would require the ramps and platform roads to be built oversized to handle the through movement. It may also be beneficial to construct the ultimate Arizona Parkway overpass with only three lanes in each direction. Instead of carrying all four lanes from the Arizona Parkway across the freeway, the fourth lane could be used as the entrance and exit ramp lanes, which would reduce the merge and diverge congestion and reduce the cost of the overpass.

This interchange template would require approximately 17.7 acres of additional right-of-way for the ramps and sideslopes. This right-of-way does not include any contingency for items such as drainage. The access control limits are shown on the figure and would extend the farthest of all of the options along the Arizona Parkway. It is recommended that they be extended 300 feet from the merge and diverge points for the ramps entering and exiting the Arizona Parkway.

The approximate cost would be \$47 million which is the highest among the interchange templates. The cost would be reduced by approximately \$20 million if the interchange were constructed without the Arizona Parkway overpass (see Phase 1 estimate in Appendix B).



Signal Phase Diagrams

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Southwest Signal		Southeast Signal	
Phase 1	Phase 2	Phase 1	Phase 2

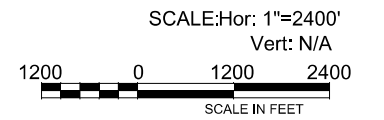
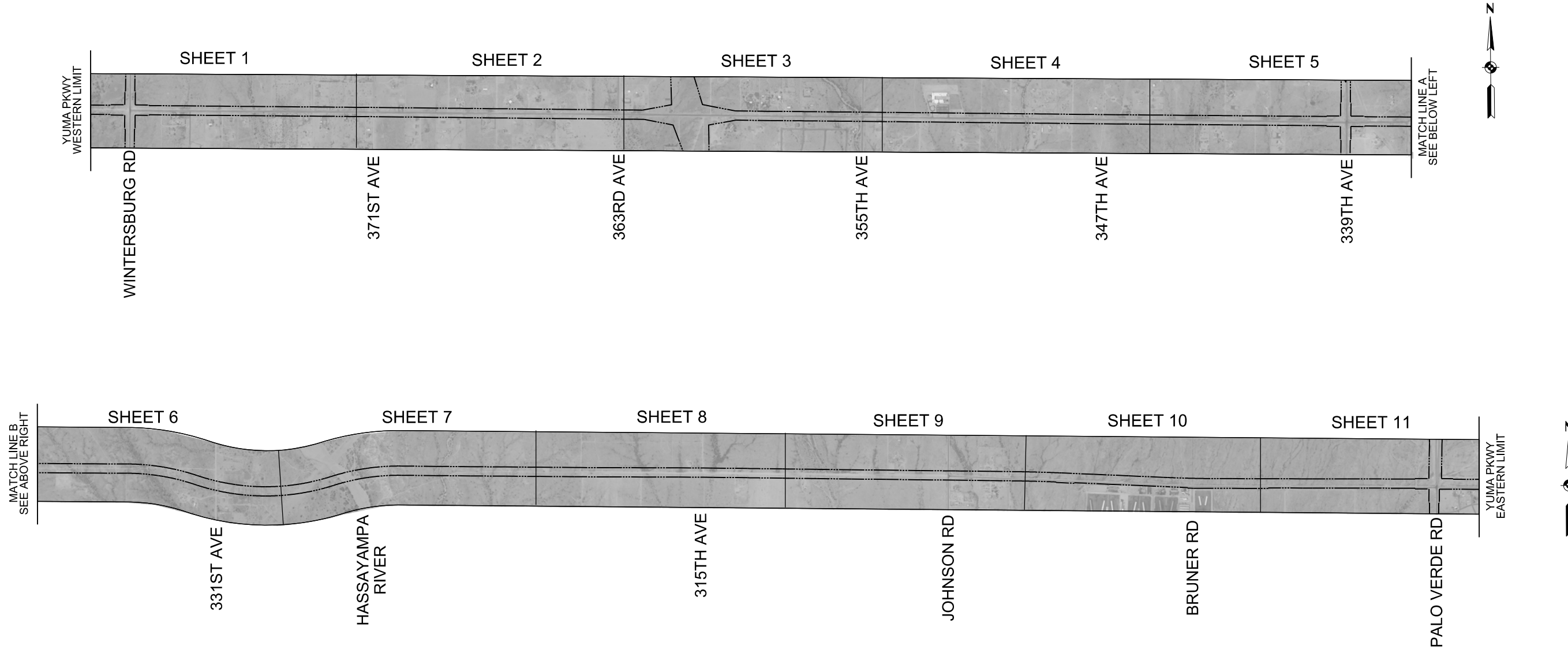


Kimley-Horn
and Associates, Inc.



APPENDIX TM5-04

DETAILED PREFERRED ALIGNMENT DRAWINGS



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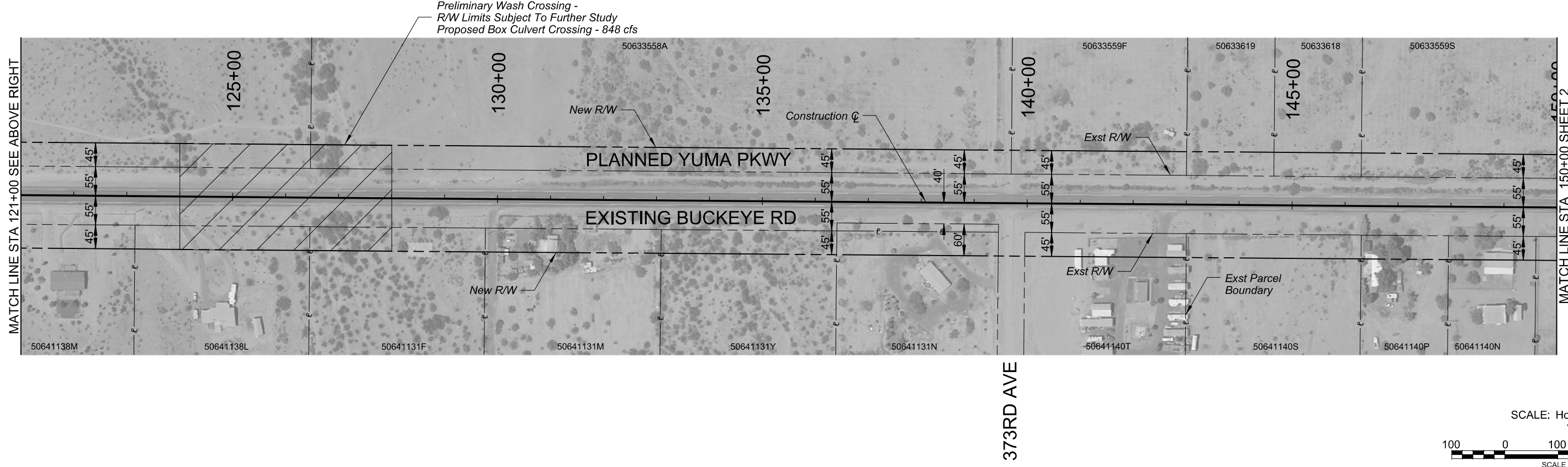
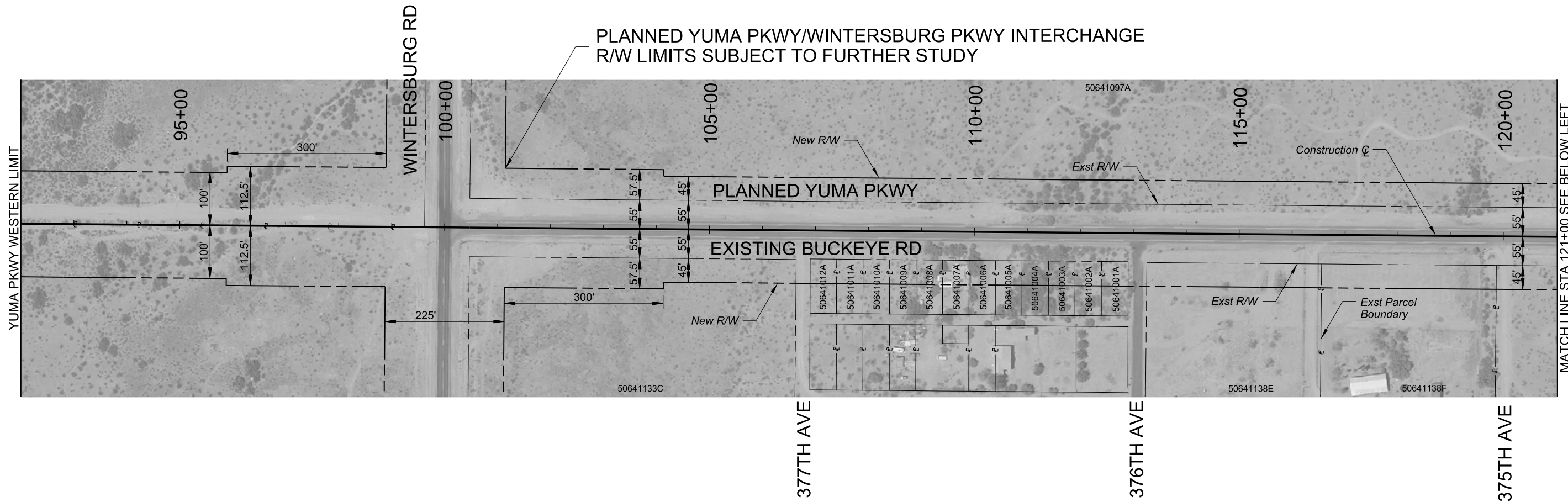
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KEY MAP





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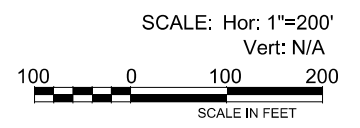
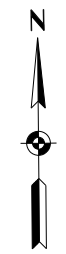
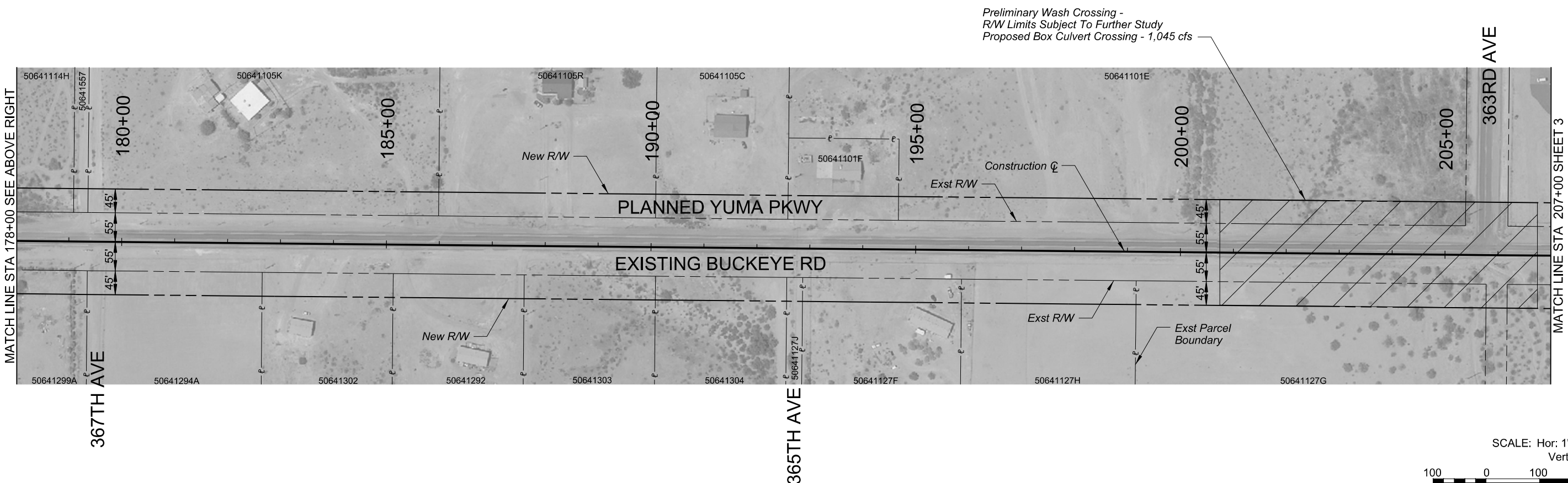
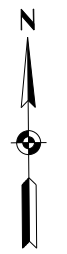
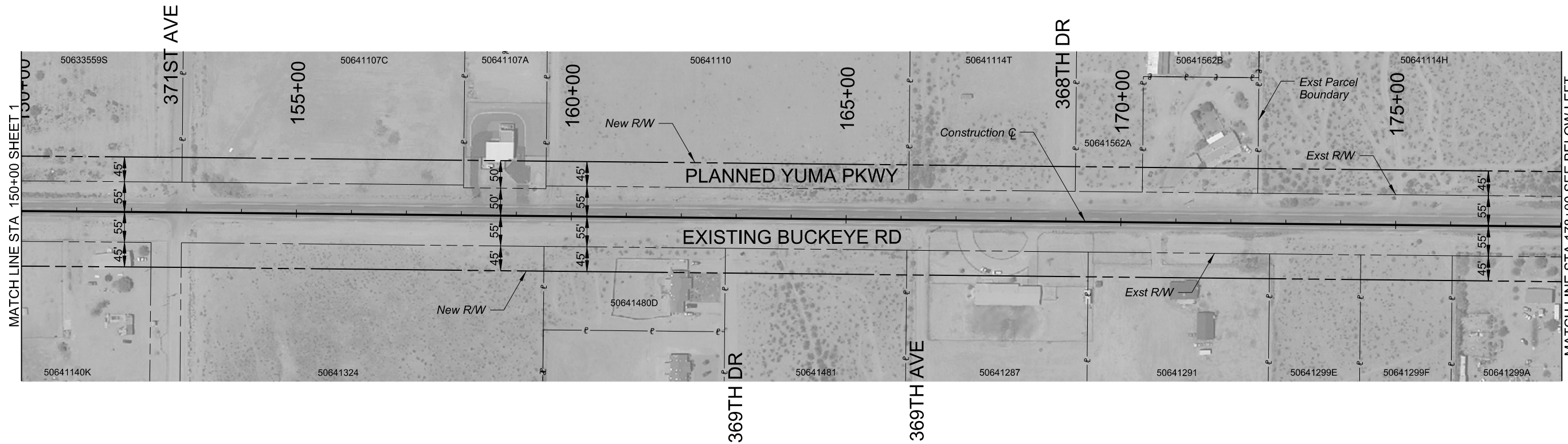
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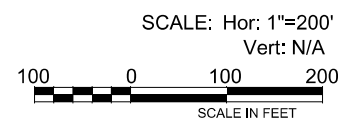
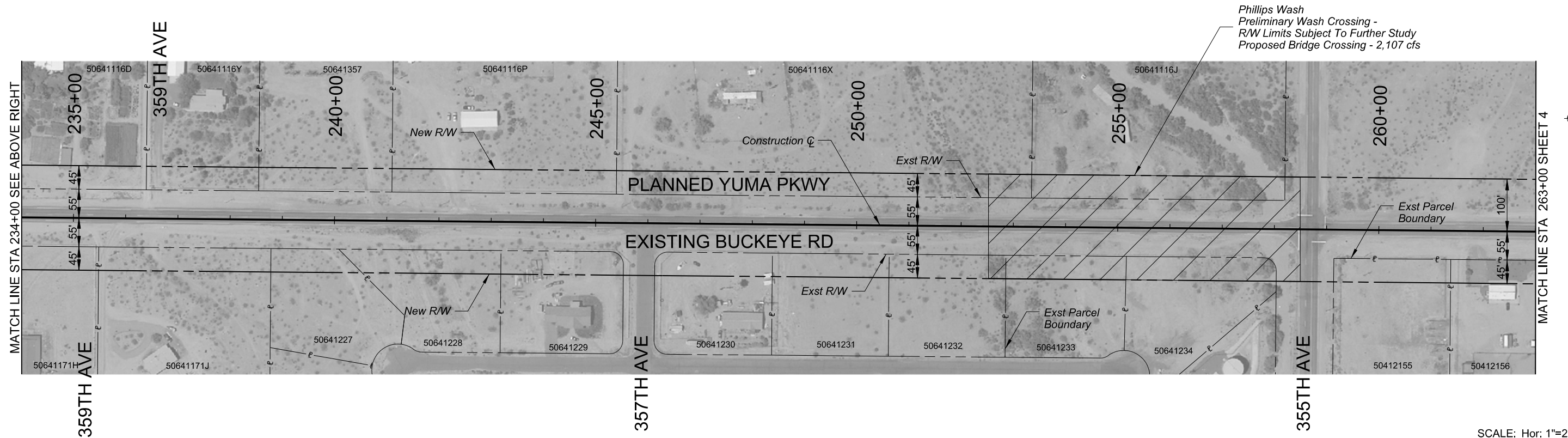
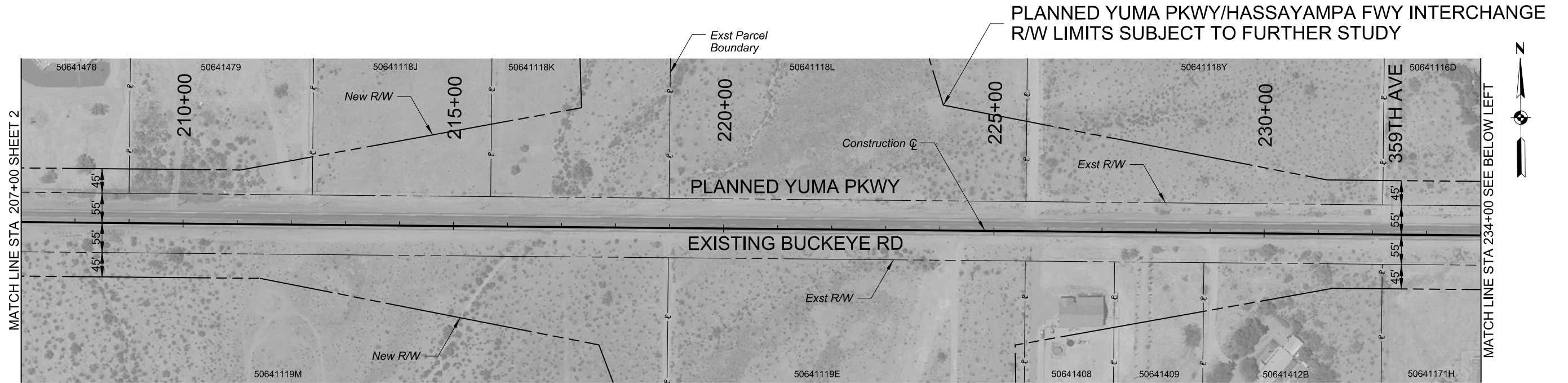
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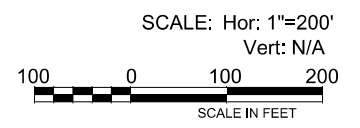
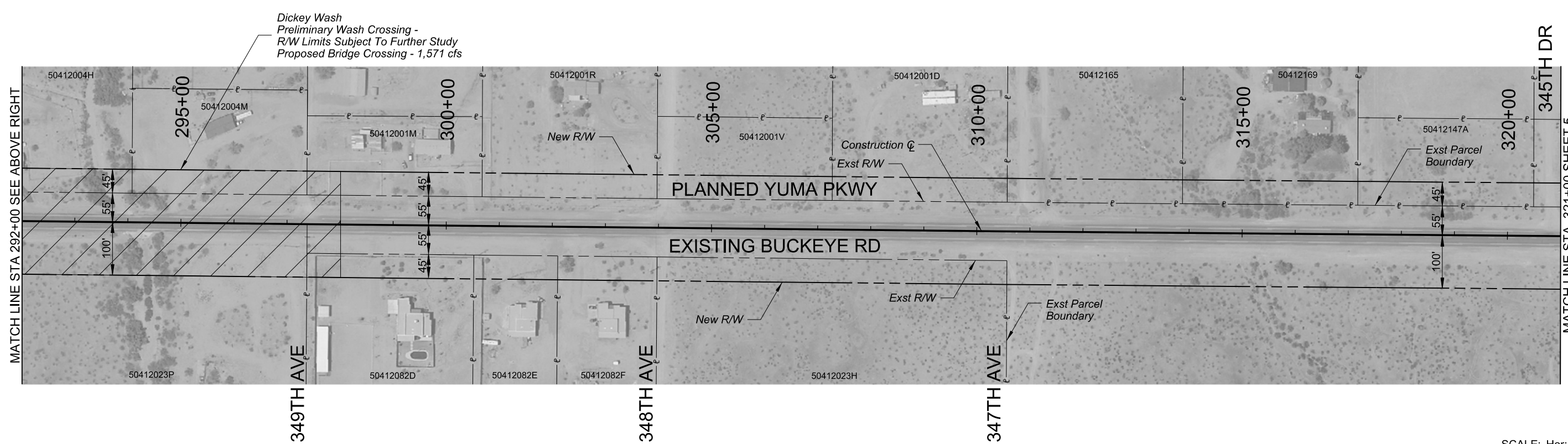
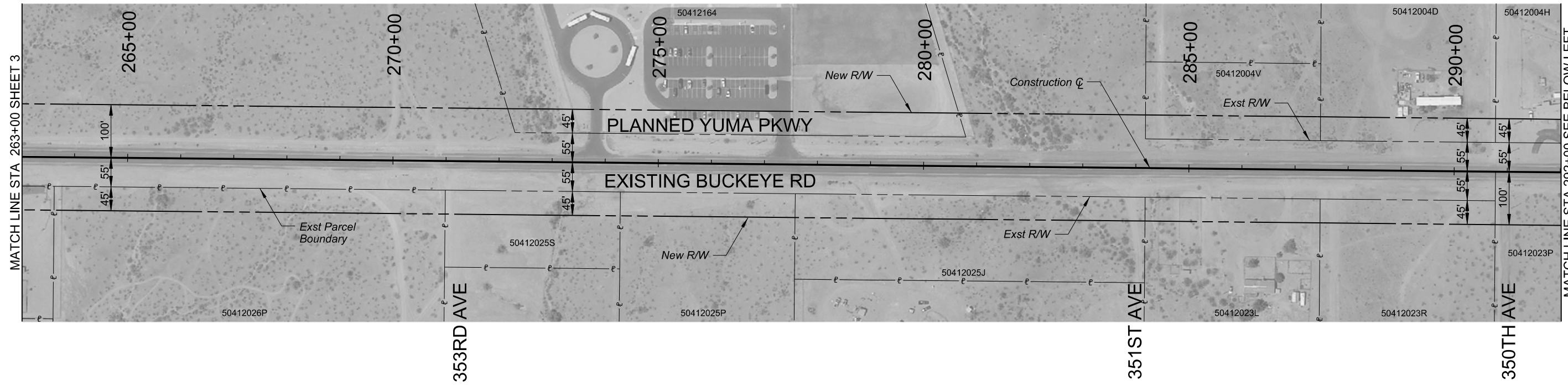
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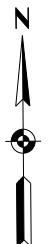
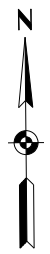
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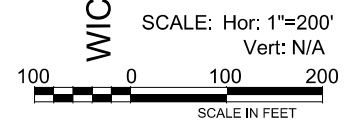
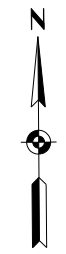
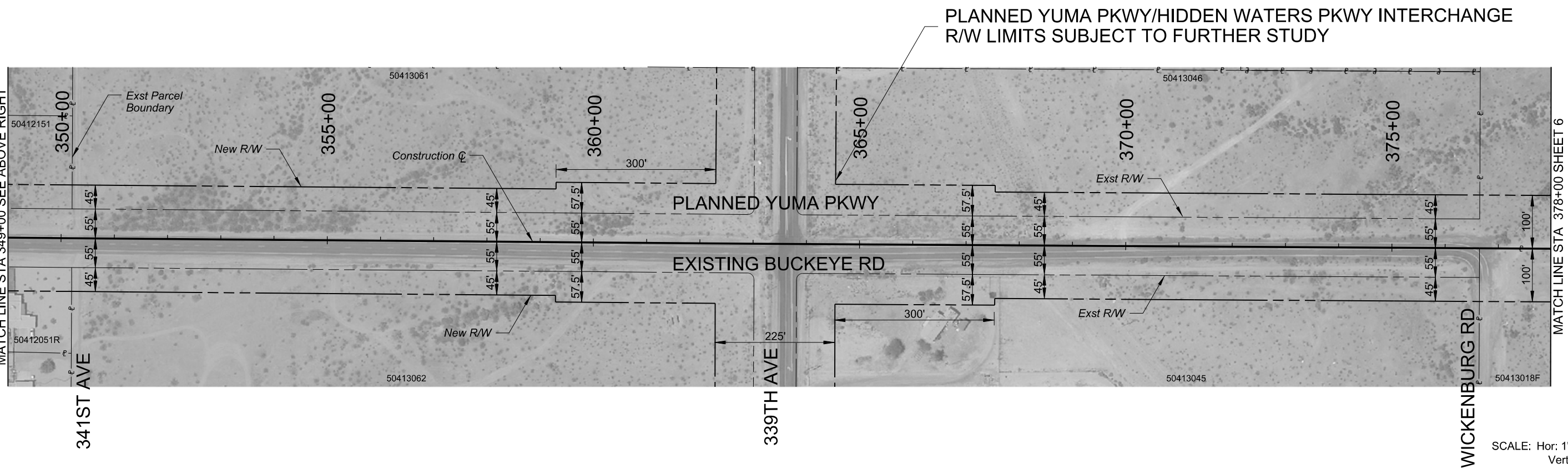
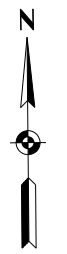
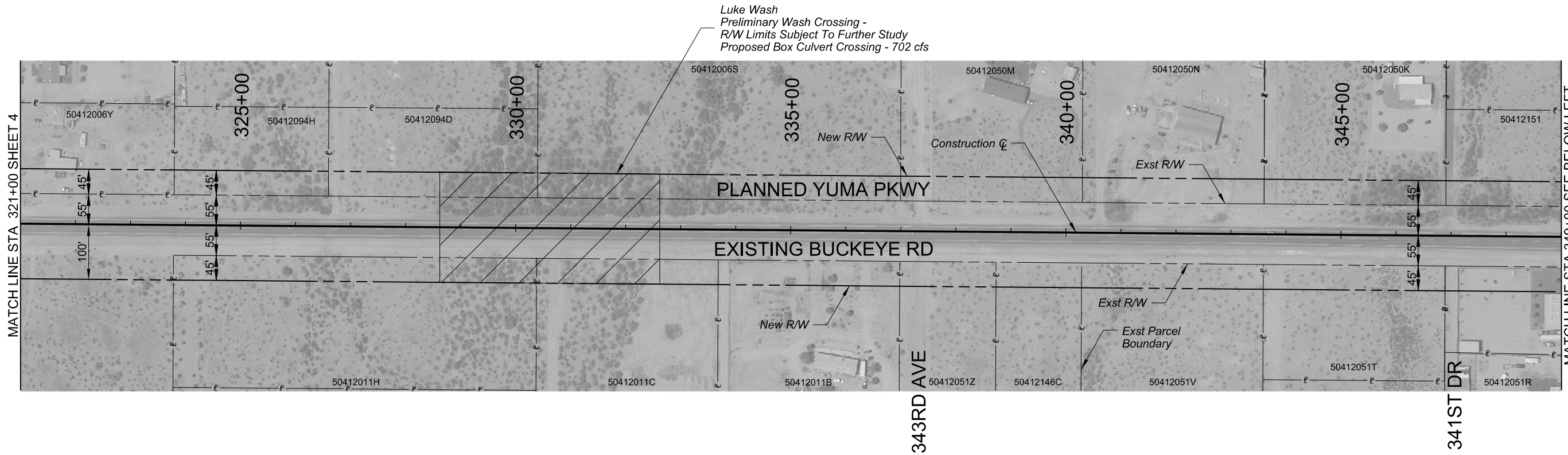
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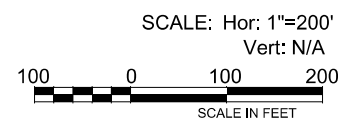
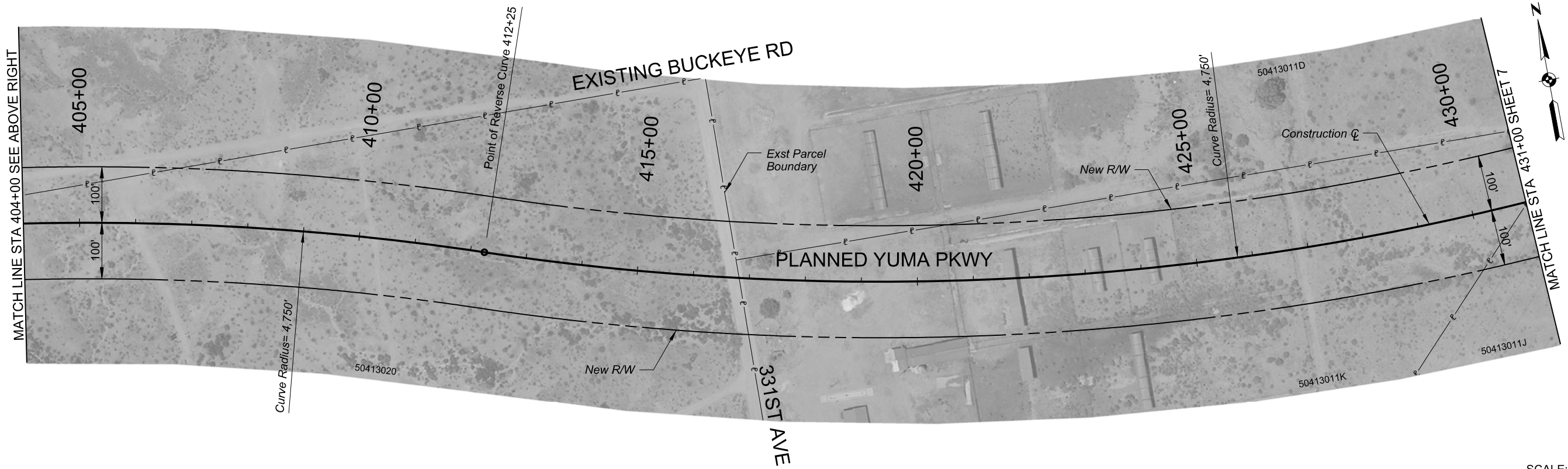
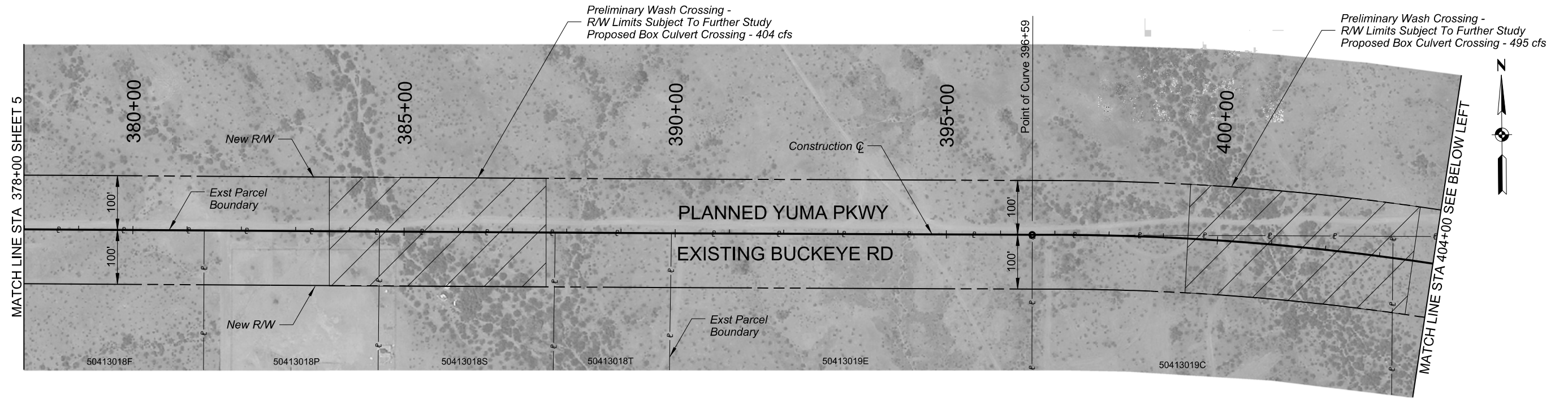
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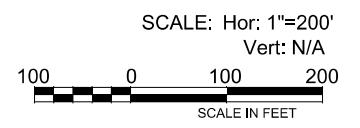
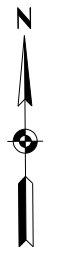
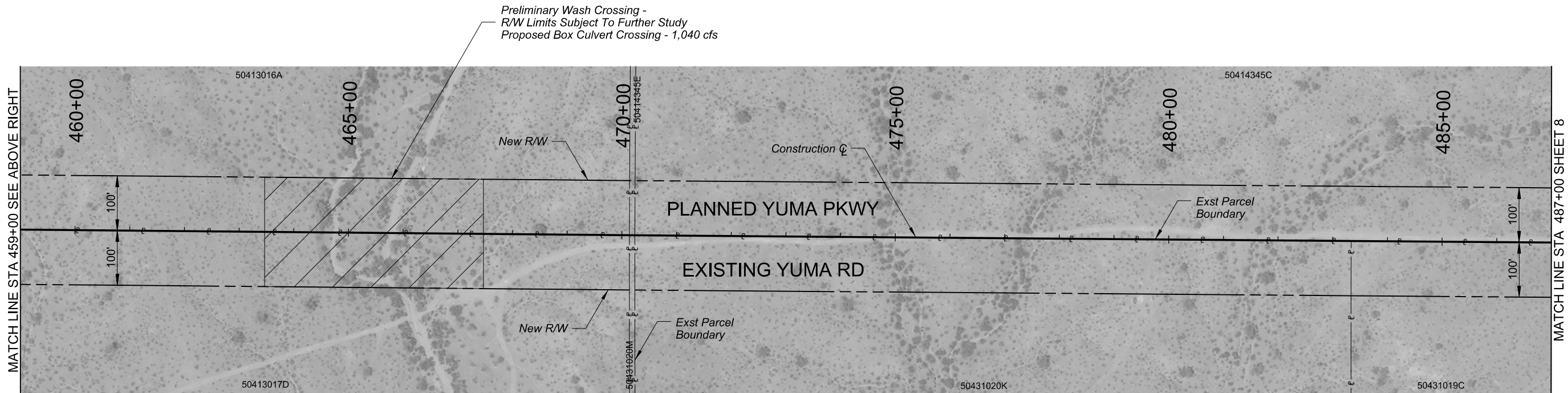
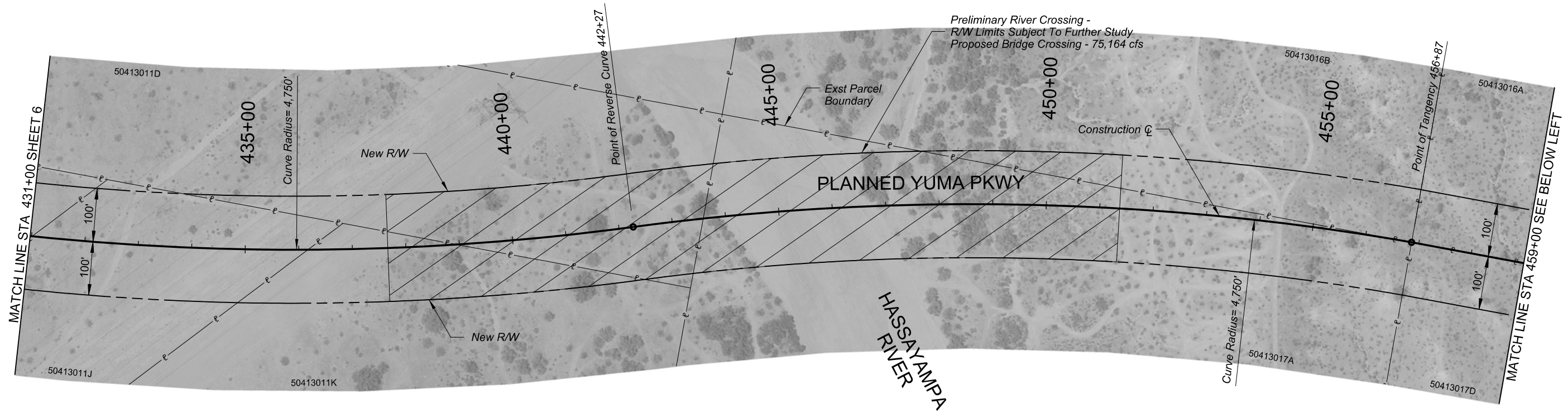
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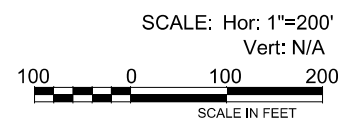
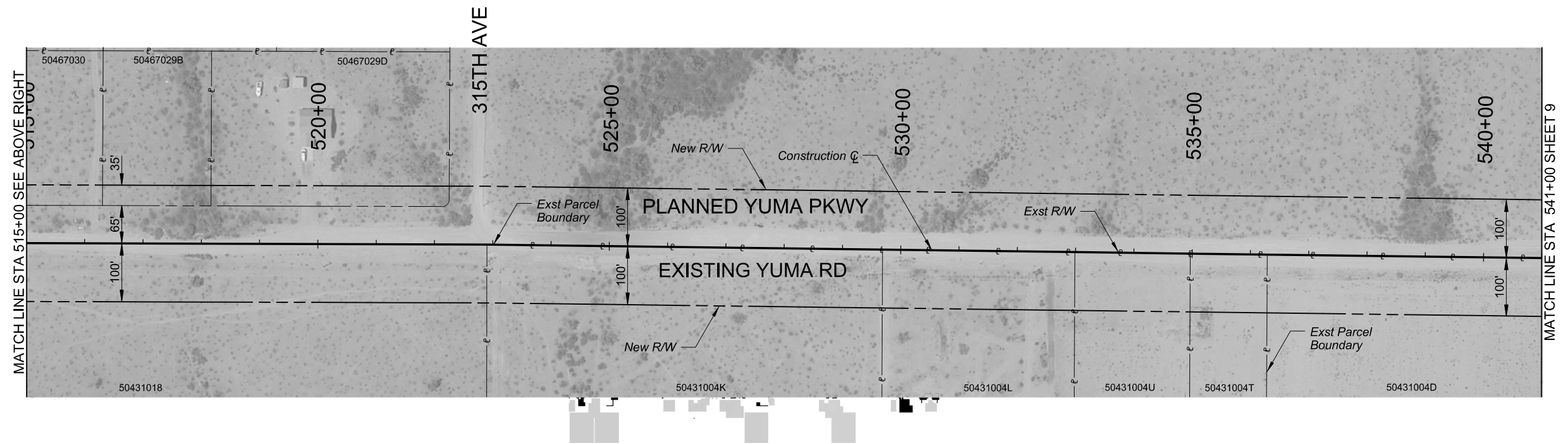
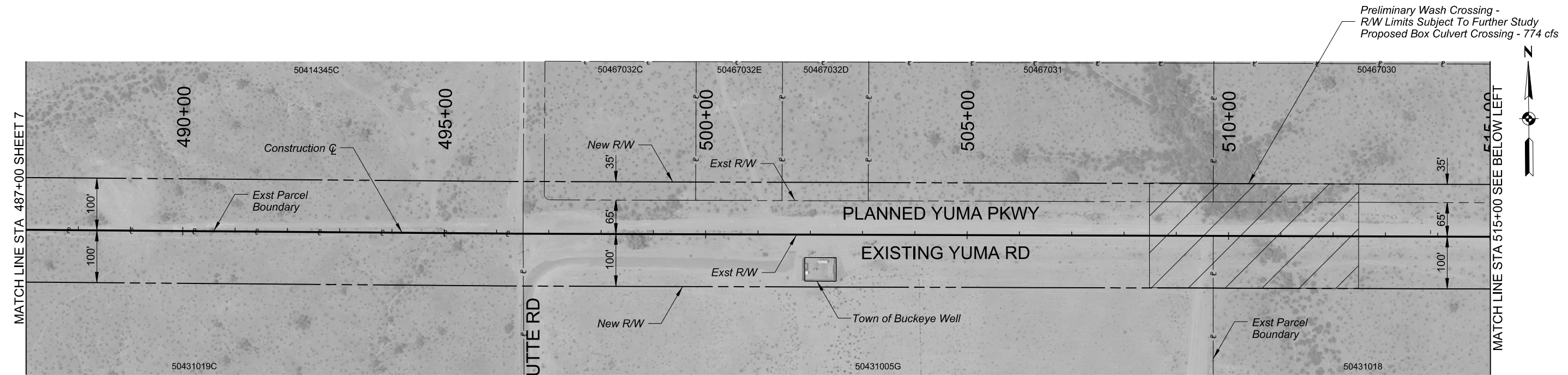
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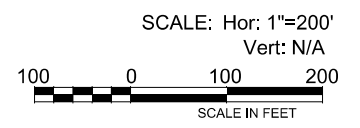
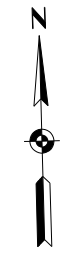
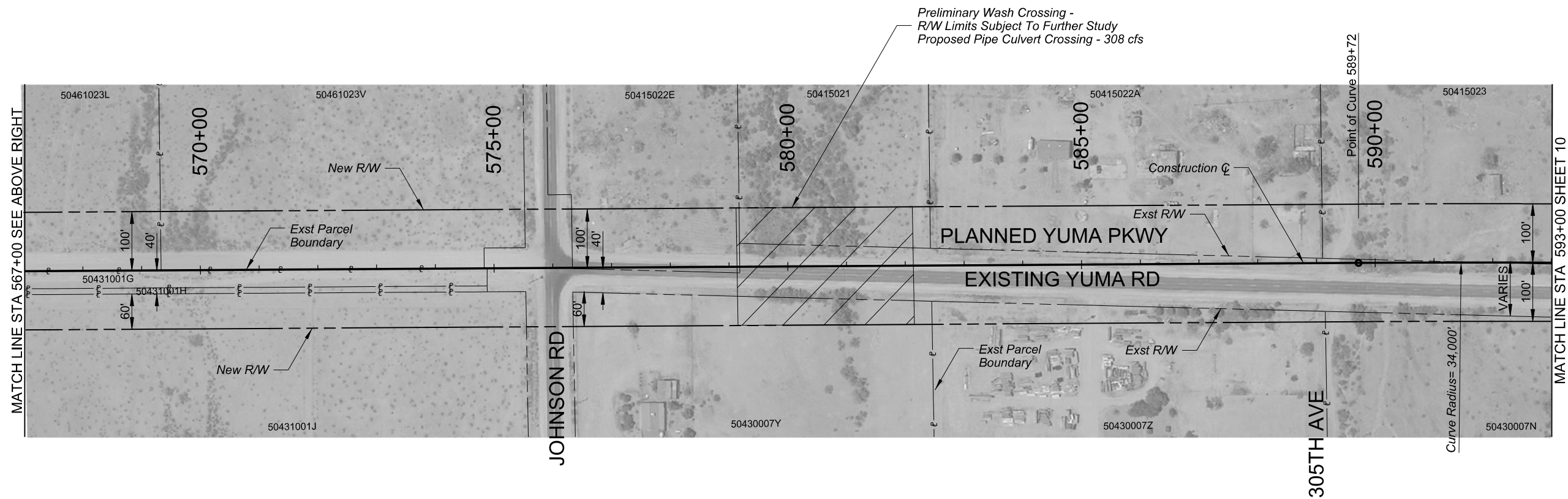
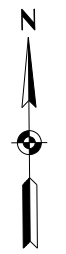
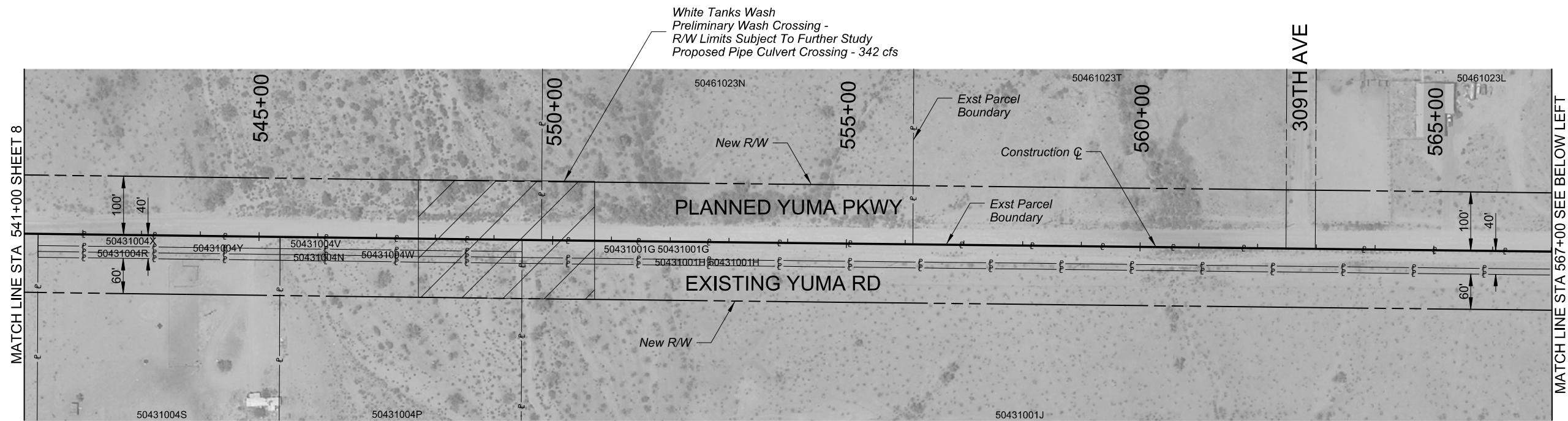
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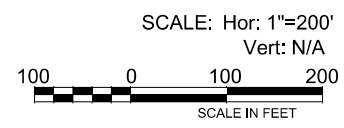
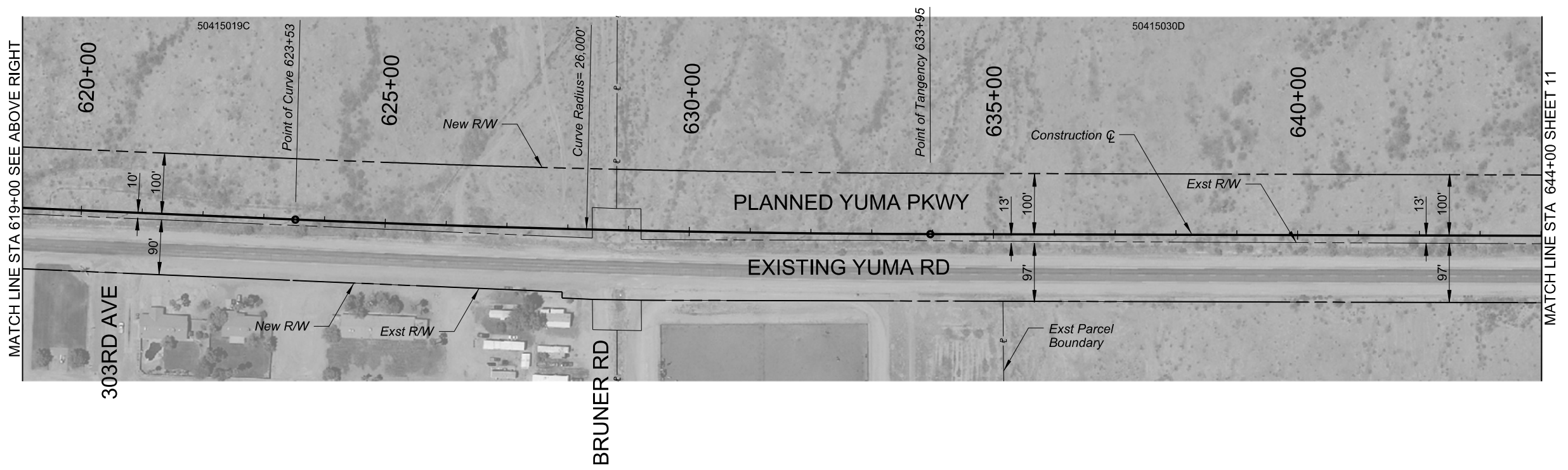
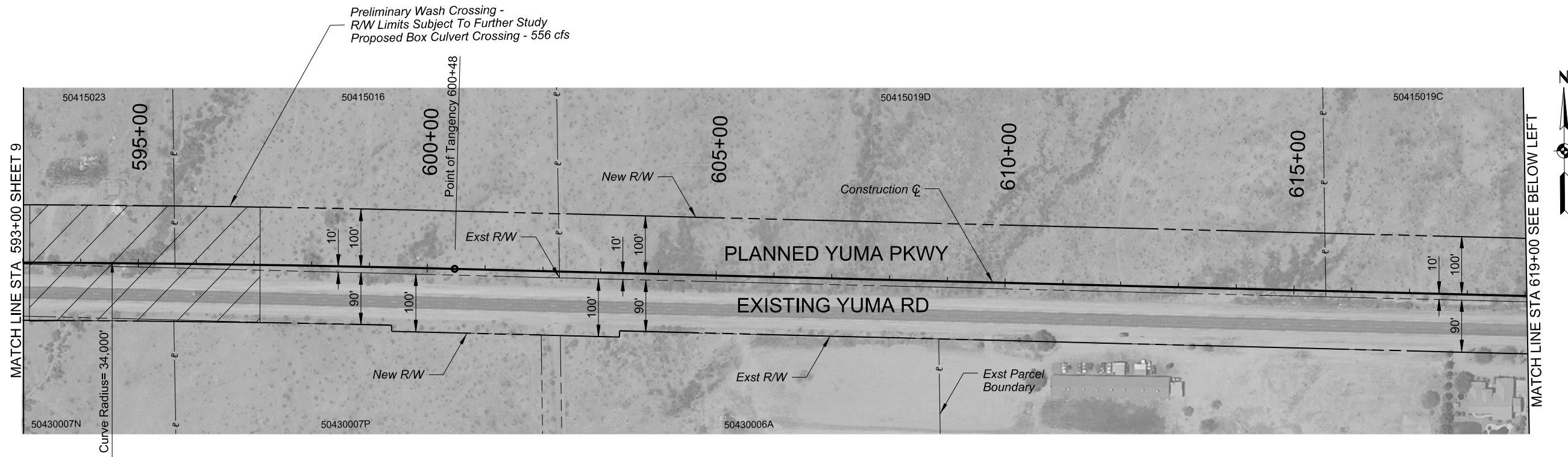
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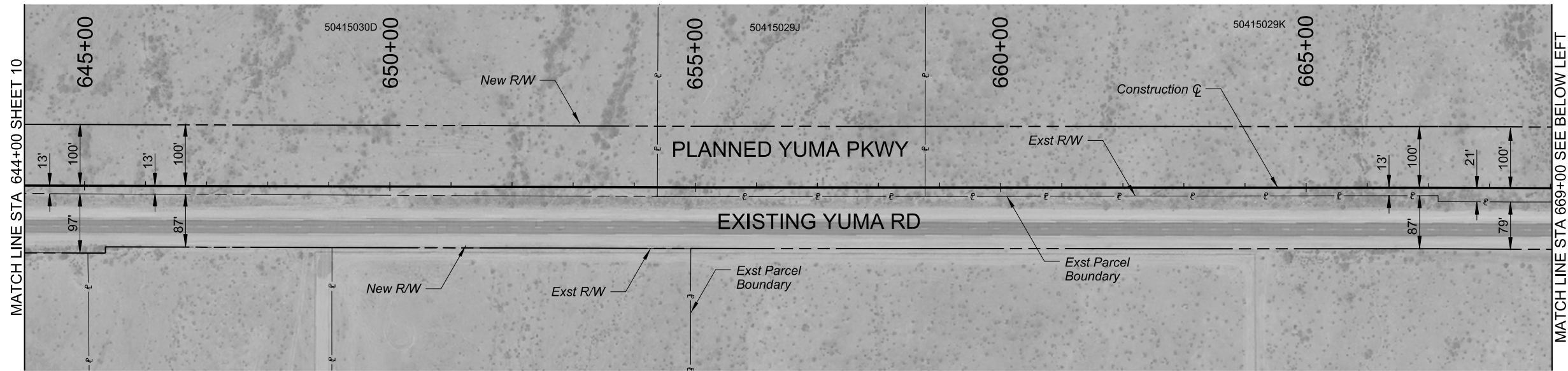
SHEET 10 OF 11



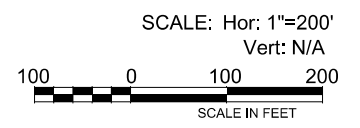
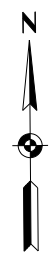
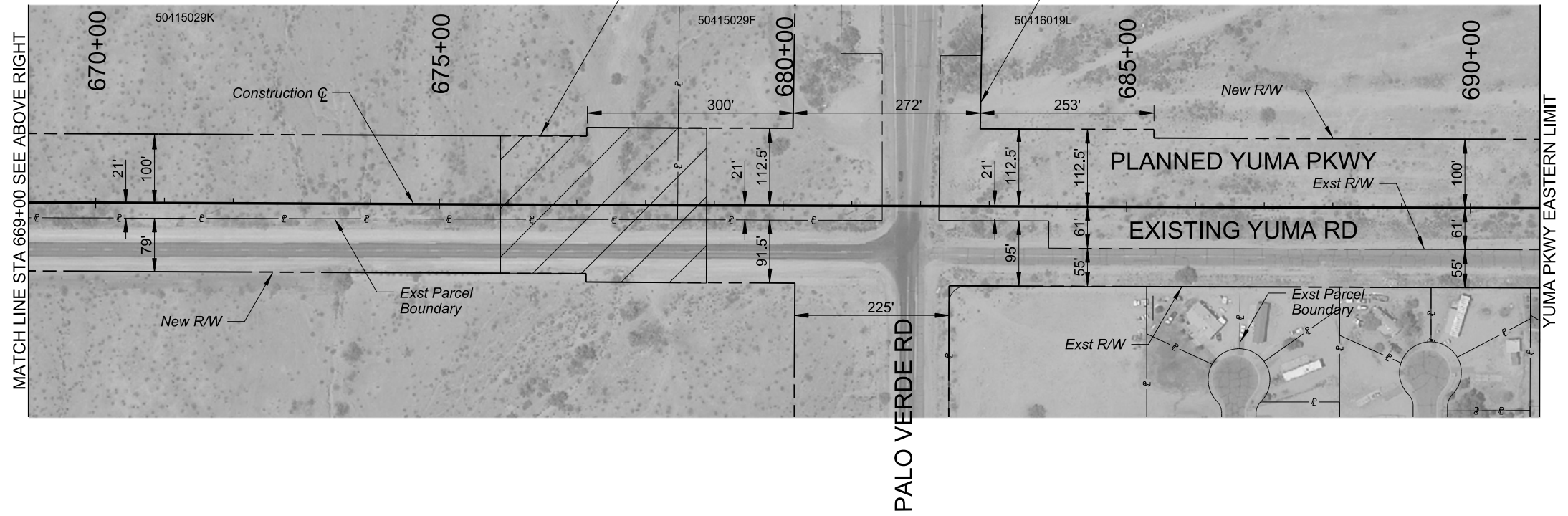
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PLANNED YUMA PKWY/SUN VALLEY PKWY INTERCHANGE
R/W LIMITS SUBJECT TO FURTHER STUDY



MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION

YUMA PARKWAY FEASIBILITY STUDY

MCDOT PROJECT NO. TT005
CONTRACT NO. 2010-055

RECOMMENDED FUTURE
RIGHT-OF-WAY CORRIDOR

SHEET 11 OF 11

