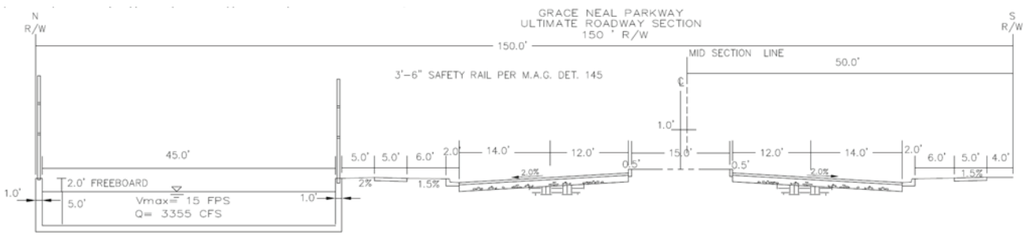
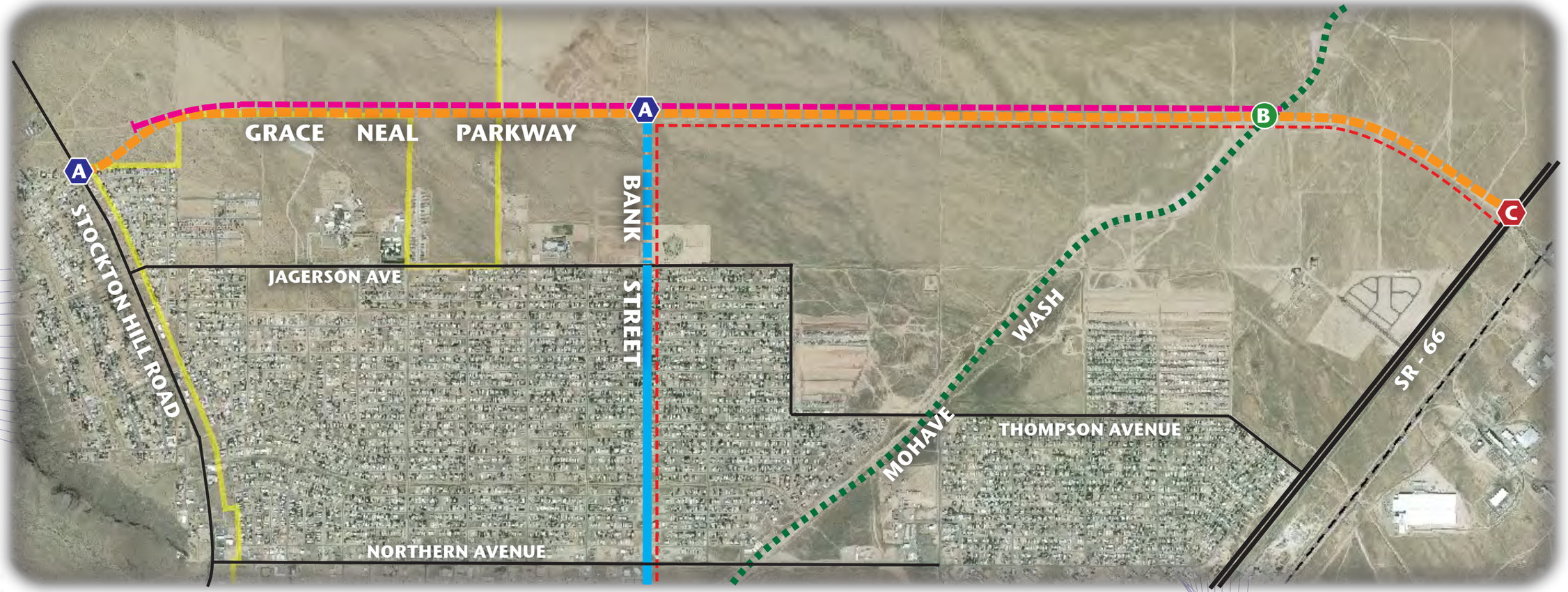
GRACE NEAL PARKWAY
DESIGN CONCEPT REPORT
Stockton Hill Road to SR-66

&

BANK STREET ASSESSMENT
Northern Avenue to Grace Neal Parkway





PROPOSED - GRACE NEAL PARKWAY
PROPOSED - STORM CHANNEL
PROPOSED - BANK STREET
EXISTING - BANK STREET
EXISTING - POWER LINES
EXISTING - NATURAL WASH
A PROPOSED SIGNALED INTERSECTION
B PROPOSED BRIDGE
C EXISTING SIGNALED INTERSECTION

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April 30, 2007

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INTRODUCTION

PROJECT LOCATION:

Grace Neal Parkway and Bank Street are located in the northern Kingman area partially outside of the Kingman city limits, as shown in **Figure 1.**

Grace Neal Parkway is approximately 5 miles in length. The study limits for Grace Neal Parkway are from Stockton Hill Road (west boundary) to State Route 66 (east boundary). The existing right-of-way along this section of road ranges from 0 to 100 feet per Mohave County Assessor Maps. Grace Neal Parkway is bordered on the north and south by mostly vacant land.

The project length of Bank Street is approximately 1.5 miles and extends from Northern Avenue north to Grace Neal Parkway. Bank Street is fully developed on both sides from Northern Avenue to Jagerson Avenue.

PURPOSE AND NEED:

The proposed improvements to Grace Neal Parkway are required to provide additional vehicular and pedestrian access to a rapidly developing area. In addition, the proposed parkway will connect Stockton Hill Road and Route 66 more efficiently than the current roadway layout.

There is also need to mitigate flooding hazards by intercepting flow crossing Grace Neal Parkway and conveying the flow to Mohave Wash.

The proposed improvements to Bank Street are intended to accommodate the additional vehicle movements generated by the proposed developments to the north. These recommendations will improve operational efficiency, safety, and functional use of the roadway during storm events.

PROPOSED IMPROVEMENTS:

The design concept report discusses of creating a new arterial roadway providing safety and convenience for vehicular traffic and pedestrians. Although Grace Neal is referred to as a parkway, its designation for design is arterial. Grace Neal Parkway will become a 4-lane urban arterial corridor with curbs and dual sidewalks as well as a 15 foot landscaped median. It will also be bordered with a drainage canal conveying intercepted runoff into Mohave Wash. Right-of-way acquisition will be a major portion of preliminary analysis as current dedication differs along the corridor.

Future Bank Street improvements will include extending the pavement north of Jagerson Avenue and widening to include two travel lanes in each direction and sidewalks. Drainage improvements, culverts, and channels will be included in the project as well. Major utilities may have to be relocated. Right-of-way acquisitions are necessary as well as significant coordination between many government agencies and private development groups.

Figure 1-Project Location in Kingman, Arizona

JURISDICTION:

The improvement project resides within Mohave County jurisdiction. The proposed Grace Neal Parkway right-of-way lies within Kingman city limits from Stockton Hill Road to the west section line of section 19. The right-of-way then follows the city limits along the mid-section line to the east section line of section 20. The remaining right-of-way to SR66 is outside the City of Kingman. The studied section of Bank Street is completely outside of city limits and controlled by Mohave County. The Arizona Department of Transportation has jurisdiction of the projected intersection of Grace Neal and Route 66. Extensive inter-governmental coordination will be necessary between these agencies for this project.

BACKGROUND CONSIDERATIONS

EXISTING ROADWAY:

Grace Neal Parkway
Grace Neal Parkway currently is a two lane unimproved earth road extending from Stockton Hill Road to the Mohave Airport Drive intersection at Highway Route 66. The alignment follows the center section line from section 19 to western half of section 22, with curves at both ends to meet State Route 66 and Stockton Hill Road at right angles. The right of way, where present, is asymmetric along the road as power poles line the south side edge from Bank Street to the intersection with State Route 66. Grace Neal also crosses into and out of several washes with loose soil, the largest being Mohave Wash near the Route 66 intersection.

The land on both sides of Grace Neal Parkway is mostly unimproved, although several subdivisions are being developed at the western side of the intersection of Bank St and Grace Neal, and another near the township 17 line and section 19 named Eagle View. In the City of Kingman General Plan 2020, the area north of Jagerson Avenue is listed as a Third Tier Growth Area, mainly due to the lack of existing infrastructure and development. More utility infrastructure has been introduced to this area recently due to planned developments, faster than was anticipated in the Kingman General Plan. Further improvements are expected in the area as well.

Bank Street
The studied portion of Bank Street for this report extends from Northern Avenue to Grace Neal Parkway. The roadway from the intersection at Northern Avenue northward to Jagerson Avenue is a two lane paved roadway with no curb, gutter, or sidewalk. The posted speed limit is 35 mph. The Jagerson Avenue intersection is controlled by a 2 way STOP sign on Bank Street. Beyond Jagerson Avenue to the north, half-street improvements halve been recently completed along the Cerbat Vistas Subdivision for an approximate length of 800 feet and terminating at the northern perimeter of the Cerbat Vista Phase A subdivision. The remaining portion of Bank Street is unpaved.

Both sides of Bank Street are fully developed south of Jagerson Avenue. The proposed Cerbat Vista Subdivision is located along the west side of Bank Street from Jagerson Avenue to Grace Neal Parkway. The eastern side of the road has little development except for a City of Kingman pumping facility and the access to a small park on the Northeast corner of the intersection of Jagerson Avenue and Bank Street. There are no current plans for development to the east.

EXISTING DRAINAGE:

Grace Neal Parkway
The existing drainage patterns along the Grace Neal Parkway alignment from Stockton Hill Road to Mohave Wash are from the northwest to southeast ultimately discharging into Mohave Wash. There are several washes that intersect Grace Neal Parkway. Currently, these washes are crossing the unimproved earth road of Grace Neal Parkway. Some are then intersected by the existing ditch along the westbound side of Jagerson Avenue and discharged into Mohave Wash. Others discharge directly into Mohave Wash.

The next section of the Grace Neal Parkway alignment from Mohave Wash to State Route 66 has existing drainage patterns from the southeast to northwest toward Mohave Wash. Currently, several washes cross the unimproved earth road of Grace Neal Parkway and discharge directly into Mohave Wash.

Grace Neal Parkway is within the Kingman Area Master Drainage Plan Update (AMPDU), Mohave County, Arizona. Brooks has obtained updates through June 2000. The U.S. Army Corps of Engineers HEC-1 model was obtained from the Mohave County. The model is then modified with the latest precipitation frequency from NOAA ATLAS 14 (See **Appendix A4**). The results of the updated HEC-1 have been provided in the **Appendix A8**. It was then used to design the proposed drainage channel along the westbound side of Grace Neal Parkway from Mohave Wash to Stockton Hill Road. It also was used to design the channel along the eastbound direction of Grace Neal Parkway from Mohave Wash to State Route 66 and the drainage condition along Bank Street from Grace Neal Parkway to Jagerson Avenue. **Appendix A2** shows the location and the discharge into the channel based on the HEC-1 model results.

Bank Street
Two artificial drainage channels cross Bank Street and flow from west to east, draining a large development area. Butler Wash crosses Bank Street between McVicar Avenue and Suffock Avenue. Bull Mountain Wash crosses between Devlin and John L. Avenues. The drainage along Bank Street from Grace Neal Parkway to Jagerson Avenue is managed into the shallow ditch along the western edge of Bank Street. The ditch directs the flow southerly into an existing channel along the north side of Jagerson Avenue. The flow continues through an existing 60” CMP culvert at Bank Street through the open channel to Mohave Wash. The overflow during storm events from the Jagerson channel crosses overtops Bank Street to the adjacent park and the downstream channel.

FEMA FLOODPLAINS:

Grace Neal Parkway
Grace Neal Parkway crosses Flood Zone B and C at varying intervals and Flood Zone AH where it crosses Mohave Wash. This information was obtained from the Flood Insurance Rate Map (FIRM), Panel number 2165 of 3450, Map Number 040058-2165C, dated March 1, 1983 and Panel number 2170 of 3450, Map Number 040058-2170B, dated March 15, 1982, published by Federal Emergency Management Agency

(FEMA). Flood Zone B is an area between the limits of the 100 year and 500 year flood event, or subject to less than 1 foot of flooding in a 100-year event. Zone C is an area of minimal flooding. Zone AH is an area of 100-year shallow flooding with a constant water-surface elevation (usually areas of ponding) where average depths are between 1 and 3 feet. **Appendix A5** shows the location of the site on the FEMA map.

This roadway area generally drains from northwest to southeast until meeting Mohave Wash. There are several washes that intersect Grace Neal Parkway. Currently, these washes are crossing the unimproved earth road of Grace Neal Parkway. Some are then intersected by the existing ditch along the westbound side of Jagerson Avenue and discharged into Mohave Wash. Others discharge directly into it. From there, Mohave Wash drains north to Red Lake. The project crosses FEMA Flood Zones B and C at varying intervals, and zone AH where it crosses Mohave Wash. Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding with a constant water-surface elevation (usually areas of ponding) where average depths are between 1 and 3 feet. The base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone. The FEMA floodplain map is included in **Appendix A5**.

Bank Street
FEMA classifies the intersections with Bank Street and both Butler and Bull Mountain Wash as Flood Zone A. Bank Street crosses another Flood Zone A at Jagerson Avenue, with the remainder of the project area in Zones B and C.

EXISTING ROADWAY PROFILE:

Grace Neal Parkway
The existing roadway profile conforms to the natural ground indentations. Falling at a fairly constant slope from west to east, it occasionally dips down as it crosses natural washes. After crossing Mohave Wash the elevation increases until matching with Highway Route 66. Without any improvements, the roadway becomes impassable during storm events as water flows cross the road.

Bank Street
It appears that the paved section of Bank Street within the project limits slopes downward to the south with an almost constant grade. The unpaved section north of Jagerson Avenue is rough graded but mostly follows the natural ground elevations. The roadway is slightly higher than the surrounding land surfaces. Along most of the road, the surface soil from adjacent properties blends in with the edge of the pavement. It appears as though water may cross the road during severe storm events at the wash crossings.

EXISTING SURFACE:

Grace Neal Parkway
The existing surface is mostly vehicle compacted bare soil, changing to granular alluvial soil in the washes with occasional vegetative cover. Near the intersection with Highway Route 66 the roadway appears to have been rough graded and machine compacted.

Bank Street
The existing surface of Bank Street is asphalt pavement from Jagerson Avenue to Northern Avenue. North of Jagerson Avenue, the surface consists of compacted soil, with improvements underway by Cerbat Vista developers adjacent to their development.

EXISTING SUBSURFACE CONDITIONS:

Grace Neal Parkway
The existing subsoil consist of silty and clayey sands with small amounts of gravel and varying degrees of calcareous cementation at 15 feet below grade, generally favorable for the support of new pavement construction. Groundwater is not expected to be a factor in the construction or design of the roadway.

Bank Street
A subsurface geotechnical investigation of Bank Street was not included as part of the scope of this DCR.

PLANNED ADJACENT PROJECTS AND LAND USE:

Grace Neal Parkway
Subdivisions currently planned adjacent to Grace Neal Parkway include:

1. Eagle View
2. Prairie Heights Estates
3. Cerbat Vistas
4. (Proposed)

An excerpt from the Mohave County General Plan (revised August, 2005) is shown in **Figure 2**. The land bordering Grace Neal Parkway is mainly planned for suburban residential development and planned urban residential development. The known proposed residential projects lie within the low density residential zone. Special attention is given to the designated urban land use area, where currently several unpaved roads exist. More intersections at Grace Neal Parkway are necessary for access to this area.

Assuming this area develops as planned, Grace Neal Parkway will be used extensively as an arterial roadway providing access to major north-south thoroughfares in Stockton Hill Road, Bank Street, and State Route 66. The intersection of State Route 66 at Mohave Airport Drive represents the eastern terminus of Grace Neal Parkway, thus this roadway may service local truck traffic generated by commercial/industrial land uses within the Kingman Airport Industrial Park.

Bank Street
Land adjacent to Bank Street has been completely built out south of Jagerson Avenue to Northern Avenue. No additional construction is expected along this corridor. Further construction is expected within the Cerbat Vista Subdivision on the western edge of Bank Street north of Jagerson Avenue. This area currently is receiving half-street improvements. The eastern half borders a public park, city utility substation, and private property. There are currently no plans for additional improvements other than utility infrastructure placement.

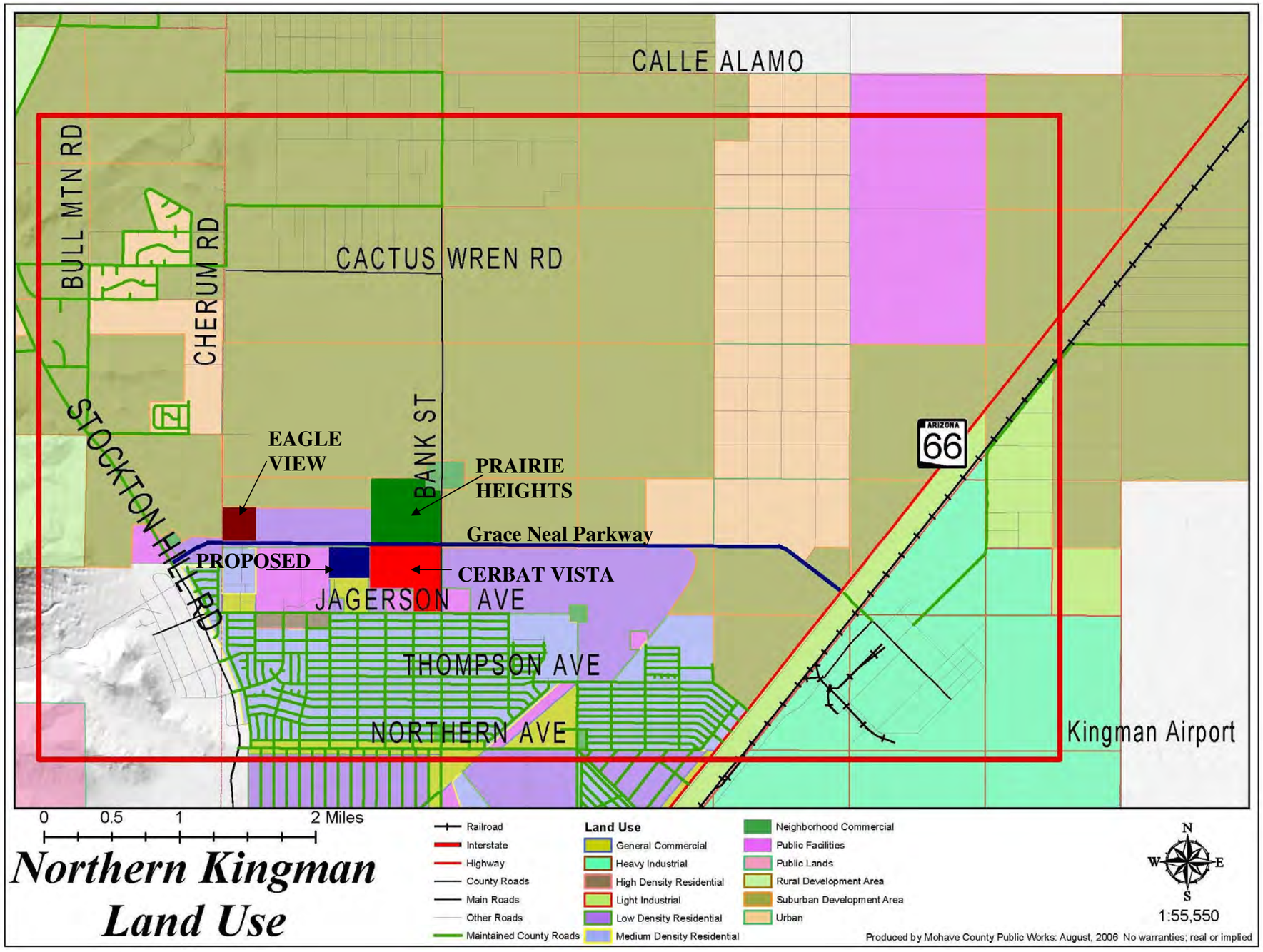


Figure 2- Mohave County General Plan for the Kingman Area

PROPERTY OWNERSHIP:

Table 1 shows property ownership adjacent to Grace Neal Parkway as recorded in maps obtained from the county. Acquisition of more right-of-way will be required for Grace Neal Parkway in some locations. Information is expected to change in the near future as subdivision development continues and lots are subdivided.

Table 1-Grace Neal Parkway-Adjacent Property Information

Assessor #	R/W Side	From Sta	To Sta	R/W Easement	Owner	Property Use
310-15-003	Both	275+00	277+50	0'	Hafkey Tommy Ernest	Ranch Property
310-15-012	South	222+74	275+00	42'-84'	Hafkey Tommy Ernest	Ranch Property
310-15-011	North	249+00	259+26	0'	FATCO TR 4451A	Vacant Land
unassigned	North	117+03	169+90	0'	AZ State Trust Land	Vacant Land
310-15-013	North	222+74	249+00	42'	FATCO TR 4451/TRUST DEPT	Vacant Land
310-01-067	South	196+32	222+74	35'	Hafley Leonard Edward	Ranch Property
310-01-065	North	196+32	222+74	35'	FATCO TR 4451	Vacant Land
310-01-085	North	169+90	196+32	50'	Neal John Tracy	Vacant Land
310-01-082	South	169+90	196+32	50	DBA Development LLC	Vacant Land
310-01-081	South	165+23	169+90	50	City of Kingman	Municipal Lands
310-01-083	South	121+69	165+23	50	Arnold Investment Corp	Vacant Land
310-01-084	South	117+03	121+69	35.3	Arnold Investment Corp	Vacant Land
310-26-042	South	90+71	117+03	40' to be added	Hualapai Development LLC	Vacant Land
310-26-044	North	90+71	117+03	100'	Prairie Heights Estates LLLP	Vacant Land
310-26-026	North	77+74	90+71	100'	Bruno Lee/Schritter Jay/Short James	Ranch Property
310-26-027	South	77+74	90+71	0'	Bruno Lee/Schritter Jay/Short James	Ranch Property
310-26-025	North	64+44	77+74	100'	Bruno Lee/Schritter Jay/Short James	Ranch Property
310-26-028	South	73+79	77+74	0'	Bruno Lee/Schritter Jay/Short James	Ranch Property
310-26-001	South	51+14	73+79	0'	Mohave Community College	State Lands
310-26-033	North	51+14	64+44	100'	Bruno Lee/Schritter Jay/Short James	Ranch Property
310-26-009	South	31+64	46+87	0'	Park West Communities, Inc	Mobile Homes
310-26-032	North	31+64	51+15	100'	State Title TR 31-104	Vacant Land
330-01-057	North	10+00	31+64	0'	Nayeri Majid/Vahid/Zarbinian Mohammad Kasra	Vacant Land
330-01-056	North	10+00	31+64	0'	State of Arizona	State Lands

EXISTING UTILITIES:

The following **Table 2** shows known utilities in the area. The most extensive coordination is required with Unisource Energy, with 69 kV overhead lines running parallel with Grace Neal Parkway from Bank Street eastward to the SR 66 intersection, and several 12.5 kV lines also crossing at various points. Unisource Energy has stated that they currently do not have the ability to underground their high voltage power lines. Therefore, pole relocation will be necessary at areas of conflict. Water and sewer line locations were provided from the City of Kingman. Other utilities, such as cable and telephone, were not reported in the area at the time this report was written. Locations of existing utilities are shown on **Figure 3.** Conflicts discovered are included in **Table 3**. Additional conflicts may be found with utilities that have not yet provided information or are part of ongoing development construction.

Table 2-Utility Contacts

UTILITY	COMPANY	CONTACT	Phone #
PHONE	FRONTIER COMMUNICATIONS	RON TAYLOR	928-757-0271
ELECTRIC	UNISOURCE ENERGY	MARVIN YARBROUGH	928-681-8928
GAS	UNISOURCE GAS	JEFF FIELD	928-757-0263
WATER	CITY OF KINGMAN	JACK KRAMER	928-692-3101
CABLE	NPG CABLE CO	JEREMY BRUNK	928-757-5328
FIRE DEPT	CITY OF KINGMAN	DOUG BRADLEY-CHIEF	928-753-8140

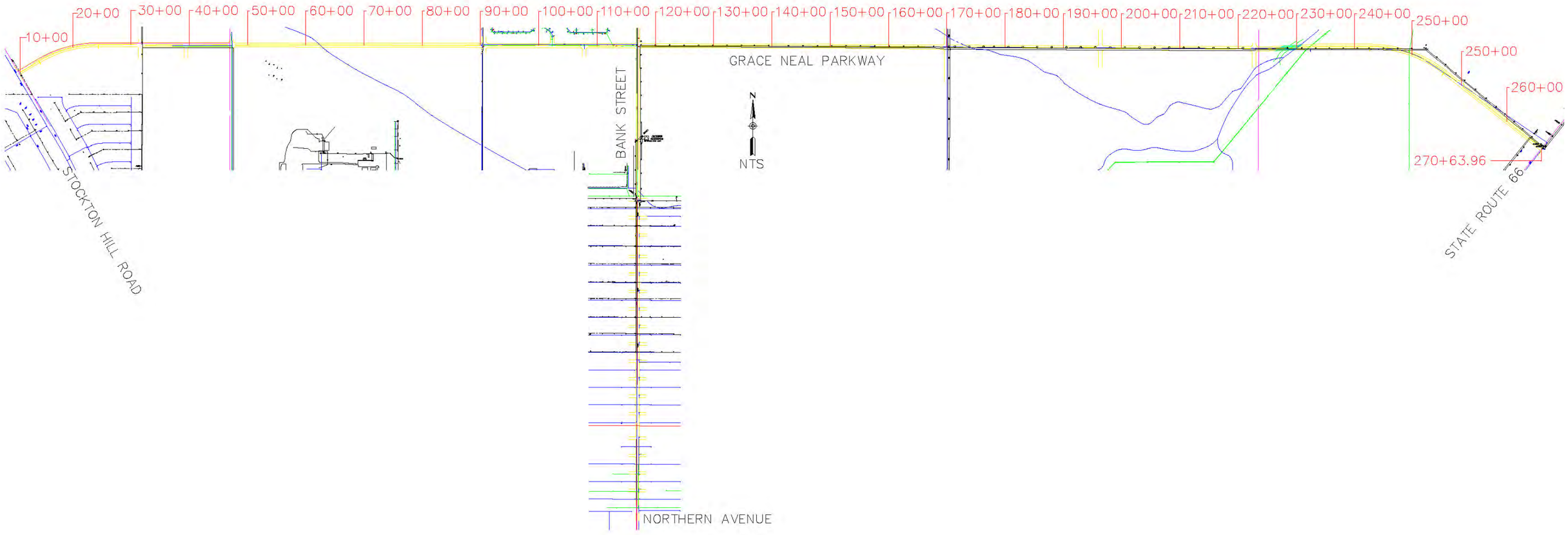


Figure 3-Existing Utility Locations

Grace Neal Parkway FC

Electric Line

Water Line

100+00 Grace Neal Parkway Stationing

Sewer Line

Wash

Fiber Optic cable

Gas Line

Table 3- Preliminary Utility Conflict Assessment for Grace Neal Parkway

COMPANY	FACILITY	POTENTIAL CONFLICT
UNISOURCE ENERGY	69kV Overhead Electric Sta. 117+50 to 277+50	Yes, with roadway widening Action: Relocate
	12.5 kV Overhead Electric Sta. 170+50	Yes, with channel Action: Relocate
	12.5 kV Overhead Electric Sta. 90+43	Yes, with channel Action: Relocate
	12.5 kV Overhead Electric Sta. 32+01 to 47+60	Yes, with channel Action: Relocate
UNISOURCE GAS	4" Gas Main Sta.~ 47+00	Yes, with channel Action: Relocate
	4" Gas Main Sta.~ 117+00	Yes, with channel Action: Relocate
	Proposed 4" Gas Main Sta. 10+00 to 47+00	Verify status w/ Unisource
CITY OF KINGMAN	12" Water Line Sta. 37+11 to 47+41	No, designed w/ half street improvements
	12" Water Line Sta. 90+23	Yes, with channel Action: Relocate
	8" Water Line Sta. 90+16	Yes, with channel Action: Relocate
	8" Water Line Sta 90+62 to 116+82	Record drawing not yet available
	16" Water Line Sta. 170+06	Yes, with channel Action: Relocate
	16" Water Line Sta. 170+06 to 277+62	Yes, with roadway widening Action: Relocate
	12" Sewer Line Sta 37+11 to 47+31	No, designed w/ half street improvements
	Sewer Line Sta. 90+62 to 116+90	Record drawing not yet available
	15" Sewer Line Sta. 231+39 to 233+18	Yes, with channel Action: Relocate
CITY OF KINGMAN CONT	15" Sewer Line Sta. 90+61 to 116+90	Record Drawing not yet available
	27" Sewer Line Sta. 231+51 to 233+30	Yes, with channel Action: Relocate
	10" Sewer Line Sta. 249+45	Yes, with channel Action: Relocate
FRONTIER	Proposed Underground Conduit Sta. ~117+00	Verify status w/ Frontier

TRAFFIC:

In order to determine potential traffic impacts on Grace Neal Parkway by proposed developments along the corridor, traffic impact information was obtained, when available, from various studies conducted by developers who currently have proposed subdivisions adjacent to Grace Neal Parkway between Stockton Hill Road and Andy Devine Avenue (Route 66). The City of Kingman and Mohave County provided additional traffic data associated with the study area.

During the review of the data, it was found that the design of offsite roadway improvements to Bank Street and Grace Neal Parkway, associated with the Cerbat Vista and Prairie Heights Estates subdivision projects is underway and being completed by Mohave Engineering and Associates. The improvements are limited to the area immediately adjacent to the projects' boundaries and the intersections of Jagerson Avenue/Bank Street and Grace Neal Parkway/Bank Street. These improvements include sidewalk, curb and gutter. Roadway improvements to Eastview Drive and Grace Neal Parkway are also planned as part of the Eagle View subdivision located at the Northeast corner of Grace Neal Parkway and Cherum Road.

Key intersections in the study area involving Grace Neal Parkway and Bank Street are listed in Tables 4a and 4b. Only the major intersections for Bank Street are included in the table, as there are fifteen (15) local residential street intersections in the one mile segment from Northern Avenue to Jagerson Avenue.

Table 4a- Intersections

	Grace Neal Parkway
Intersecting Roads	Stockton Hill Road
	Cherum Road
	Kingman Ranch Road
	Eastview Drive
	Pueblo Pequeño Avenue
	Bank Street
	Northview Drive
	Long Mountain Drive
	State Route 66

Table 4b

	Bank Street
Intersecting Roads	Northern Avenue
	Thompson Avenue
	Jagerson Avenue
	Grace Neal Pkwy
	No Name Street

Due to the lack of existing traffic count data at the majority of these intersections, along with the fact that Grace Neal Parkway has yet to be constructed, operational analysis of these intersections was not calculated in this DCR. Based on data in the Prairie Heights Estates Traffic Impact Analysis (TIA), the intersection of Bank Street/Jagerson Avenue currently operates at an adequate level of service B during the weekday peak hour hours. Level of service (LOS) is a qualitative measure of the traffic operations at an intersection or on a roadway segment. Level of service is ranked from LOS A, which signifies little or no congestion and is the highest rank, to LOS F, which signifies congestion and jam conditions. LOS D is typically considered adequate operation at signalized and un-signalized intersections.

At un-signalized intersections, level of service is calculated for those movements which must either stop for or yield to oncoming traffic and is based on average control delay for the particular movement. Control delay is the portion of total delay attributed to traffic control measures such as stop signs and traffic signals. The criteria for level of service at un-signalized intersections are shown below in **Table 5.**

Table 5-Level of Service Definition

LEVEL OF SERVICE	DELAY
A	≤ 10 seconds
B	> 10 and ≤ 15 seconds/vehicle
C	> 15 and ≤ 25 seconds/vehicle
D	> 25 and ≤ 35 seconds/vehicle
E	> 35 and ≤ 50 seconds/vehicle

FUTURE TRAFFIC:

In order to assess the expected impacts of various projects and land uses, future traffic data was collected from the Kingman Area Transportation Study (KATS) conducted by Parsons Brinckerhoff (PB) in January 2005 and the Traffic Impact Analysis reports written by SouthWest Traffic Engineering (SWTE) for the Prairie Heights Estates and Cerbat Vista subdivisions. All of the roadways investigated in the reports projected increases in traffic flow. While there were no Grace Neal Parkway intersections, projected traffic volumes on Grace Neal Parkway were calculated in the KATS due to planned development in the northern area of Kingman. The SWTE report analyzed specific existing and planned intersections as part of the Cerbat Vista and Prairie Heights Estates developments. The SWTE reports can be found in **Appendix B1.**

Below is an excerpt from the KATS relating the role Grace Neal Parkway and Bank Street had on the traffic count projections in the report.

Future Planned Street System

In order for an analysis of future traffic operations, a future base street system must be established. The future base street system for the analysis assumes that the street system is developed as follows:

1. *The existing street system is maintained*
2. ***Grace Neal Road is constructed from SR 66 to Stockton Hill Road***
3. *Airway Avenue underpass is constructed across BNSF railroad tracks*
4. ***Bank Street is extended north from Jagerson Avenue to Grace Neal Road***
5. *Bank Street is widened to four through lanes between Airway Avenue and Gordon Drive.*

Forecast models used in the KATS were set with these assumptions to create projected traffic in the city of Kingman. The Parsons-Brinckerhoff KATS used a 4% annual growth rate estimate in calculating future traffic data for the exterior regions of the city, although the region currently appears to be exceeding that rate. The SWTE TIA's used higher growth projections (6%) based on the specific subdivisions planned along the Grace Neal Parkway and Bank Street corridors. While the KATS projected the area to the east of the intersection of Grace Neal Parkway/Bank Street to develop faster than then the area to the west, since early 2005, development trends show the area to the west growing at a larger rate. This growth shows the potential need for a gradual phasing of the Grace Neal Parkway roadway improvements beginning from the west and moving towards the east. **Figure 4** shows the 2023 KATS projected traffic volumes along Grace Neal Parkway.

The level of service forecasts for the DCR study area are also presented in the Kingman Area Transportation Study. These are compiled in **Table 6.**

Table 6-Roadway Levels of Service (from KATS)

STREET	SEGMENT	JURISDICTION	THROUGH LANES	EXISTING ADT	EXISTING LOS	2023 ADT	2023 LOS
Route 66	Northern to Grace Neal	ADOT	4	10,100	A	26000	C
Stockton Hill Rd	North of Jagerson	City	2	2,900	A	10000	C
Bank Street	Northern to Jagerson	City	2	4,200	B	12000	D
Grace Neal	SHR to Bank	County	2	NA	NA	3000	B
Grace Neal	Bank to SR 66	County	2	NA	NA	9000	C

There are key differences between the KATS and SWTE studies. The KATS examined, at a macroscopic level, the entire major street network system in the greater Kingman Area, while the SWTE studies provided microscopic evaluations for the intersections immediately adjacent to the proposed developments.

Currently, Stockton Hill Road and State Route 66 serve as the key north south roadways in the greater Kingman area providing access to the dense commercial and employment areas near Interstate 40. Over the past several years, development has rapidly occurred along Stockton Hill Road, while development along Route 66 has been slow yet steady. This has led to high levels of vehicles, along with the expected delays, on Stockton Hill Road. With limited connections between Stockton Hill Road Route 66, drivers have few options but to endure traffic on Stockton Hill Road. Furthermore, while the Stockton Hill Road corridor will continue to develop, there are indications that new developments along Route 66, especially adjacent to the Kingman Industrial/Air Park, are in the process of being planned and will also serve as destination points.

As Bank Street is developed northward and Grace Neal Parkway is improved, their utilization will reduce the strain on Stockton Hill Road and provide direct access to Route 66 and the Kingman Industrial/Air Park for the large northwestern Kingman area. The extension of Cherum Road south to intersect with Grace Neal Parkway would further alleviate peak driving congestion on the single lane Stockton Hill Road.

Parsons Brinckerhoff 5

Figure 4- Year 2023 projected daily volume as presented in the Kingman Area Transportation Study (in thousands)

In order to obtain a clear understanding of what type, and how many lanes that Grace Neal Parkway between Stockton Hill Road and Bank Street between Grace Neal Parkway and Airway Avenue Route 66 must be designed as, , a specific Traffic Distribution/Demand Model can be completed. Such a model could require the following elements.

Data Collection – Task 1

Collection of weekday 24-hour bi-directional traffic counts at the following locations;

Route 66 north of Mohave Airport Drive
Route 66 south of Mohave Airport Drive
Stockton Hill Road North of Jagerson Avenue
Stockton Hill Road South of Jagerson Avenue
Bank Street between Thompson and Northern Avenues

Collection of AM (7:00 AM to 9:00 AM) and PM (4:00 PM to 6:00 PM) weekday peak hour traffic counts at the intersections of Grace Neal Parkway/Route 66, Bank Street/Northern Avenue, Bank Street/Thompson Avenue, and Bank Street/Jagerson Avenue.

These traffic counts will be used to form a basis of volumes for the transportation model development.

If available from Mohave County, collect information on surrounding developments within the immediate area adjacent to the proposed Grace Neal Parkway alignment. This collected land use information will be used in the Trip Generation and Traffic Projection tasks to determine the future traffic volumes on Grace Neal between Stockton Hill Road and Route 66.

Traffic Distribution/Demand Model – Task 2

A traffic distribution/demand model using the information collected in Task 1 (Data Collection) can then be developed. The model should include Grace Neal Parkway, Bank Street, regional roadways in the surrounding area, including Route 66 and Stockton Hill Road, along with key intersections.

Trip Generation/Distribution – Task 3

Calculate generation rates for the land uses adjacent to Grace Neal Parkway based on the information collected from the County. The projected traffic volumes for each area (residential and commercial) should be coded into the traffic distribution/demand model.

Traffic Projections – Task 4

Using data collected in Task 1 and trip assignments developed in Task 3, future volumes can be projected using the traffic distribution/demand model for Grace Neal for the opening year of Grace Neal Parkway, five years after the opening year, and the year 2020.

Capacity Analysis – Task 5

Levels of service can then be calculated for the key study intersections in accordance with the 2000 Highway Capacity Manual. Using data collected in Task 1 and trip assignments developed in Task 3, the key study intersections can be analyzed for levels of service for opening year of the roadway, five years after the opening year of the Grace Neal Parkway, and the year 2020 with the new roadway.

The main intersections include; Grace Neal Parkway/Stockton Hill Road, Grace Neal Parkway /Bank Street, Grace Neal Parkway/State Route 66, Bank Street/Northern Avenue, Bank Street/Thompson Avenue, and Bank Street/Jagerson Avenue. These main intersections can be analyzed to determine the necessary intersection configurations required to accommodate the projected peak hour volumes.

The propose Grace Neal Parkway between State Route 66 and Stockton Hill Road should be analyzed to verify the cross sections required to accommodate the projected daily traffic volumes.

Traffic Signal Warrant Analyses – Task 6

Traffic signal warrant analyses should be calculated for the main intersections along Grace Neal Parkway. It is assumed that the intersections of Grace Neal Parkway/Stockton Hill Road and Grace Neal Parkway /Bank Street can be analyzed for each of the analysis years to determine if and when a traffic signal would be warranted for installation.

Phased Improvements – Task 7

Based on the analysis, a phased improvement schedule identifying what improvements are required as the area adjacent to the proposed Grace Neal Parkway develops can be completed. Bench marks should be identified that will trigger when additional improvements (additional through lanes, traffic signal, etc) are required, such as building permits for homes.

Regardless, the roadway designed for traffic flow requirements must provide for specific traffic impacts of large subdivisions and also for possible future large impact development.

TRAFFIC SIGNALS:

There are two traffic signals located within this subject area. One is located at the intersection of Bank Street and Northern Avenue. This signal system is owned by Mohave County and operated by ADOT. The second is located at Grace Neal Parkway and State Route 66 across from Mohave Airport Drive. This system is owned and operated by ADOT.

ENVIRONMENTAL CONDITIONS:

A phase I environmental site assessment was conducted on July 27, 2006 along the Grace Neal Parkway corridor. At the time of the site reconnaissance, several areas of wildcat dumping were observed along the alignment. Most of the materials observed were of household trash, concrete, and appliances. Two possible trash pits were also discovered in the right-of-way, also appearing to contain buried household trash and concrete.

Based on the information collected during the site assessment, no further investigation into Recognized Environmental Conditions (ASTM 1527) at the property is recommended. However, debris in the areas of wildcat dumping should be removed and properly disposed of. Also, if the trash pits are found to lie within the right-of-way, these should also be cleaned and properly disposed. Should any unusual odors or debris be encountered during the removal process, a qualified environmental professional should be notified to evaluate the materials encountered. The full report on Phase I Environmental Site Assessment for Grace Neal Parkway as well as the location of hazards encountered can be found in **Appendix D1**.

IMPACT FEES ASSESSMENT:

Much research has recently been dedicated to determining appropriate development impact fees for various types of development. The Maricopa Association of Governments commissioned Planning and Research Inc. to produce a Best Practices Paper as part of their Growing Smarter Implementation Project. This was done to better assist the city governments in creating updates to their general plans as required by the "Growing Smarter" legislation.

Impact fees are put in place to have developers pay for additional infrastructure needed to sustain new developments. This is especially important for County governments who cannot impose sales taxes and rely on development impact fees for water, sewer, streets, parks, and public safety facilities. Extensive infrastructure improvements are required in the area adjacent to Grace Neal Parkway, where no currently paved roads exist and utilities are limited and residential developments will create an immediate need for transportation.

Published transportation impact fees imposed by cities vary greatly based on the existing roadway infrastructure. The most expensive transportation impact fee area in Maricopa County, Northern Peoria, is at $4,028 per detached residential household. The next closest impact fee was from the northern Black Canyon area of Phoenix, where the Transportation Impact Fee is $2,700. Both areas are currently developing their transportation system, therefore, they have much higher impact fees than other fully developed areas such as Scottsdale which do not charge transportation impact fees. The Northern Kingman Area has a need to provide funding for new roadways, especially arterials such as Grace Neal Parkway, Bank Street, and Cherum Road. The City of Kingman, where the road infrastructure is almost completely in place, currently charges a $735 single family residential transportation impact fee. The City of Queen Creek in Maricopa County assesses a $450 transportation fee per trip. It is up to the local government to assess a justifiable fee to improve roadways within an area.

Pinal County approved in October a new Capital Improvement Plan for Pinal County, which included a methodology for collecting impact fees in 7 zones in Pinal County. The least expensive transportation fee is assessed in Zone 4, Copper Corridor area, with a cost of $5,967 per single family residential home. The

highest transportation fee stands at $7,850 in Zone 2. A similar methodology may be used for Mohave County to address Transportation Impact Fees as a means for paying for roadway infrastructure.

Impact fees assessed must follow two main principles: there must be reasonable connection between the development and the benefit for which the fee is assessed, and a rough proportionality between the fee charged and the burden of use generated by the development. Any methodology for impact fee calculation requires consideration of presenting a fee (cost of improvements) per new trip generated. In turn, an impact fee may account for the proportional impact of a range of developments (e.g., residential, commercial, etc.) and potentially an expanded development area. The following presents a potential concept approach to evaluating traffic impact fees:

Step 1: Determine residential development zones (area producing trips) and corresponding attraction zone (local retail/office/industrial areas attracting trips in addition to regional destinations) involving Grace Neal Parkway carrying a percentage of trips between zones, and determine future commercial development zones which may attract a significant percentage of trips using Grace Neal Parkway.

Step 2: Determine the volume of new, site-generated trips within each identified development zone and including all potential residential/commercial developments, and forecast future traffic volume on Grace Neal Parkway upon full build-out (or by build-out phase).

Step 3: Conduct planning-level capacity analysis or computer modeling of Grace Neal Parkway operations (intersection and segment/mid-block) under build-out condition to determine/verify roadway improvements (e.g., auxiliary lanes, signals, etc.) necessary to mitigate identified operations deficiencies.

Step 4: Estimate the total cost of developing the Grace Neal Parkway ultimate section and any supplemental roadway and traffic control improvements as necessary to support full build-out of new developments.

Step 5: Determine traffic impact fees as a function of total improvements costs (Step 4) and volume of new, site-generated trips (Step 2) within each development zone.

DESIGN CRITERIA:

Grace Neal Parkway

Street Classification	Urban Arterial
Design Speed	55 mph
2020 Design Level of Service	C
Right of Way Width	150 feet
Number of Lanes	2 each direction
Width of Travel Way	52 feet
Design Life for Pavement	20 years
Horizontal Alignment Controls	
Min curve length	1800 feet
Max superelevation	none
Vertical Alignment Controls	
Maximum Grade	4%
Stopping Sight Distance	500 feet
Intersection Sight Distance	730 feet
Bicycle Lane Width	N/A
Curb and Gutter Style	Type A per MAG standard detail #220
Median Width	15.00 feet
Sidewalk Width	Dual 5 foot sidewalks
Pavement Cross Slope	2%
Intersection Corner Radii	45 feet
Drainage	
Off-Site	100 year
On-Site	100 year

Bank Street

Street Classification	Urban Minor Arterial
Design Speed	45 mph
2020 Design Level of Service	C
Right of Way Width	84 feet
Number of Lanes	2 each direction
Width of Travel Way	52 feet
Design Life for Pavement	20 years
Horizontal Alignment Controls	
Min curve length	1100 feet
Max superelevation	none
Vertical Alignment Controls	
Maximum Grade	4%
Stopping Sight Distance	365 feet
Intersection Sight Distance	595 feet
Bicycle Lane Width	N/A
Curb and Gutter Style	Type A per MAG standard detail #220
Median Width	N/A
Sidewalk Width	Dual 5 foot sidewalks
Pavement Cross Slope	2%
Intersection Corner Radii	45 feet
Drainage	
Off-Site	100 year
On-Site	100 year

Recommendations

CONCEPTUAL ROADWAY SCOPE:

Grace Neal Parkway

The proposed ultimate roadway section for Grace Neal Parkway is shown in the **Cross Section Exhibits Sheets 1-6**. It shows a 4 lane, arterial roadway with a 150 foot right-of-way from Route 66 westward to Stockton Hill Road. Left turn lanes are included at key intersections. The pavement design is consistent for the entire length of the project, although the sidewalks may meander around electric poles and possible bus bays. The pavements structural section consists of a minimum of 2 inch asphalt concrete surface over a 6 inch aggregate base, subject to a geotechnical investigation and pavement design. The pavement is expected to have a design life of 20 years and sustain an average daily traffic of 12,700 vehicles per lane. The class breakdown for the design roadway traffic is presented in **Table 7**. The projected roadway use is conservative compared to the average traffic counts conducted by MAG for major arterial roadways, which consists of 93.3% light vehicle and 6.7% total medium/heavy vehicle use.

Table 7- Designed Pavement Use

FHWA CLASS	VEHICLE DESCRIPTION	% OF TOTAL TRAFFIC
1,2,3	LIGHT VEHICLES	87%
4,5,6,7	MEDIUM WEIGHT VEHICLES	8%
8,9,10,11,12,13	HEAVY VEHICLES	5%

The intersection curb returns will incorporate dual sidewalk ramps and the median will allow for crosswalks at major intersections. Final design and construction is expected to be the responsibility of developers of adjacent properties with the County overseeing the project.

Bank Street

The roadway cross section designed for Bank Street north of Jagerson Ave is shown in the **Cross Section Exhibit Sheet 7.** The pavement structural section consists of a minimum 2 inch asphalt concrete surface over a 6 inch aggregate base, subject to a geotechnical investigation and pavement design. A 5 foot sidewalk borders the roadway on each side. The section includes curb and gutter. As the developers of the Cerbat Vista subdivision, Hualapai Development LLC, will be required to provide improvements for Bank Street adjacent to their property.

CONCEPTUAL DRAINAGE SCOPE:

Grace Neal Parkway

Along the north side of the westbound lanes of Grace Neal Parkway from Mohave Wash to Stockton Hill Road, stormwater will be intercepted by the proposed drainage channel and ultimately discharge into Mohave Wash, which runs north to Red Lake. There are generally several options to design drainage channels. However, due to the limitation of the right-of-way, a rectangular concrete channel will be the only option discussed for the conceptual ultimate design. The channel design options are presented in **Table 8**.

Table 8- Channel Design Options

SUMMARY OF THE CHANNEL DESIGN ALTERNATIVES ALONG GRACE NEAL PARKWAY FROM STOCKTON HILL RD TO SR 66

EARTHEN TRAPEZOIDAL CHANNEL						
LOCATION Collection Pt	Water Depth* (ft)	DISCHARGE (cfs)	VELOCITY (fps)	SIDE SLOPE	BOTTOM WIDTH (ft)	TOP WIDTH (ft)
5392 to 5514	5	1137	5.98	4:1	18	74
5514 to 5530	5	1964	5.95	4:1	46	102
5530 to 5573	5	2324	5.96	4:1	58	114
5573 to Mohave Wash	5	3355	5.99	4:1	92	148
5573 to Mohave Wash	3	3355	5.98	4:1	175	215
5585 to Mohave Wash	3	406	5.86	4:1	11	51

CONCRETE TRAPEZOIDAL CHANNEL						
LOCATION Collection Pt	Water Depth* (ft)	DISCHARGE (cfs)	VELOCITY (fps)	SIDE SLOPE	BOTTOM WIDTH (ft)	TOP WIDTH (ft)
5392 to 5514	5	1137	15.24	1:1	13	27
5514 to 5530	5	1964	15.75	1:1	26	40
5530 to 5573	5	2324	15.60	1:1	32	46
5573 to Mohave Wash	5	3355	15.90	1:1	48	62
5573 to Mohave Wash	3	3355	15.96	1:1	85	95
5585 to Mohave Wash	3	406	13.53	1:1	7	17

CONCRETE RECTANGULAR CHANNEL						
LOCATION Collection Pt	Water Depth* (ft)	DISCHARGE (cfs)	VELOCITY (fps)	SIDE SLOPE	BOTTOM WIDTH (ft)	TOP WIDTH (ft)
5392 to 5514	5	1137	14.44	N/A	19	19
5514 to 5530	5	1964	14.79	N/A	33	33
5530 to 5573	5	2324	14.80	N/A	39	39
5573 to Mohave Wash	5	3355	14.79	N/A	57	57
5573 to Mohave Wash	3	3355	14.94	N/A	94	94
5585 to Mohave Wash	3	406	13.53	N/A	10	10

Note:
(*) The Channel Depth is equal to the Water Depth+2' freeboard
CP 5392 is located at approximately Sta 24+00
CP 5514 is located at approximately Sta 48+50
CP 5530 is located at approximately Sta 88+50
CP 5573 is located at approximately Sta 170+00
CP 5585 is located at approximately Sta 245+00
Mohave Wash is located at approximately at 228+00

The rectangular concrete channel will be designed to handle 100-year discharges per the Kingman AMPDU HEC-1 model as shown in **Appendix A1**. The concrete channel will be constructed in accordance with Mohave County regulations. It will have two feet of freeboard and have a maximum velocity of 15 feet per second. The widths of the channel are calculated using FlowMaster V6.1 by Haestad Methods, Inc. as shown in **Appendix A6.**

Vertical drop structures in the concrete channel are recommended. Due to the natural steepness of the ground slope along the channel, the conceptual design includes a series of gentle slopes and vertical drops to produce low non-erosive velocities.

Along the eastbound lanes of Grace Neal Parkway from Mohave Wash to State Route 66, the general wash's flow patterns will be intercepted by the proposed drainage channel and ultimately discharge into Mohave Wash, which runs north to Red Lake. There are several options available to design the channel including: trapezoidal earth channel, trapezoidal grouted rock channel, trapezoidal concrete channel and rectangular concrete channel. After reviewing the improvement alternatives, the earthen channel is recommended over the other methods. Although the earth channel is wider than any other method, the finished product typically has a more natural appearance and function, and results in insignificant disturbance of riparian habitat and cultural features. It also has less risk to the public as a result of a lower velocity of water moving through the channel and less potential for structural failure. In addition, the earth channel has the lowest construction cost. The channel design options are presented in **Appendix A3.**

The trapezoidal earthen channel will be designed to handle the 100-year discharges per the Kingman AMDU HEC-1 model as shown in **Appendix A1**. The earthen channel will be constructed in accordance with Mohave County regulations. It will have two feet of freeboard and have a maximum velocity of 6 feet per second. With the velocity higher than 2 fps, there will not be a sediment depositional issue. Riprap toe protection may be used to increase channel stability.

The Mohave Wash Bridge design should provide a long-term crossing weathering flow from Mohave Wash during storm events and the flows from the two parallel interceptor channels engaging Mohave Wash in the same vicinity. This presents a serious potential for scour at the pile foundations. The Wash may be widened and lined with rip-rap to slow the velocity sufficiently to reduce this risk. The bridge should be skewed to reduce the bridge dimensions and cost. A conceptual draft is shown in the **Mohave Wash Bridge Conceptual Exhibit on page 37**.

A drainage easement at the wash is required in order to provide adequate room for the interceptor channels to merge into the existing bottom of the wash and still provide the capacity to convey the required flow. Furthermore, rip-rap must also extend beyond the width of the channel as it enters the wash to reduce scouring. A way to reduce the size of the channels would be to improve Mohave Wash itself and make it deeper and wider, allowing the parallel interceptor channels to remain deeper when they intersect Mohave Wash. Further study is required at Mohave Wash to determine the effects of modifying the depth.

Bank Street

The storm water run-off along Bank Street from Grace Neal Parkway and Jagerson Avenue will be conveyed along the curb and gutter southerly and drain into the existing channel along Jagerson Avenue through the spillway. Based on conceptual analysis it is recommended that the existing 60" CMP culvert at Bank Street be replaced with five 60" CMP culverts to meet the discharge requirement. The culvert calculations are presented in **Appendix A7.** Based on a current visual analysis of Bank Street south of Jagerson Avenue to Northern Avenue, it appears that flooding is a recurring issue. Extending the curb and gutter design from north of Jagerson Avenue southward to Northern Avenue and providing curb openings at intersecting washes may greatly improve drainage performance along this roadway although a more detailed hydraulic analysis is outside the scope of this current project.

INTERIM CHANNEL:

As requested by the Mohave County, the temporary channel is analyzed from Bank Street to Mohave Wash along the westbound lanes of Grace Neal Parkway. There are two temporary channel design options available including: trapezoidal earthen channel and trapezoidal grouted-rock channel. After reviewing the temporary alternatives, the earthen channel is recommended over the grouted rock. There is little difference in channel width between the earthen channel and the grouted rock channel. In addition, the earthen channel has the lower construction cost. The channel designs for 100 year flows are presented in **Appendix A3.** The cross section of the interim roadway can be found in the **Cross Section Exhibits** on **page 29**.

Per Mohave County instruction, the temporary earthen channel conceptual design will have no freeboard and have a maximum velocity of 6 feet per second. With the velocity higher than 2 fps, there should not be a sediment depositional issue. Riprap toe protection may be used to increase channel stability. The conceptual design of the interim channel was based on 150' of available right-of-way. Current Right-of-way varies from 35.3' to 100'.

Table 9- Interim Channel Design Options From Bank Street to Mohave Wash for 100 year discharges.

THE EARTHEN TRAPEZOIDAL CHANNEL

LOCATION	Water Depth* (ft)	DISCHARGE (cfs)	VELOCITY (fps)	SIDE SLOPE	BOTTOM WIDTH (ft)	TOP WIDTH (ft)
Bank St to 5573	7	2324	5.93	4:1	28	84
5573 to Mohave Wash	7	3355	5.99	4:1	52	108
5573 to Mohave Wash	5	3355	5.99	4:1	92	132

THE GROUTED ROCK TRAPEZOIDAL CHANNEL

LOCATION	Water Depth* (ft)	DISCHARGE (cfs)	VELOCITY (fps)	SIDE SLOPE	BOTTOM WIDTH (ft)	TOP WIDTH (ft)
Bank St to 5573	7	2324	5.93	3:1	35	77
5573 to Mohave Wash	7	3355	5.95	3:1	59	101
5573 to Mohave Wash	5	3355	5.99	3:1	97	127

Note:
(*) The Channel Depth is equal to the Water Depth+0' freeboard
CP 5573 is located at approximately Sta 170+00 of the Grace Neal Parkway Conceptual Alignment

As discussed in the Drainage Issues section of this report, additional soils data has been recently aquired by the County that may affect the expected flows in the interim channel. It is recommended that an updated drainage model be developed with the revised soil information to provide more accurate flow rates expected in the channel. This information should be reviewed along with expected right-of-way restrictions to determine what level of channel design is possible.

CONCEPTUAL TRAFFIC SCOPE:

Grace Neal Parkway will provide arterial service to a rapidly developing Northern Kingman area, making it necessary to provide for future collector roads. The conceptual design provides for access to Grace Neal Parkway at all roadways currently named and recorded by the city, as well as at every mid section line - approximately every ½ mile.

SWTE recommended, in the Prairie Heights Estates TIA, converting the control at the intersection of Bank Street and Jagerson Avenue to a 4-way STOP in order to mitigate the traffic flow North and Southbound. Existing signal control at the intersection with State Route 66 will follow a currently undergoing improvement study being overseen by ADOT.

Phasing options for Grace Neal Parkway are depicted in the **Figure 5.**

The first option is to construct the northernmost lanes from Bank Street to Stockton Hill Road, thereby connecting the two currently developing subdivisions of Prairie Heights and Eagle View Estates which are on the northern border of Grace Neal Parkway. The north half-street will be striped for one lane each direction. Also, the concrete channel will need to be completely developed along the roadway to Bank Street. As adjacent developments continue south of Grace Neal Parkway, the southernmost half-street will need to be constructed. At this point the median should be built to complete the ultimate cross section. This plan will have a higher initial cost as there will be less adjacent developments to complete half-street improvements but will help insure uniformity in the roadway design and provide immediate usage.

Option 2 is paced to be built as development requires. The northern half-street is built as required for the subdivisions to be tied into the closest paved North-South arterial. Prairie Heights Subdivision will tie into Bank Street, and Eagle View Subdivision will tie into Stockton Hill Road. Existing conditions may remain between subdivisions until adjacent properties are developed. Such phased construction will reduce the efficiency of the parkway and may not be completely constructed for many years.

The section of Grace Neal Parkway from Bank Street to State Route 66 isn't expected to be developed until after the western portion is built out. It would then follow similar construction sequencing in that the channel would have to be constructed first alongside the half-street. The southern portion of the roadway will be constructed as development and roadway traffic mandates.

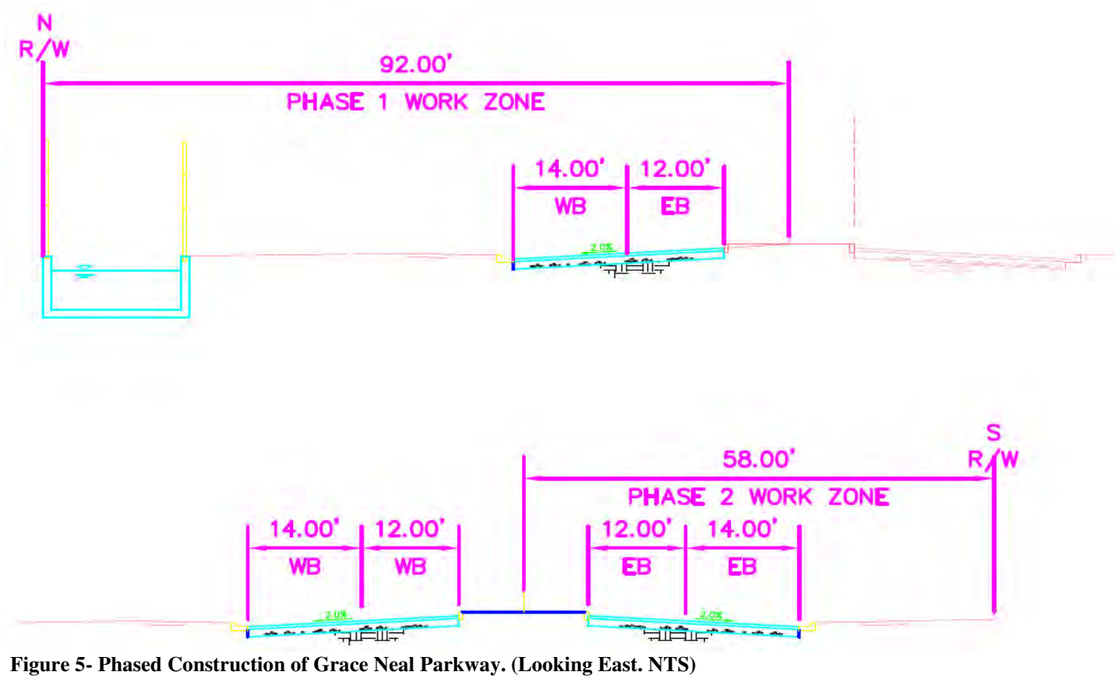


Figure 5- Phased Construction of Grace Neal Parkway. (Looking East. NTS)

CONCEPTUAL CONSTRUCTION SCOPE:

It is understood that Grace Neal Parkway and Bank Street will be constructed by the developers of adjacent properties as part of their subdivision projects and as needed by Mohave County. Currently, because of the rural environment, few working restrictions exist. There is virtually no existing traffic so there should be little annoyance with traffic lane closures. This report will serve as the basis for design for developers and utility companies as more infrastructure comes to the Grace Neal Parkway corridor.

The section of Grace Neal Parkway west of Bank Street is expected to develop much sooner than the eastern section. A conceptual interim channel and access road design east of Bank Street is required to allow the flow from the improved drainage channel to be safely transported to Mohave Wash. The roadway will have a compacted earth surface similar to the existing conditions, yet will have an earthen channel running adjacent to it. The traveled way width and channel cross section are shown in the Cross Section Exhibits section.

CONCEPTUAL UTILITY SCOPE:

Electric:
Consideration is given to minimize interference to power lines in the project area. Three 12.5kV power lines cross over Grace Neal Parkway, and may require relatively minimal interference. The 69 kV power lines running parallel to the center line of Grace Neal Parkway will likely be relocated throughout the project. The lines will either be relocated between the proposed curb and right of way line or moved underground, although according to Unisource Energy, undergrounding the 69kV line is not a feasible option. At the sections of Grace Neal Parkway with a drainage channel at the southern side, the poles may be relocated between the southern sidewalk and the drainage channel or moved outside of the channel completely. Currently, Unisource requires at least 10 feet of easement for the distribution lines, and 15 feet for the 69kV lines. This space is available in the 150 foot right-of-way corridor. Coordination with Unisource Energy is currently ongoing for the purpose of establishing a conceptual utility corridor. It is imperative that developers continue a dialogue with Unisource to establish a mutually agreed upon electric corridor location.

Telecommunications/fiber optic:
Frontier Communications has proposed projects intersecting Grace Neal Parkway at Bank Street. They have also mentioned running a fiber optic cable along Grace Neal Parkway from Bank Street towards Stockton Hill Road. Coordination between Frontier and developers will ease construction for both the roadway and their utilities.

PAVEMENT ISSUES:

Based on the Geotechnical report for this project, the soils for the length of Grace Neal Parkway consists of silty and clayey sands with small amounts of gravel. R-values and correlated R-values range from 31 to 67. The geotechnical report can be found in **Appendix E1.**

Grace Neal Parkway is designated as a rural arterial road in the Mohave County and Kingman Area General Plan. A pavement section consisting of 5” of Asphaltic Concrete over 8” Asphaltic Base Concrete is recommended. This provides for 1,300 daily 18 kip Equivalent Single Axle Loads per lane, or using the assumed traffic class distribution, approximately 12,700 vehicles per day per lane.

More detailed pavement design parameters are provided in the Geotechnical report.

A geotechnical investigation of Bank Street was not performed for this report.

LIGHTING SCOPE:

The conceptual design includes raised curb medians and outside curbs, and also provides for bicycle traffic on the pavement. Appropriate lighting is necessary to ensure the safety of both vehicles and pedestrians utilizing the sidewalks. The final design and construction of the street light system will require analysis and recommendations by a qualified electrical engineer.

TRAFFIC SIGNALS:

One new traffic signal is proposed at the intersection of Grace Neal Parkway and Stockton Hill Road. It is anticipated that Grace Neal will have dedicated left turn and right turn lanes. The existing light at the Route 66 intersection will likely continue to operate as is. All other intersections will be STOP sign controlled, with a signal warrant study conducted on the Bank Street and Grace Neal Parkway as development along Bank Street continues.

MOHAVE WASH BRIDGE SCOPE:

The proposed bridge is located along Grace Neal Parkway at Mohave Wash, approximately 5000 feet west of Highway Route 66. At the new bridge location, the current Mohave Wash channel is approximately 100 feet wide and has approximately 6 feet of depth. The vegetation in the area of the proposed bridge consists of typical desert grass and shrubs.

The proposed bridge will be a four-lane roadway with raised median and sidewalks. The bridge will be approximately 330 feet long by approximately 81 feet wide. The proposed bridge should be designed to have two feet of freeboard minimum for the 100-year event and skewed to allow room for the dual parallel interceptor channels to flow into Mohave Wash.

In general, the proposed bridge should be designed to have as little impact as possible to the wash. If possible, the bridge should be designed so that there is no disturbance to the flow whatsoever. Whenever piers are used, they need to be oriented parallel to flow. Impacts upon channels and floodplains created by bridge usually take the form of the increased flow velocities through and downstream of the bridges, increased scour and upstream ponding due to backwater effects. These impacts can cause flood damage to the wash, and to the bridge structure itself. The structural firm should be contacted for review and supplemental recommendations for the bridge structural span as well as the structural loads at abutments and piers.

For structures in channel areas, the up stream and down stream edges should have turn-down cut off walls. The cut off walls and the foundations deriving support will be required at least 3 feet below the design scour and/or stream bed degradation elevation. Mohave Wash flows intermittently and is subject to relatively high flow stages. There is a potential for scour at this site. A determination of scour was outside the scope of this report.

RIGHT OF WAY SCOPE:

New right-of-way will be required for this project. Generally, the right of way will extend 100 feet north of the mid section line and 50 feet south. Additional right-of-way will be needed to provide the necessary room for the channel as it widens toward Mohave Wash. The type of channel utilized will govern the extent of acquisition. The plans define 150 feet at the western end of Grace Neal Parkway to tie into the intersection at Stockton Hill Road at the desired 90 degree angle. The acquisition of land is expected to be time consuming as land is required both within Kingman city limits and in Mohave County. Also affecting the right-of-way schedule is the number of properties involved. The **Existing Right-of-Way Exhibit** is located on page 26.

Table 10- Right of Way Summary

Assessor #	R/W Side	From Station	To Station	Frontage Length (ft)	R/W Easement (ft)	R/W Required (ft)	Area Required (sf)	Total Cost
310-15-003	Both	275+00	277+50	250	0	150	37500	$ 51,653
unassigned	North	117+03	169+90	5287	42	100	306646	$ 422,377
310-15-011	North	249+00	259+26	1026	0	30-65	46170	$ 63,595
310-15-012	Both	222+74	275+00	5226	84	50-150	131730	$ 181,446
310-15-013	North	222+74	249+00	2626	42	100	152308	$ 209,791
310-01-067	South	196+32	222+74	2642	35	50	39630	$ 54,587
310-01-065	North	196+32	222+74	2642	35	100	171730	$ 236,543
310-01-085	North	169+90	196+32	2642	50	100	132100	$ 181,956
310-01-082	South	169+90	196+32	2642	50	50	0	$ -
310-01-081	South	165+23	169+90	467	50	50	0	$ -
310-01-083	South	121+69	165+23	4354	50	50	0	$ -
310-01-084	South	117+03	121+69	466	35.3	50	6850.2	$ 9,436
310-26-042	South	90+71	117+03	2632	40	50	26320	$ 36,253
310-26-044	North	90+71	117+03	2632	100	100	0	$ -
310-26-026	North	77+74	90+71	1297	100	100	0	$ -
310-26-027	South	77+74	90+71	1297	0	50	64850	$ 89,325
310-26-025	North	64+44	77+74	1330	100	100	0	$ -
310-26-028	South	73+79	77+74	395	0	50	19750	$ 27,204
310-26-001	South	51+14	73+79	2265	0	50	113250	$ 155,992
310-26-033	North	51+14	64+44	1330	100	100	0	$ -
310-26-009	South	31+64	46+87	1523	0	50	76150	$ 104,890
310-26-032	North	31+64	51+15	1951	100	100	0	$ -
330-01-057	South	10+00	31+64	2164	0	135	292140	$ 402,397
330-01-056	North	10+00	31+64	2164	0	15	32460	$ 44,711
TOTAL								**$ 2,272,155**

CONCEPTUAL COST ESTIMATE:

A conceptual cost estimate was created for the ultimate design of Grace Neal Parkway and for Bank Street. Unit costs were derived from local contractors and published bid documents for public roadway projects in Arizona.

Table 11 shows the total cost for the entire roadway development including all land acquisition costs to complete a 150' right-of-way assuming $50,000 per acre. Additional survey information is needed to establish a vertical alignment. Additional earthwork may be required.

The utility costs were based on recently received relocation estimates from Unisource Energy based on a conceptual roadway layout submitted in October 2006. Updated plans were submitted in December providing more space for the 69 kV electric lines as discussed with Unisource. Unisource is currently reviewing the updated plan layout, which may reduce the relocation costs, currently given as $253,000 per mile.

Although construction may take place "piecemeal", and several years in the future, all cost estimates are presented in 2007 dollars.

Table 11-Grace Neal Parkway Conceptual Total Cost Estimate

Pay Item No.	Description	Engineer's Estimate-Conceptual			
		Unit	Quantity	Unit Price	Amount
	GENERAL WORK				
1	LANDSCAPING	JOB	1	$ 75,000.00	$ 75,000
2	TRAFFIC SIGNALS	EA	1	$ 20,000.00	$ 20,000
3	CLEAR AND GRUB	ACRE	92	$ 1,000.00	$ 92,086
4	FENCE REMOVAL	LF	280	$ 3.00	$ 840
5	STREET LIGHTS	EA	72	$ 10,000.00	$ 720,000
6	UTILITY RELOCATIONS	JOB	1	$ 1,050,000.00	$ 1,050,000
				SUBTOTAL	$ 1,957,926
	PAVEMENT QUANTITIES				
1	SUBGRADE PREP	SY	251,262	$ 2.25	$ 565,340
2	ASPHALT CONCRETE PAVEMENT	TON	48,670	$ 80.00	$ 3,893,570
3	AGGREGATE BASE COURSE	TON	75,276	$ 50.00	$ 3,763,784
4	CONCRETE SIDEWALK, W=5.0'	SF	254,415	$ 4.00	$ 1,017,660
5	CONCRETE VERTICAL C & G, H=6"	LF	53,508	$ 14.00	$ 749,112
6	SURVEY & R/W MONUMENTS	EA	17	$ 200.00	$ 3,400
7	MEDIAN CONCRETE VERTICAL CURB	LF	51,036	$ 10.00	$ 510,363
8	CONCRETE SIDEWALK RAMPS	EA	40	$ 1,000.00	$ 40,000
9	EARTHWORK	CY	17,616	$ 4.00	$ 70,464
				SUBTOTAL	$ 10,613,694
	DRAINAGE WORK				
1	CONCRETE CHANNEL LINING	CY	57,260	$ 125.00	$ 7,157,454
2	SAFETY RAIL	LF	44,060	$ 8.00	$ 352,480
3	DRAINAGE EARTHWORK	CY	252,738	$ 4.00	$ 1,010,951
4	CATCH BASINS, MAG STD DET 533-1 TYPE D	EA	14	$ 2,500.00	$ 35,000
5	30" STORM DRAIN	LF	1,316	$ 80.00	$ 105,280
6	36" STORM DRAIN	LF	350	$ 90.00	$ 31,500
7	RIP RAP	CY	1,500	$ 40.00	$ 60,000
8	CONCRETE ROADWAY BRIDGE	SF	28,350	$ 135.00	$ 3,827,250
				SUBTOTAL	$ 12,579,915
	SIGNAGE AND STRIPING				
1	STRIPING	LF	53,508	$ 0.50	$ 26,754
2	SIGNAGE	LS	1	$ 50,000.00	$ 50,000
				SUBTOTAL	$ 76,754
				CONSTRUCTION SUBTOTAL	$ 25,228,288
1	TRAFFIC CONTROL	JOB	1	$ 126,416	$ 126,416
2	CONTINGENCY (15%)	JOB	1	$ 3,792,493	$ 3,792,493
3	MOBILIZATION	JOB	1	$ 126,416	$ 126,416
4	RIGHT-OF-WAY ACQUISITION	JOB	1	$ 1,893,462	$ 1,893,462
5	SURVEYING	JOB	1	$ 252,833	$ 252,833
6	GEOTECHNICAL	JOB	1	$ 252,833	$ 252,833
7	DESIGN	JOB	1	$ 2,528,329	$ 2,528,329
				GRACE NEAL PKWY GRAND TOTAL	**$ 34,201,071**

The estimated cost for Bank Street is shown in **Table** 12. It involved removing the existing pavement from Northern Avenue to Jagerson, Avenue. This cost does not involve costs for modifying existing drainage crossings or improvements south of Jagerson Avenue. It also assumes no modifications to the vertical alignment are needed.

Table 12-Bank Street Conceptual Total Cost Estimate

Pay Item No.	Description	Engineer's Estimate			
		Unit	Quantity	Unit Price	Amount
	GENERAL WORK				
1	LANDSCAPING	JOB	1	$ 10,000.00	$ 10,000
2	TRAFFIC SIGNALS	EA	1	$ 20,000.00	$ 20,000
3	CLEAR AND GRUB	ACRE	9.5	$ 1,000.00	$ 9,500
4	STREET LIGHTS	EA	24	$ 10,000.00	$ 240,000
5	UTILITY RELOCATIONS	JOB	1	$ 50,000.00	$ 50,000
				SUBTOTAL	$ 329,500
	PAVEMENT QUANTITIES				
1	SUBGRADE PREP	SY	15,253	$ 2.25	$ 34,320
2	ASPHALT CONCRETE PAVEMENT	TON	5,148	$ 80.00	$ 411,840
3	AGGREGATE BASE COURSE	TON	14,929	$ 50.00	$ 746,460
4	CONCRETE SIDEWALK, W=5.0'	SF	66,060	$ 4.00	$ 264,240
5	CONCRETE VERTICAL C & G, H=6"	LF	13,212	$ 14.00	$ 184,968
6	SURVEY & R/W MONUMENTS	EA	6	$ 200.00	$ 1,200
7	CONCRETE SIDEWALK RAMPS	EA	80	$ 1,000.00	$ 80,000
8	EARTHWORK	CY	4,576	$ 4.00	$ 18,304
				SUBTOTAL	$ 1,741,332
	DRAINAGE WORK				
1	CATCH BASINS, MAG STD DET 533-1 TYPE D	EA	2	$ 2,500.00	$ 5,000
2	30" STORM DRAIN	LF	60	$ 80.00	$ 4,800
3	36" STORM DRAIN	LF	1,500	$ 90.00	$ 135,000
4	RIP RAP	CY	74	$ 40.00	$ 2,960
				SUBTOTAL	$ 147,760
	REMOVAL WORK				
1	REMOVE EXISTING PAVEMENT	SY	15253	$ 10.00	$ 152,533
				SUBTOTAL	$ 152,533
	SIGNAGE AND STRIPING				
1	STRIPING	LF	7,960	$ 0.50	$ 3,980
2	SIGNAGE	LS	1	$ 5,000.00	$ 5,000
				SUBTOTAL	$ 8,980
				CONSTRUCTION SUBTOTAL	$ 2,380,105
1	CONTINGENCY (15%)	JOB	1	$ 238,011	$ 238,011
2	MOBILIZATION (0.5%)	JOB	1	$ 11,901	$ 11,901
3	GEOTECHNICAL (1%)	JOB	1	$ 23,801	$ 23,801
4	TRAFFIC CONTROL (2%)	JOB	1	$ 47,602	$ 47,602
5	SURVEYING	JOB	1	$ 23,801	$ 23,801
6	DESIGN	JOB	1	$ 238,011	$ 238,011
		BANK ST GRAND TOTAL			**$ 2,963,231**

The interim cross section will be constructed from Bank Street to Mohave Wash, namely providing an access road along the 69 kV lines. The concrete channel will transition to an interim earthen channel east of Bank Street conveying the flow to Mohave Wash. No improvement is considered east of Mohave Wash.

Table 13- Grace Neal Parkway Interim Channel Cost Estimate

Pay Item No.	Description	Engineer's Estimate-Conceptual			
		Unit	Quantity	Unit Price	Amount
	ROADWAY QUANTITIES				
1	ROADWAY GRADING	SY	37,333	$ 2.25	$ 84,000
				SUBTOTAL	$ 84,000
	DRAINAGE WORK				
1	DRAINAGE EARTHWORK	CY	140684	$ 4.00	$ 562,738
2	RIP RAP	CY	1,500	$ 40.00	$ 60,000
				SUBTOTAL	$ 622,738
				CONSTRUCTION SUBTOTAL	$ 706,738
1	CONTINGENCY (15%)	JOB	1	$ 106,011	$ 106,011
2	MOBILIZATION	JOB	1	$ 3,534	$ 3,534
3	SURVEYING	JOB	1	$ 7,067	$ 7,067
4	GEOTECHNICAL	JOB	1	$ 7,067	$ 7,067
5	DESIGN	JOB	1	$ 70,674	$ 70,674
		INTERIM CHANNEL GRAND TOTAL			**$ 901,091**

CONSTRUCTION/DESIGN ISSUES

ROADWAY ISSUES:

The roadway profile will require some refinement in final design to optimize hydraulic considerations and earthwork.

Subdivision plans are already being developed for properties bordering Grace Neal Parkway, so care needs to taken to address the impact of any offsite improvement plans from developers.

- **Median openings:** Openings proposed in this report are based on known preliminary designs for subdivision entrances, and named cross roads found on the City of Kingman's CAD drawings. Additional median openings or relocation of planned locations may be required, especially for intersections not currently maintained.
- **Utility locations:** There are proposed projects to extend gas mains, cable and telephone lines across Grace Neal Parkway to future development sites. Contractors must contact Arizona Blue Stake for the most up to date information.

DRAINAGE ISSUES:

The channel dimensions were sized based on the HEC-1 analysis for the Kingman Area Master Plan Update, Mohave County prepared by Robert L. Ward, P.E. with a run date of April 03, 2006. The precipitation data was updated to use values from NOAA Atlas 14, however the soils data was not updated to include the latest soils map developed from USDA soil surveys. This may modify the flows experienced during 100 yr events by the Grace Neal channel.

As discussed in the INTERIM CHANNEL section of this report, the existing right-of-way east of Bank Street is insufficient to allow room for a channel as seen in **Table 9** and an access road meeting the County's design criteria, even when omitting freeboard. The restriction in channel depth is that it must match the existing Mohave Wash bottom. The interim inceptor channel may be constructed as the ultimate concrete rectangular channel as shown in the ultimate plan view exhibits in order to reduce the overall cost of the project by reducing the amount of earthwork required although this will increase the initial project cost. The plan view of Grace Neal Parkway shows a vertical wall concrete channel just outside of the 150 foot right-of-way at the proposed Mohave Wash Bridge with a channel water depth of 3 feet and 2 feet of freeboard.

There are four ultimate design options for the type of channel being used at the eastern side of Mohave Wash on Grace Neal Parkway. With no surrounding development in this area, and the power poles already being relocated, there is some flexibility in what type of channel to use. The only hindrance would be the amount of skew at the bridge to move the centerline of the roadway further north of the mid section line to provide space for the chosen channel.

OFF-SITE IMPACTS:

There are several subdivisions being developed along Grace Neal Parkway that could potentially impact this project.

The Eagle View subdivision is located north of Grace Neal about 3700 feet east of Stockton Hill Road. Due to the increase in post-development flow, the Eagle View subdivision will require approximately 1.0 acre-ft of detention according to the Final Drainage Report for Eagle View date Feb 09, 06 by Mohave Engineering Associates, Inc. The on-site and off-site flows discharge into the proposed concrete channel along the westbound of Grace Neal Parkway. Due to the different delineation areas and method of calculation, the discharge from the HEC-1 model by Mohave County is 1964 cubic feet per second (cfs) compared to 1711 cfs from HydroCAD estimated by Mohave Engineers Associates, Inc. The discharge of 1964 cfs from HEC-1 by Mohave County should be used for the conceptual design of the concrete channel.

The Prairie Heights Estates subdivision is located at the northwest corner of the Grace Neal Parkway and Bank Street intersection. According to the Revised Amended Final Improvement Plan Drainage Report for Prairie Heights Estates dated August 14, 06 by Mohave Engineering Associates, Inc, detention is not required for this project and the development of this site will not adversely affect adjacent or down stream properties. The on-site and off-site flows discharge into the proposed concrete channel along the westbound direction of Grace Neal Parkway. Due to the different delineation areas and method of calculation, the discharge from the HEC-1 model by Mohave County is 2,324 cfs compared to 2,333 cfs estimated by Mohave Engineers Associates, Inc. The discharge of 2,324 cfs from the HEC-1 model by Mohave County will be used for the conceptual design the concrete channel.

The Cerbat Vistas subdivision is located at the southwest corner of the Grace Neal Parkway and Bank Street intersection. Due to the increase in post-development flow, the Cerbat Vistas subdivision will require approximately 0.92 acre-ft of detention according to the Final Drainage Report for Cerbat Vistas date Dec 08, 05 by Mohave Engineering Associates, Inc. The on-site and off-site flows discharge into the existing channel along the westbound lanes of Jagerson Avenue. Due to the different delineation areas and method of calculation, the discharge from the modified HEC-1 model by Mohave County is 802 cfs compared to 710 cfs estimated by Mohave Engineers Associates, Inc. The discharge of 802 cfs from the HEC-1 model by Mohave County will be used for the conceptual design of the culverts under Bank Street. **Appendix A8** shows the peak run-off in the existing channel along the westbound lanes of Jagerson Avenue.

RIGHT-OF-WAY ISSUES:

Jurisdiction of the right-of-way for Grace Neal Parkway currently varies throughout section 19, township 22N, range 16W. For 2,260 feet, the south 50 feet of right-of-way will be in Mohave County limits. The remaining portion of the right-of-way lies within the City of Kingman. It is understood that the county will own and maintain the full length of the roadway.

The amount of dedicated right-of-way is shown in the Existing Right-of-Way Exhibit on page 26. Land acquisition is a time consuming process and should begin as soon as possible to avoid conflicts with new development.

UTILITY ISSUES:

General
There are several existing utilities in the project corridor that will require coordination. As utilities have expressed interest in expanding their services in the right-of-way of Grace Neal Parkway, coordination with the developers during design and construction of proposed utility and roadway projects will help mitigate possible future conflicts.

As current construction continues due to subdivisions adjacent to Grace Neal Parkway, the possibility of utility conflicts will increase. As a preliminary estimate, the City of Kingman expects a minimum trunk sewer line of 12" within Grace Neal Parkway right-of-way. It is understood that Eagle View Subdivision has recently installed a 12" sewer main and an 8" waterline within Grace Neal Parkway. It is understood Prairie Heights Subdivision has installed a 15" sewer main 8" waterline within Grace Neal Parkway. Potential conflicts arise for new service connections that intersect the proposed drainage channel if the planned utility installation does not take into account the depth of the parallel channel. Any gravity sewer installation servicing subdivisions north of Grace Neal Parkway may need to locate the sewer at culvert locations to avoid conflict with the drainage channel.

69kV Electric Line
The existing overhead 69kV and 12kV lines are in conflict with the proposed roadway improvements. The ultimate goal is for the county to relocate the lines running parallel to Grace Neal Parkway either underground or further south of the right-of-way. Unisource, however, has acknowledged that they do not have the ability to move the 69 kV lines underground, and are currently reviewing the conceptual roadway to determine the best location for the lines. There is still the option of undergrounding the 12.5 kV lines that cross Grace Neal Parkway and run adjacent to Bank Street and Cherum Road.

Furthermore, the 69kV line cannot be out of service anytime during the summer peak electricity demand months, making the timing of construction highly important.

SETTLEMENT ISSUES:

Estimated settlements of shallow foundations under design loads are on the order of ½ to 1-inch, virtually all of which will occur during construction. Post-construction differential settlements will be negligible, under existing and compacted moisture contents. Additional localized settlements of the same magnitude could occur if native supports soils were to experience a significant increase in moisture content.

LANDSCAPING ISSUES:

Protected native plants will be salvaged from the right-of-way and made available for use in the median landscaping. It is anticipated the character of the roadway landscaping will incorporate the native plants and other water-conserving species so as to minimize maintenance.

SIDEWALK ISSUES:

The 5 foot sidewalks along Grace Neal Parkway are anticipated to be used exclusively by pedestrians. There is sufficient clearance alongside these sidewalks to accommodate pedestrians without being uncomfortably close to passing traffic. Sufficient space has been given on the northern and southern landscaped areas to provide for meandering sidewalks. The sidewalks, as well as all pedestrian accessways must meet Americans with Disabilities Act (ADA) requirements.

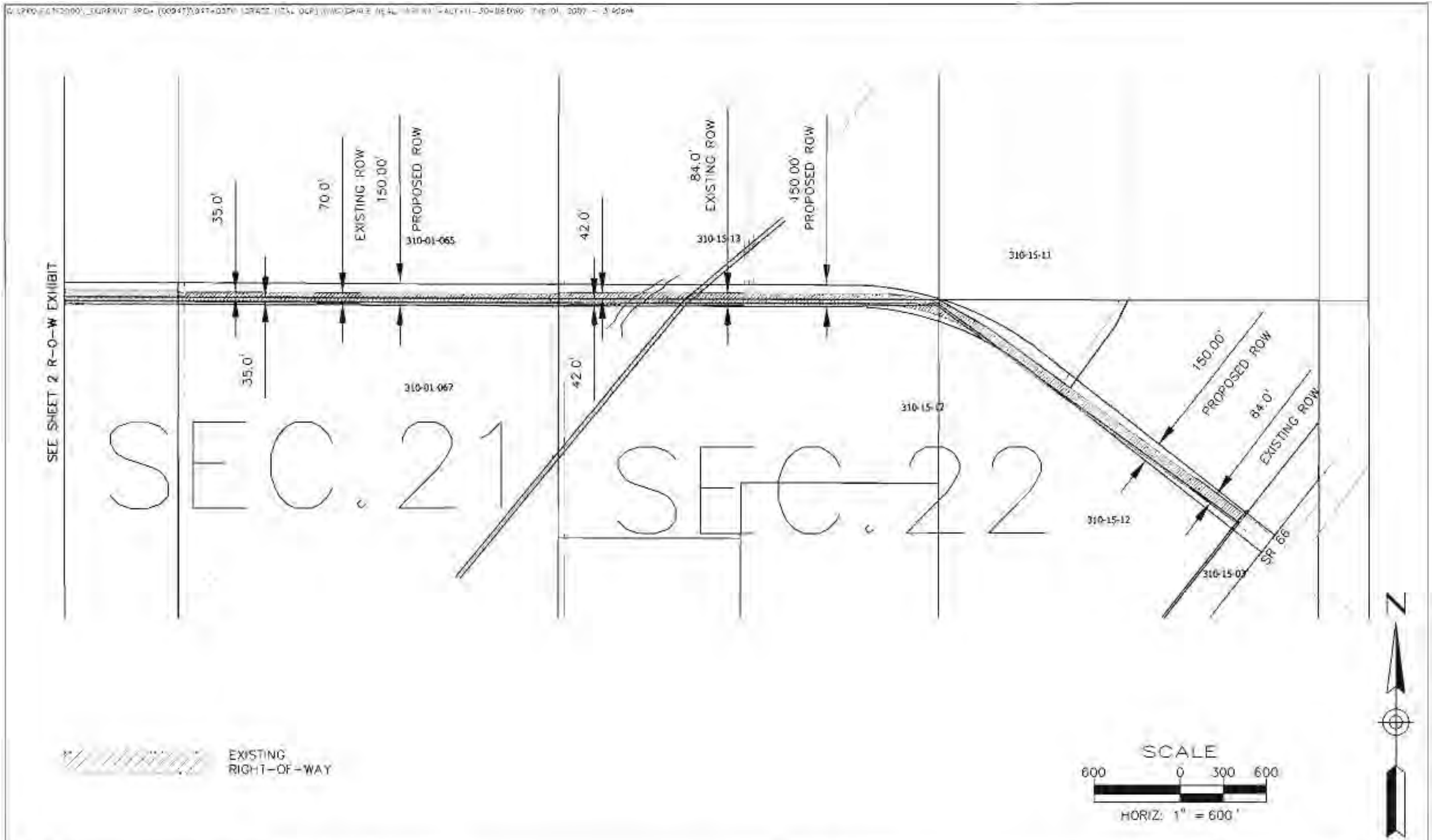
BIKE LANE ISSUES:

Bike lanes were not specifically designated on the roadway surface for either Grace Neal Parkway or Bank Street roadways. Public requests for bicycle lanes were received during an open house and via email. Adequate space for full bike paths is not available for the Grace Neal Parkway corridor because of the parallel channel and right-of-way constraints. With wider outside roadway lanes proposed, and currently low traffic counts, it is expected that bicyclists will have adequate room to travel on pavement without excessive interference from vehicular traffic. As vehicle demands on this roadway increase, the County should re-assess bicycle safety.

BUS BAY LOCATION ISSUES:

Sufficient space is available for bus bays along Grace Neal Parkway from Stockton Hill Road to Bank Street between the back of curb and right-of-way line. Sidewalks may be shifted to accommodate the necessary room for a 10 foot curb jog per MAG Standard Detail 252. Power poles are a factor in deciding the optimal location of the bus bay.

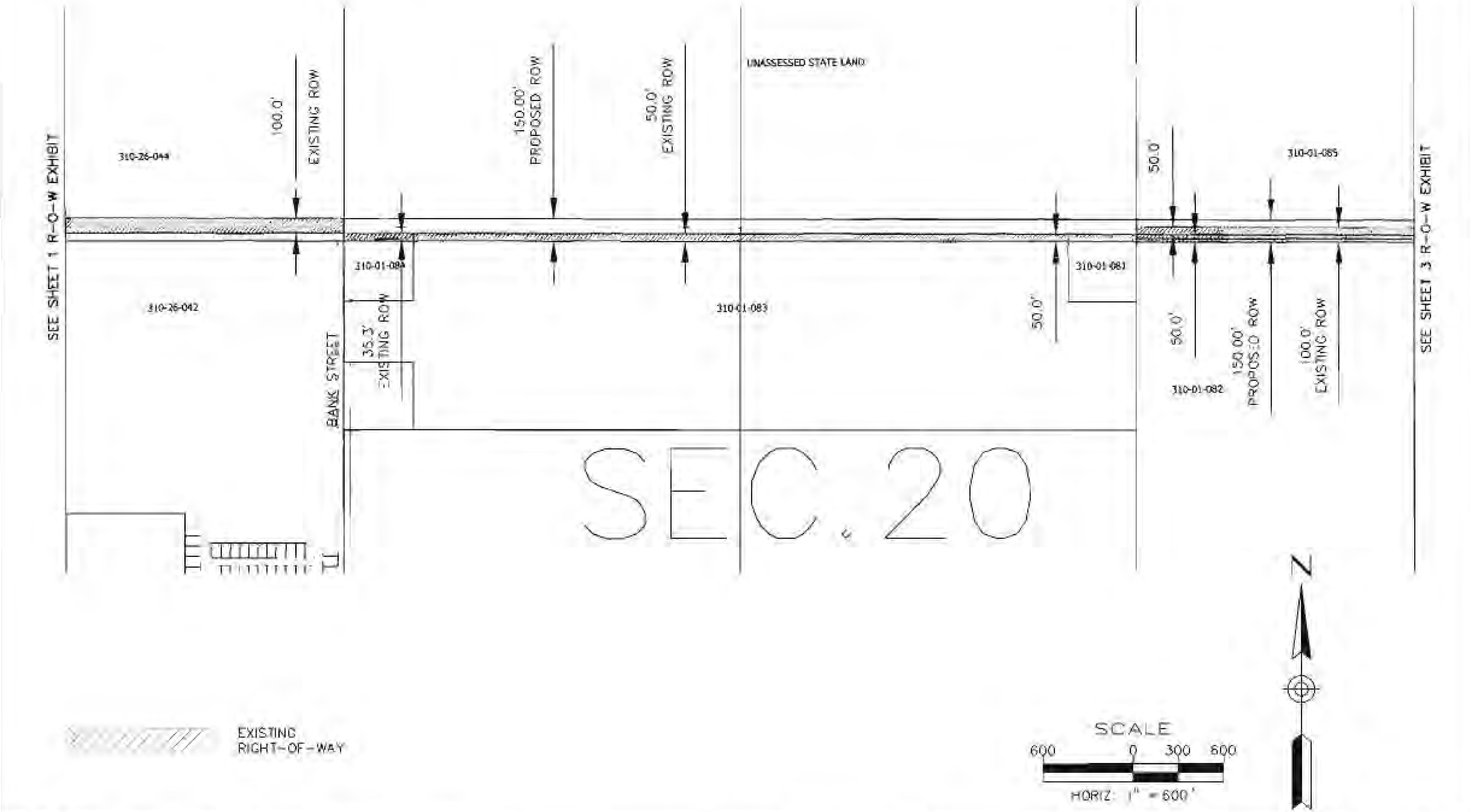
EXISTING
RIGHT-OF-WAY
EXHIBITS



BROOKS ENGINEERS & SURVEYORS INC.		BY	DATE
	DESIGNED	VRR	1/31/07
	DRAWN	VRR	1/31/07

GRACE NEAL DCR
EXISTING RIGHT-OF-WAY EXHIBIT

JOB NUMBER	947-05TM
SHEET	OF
3	3



BROOKS ENGINEERS & SURVEYORS INC.		BY	DATE
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	DRAWN	VRR	1/31/07

GRACE NEAL DCR
EXISTING RIGHT-OF-WAY EXHIBIT

JOB NUMBER	547-05TM
SHEET 2	OF 3

BROOKS ENGINEERS & SURVEYORS INC.

	BY	DATE
DESIGNED	VRR	1/31/07
DRAWN	VRR	1/31/07

GRACE NEAL DCR
EXISTING RIGHT–OF–WAY EXHIBIT

JOB NUMBER	947–05TM
SHEET 1	OF 3

CROSS SECTION EXHIBITS

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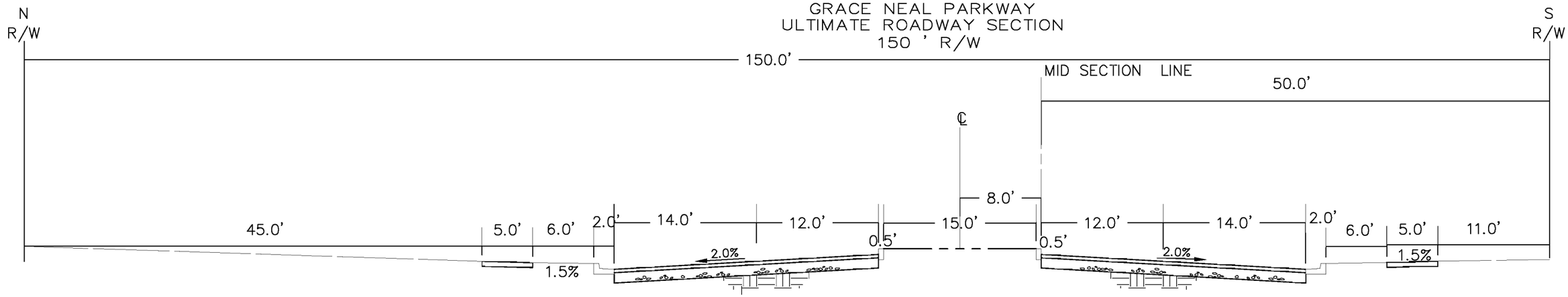

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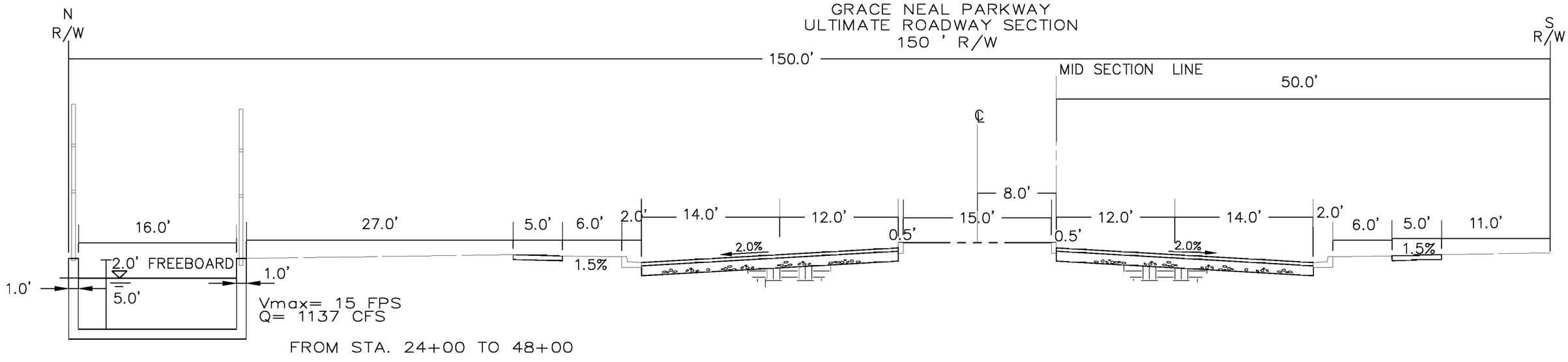

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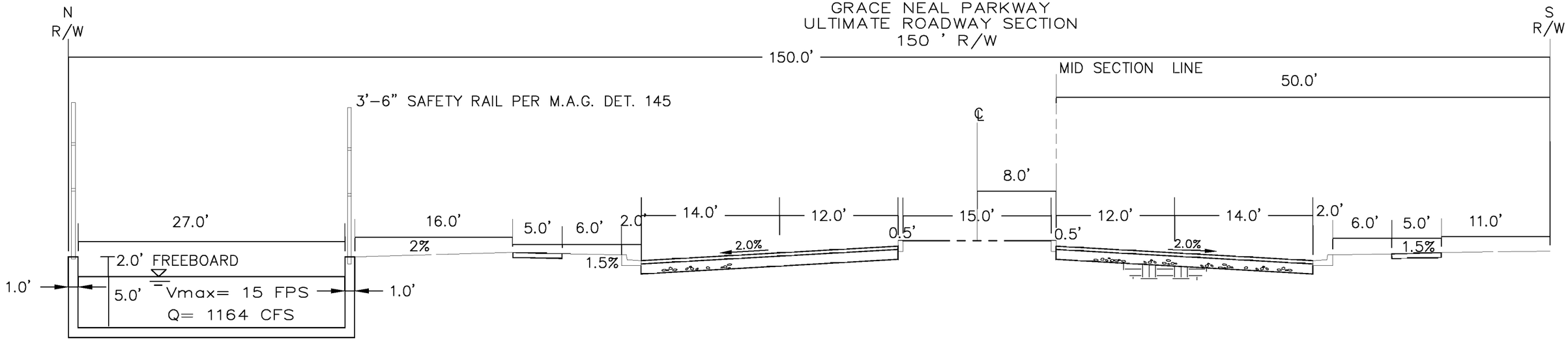
BROOKS ENGINEERS & SURVEYORS INC.
4602 E. ELWOOD STREET, #16
Phoenix, Arizona 85040
Phone (602) 437-3733
Fax (480) 858-0204

	BY	DATE
DESIGNED	VRR	12/20/06
DRAWN	VRR	12/20/06

GRACE NEAL DCR
CROSS SECTIONS

JOB NUMBER	947-05TM
SHEET	OF
1	7

GRACE NEAL PARKWAY
ULTIMATE ROADWAY SECTION
150 ' R/W



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ULTIMATE ROADWAY SECTION
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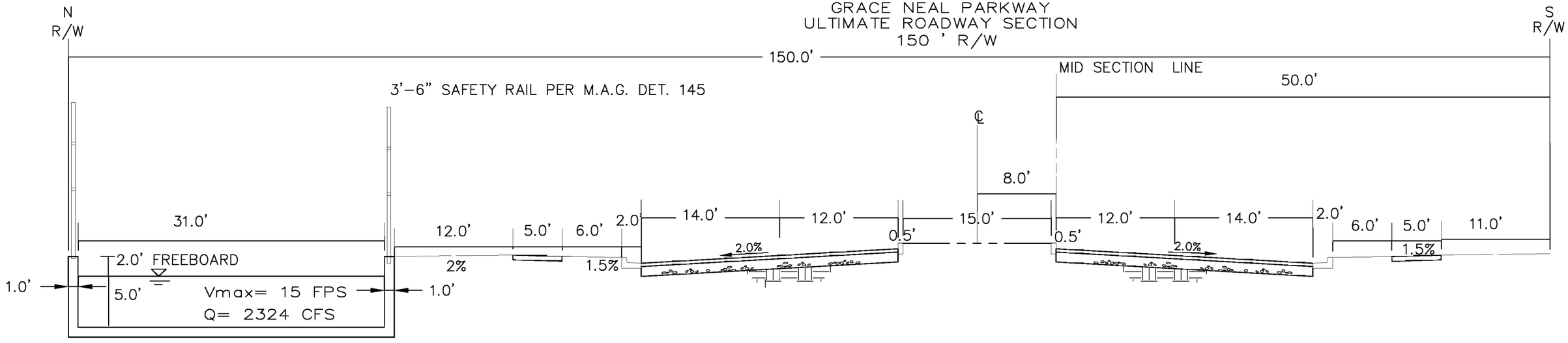

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BROOKS ENGINEERS & SURVEYORS INC.
4602 E. ELWOOD STREET, #16
Phoenix, Arizona 85040
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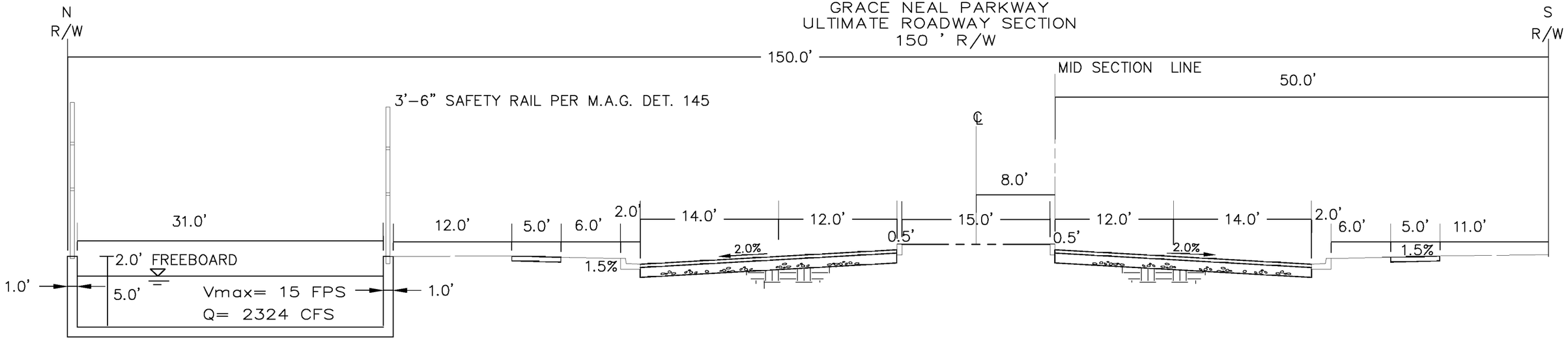
Fax (480) 858-0204

	BY	DATE
DESIGNED	VRR	12/20/06
DRAWN	VRR	12/20/06

GRACE NEAL DCR
CROSS SECTIONS

JOB NUMBER	947-05TM
SHEET	OF
2	7



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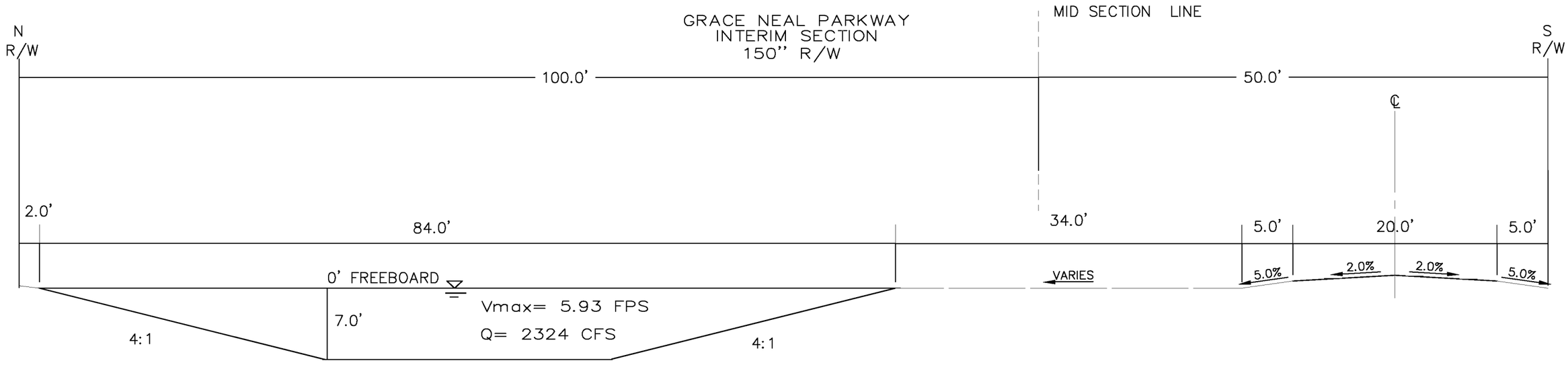


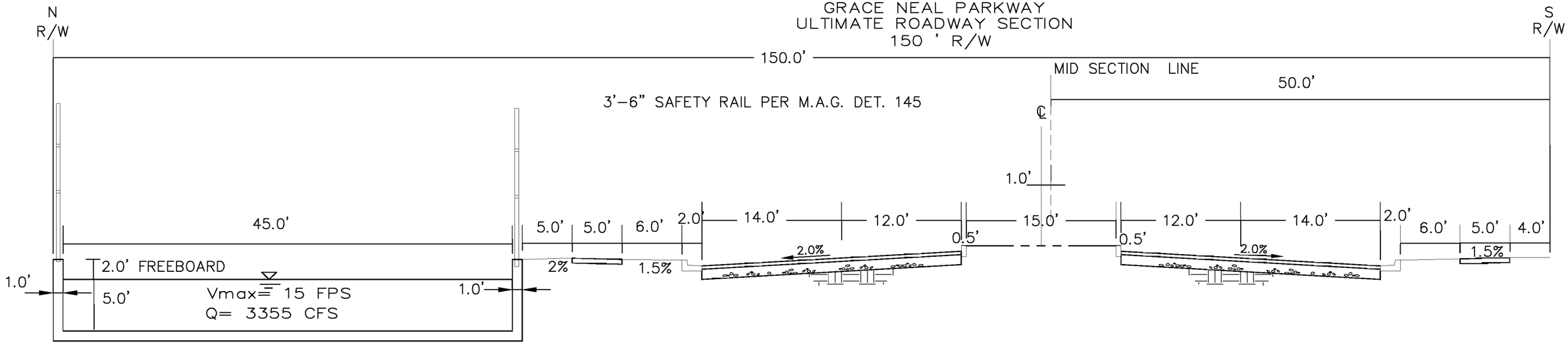
FROM STA. 117+50 TO 167+00

BROOKS ENGINEERS & SURVEYORS INC.		BY	DATE
4602 E. ELWOOD STREET, #16 Phoenix, Arizona 85040 Phone (602) 437-3733 Fax (480) 858-0204	DESIGNED	VRR	12/20/06
	DRAWN	VRR	12/20/06

GRACE NEAL DCR
CROSS SECTIONS

JOB NUMBER	947-05TM
SHEET	OF
3	7

GRACE NEAL PARKWAY
ULTIMATE ROADWAY SECTION
150 ' R/W



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INTERIM SECTION
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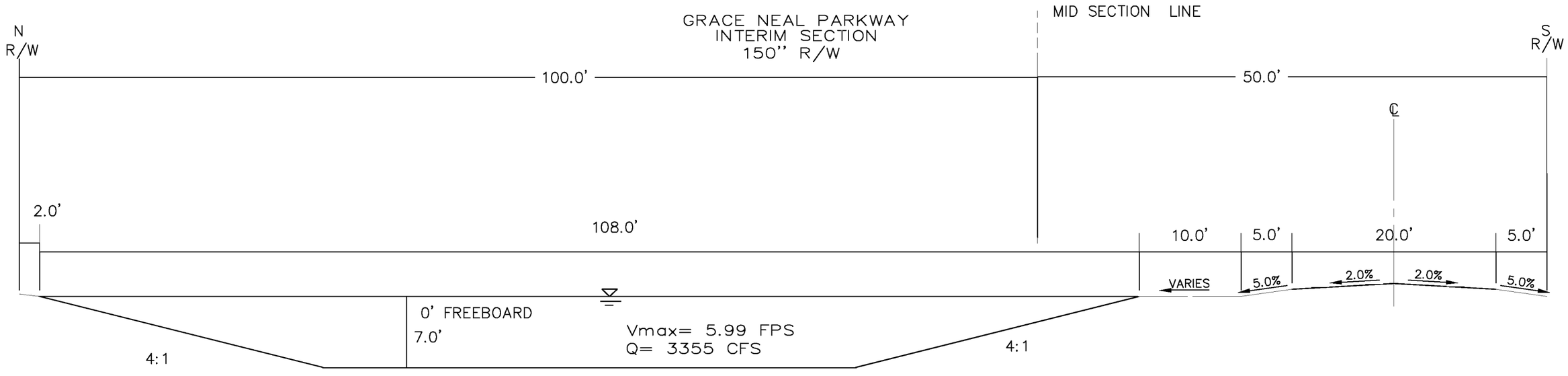

FROM STA. 167+00 TO 219+50

BROOKS ENGINEERS & SURVEYORS INC.
4602 E. ELWOOD STREET, #19
Phoenix, Arizona 85040
Phone (602) 437-3733
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	BY	DATE
DESIGNED	VRR	12/20/06
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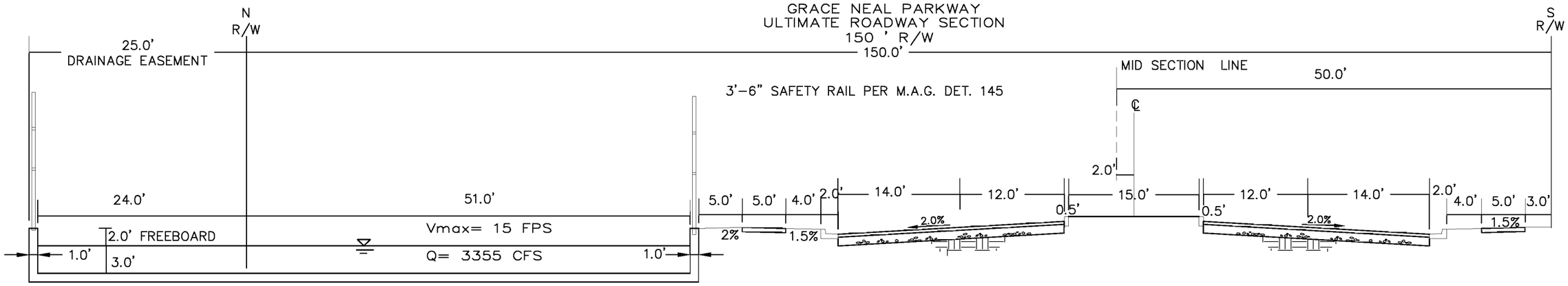
GRACE NEAL DCR
CROSS SECTIONS

JOB NUMBER	947-05TM
SHEET	OF
4	7



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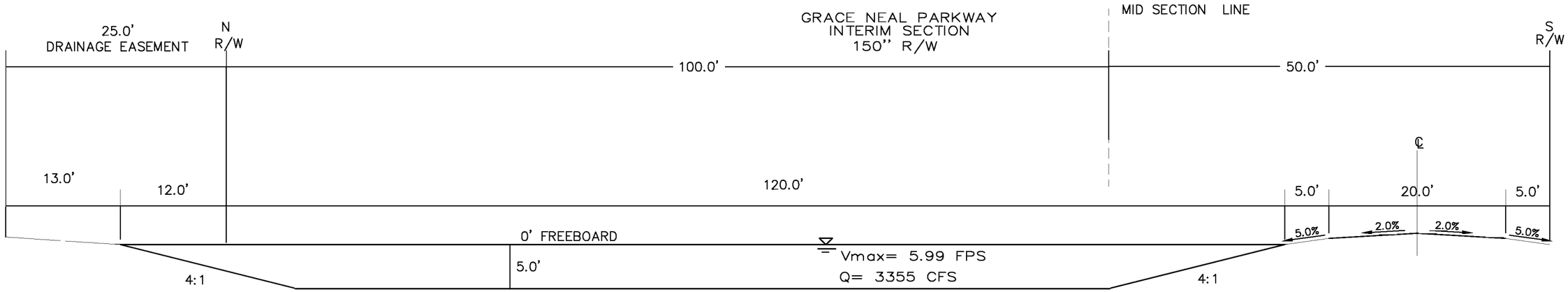

TRANSITION FROM STA. 219+50 TO 227+00 (MOHAVE WASH)

BROOKS ENGINEERS & SURVEYORS INC.
4602 E. ELWOOD STREET, #16
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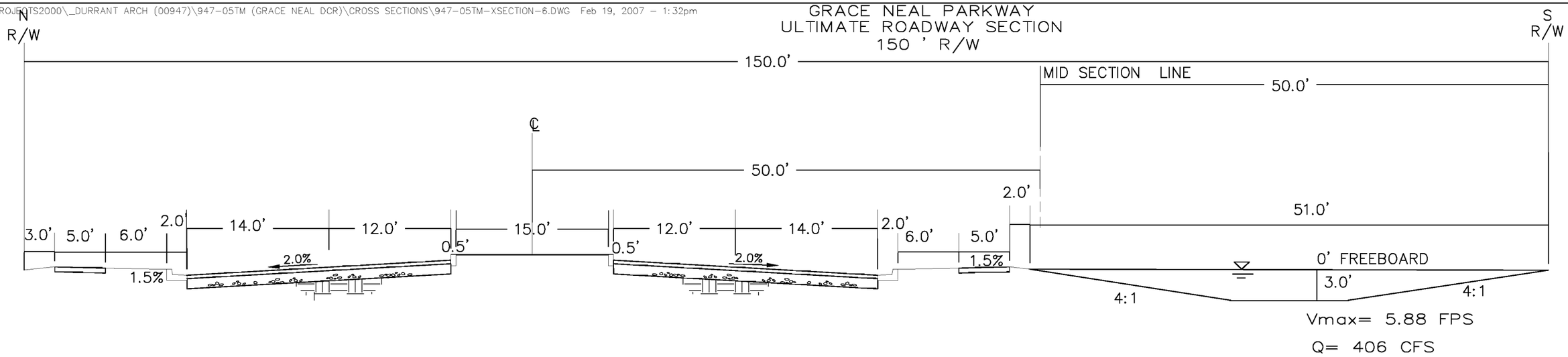
	BY	DATE
DESIGNED	VRR	12/20/06
DRAWN	VRR	12/20/06

GRACE NEAL DCR
CROSS SECTIONS

JOB NUMBER	947-05TM
SHEET	OF
5	7

GRACE NEAL PARKWAY
ULTIMATE ROADWAY SECTION
150 ' R/W



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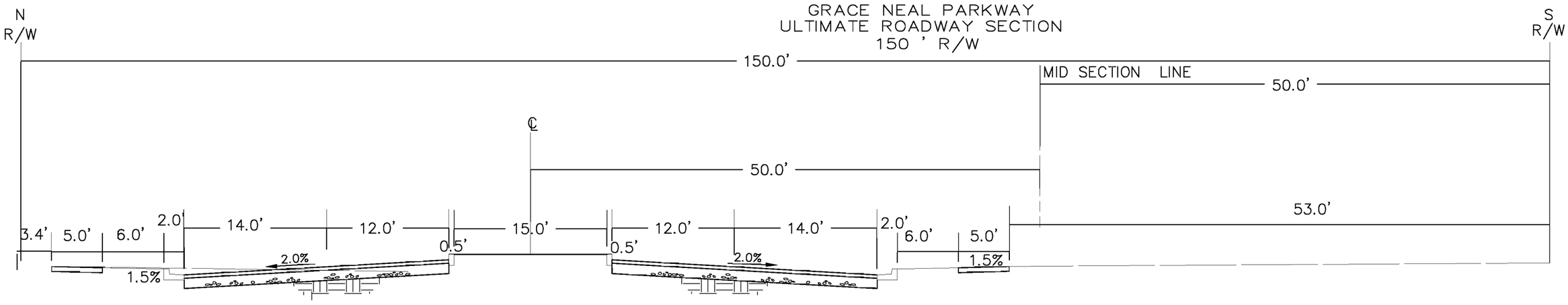

FROM STA. 245+00 TO 277+63.96

BROOKS ENGINEERS & SURVEYORS INC.
4602 E. ELWOOD STREET, #16
Phoenix, Arizona 85040
Phone (602) 437-3733
Fax (480) 858-0204

	BY	DATE
DESIGNED	VRR	12/20/06
DRAWN	VRR	12/20/06

GRACE NEAL DCR
CROSS SECTIONS

JOB NUMBER	947-05TM
SHEET	OF
6	7

BANK STREET SECTION
NORTHERN AVE TO GRACE NEAL PARKWAY
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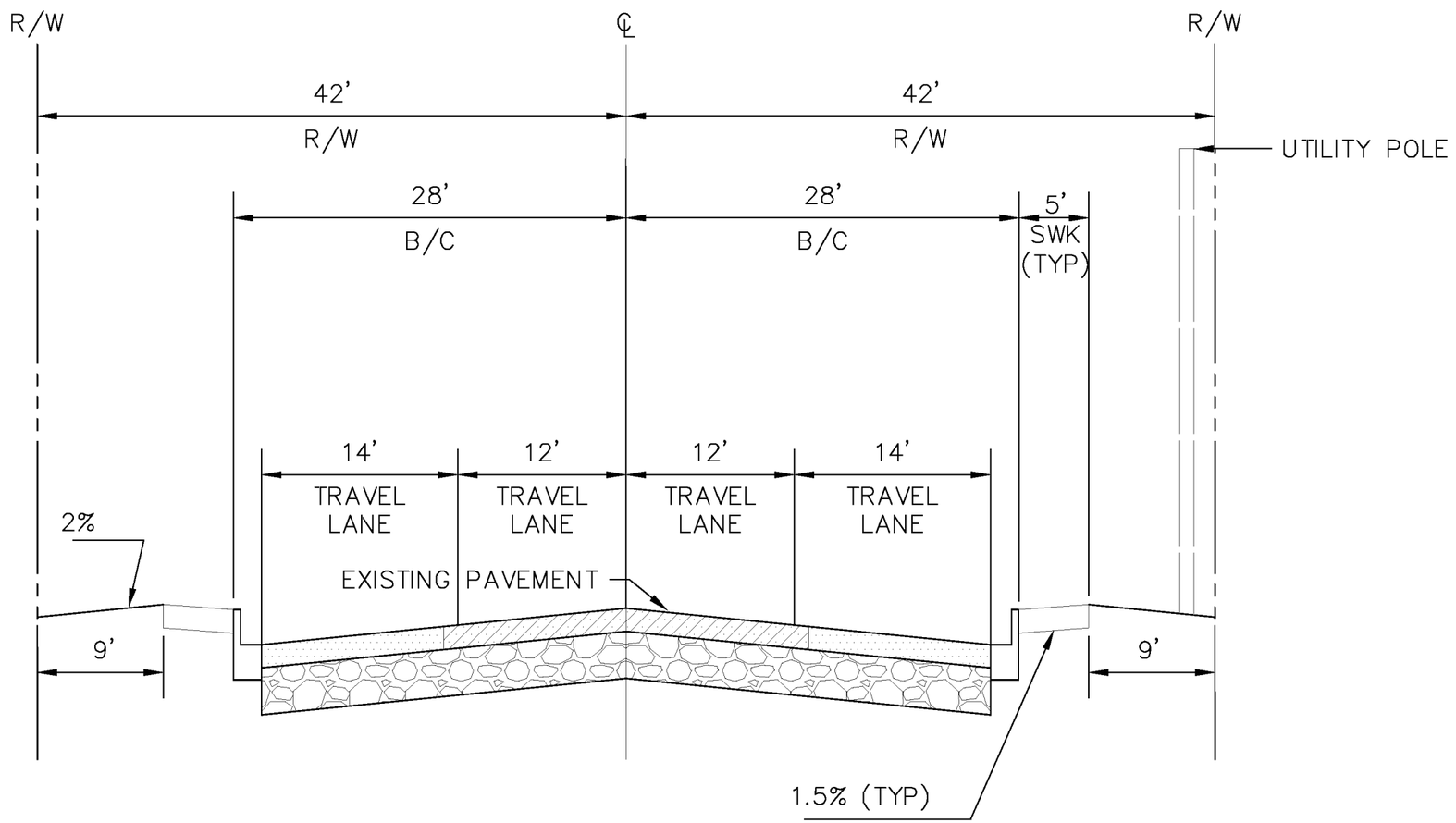

BROOKS ENGINEERS & SURVEYORS INC.
4602 E. ELWOOD STREET, #19
Phoenix, Arizona 85040
Phone (602) 437-3733
Fax (480) 858-0204

	BY	DATE
DESIGNED	VRR	12/20/06
DRAWN	VRR	12/20/06

GRACE NEAL DCR
CROSS SECTIONS

JOB NUMBER	947-05TM
SHEET 7	OF 7

MOHAVE WASH BRIDGE
CONCEPTUAL
EXHIBIT

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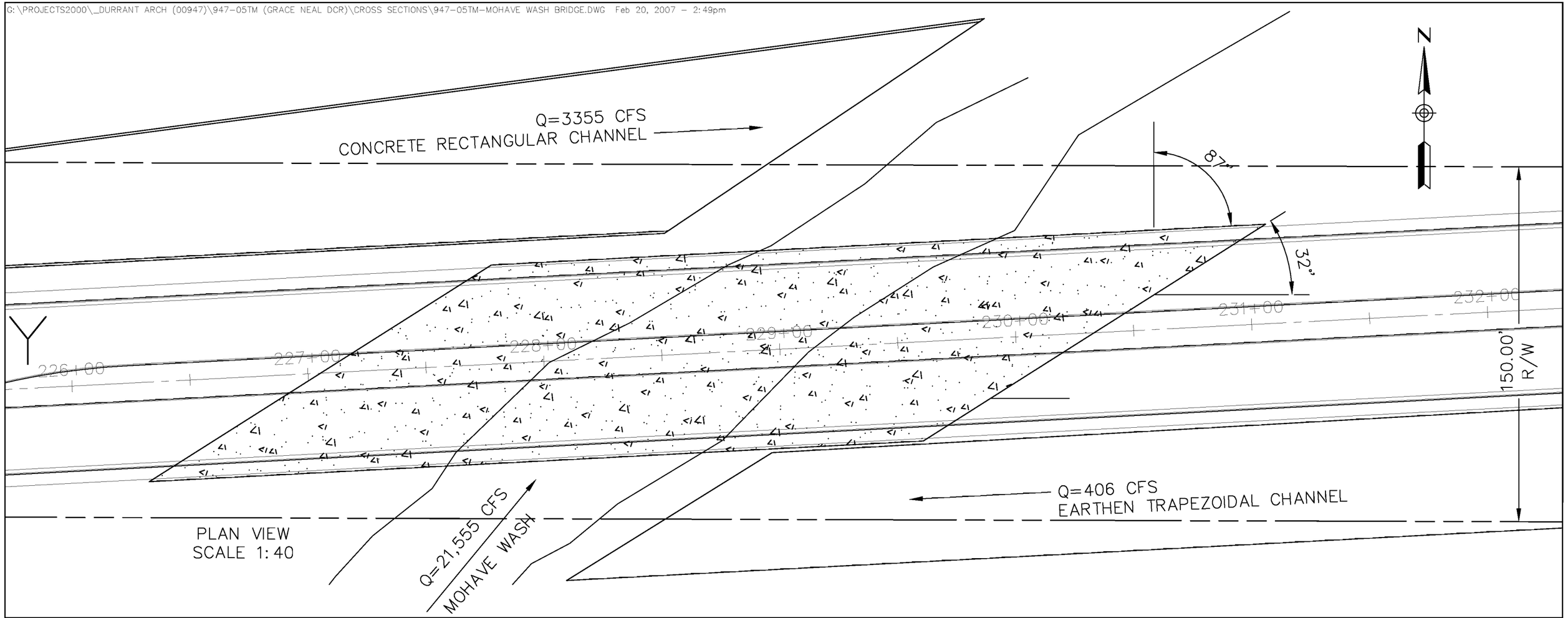

PLAN VIEW
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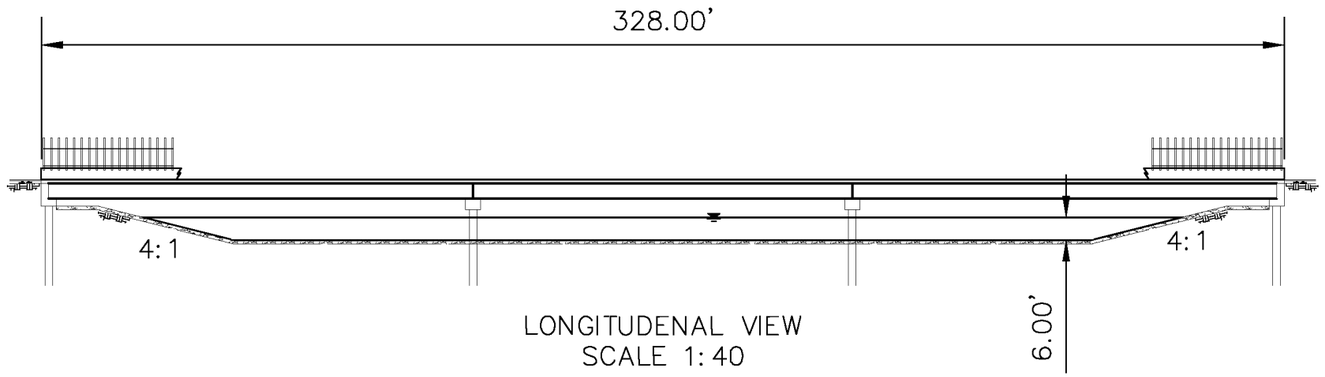
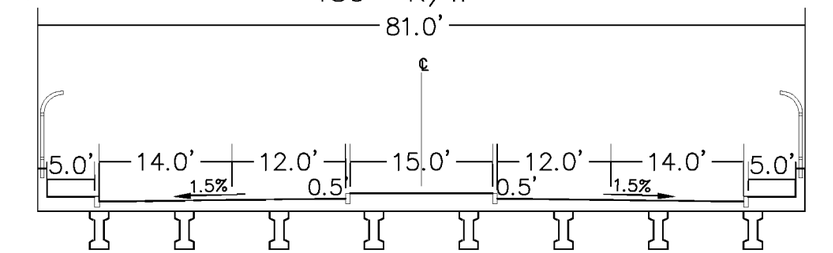


LONGITUDENAL VIEW
SCALE 1:40

GRACE NEAL PARKWAY
ULTIMATE MOHAVE WASH BRIDGE SECTION
150 ' R/W



FROM STA. 227+00 TO 230+30

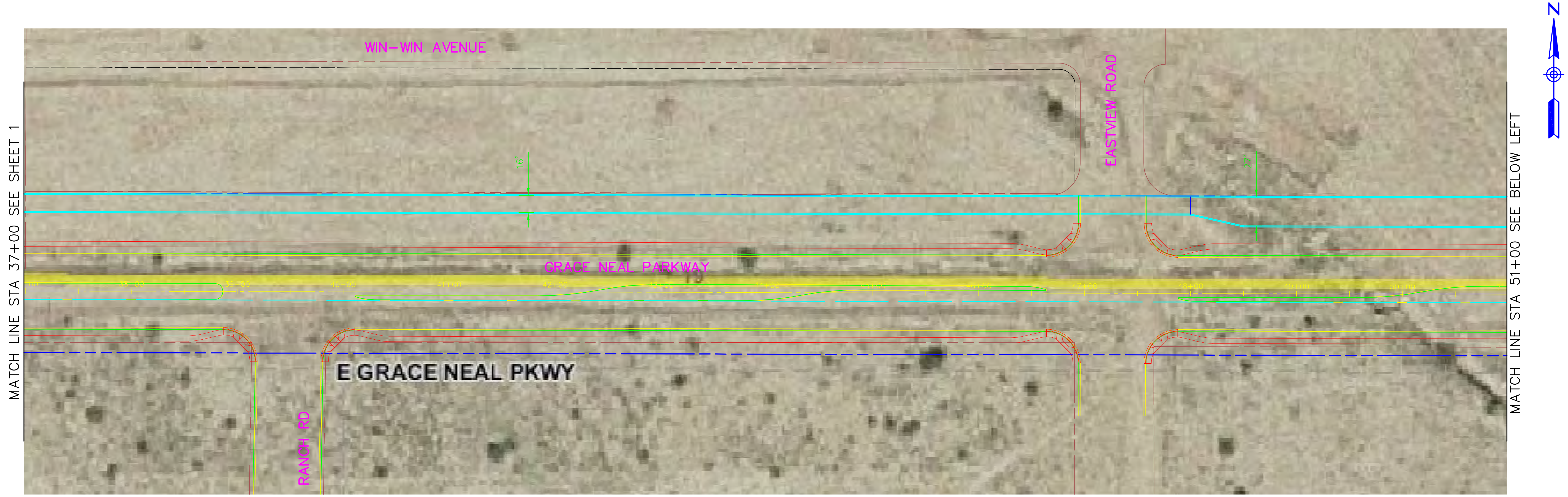
BROOKS ENGINEERS & SURVEYORS INC.		BY	DATE
4602 E. ELWOOD STREET, #16 Phoenix, Arizona 85040 Phone (602) 437-3733 Fax (480) 558-0204	DESIGNED	VRR	1/20/07
	DRAWN	VRR	1/20/07

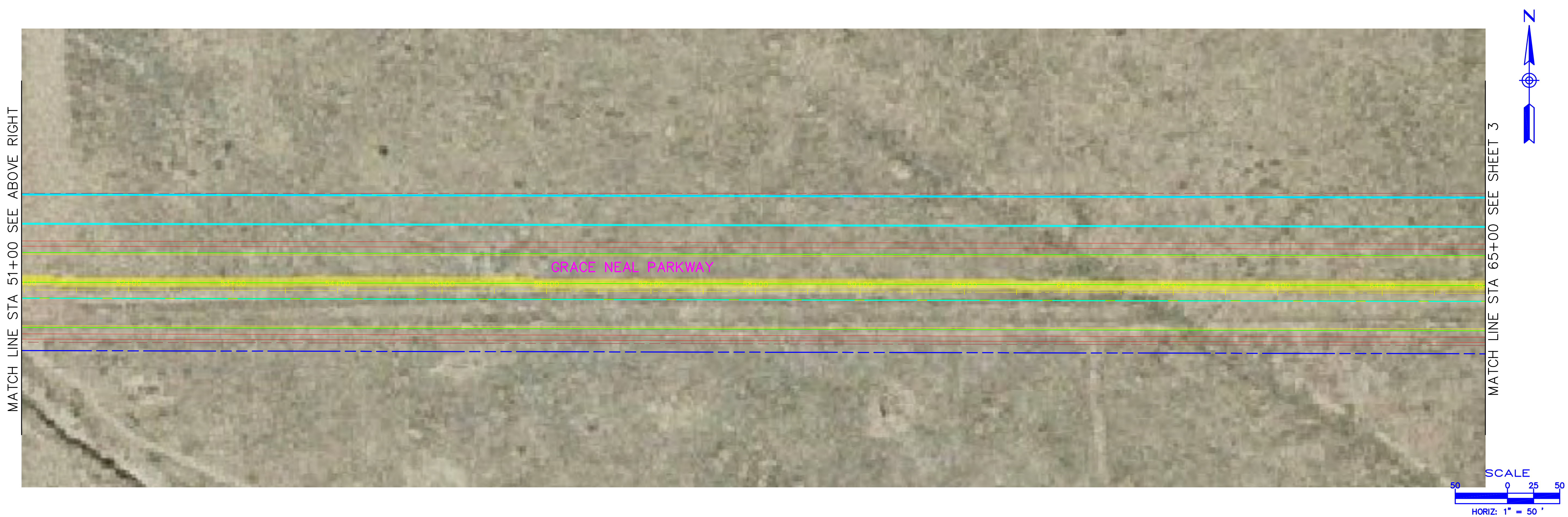
GRACE NEAL DCR
MOHAVE WASH BRIDGE CONCEPTUAL EXHIBIT

JOB NUMBER	947-05TM
SHEET	OF
1	1

PLAN VIEW
ROADWAY LAYOUT
EXHIBITS


E GRACE NEAL PKWY

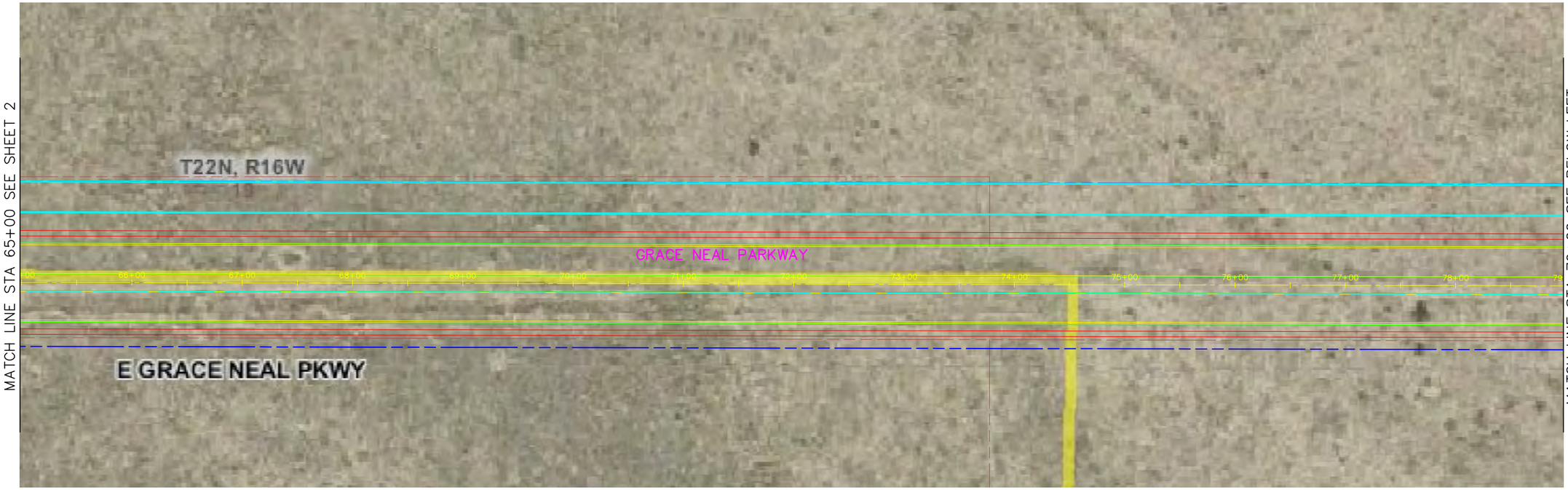


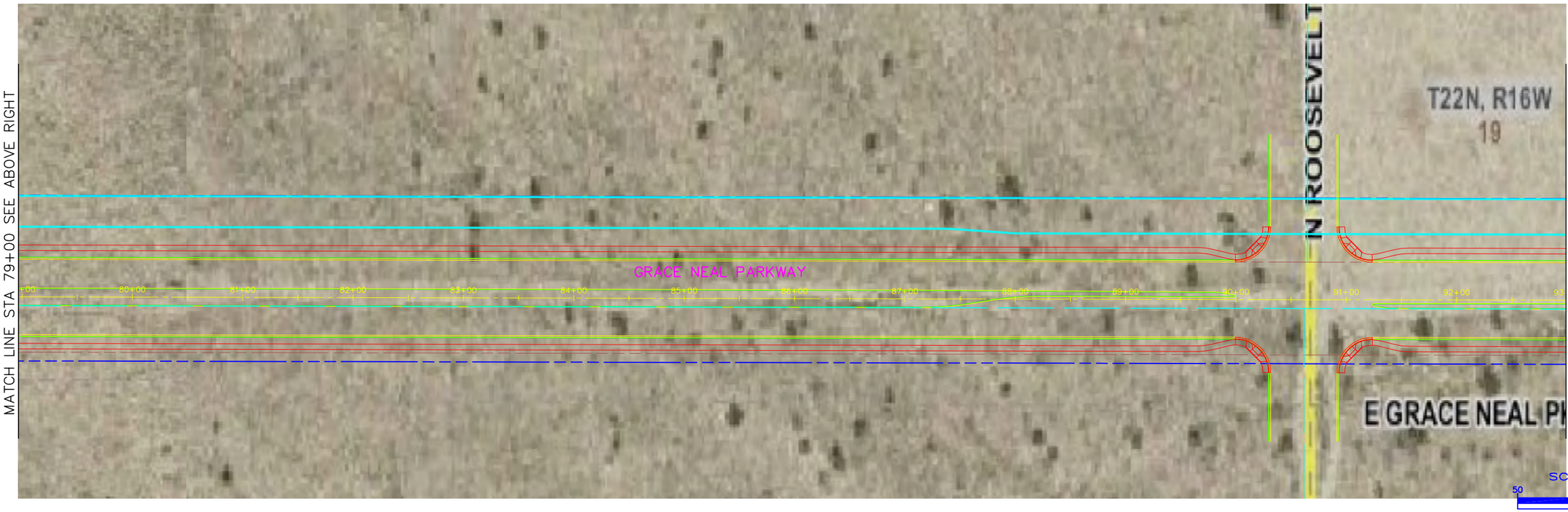


GRACE NEAL PARKWAY LAYOUT EXHIBIT

BROOKS ENGINEERS & SURVEYORS INC.
4602 E. ELWOOD STREET #16
PHOENIX, ARIZONA 85040
(PHONE) (602) 437-3733
(FAX) (480) 858-0204

DESIGNED BY	VR
DRAWN BY	MWL
CHECKED BY	MAS
SCALE (HORIZONTAL)	1"=50'
SCALE (VERTICAL)	N/A
DATE	10-12-06
JOB NUMBER	947-05TM
SHEET	2 OF 14





GRACE NEAL PARKWAY
LAYOUT EXHIBIT

BROOKS ENGINEERS & SURVEYORS INC.
4602 E. ELWOOD STREET #10
PHOENIX, ARIZONA 85040
(PHONE) (602) 437-0753
(FAX) (480) 858-0304

DESIGNED BY
VR
DRAWN BY
MWL
CHECKED BY
MAS
SCALE (HORIZONTAL)
1"=50'
SCALE (VERTICAL)
N/A
DATE
10-12-06
JOB NUMBER
947-05TM
SHEET
3 OF 14

SCALE
HORIZ: 1" = 50'
50 0 25 50

BROOKS ENGINEERS & SURVEYORS INC.
4000 E. BROOKS, SUITE 116
PRESCOTT VALLEY, ARIZONA 86314
PHONE (928) 458-2728
FAX (928) 458-4064

DESIGNED BY	VR
DRAWN BY	MWL
CHECKED BY	MAS
SCALE (HORIZONTAL)	1"=50'
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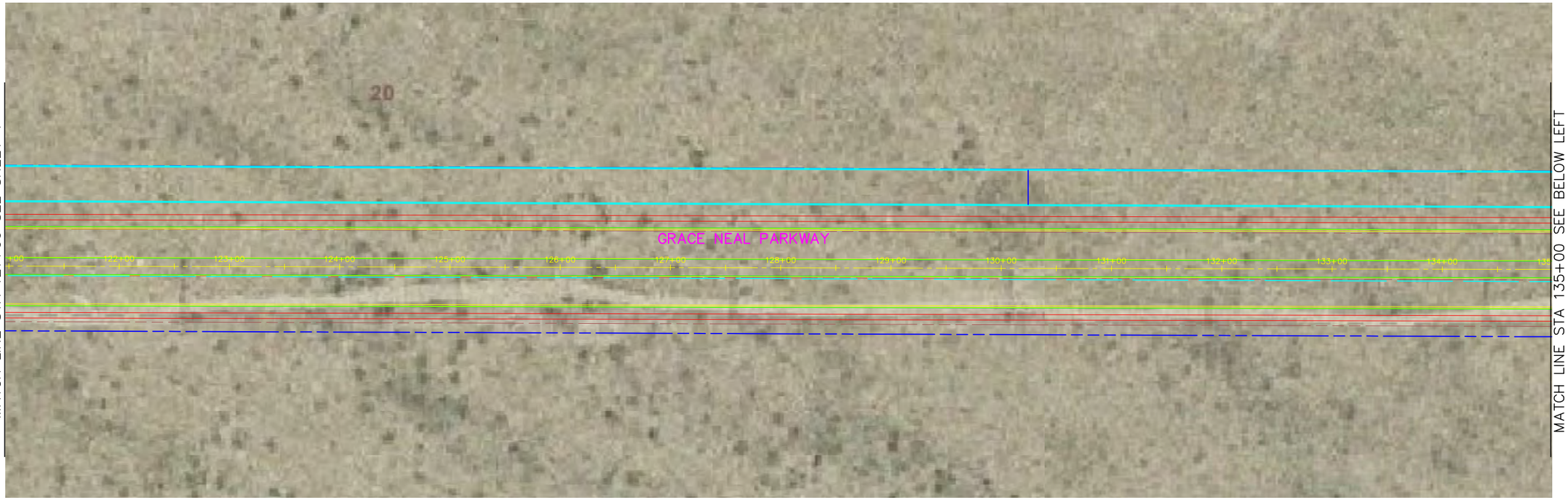
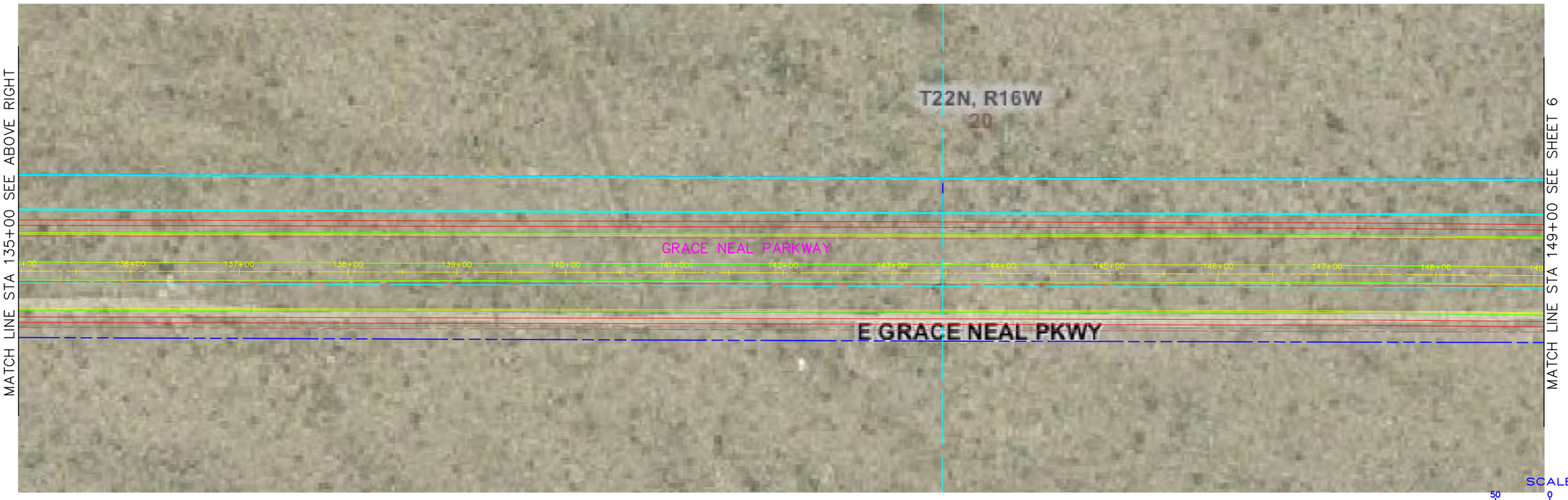
DATE	10-12-06
JOB NUMBER	947-05TM
SHEET	4 OF 14

GRACE NEAL PARKWAY
LAYOUT EXHIBIT





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HORIZ: 1" = 50 '

GRACE NEAL PARKWAY
LAYOUT EXHIBIT

BROOKS ENGINEERS & SURVEYORS INC.
4602 E. ELWOOD STREET #10
PHOENIX, ARIZONA 85040
(PHONE) (602) 437-0753
(FAX) (480) 858-0504

DESIGNED BY
VR
DRAWN BY
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CHECKED BY
MAS
SCALE (HORIZONTAL)
1"=50'
SCALE (VERTICAL)
N/A
DATE
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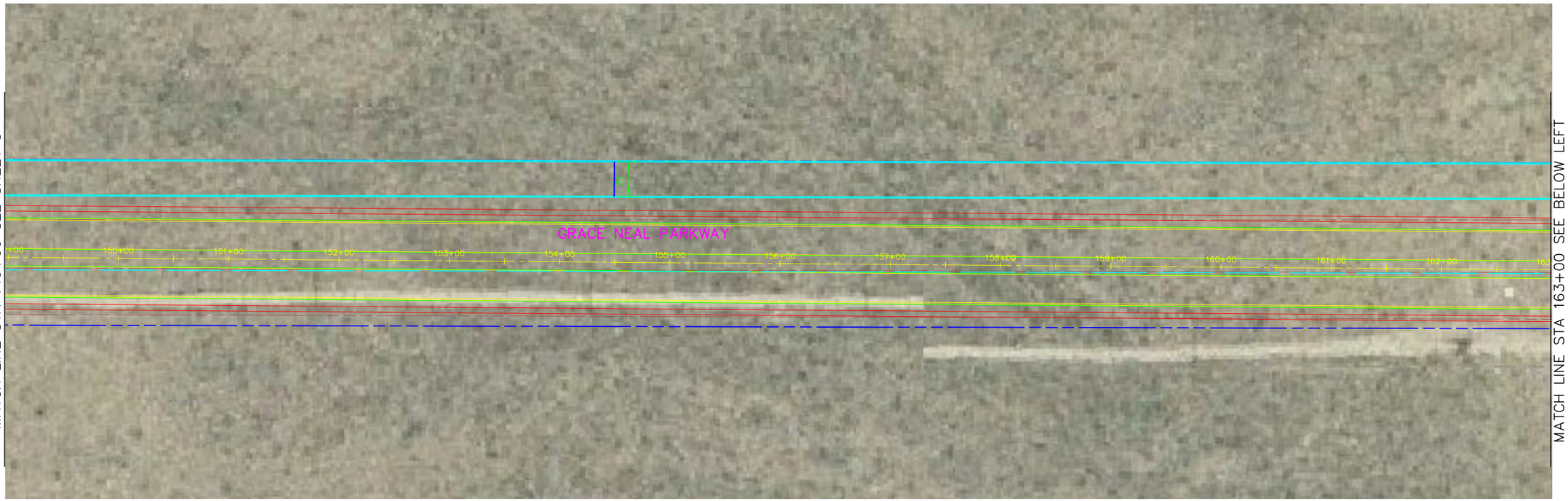
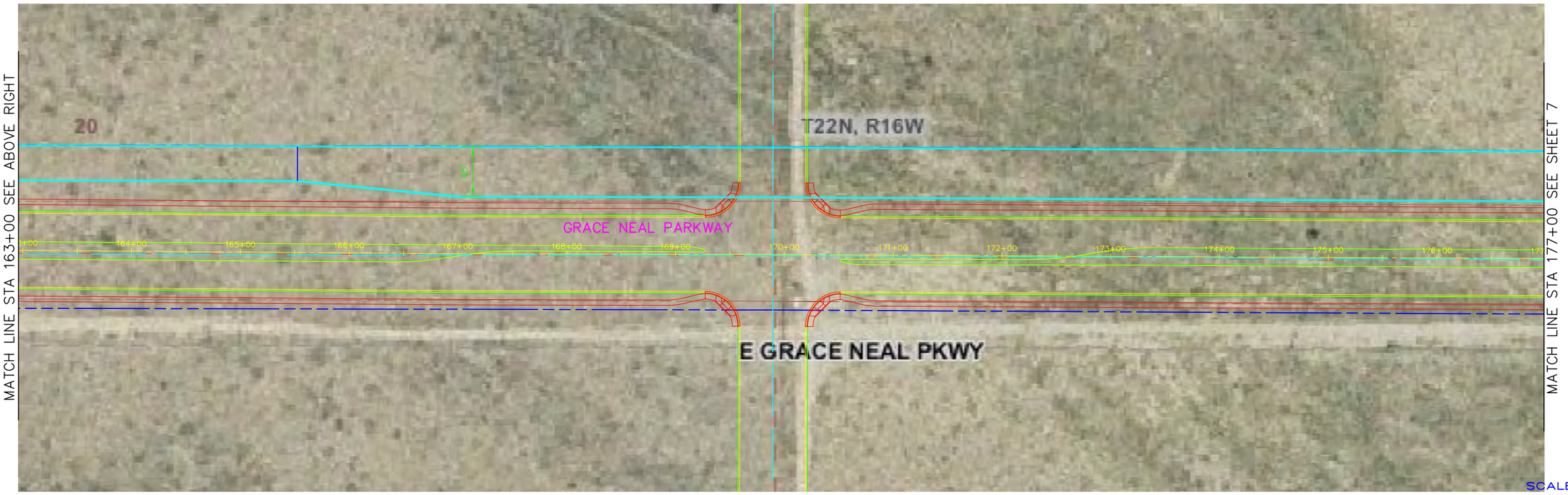
JOB NUMBER
947-05TM
SHEET
5 OF 14





GRACE NEAL PARKWAY
LAYOUT EXHIBIT

BROOKS ENGINEERS & SURVEYORS INC.
4602 E. ELWOOD STREET #10
PHOENIX, ARIZONA 85040
(PHONE) (602) 437-0753
(FAX) (480) 858-0504

DESIGNED BY
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DRAWN BY
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CHECKED BY
MAS
SCALE (HORIZONTAL)
1"=50'
SCALE (VERTICAL)
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DATE
10-12-06
JOB NUMBER
947-05TM
SHEET
6 OF 14

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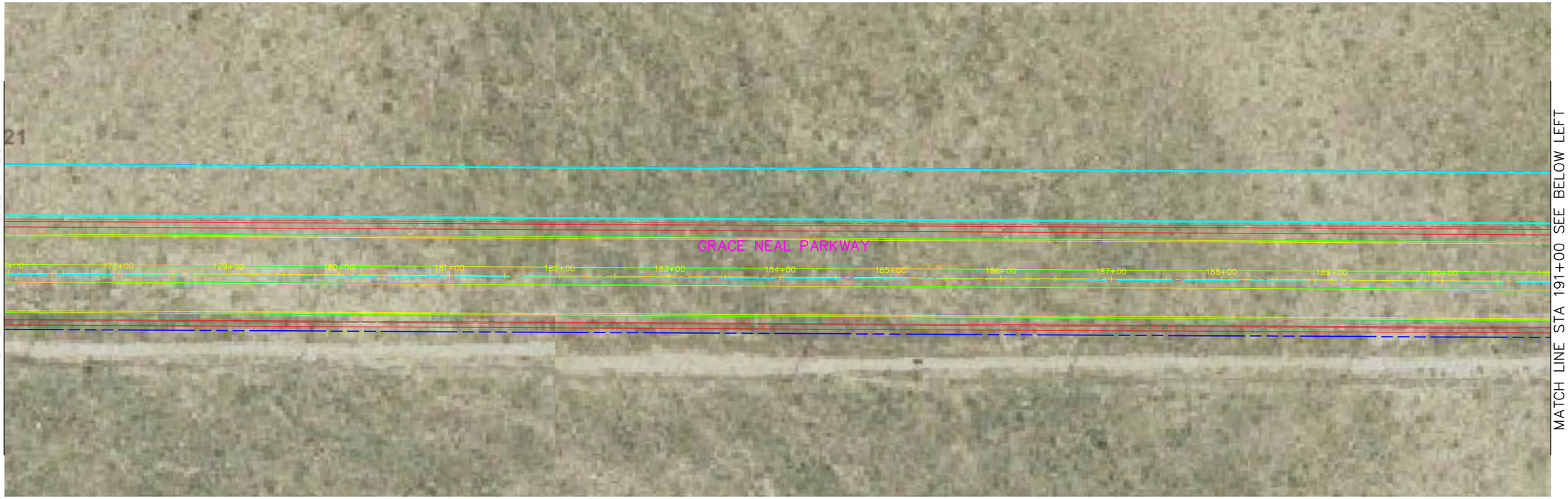

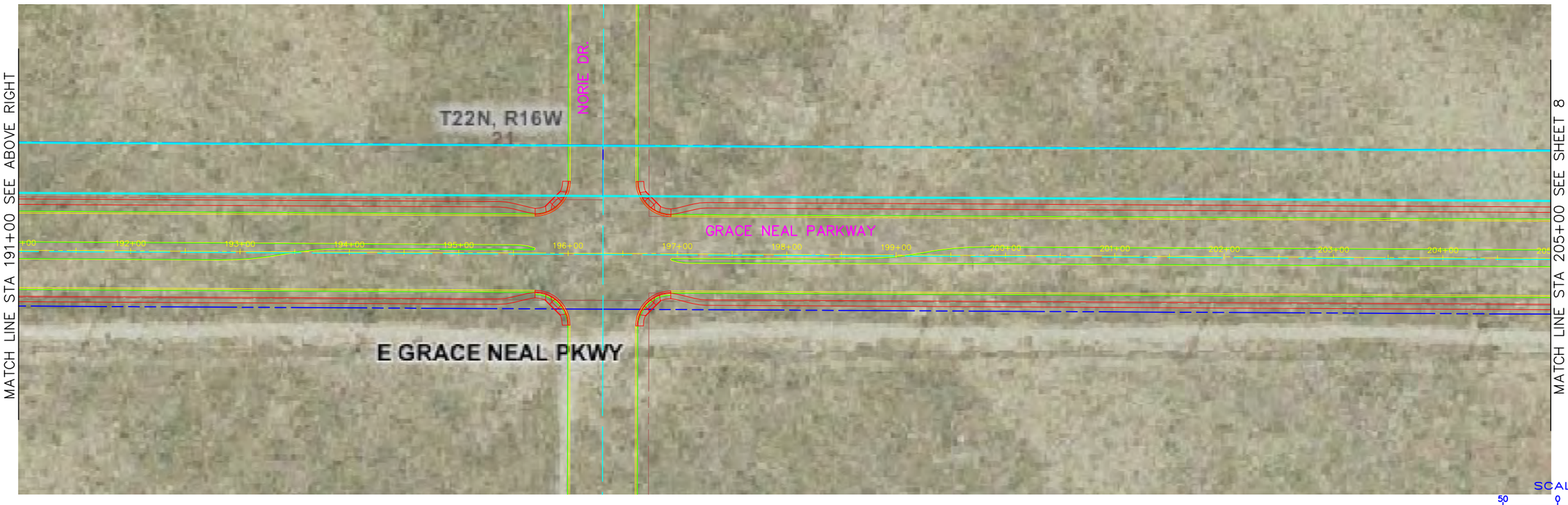

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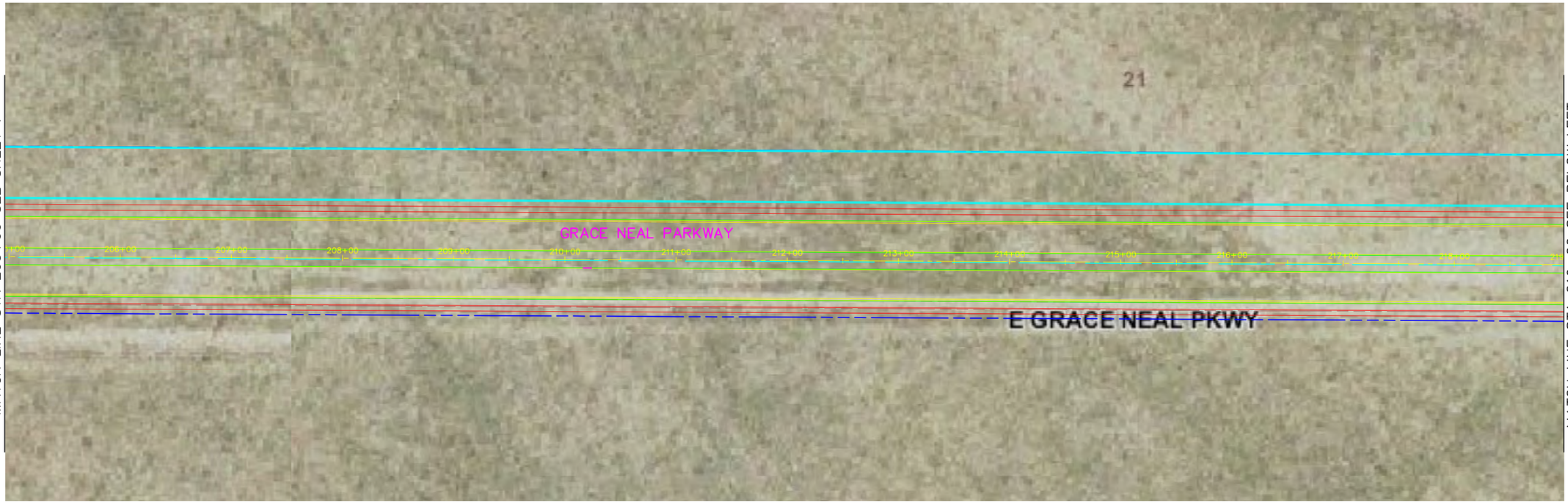
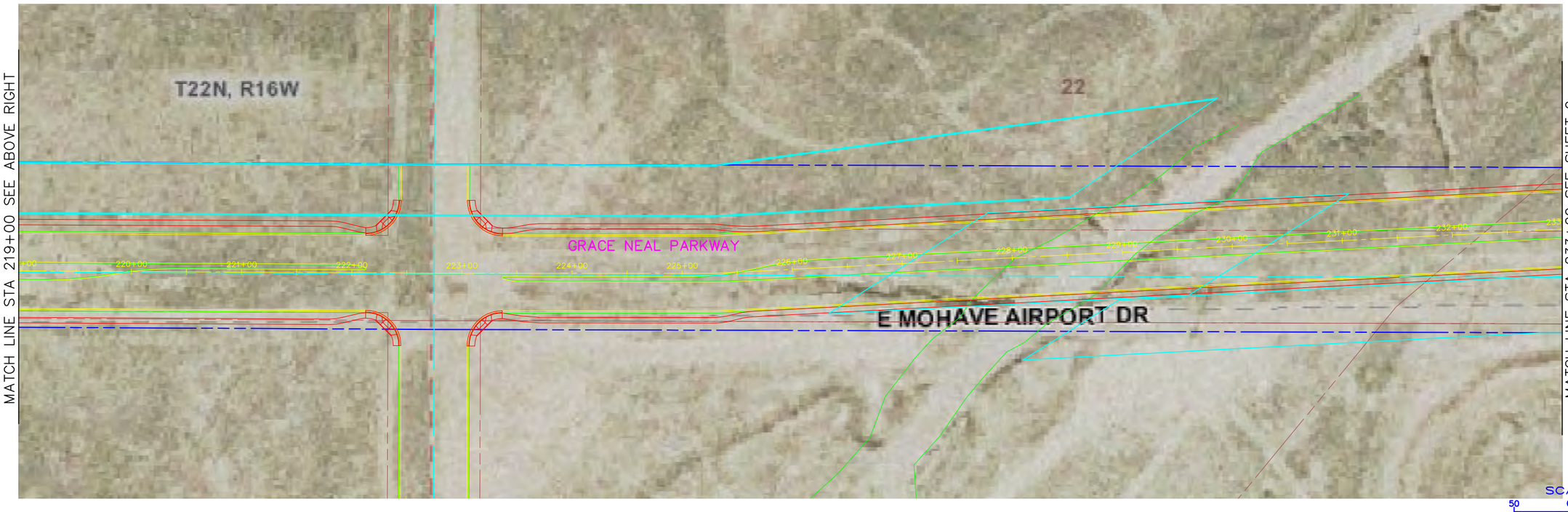
GRACE NEAL PARKWAY
LAYOUT EXHIBIT

BROOKS ENGINEERS & SURVEYORS INC.
4602 E. ELWOOD STREET #10
PHOENIX, ARIZONA 85040
(PHONE) (602) 437-0753
(FAX) (480) 858-0304

DESIGNED BY
VR
DRAWN BY
MWL
CHECKED BY
MAS
SCALE (HORIZONTAL)
1"=50'
SCALE (VERTICAL)
N/A
DATE
10-12-06
JOB NUMBER
947-05TM
SHEET
7 OF 14





SCALE
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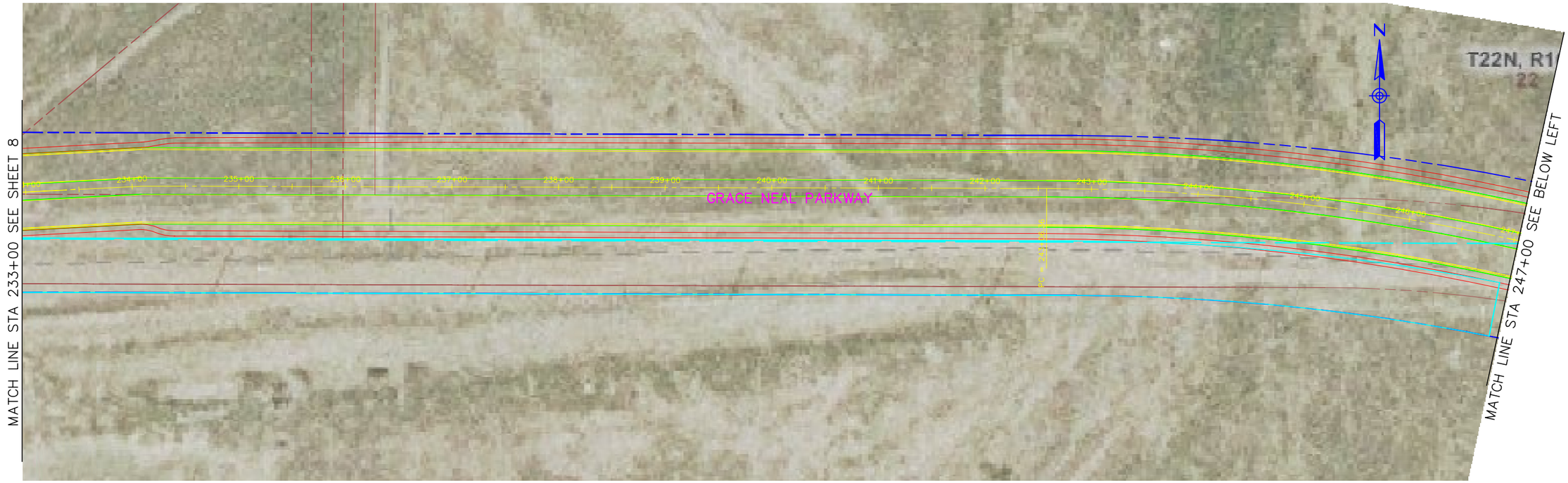
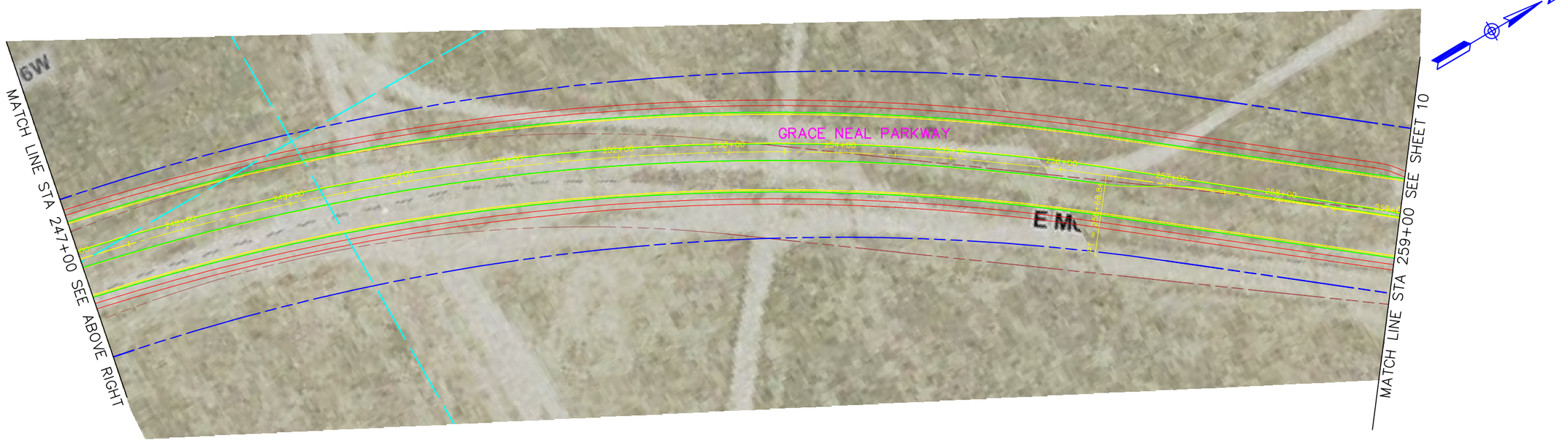
GRACE NEAL PARKWAY
LAYOUT EXHIBIT

BROOKS ENGINEERS & SURVEYORS INC.
4602 E. ELWOOD STREET #10
PHOENIX, ARIZONA 85040
(PHONE) (602) 437-0753
(FAX) (480) 656-0204

DESIGNED BY	VR
DRAWN BY	MWL
CHECKED BY	MAS
SCALE (HORIZONTAL)	1"=50'
SCALE (VERTICAL)	N/A
DATE	10-12-06
JOB NUMBER	947-05TM
SHEET	8 OF 14





SCALE
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HORIZ: 1" = 50 '

GRACE NEAL PARKWAY
LAYOUT EXHIBIT

BROOKS ENGINEERS & SURVEYORS INC.
4602 E. ELWOOD STREET #10
PHOENIX, ARIZONA 85040
(PHONE) (602) 437-0753
(FAX) (480) 656-0304

DESIGNED BY
VR
DRAWN BY
MWL
CHECKED BY
MAS
SCALE (HORIZONTAL)
1"=50'
SCALE (VERTICAL)
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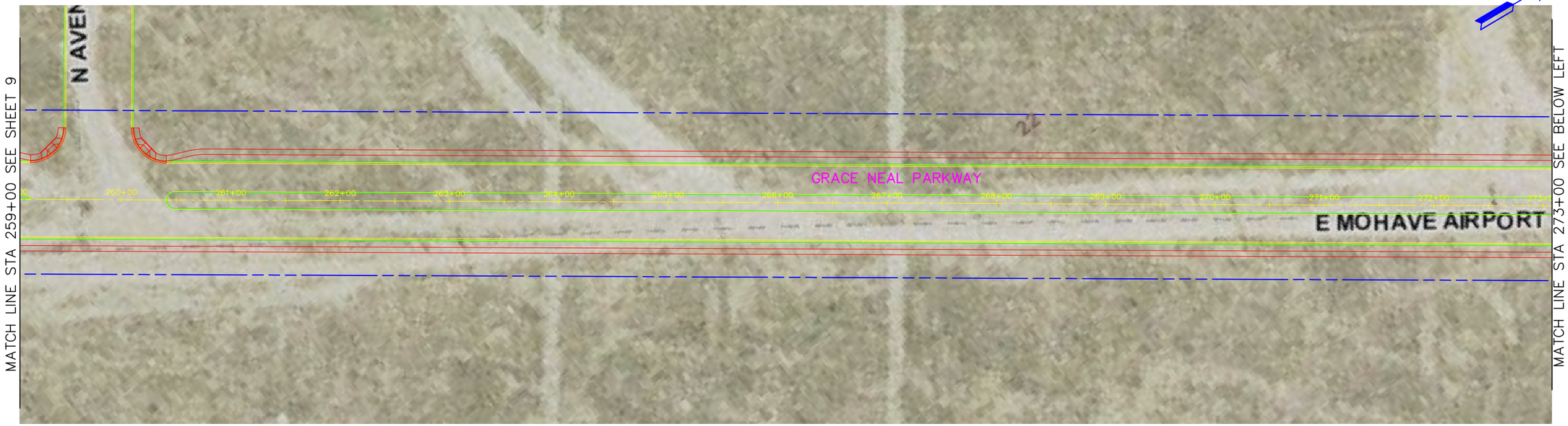
DATE
10-12-06
JOB NUMBER
947-05TM
SHEET
9 OF 14



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GRACE NEAL PARKWAY
LAYOUT EXHIBIT

BROOKS ENGINEERS & SURVEYORS INC.
4602 E. ELWOOD STREET #10
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(PHONE) (602) 437-0753
(FAX) (480) 656-0204

DESIGNED BY
VR
DRAWN BY
MWL
CHECKED BY
MAS
SCALE (HORIZONTAL)
1"=50'
SCALE (VERTICAL)
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DATE
10-12-06
JOB NUMBER
947-05TM
SHEET
10 OF 14

BANKS STREET LAYOUT EXHIBIT

BROOKS ENGINEERS & SURVEYORS INC.
4602 E. ELWOOD STREET #16
PHOENIX, ARIZONA 85040
(PHONE) (602) 437-3733
(FAX) (480) 858-0204

DESIGNED BY	VR
DRAWN BY	MWL
CHECKED BY	MAS
SCALE (HORIZONTAL)	1"=50'
SCALE (VERTICAL)	N/A
DATE	10-12-06
JOB NUMBER	947-05TM
SHEET	11 OF 14

BANKS STREET LAYOUT EXHIBIT

SCALE

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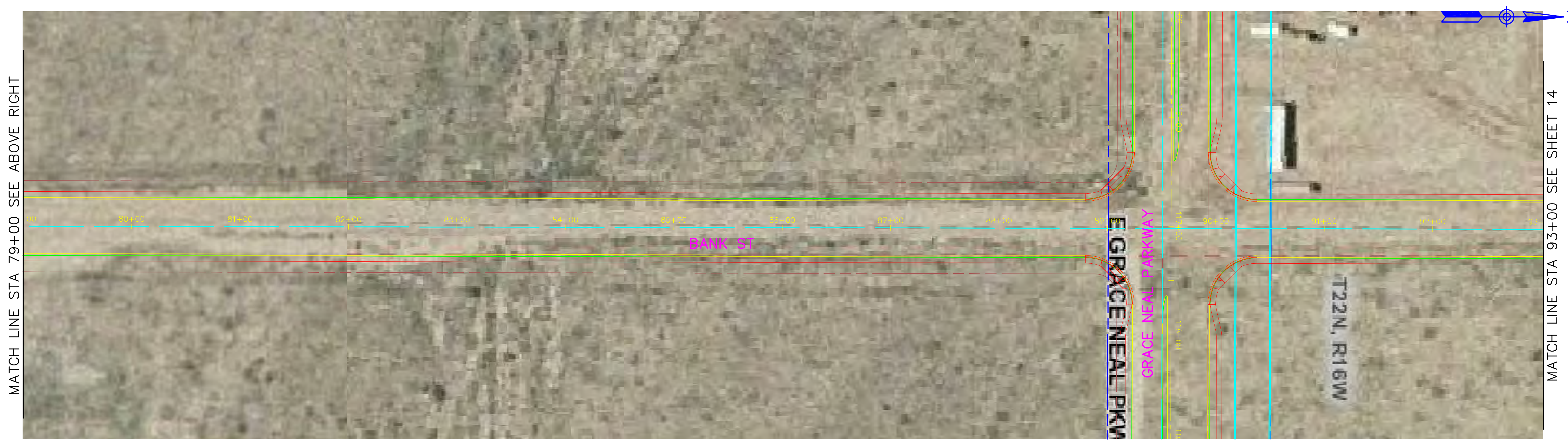
HORIZ: 1" = 50 '

BROOKS ENGINEERS & SURVEYORS INC.

4602 E. ELWOOD STREET #16
PHOENIX, ARIZONA 85040
(PHONE) (602) 437-3733
(FAX) (480) 858-0204

DESIGNED BY	VR
DRAWN BY	MWL
CHECKED BY	MAS
SCALE (HORIZONTAL)	1"=50'
SCALE (VERTICAL)	N/A
DATE	10-12-06
JOB NUMBER	947-05TM
SHEET	12 OF 14



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BANK STREET LAYOUT EXHIBIT

BROOKS ENGINEERS & SURVEYORS INC.

4602 E. ELWOOD STREET #16
PHOENIX, ARIZONA 85040
(PHONE) (602) 437-3733
(FAX) (480) 858-0204

DESIGNED BY VR

DRAWN BY MWL

CHECKED BY MAS

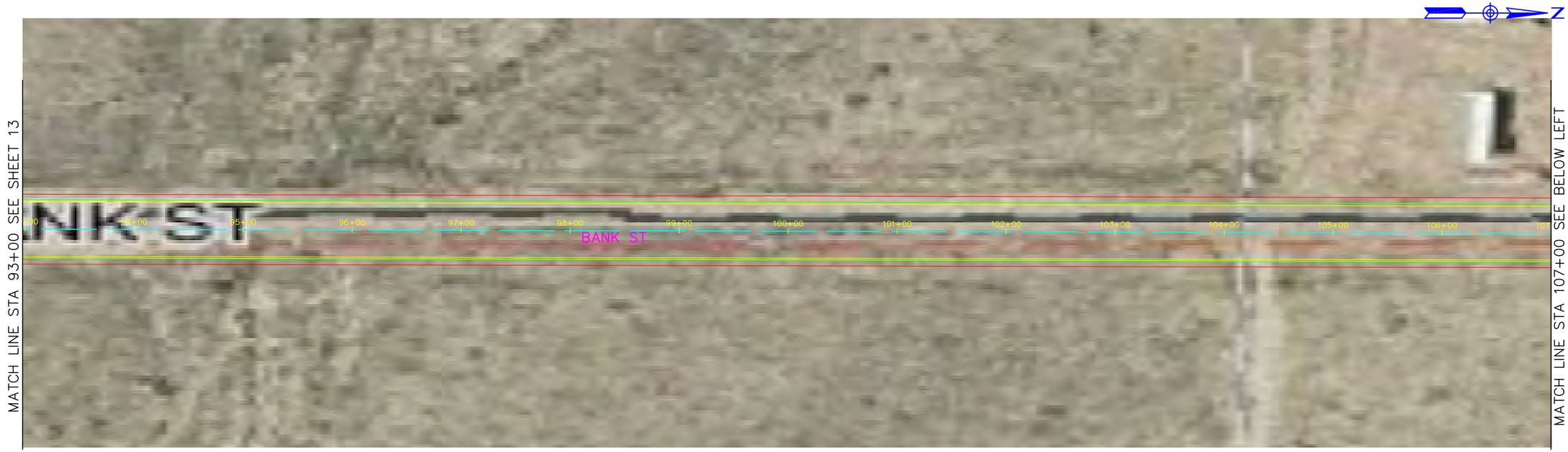
SCALE (HORIZONTAL) 1"=50'

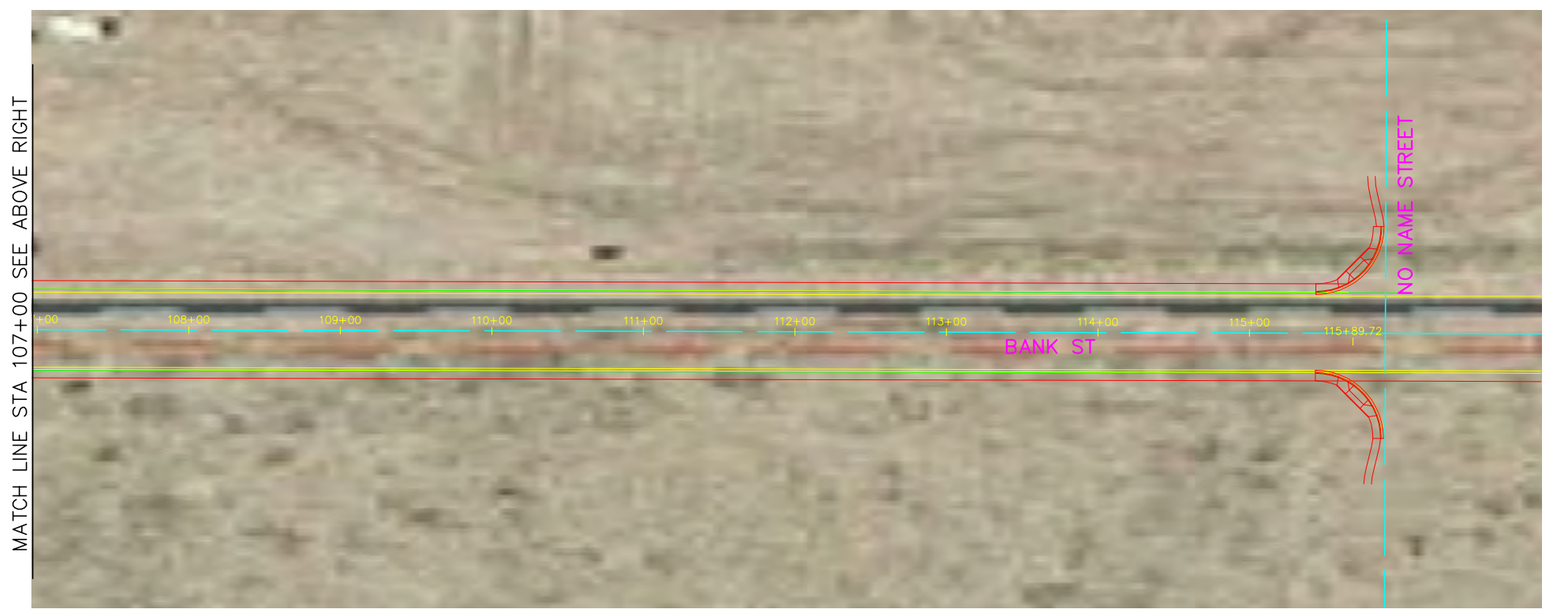
SCALE (VERTICAL) N/A

DATE 10-12-06

JOB NUMBER 947-05TM

SHEET 13 OF 14





SCALE
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BANK STREET
LAYOUT EXHIBIT

BROOKS ENGINEERS & SURVEYORS INC.
4602 E. ELWOOD STREET #10
PHOENIX, ARIZONA 85040
(PHONE) (602) 437-0753
(FAX) (480) 858-0504

DESIGNED BY
VR
DRAWN BY
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MAS
SCALE (HORIZONTAL)
1"=50'
SCALE (VERTICAL)
N/A
DATE
10-12-06
JOB NUMBER
947-05TM
SHEET
14 OF 14

APPENDIX

A1

GRACE NEAL PARKWAY
HYDROLOGY CALCULATIONS

CONCENTRATION POINT	SUBBASIN	PEAK Q (cfs)	TIME TO PEAK (hrs)	CHANNEL TIME (min)
[5392]	5390 (partial)	1137	12.8	(2436'/15fps)/60 = 3 min. Use 4 min(*)
[5514B]	5510 (partial)	1059	13.27	(5444'/15fps)/60 = 6 min Use 8 min(*)
	5530 (all)	365	13.27	(7085'/15fps)/60 = 8 min
[5573]	5570 (all)	1034	13.27	None
[5585]	3260 (partial)	406	12.53	None

Note:
(1) Assume Peak Q in Mohave Wash is the same (Q100=21,555 cfs)
(2) Assume Channel Velocity (Ave) = 15 fps
(3) Assume no attenuation from Channel Routing along Grace Neal Channel
(*) The channel time is rounding up to 4 and 8 min due to the interval of the hydrograph.

CONCENTRATION POINT	SUBBASIN	LENGTH** (ft)	EXISTING SLOPE
[5392]	5390	2436	(3540-3490)/2436 = 0.0205'/FT
[5514B]	5510	5444	(3490-3400)/5444 = 0.0165'/FT
-	5530	7085	(3400-3315)/7085 = 0.0120'/FT
[5573]	5570	5568	(3315-3275)/5568 = 0.0072'/FT
[5585]	3260	N/A	N/A

Note:
(**) Length is measured from Concentration Point (CP) to next CP along Grace Neal Channel.

The Hydrology Calculations are based on the HEC-1 Model of Kingman Area Master Drainage Plan Updated, Mohave County Arizona Dated August 01, 2000

Peak Discharges for 100-year, 24-hour event at key locations along the approximate Grace Neal Alignment

Concentration Point (HEC-1 I.D.)	**100-year Peak Q** (cfs)	**Time to Peak** (hours)
5392	1137	12.87
5392+5514	1964	13.07
5392+5514+5530	2324	13.20
5392+5514+5530+5573	3355	13.33

Notes:
Approximate Gracie-Neal alignment cuts through watershed mapped under original study (Kingman Area Mohave Wash Update).
Hydrographs were cut from HEC-1 output (using the KO card at selected locations) and pasted into Excel (see worksheets below).
Hydrographs were then shifted to account for channel flow times and summed (added) at the correct locations to manually obtain
peak discharges (see Exhibit 2 map and watershed map).

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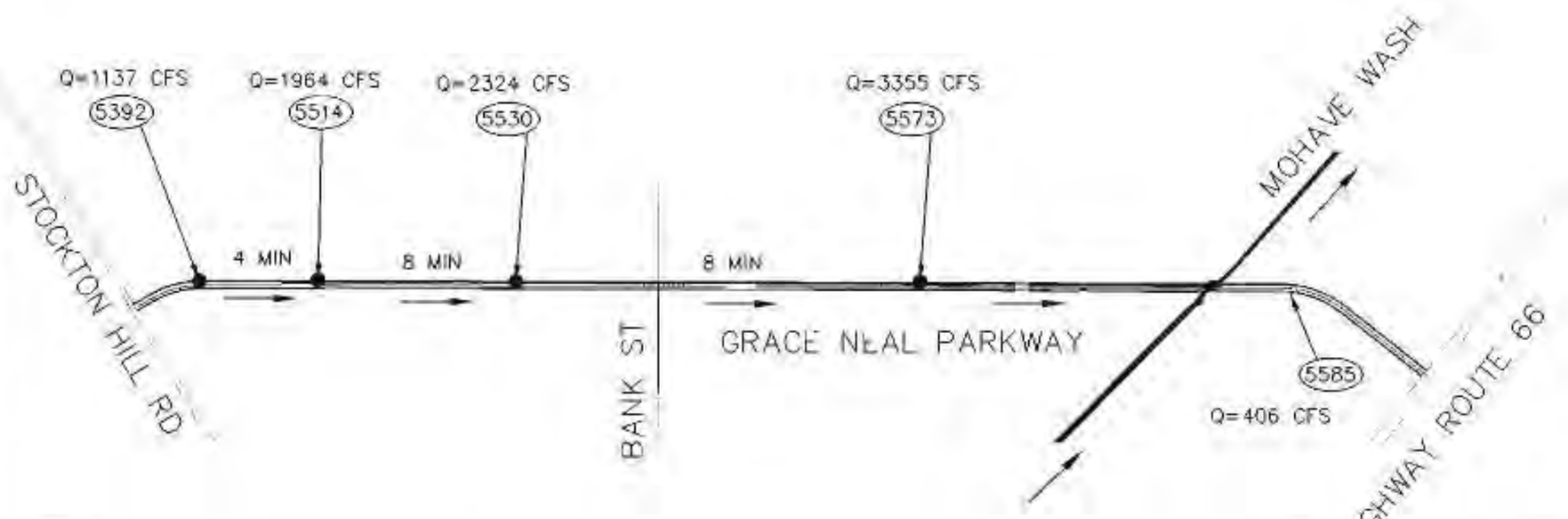
APPENDIX

A2

LEGEND:

(5392) CONCENTRATION POINT



NOTE:

(5392) is located at approximately Sta 24+00

(5514) is located at approximately Sta 48+50

(5530) is located at approximately Sta 88+50

(5573) is located at approximately Sta 170+00

(5585) is located at approximately Sta 245+00

MOHAVE WASH is located at approximately Sta 229+00

BROOKS ENGINEERS & SURVEYORS INC.
4602 E. ELWOOD STREET, #16
Phoenix, Arizona 85040
Phone (602) 437-8733
Fax (480) 948-0904

	BY	DATE
DESIGNED	JT	9/15/06
DRAWN	JT	9/15/06

GRACE NEAL PARKWAY
LOCATION AND DISCHARGE EXHIBIT

JOB NUMBER	947-05TM
SHEET	OF
1	1

APPENDIX

A3

SUMMARY OF THE CHANNEL DESIGN ALTERNATIVES ALONG GRACE NEAL PARKWAY FROM STOCKTON HILL RD TO MOHAVE WASH

THE EARTHEN TRAPEZOIDAL CHANNEL

LOCATION	Water Depth* (ft)	DISCHARGE (cfs)	VELOCITY (fps)	SIDE SLOPE	BOTTOM WIDTH (ft)	TOP WIDTH (ft)
5392 to 5514	5	1137	5.98	4:1	18	74
5514 to 5530	5	1964	5.95	4:1	46	102
5530 to 5573	5	2324	5.96	4:1	58	114
5573 to Mohave Wash	5	3355	5.99	4:1	92	148
5573 to Mohave Wash	3	3355	5.98	4:1	175	215

THE GROUTED ROCK TRAPEZOIDAL CHANNEL

LOCATION	Water Depth* (ft)	DISCHARGE (cfs)	VELOCITY (fps)	SIDE SLOPE	BOTTOM WIDTH (ft)	TOP WIDTH (ft)
5392 to 5514	5	1137	5.98	3:1	23	65
5514 to 5530	5	1964	5.95	3:1	51	93
5530 to 5573	5	2324	5.96	3:1	63	105
5573 to Mohave Wash	5	3355	5.99	3:1	97	139
5573 to Mohave Wash	3	3355	5.98	3:1	178	208

THE CONCRETE TRAPEZOIDAL CHANNEL

LOCATION	Water Depth* (ft)	DISCHARGE (cfs)	VELOCITY (fps)	SIDE SLOPE	BOTTOM WIDTH (ft)	TOP WIDTH (ft)
5392 to 5514	5	1137	14.21	1:1	11	25
5514 to 5530	5	1964	14.55	1:1	22	36
5530 to 5573	5	2324	14.99	1:1	26	40
5573 to Mohave Wash	5	3355	14.91	1:1	40	54
5573 to Mohave Wash	3	3355	14.91	1:1	72	82

THE CONCRETE RECTANGULAR CHANNEL

LOCATION	Water Depth* (ft)	DISCHARGE (cfs)	VELOCITY (fps)	SIDE SLOPE	BOTTOM WIDTH (ft)	TOP WIDTH (ft)
5392 to 5514	5	1137	14.21	N/A	16	16
5514 to 5530	5	1964	14.55	N/A	27	27
5530 to 5573	5	2324	14.99	N/A	31	31
5573 to Mohave Wash	5	3355	14.91	N/A	45	45
5573 to Mohave Wash	3	3355	14.91	N/A	75	75

Note:
(*) The Channel Depth is equal to the Water Depth+2' freeboard
CP 5392 is located at approximately Sta 24+00
CP 5514B is located at approximately Sta 48+50
CP 5530 is located at approximately Sta 88+50
CP 5573 is located at approximately Sta 170+00

SUMMARY OF THE CHANNEL DESIGN ALTERNATIVES ALONG GRACE NEAL PARKWAY FROM SR 66 TO MOHAVE WASH

THE EARTHEN TRAPEZOIDAL CHANNEL

CHANNEL TYPE	Water Depth* (ft)	DISCHARGE (cfs)	VELOCITY (fps)	SIDE SLOPE	BOTTOM WIDTH (ft)	TOP WIDTH (ft)
Earth Trapezoidal	3	406	5.88	4:1	11	51
Grouted Rock Trapezoidal	3	406	5.88	3:1	14	44
Concrete Trapezoidal	3	406	13.53	1:1	7	17
Concrete Rectangular	3	406	13.53	N/A	10	10

Note:
(*) The Channel Depth is equal to the water depth + 2' freeboard.
The channel is from CP 5585 (approximately Sta 245+00) to Mohave Wash.

SUMMARY OF THE TEMPORARY CHANNEL DESIGN ALTERNATIVES ALONG GRACE NEAL PARKWAY FROM BANK ST TO MOHAVE WASH

THE EARTHEN TRAPEZOIDAL CHANNEL

LOCATION	Water Depth* (ft)	DISCHARGE (cfs)	VELOCITY (fps)	SIDE SLOPE	BOTTOM WIDTH (ft)	TOP WIDTH (ft)
Bank St to 5573	7	2324	5.93	4:1	28	84
5573 to Mohave Wash	7	3355	5.99	4:1	52	108
5573 to Mohave Wash	5	3355	5.99	4:1	92	132

THE GROUTED ROCK TRAPEZOIDAL CHANNEL

LOCATION	Water Depth* (ft)	DISCHARGE (cfs)	VELOCITY (fps)	SIDE SLOPE	BOTTOM WIDTH (ft)	TOP WIDTH (ft)
Bank St to 5573	7	2324	5.93	3:1	35	77
5573 to Mohave Wash	7	3355	5.95	3:1	59	101
5573 to Mohave Wash	5	3355	5.99	3:1	97	127

Note:
(*) The Channel Depth is equal to the Water Depth+0' freeboard
CP 5573 is located at approximately Sta 170+00

APPENDIX

A4

POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

KINGMAN CAA AP, ARIZONA (02-4639) 35.2167 N 114 W 3507 feet

from "Precipitation Frequency Atlas of the United States" NOAA Atlas 14, Volume 1, Version 4
G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M. Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2006

Extracted: Fri Dec 22 2006

Confidence Limits | Seasonality | Location Maps | Other Info. | GIS data | Maps | Help | Docs | U.S. Map

Precipitation Frequency Estimates (inches)

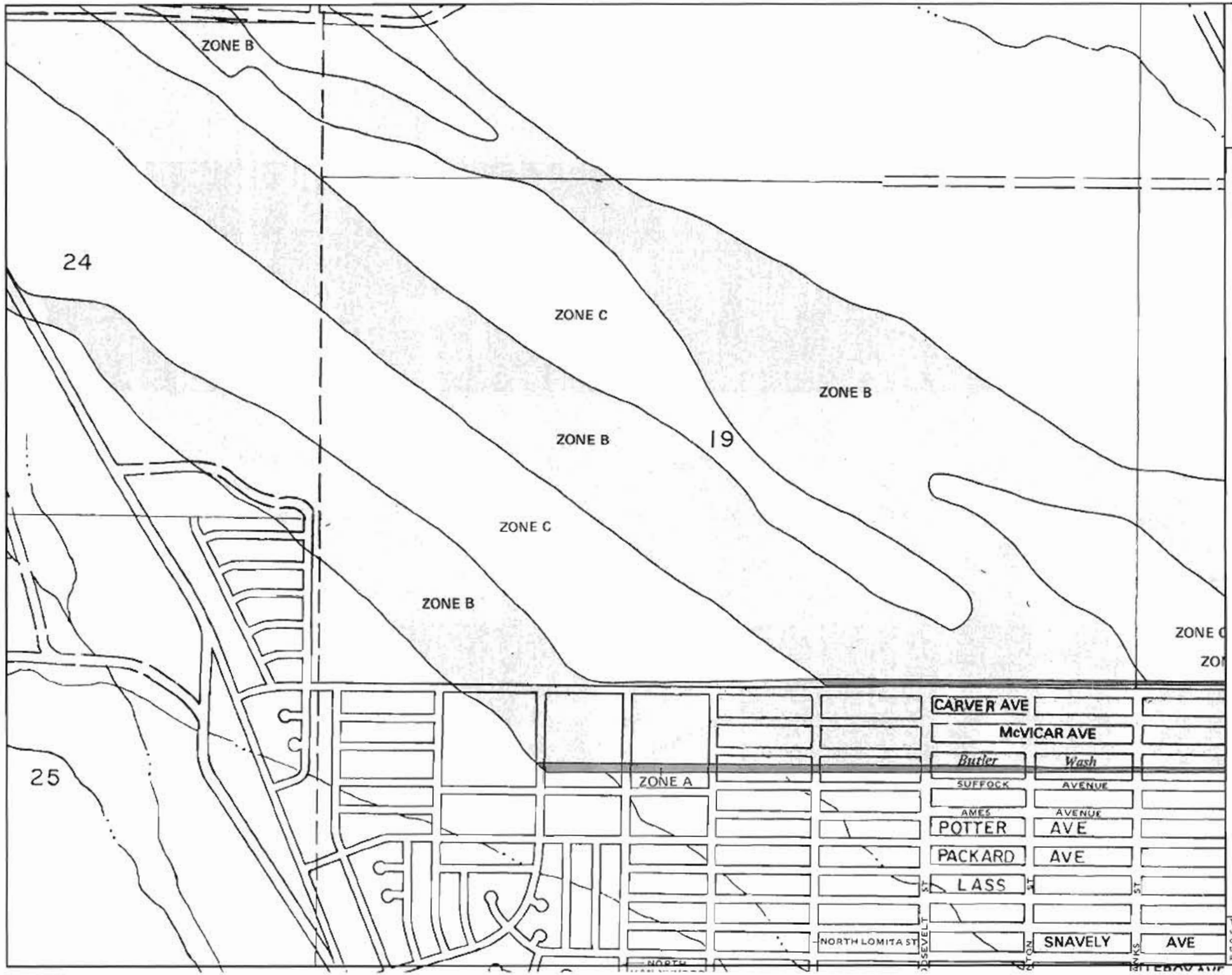
ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.19	0.29	0.36	0.48	0.60	0.66	0.71	0.84	0.98	1.21	1.36	1.56	1.81	1.97	2.43	2.86	3.31	3.69
2	0.25	0.39	0.48	0.64	0.80	0.87	0.93	1.09	1.27	1.58	1.77	2.03	2.37	2.58	3.19	3.79	4.39	4.91
5	0.33	0.54	0.67	0.90	1.12	1.23	1.29	1.50	1.74	2.17	2.41	2.76	3.21	3.53	4.39	5.21	6.12	6.86
10	0.43	0.65	0.81	1.08	1.34	1.50	1.59	1.82	2.12	2.63	2.90	3.32	3.84	4.26	5.29	6.26	7.37	8.28
25	0.52	0.80	0.99	1.33	1.64	1.88	2.01	2.29	2.64	3.27	3.59	4.07	4.71	5.26	6.49	7.64	9.03	10.14
50	0.59	0.90	1.12	1.51	1.87	2.19	2.36	2.67	3.06	3.78	4.13	4.67	5.38	6.04	7.42	8.68	10.30	11.55
100	0.67	1.01	1.26	1.69	2.10	2.51	2.74	3.09	3.51	4.33	4.70	5.30	6.08	6.85	8.38	9.73	11.57	12.97
200	0.74	1.13	1.40	1.88	2.33	2.85	3.15	3.52	3.98	4.90	5.29	5.94	6.79	7.69	9.35	10.78	12.86	14.41
500	0.84	1.27	1.58	2.12	2.63	3.33	3.74	4.18	4.66	5.70	6.12	6.83	7.76	8.86	10.68	12.17	14.58	16.33
1000	0.91	1.39	1.72	2.32	2.87	3.72	4.25	4.72	5.22	6.34	6.77	7.54	8.53	9.78	11.70	13.23	15.89	17.79

Text version of table

* These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.
Please refer to the documentation for more information. NOTE: Estimates near zero to appear as zero.

APPENDIX

A5



APPROXIMATE SCALE
1000 0 1000 FEE

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

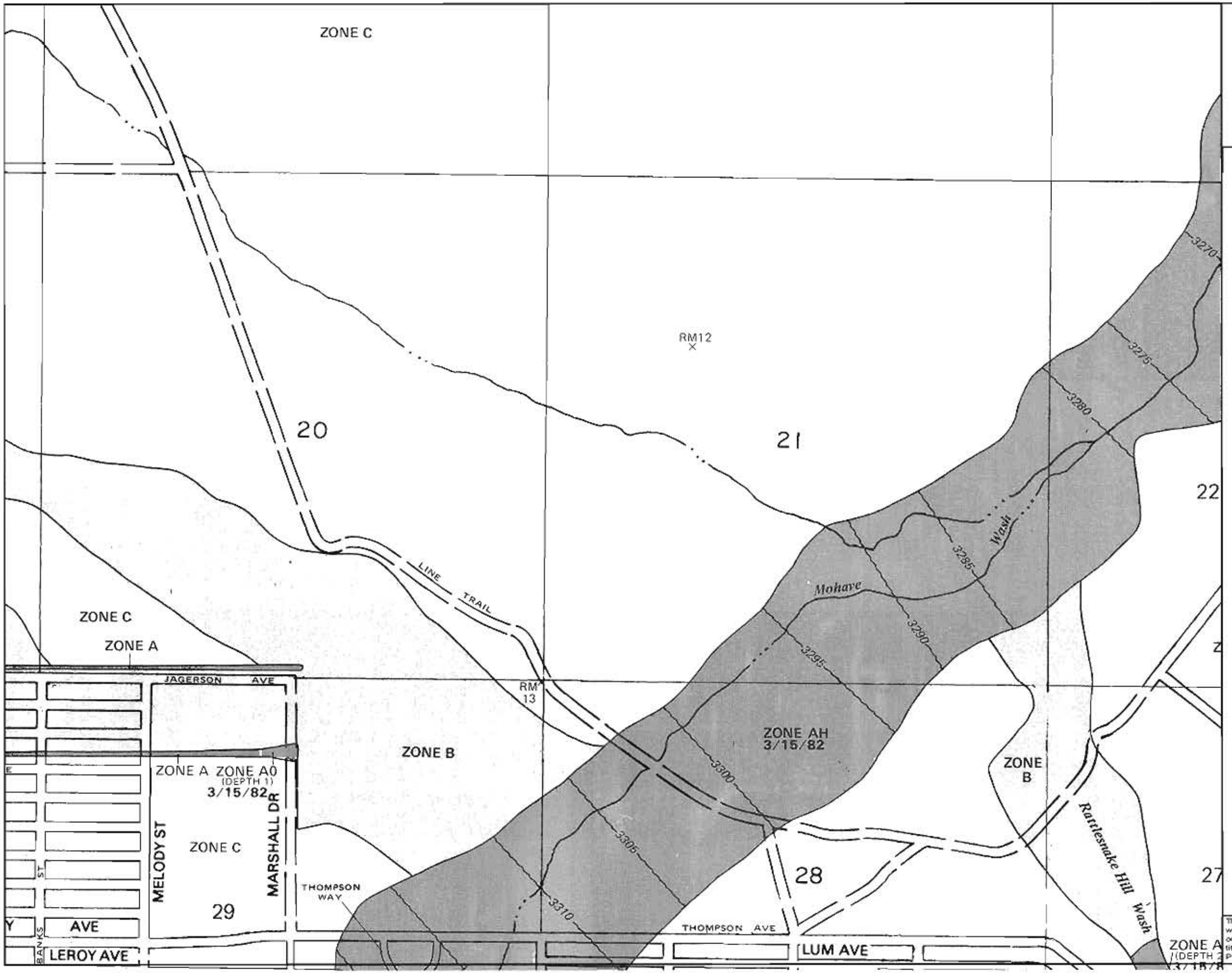
MOHAVE COUNTY, ARIZONA
(UNINCORPORATED AREA)

PANEL 2165 OF 3450
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
040058 2165 C

MAP REVISED:
MARCH 1, 1983

Federal Emergency Management Agency



APPROXIMATE SCALE
1000 0 1000 FEE

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

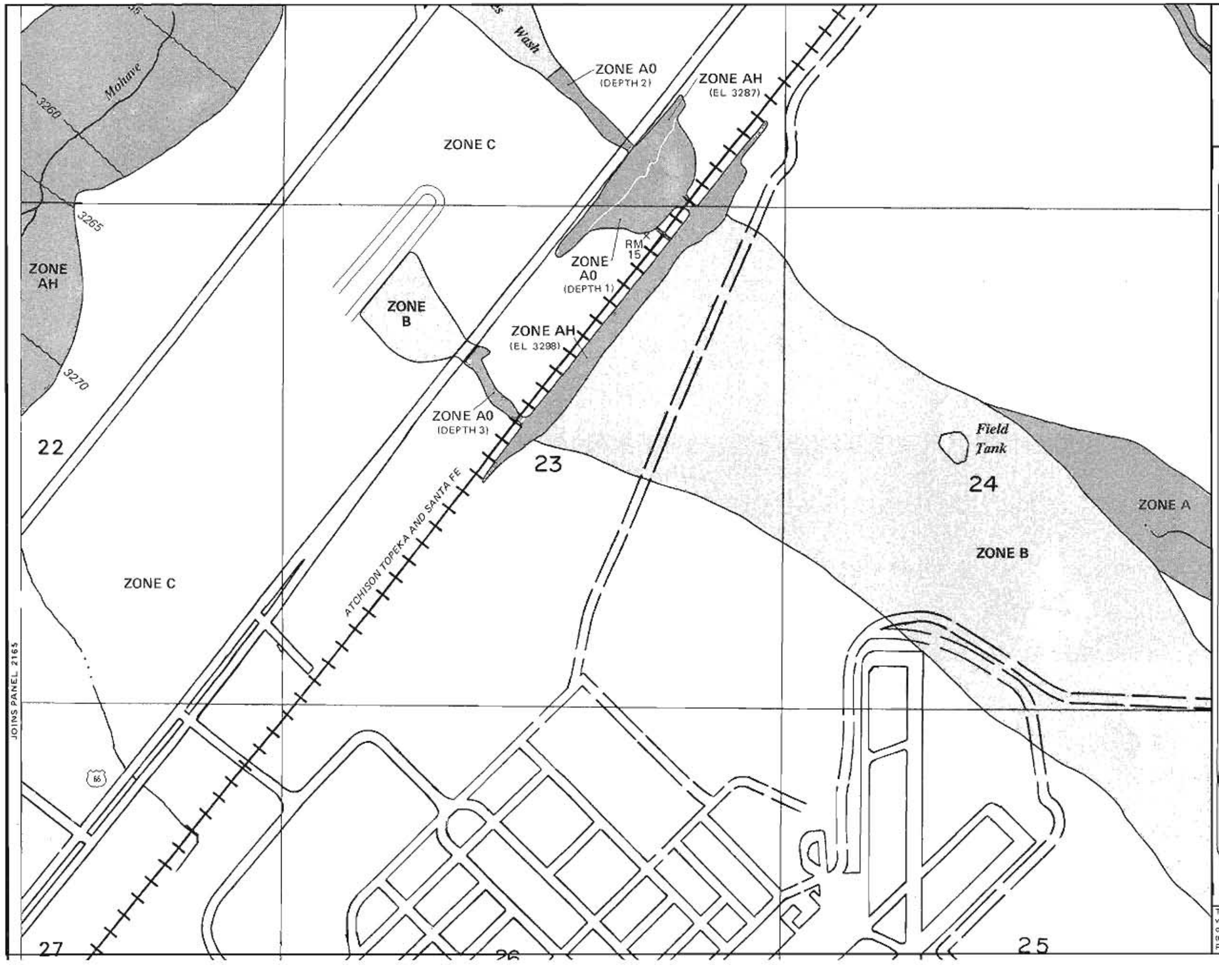
MOHAVE COUNTY, ARIZONA
(UNINCORPORATED AREA)

PANEL 2165 OF 3450
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
040058 2165 C

MAP REVISED:
MARCH 1, 1983

Federal Emergency Management Agency



APPROXIMATE SCALE

1000 0 1000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

MOHAVE COUNTY, ARIZONA

(UNINCORPORATED AREAS)

PANEL 2170 OF 3450

(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
040058 2170 B

EFFECTIVE DATE:
MARCH 15, 1982

Federal Emergency Management Agency

APPENDIX

A6

5514 TO 5530 (CONCRETE RECTANGULAR CHANNEL)
Worksheet for Rectangular Channel

Project Description	
Worksheet	5514 TO 5530 (CONCRETE RECT.
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Slope

Input Data		
Mannings Coeffic	0.013	
Depth	5.00	ft
Bottom Width	27.00	ft
Discharge	964.00	cfs

Results		
Slope	0.002884	ft/ft
Flow Area	135.0	ft²
Wetted Perim	37.00	ft
Top Width	27.00	ft
Critical Depth	5.48	ft
Critical Slope	0.002200	ft/ft
Velocity	14.55	ft/s
Velocity Head	3.29	ft
Specific Ener	8.29	ft
Froude Numb	1.15	
Flow Type	Supercritical	

5392 TO 5514 (CONCRETE RECTANGULAR CHANNEL)
Worksheet for Rectangular Channel

Project Description	
Worksheet	5392 TO 5514 (CONCRETE RECT
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Slope

Input Data		
Mannings Coeffic	0.013	
Depth	5.00	ft
Bottom Width	16.00	ft
Discharge	137.00	cfs

Results		
Slope	0.003455	ft/ft
Flow Area	80.0	ft²
Wetted Perim	26.00	ft
Top Width	16.00	ft
Critical Depth	5.39	ft
Critical Slope	0.002792	ft/ft
Velocity	14.21	ft/s
Velocity Head	3.14	ft
Specific Ener	8.14	ft
Froude Numb	1.12	
Flow Type	Supercritical	

5573 TO MOHAVE WASH (CONCRETE RECTANGULAR CHANNEL)-3' DEPTH
Worksheet for Rectangular Channel

Project Description	
Worksheet	5573 TO MOHAVE WASH (CONCRETE RECT/
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Slope

Input Data		
Mannings Coeffic	0.013	
Depth	3.00	ft
Bottom Width	75.00	ft
Discharge	355.00	cfs

Results		
Slope	0.004358	ft/ft
Flow Area	225.0	ft²
Wetted Perim	81.00	ft
Top Width	75.00	ft
Critical Depth	3.96	ft
Critical Slope	0.001779	ft/ft
Velocity	14.91	ft/s
Velocity Head	3.46	ft
Specific Ener	6.46	ft
Froude Numb	1.52	
Flow Type	Supercritical	

5530 TO 5573 (CONCRETE RECTANGULAR CHANNEL)
Worksheet for Rectangular Channel

Project Description	
Worksheet	5530 TO 5573 (CONCRETE RECT.
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Slope

Input Data		
Mannings Coeffic	0.013	
Depth	5.00	ft
Bottom Width	31.00	ft
Discharge	324.00	cfs

Results		
Slope	0.002922	ft/ft
Flow Area	155.0	ft²
Wetted Perim	41.00	ft
Top Width	31.00	ft
Critical Depth	5.59	ft
Critical Slope	0.002092	ft/ft
Velocity	14.99	ft/s
Velocity Head	3.49	ft
Specific Ener	8.49	ft
Froude Numb	1.16	
Flow Type	supercritical	

5585 TO MOHAVE WASH (CONCRETE RECTANGULAR CHANNEL)-3' DEPTH
Worksheet for Rectangular Channel

Project Description	
Worksheet	5585 TO MOHAVE WASH (CONCRETE RECTA
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Slope

Input Data		
Mannings Coeffic	0.013	
Depth	3 00	ft
Bottom Width	10.00	ft
Discharge	06 00	cfs

Results		
Slope	0 006063	ft/ft
Flow Area	30 0	ft²
Wetted Perim	16 00	ft
Top Width	10 00	ft
Critical Depth	3 71	ft
Critical Slope	0 003335	ft/ft
Velocity	13 53	ft/s
Velocity Head	2 85	ft
Specific Ener	5 85	ft
Froude Numb	1 38	
Flow Type	Supercritical	

5573 TO MOHAVE WASH (CONCRETE RECTANGULAR CHANNEL)-5' DEPTH
Worksheet for Rectangular Channel

Project Description	
Worksheet	5573 TO MOHAVE WASH (CONCRETE RECTA
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Slope

Input Data		
Mannings Coeffic	0 013	
Depth	5.00	ft
Bottom Width	45.00	ft
Discharge	355.00	cfs

Results		
Slope	0 002601	ft/ft
Flow Area	225 0	ft²
Wetted Perim	55.00	ft
Top Width	45 00	ft
Critical Depth	5.57	ft
Critical Slope	0.001866	ft/ft
Velocity	14.91	ft/s
Velocity Head	3.46	ft
Specific Ener	8.46	ft
Froude Numb	1.18	
Flow Type	Supercritical	

APPENDIX

A7

GRACE NEAL PWY

HYDROLOGY CALCULATIONS

CONCENTRATION POINT	SUBBASIN	PEAK Q (cfs)	TIME TO PEAK (hrs)	CHANNEL TIME (min)
[5392]	5390 (partial)	1372	12.8	(2436'/15fps)/60 = 3 min. Use 4 min(*)
[5514]	5510 (partial)	1342	13.2	(5444'/15fps)/60 = 6 min Use 8 min(*)
	5530 (all)	452	13.27	(7085'/15fps)/60 = 8 min
[5573]	5570 (all)	1334	13.27	None
[5585]	3260 (partial)	475	12.53	None

Note:

(1) Assume Peak Q in Mohave Wash is the same (Q100=21,555 cfs)

(2) Assume Channel Velocity (Ave) = 15 fps

(3) Assume no attenuation from Channel Routing along Grace Neal Channel

(*) The channel time is rounding up to 4 and 8 min due to the interval of the hydrograph.

CONCENTRATION POINT	SUBBASIN	LENGTH** (ft)	EXISTING SLOPE
[5392]	5390	2436	(3540-3490)/2436 = 0.0205'/FT
[5514]	5510	5444	(3490-3400)/5444 = 0.0165'/FT
-	5530	7085	(3400-3315)/7085 = 0.0120'/FT
[5573]	5570	5568	(3315-3275)/5568 = 0.0072'/FT
[5585]	3260	N/A	N/A

Note:

(**) Length is measured from Concentration Point (CP) to next CP along Grace Neal Channel.

The Hydrology Calculations are based on the HEC-1 Model of Kingman Area Master Drainage Plan Updated, Mohave County Arizona Dated August 01, 2000

Peak Discharges for 100-year, 24-hour event at key locations along the approximate Gracie-Neal alignment

Concentration Point (HEC-1 I.D.)	100-year Peak Q (cfs)	Time to Peak (hours)
5392	1372	12.87
5392+5514	2441	13.13
5392+5514+5530	2886	13.27
5392+5514+5530+5573	4214	13.40

Notes:

Approximate Gracie-Neal alignment cuts through watershed mapped under original study (Kingman Area Mohave Wash Update).

Hydrographs were cut from HEC-1 output (using the KO card at selected locations) and pasted into Excel (see worksheets below).

Hydrographs were then shifted to account for channel flow times and summed (added) at the correct locations to manually obtain peak discharges (see Exhibit 2 map and watershed map).

Culvert Calculator Report
BANK ST & JAGERSON CULVERTS

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	3,368.10	ft	Headwater Depth/Height	1.55	
Computed Headwater Elev	3,367.42	ft	Discharge	977.00	cfs
Inlet Control HW Elev.	3,366.85	ft	Tailwater Elevation	3,363.19	ft
Outlet Control HW Elev.	3,367.42	ft	Control Type	Outlet Control	

Grades					
Upstream Invert	3,359.68	ft	Downstream Invert	3,358.19	ft
Length	100.00	ft	Constructed Slope	0.014900	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	5.00	ft
Slope Type	N/A		Normal Depth	N/A	ft
Flow Regime	N/A		Critical Depth	3.99	ft
Velocity Downstream	9.95	ft/s	Critical Slope	0.020136	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	5.00	ft
Section Size	60 inch		Rise	5.00	ft
Number Sections	5				

Outlet Control Properties					
Outlet Control HW Elev.	3,367.42	ft	Upstream Velocity Head	1.54	ft
Ke	0.50		Entrance Loss	0.77	ft

Inlet Control Properties					
Inlet Control HW Elev.	3,366.85	ft	Flow Control	Submerged	
Inlet Type	Headwall		Area Full	98.2	ft^2
K	0.00780		HDS 5 Chart	2	
M	2.00000		HDS 5 Scale	1	
C	0.03790		Equation Form	1	
Y	0.69000				

Brooks Engineers & Surveyors
37 Brookside Road Waterbury, CT 06708 USA +1-203-755-1666

APPENDIX

A8

Hill Rd

5551

5331 { 5330 / 5331

5334

5335

5510

GRACE NEAL PWY

5530

BANK ST

5360

5390

5510B

5490

5540

5392

5391

5390

5470

5490

5500

5510
5513
5511
5512
5514B

5520

5521
5520

5374

5471
5470

5472

5501
5500

5502

Jagerson

5370

5361
5362
5360
5363

5570

5371

5400

5480

5493

5440

5450

5490

5492

5380

5401
5400
5402

5403

5382 { 5381 / 5380

5410

5414 { 5413 / 5412 { 5410 / 5411

5441

5420

5421
5420

5430

5422

5150

5310

5320

5177

See

5152 { 5150 / 5151

5300

5300

Northern

5312 { 5311 / 5310

3170

3171
3170
3172

```
          55          KM        COMBINE CP 5511 AND CP 5512
          56          HC        2
                      *
          57          KK   5510B      SUB
          58          KM         RUNOFF FROM SUB 5510B
          59          BA   .3497
          60          LG     .20     .35    3.94    .467
          61          UC    .283    .190
          62          UA       0       3       5       8      12      20      43      75      90      96
          63          UA     100
                      *
          64          KK   5514B      CP
          65          KM         COMBINE SUB 5510B AND CP 5513
          66          HC        2
                      *
                      *
                      *
          67          ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK

 INPUT
  LINE      (V) ROUTING           (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR         (<---) RETURN OF DIVERTED OR PUMPED FLOW

    20       5470
               V
               V
    28       5501
               .
               .
    31         .         5500
               .           .
               .           .
    38       5502.........
               V
               V
    41       5511
               .
               .
    44         .         5490
               .           V
               .           V
    51         .         5512
               .           .
               .           .
    54       5513.........
               .
               .
    57         .         5510B
               .           .
               .           .
    64       5514B.........

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*                JUN  1998              *
*             VERSION 4.1               *
*                                       *
*  RUN DATE   15NOV06  TIME  08:08:49   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*   U.S. ARMY CORPS OF ENGINEERS        *
*   HYDROLOGIC ENGINEERING CENTER       *
*        609 SECOND STREET              *
*      DAVIS, CALIFORNIA 95616          *
*          (916) 756-1104               *
*                                       *
*****************************************
```

```
                      WITH MODIFICATIONS TO SUB-BASINS 5470, 5490, 5500 AND 5510B TO REFLECT
                      THE CULVERTS DESIGN ALONG JAGERSON AVENUE UNDER BANK STREET.

                      USES 1992 ADOT HYDROLOGY MANUAL PROCEDURES.
                      CLARK UNIT HYDROGRAPH & GREEN-AMPT INFILTRATION.

                      GREEN-AMPT NUMBERS BASED ON DATA FROM:
                      "GENERAL SOIL MAP & INTERPRETATIONS, MOHAVE COUNTY, ARIZONA, 1974"

                      PREPARED BY JIMMY TONTHAT, P.E.

                      MODEL JAGERSON.DAT

                      100-YEAR, 24-HOUR HYPOTHETICAL STORM

                      RAINFALL FROM NOAA ATLAS,  ARKELL & RICHARDS SHORT DURATION RATIOS

 19 IO          OUTPUT CONTROL VARIABLES
                     IPRNT         5  PRINT CONTROL
                     IPLOT         0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                      NMIN         5  MINUTES IN COMPUTATION INTERVAL
                     IDATE     1    0  STARTING DATE
                     ITIME      0000  STARTING TIME
                        NQ       250  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     1    0  ENDING DATE
                     NDTIME     2045  ENDING TIME
                     ICENT        19  CENTURY MARK

                   COMPUTATION INTERVAL      .08 HOURS
                     TOTAL TIME BASE   20.75 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
```

```
                X     X  XXXXXXX   XXXXX          X
                X     X  X        X     X        XX
                X     X  X        X              X
                XXXXXXX  XXXX     X        XXXXX  X
                X     X  X        X              X
                X     X  X        X     X        X
                X     X  XXXXXXX   XXXXX         XXX

          THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

          THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
          THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
          NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
          DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
          KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM
```

1 HEC-1 INPUT PAGE 1

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
   1      ID        WITH MODIFICATIONS TO SUB-BASINS 5470, 5490, 5500 AND 5510B TO REFLECT
   2      ID        THE CULVERTS DESIGN ALONG JAGERSON AVENUE UNDER BANK STREET.
   3      ID
   4      ID        USES 1992 ADOT HYDROLOGY MANUAL PROCEDURES.
   5      ID        CLARK UNIT HYDROGRAPH & GREEN-AMPT INFILTRATION.
   6      ID
   7      ID        GREEN-AMPT NUMBERS BASED ON DATA FROM:
   8      ID        "GENERAL SOIL MAP & INTERPRETATIONS, MOHAVE COUNTY, ARIZONA, 1974"
   9      ID
  10      ID        PREPARED BY JIMMY TONTHAT, P.E.
  11      ID
  12      ID        MODEL JAGERSON.DAT
  13      ID
  14      ID        100-YEAR, 24-HOUR HYPOTHETICAL STORM
  15      ID
  16      ID        RAINFALL FROM NOAA ATLAS,  ARKELL & RICHARDS SHORT DURATION RATIOS
  17      ID
          *DIAGRAM
  18      IT     5                  250
  19      IO     5
          *
  20      KK    5470      SUB
  21      KM         RUNOFF FROM SUB 5470
  22      BA   .1291
  23      PH              0     .67    1.26    2.10    2.51    2.74    3.09    3.51    4.33
  24      LG    .20     .35    3.73    .600     7.6
  25      UC   .420    .297
  26      UA      0       5      16      30      65      77      84      90      94      97
  27      UA    100
          *
  28      KK    5501      CP
  29      KM         ROUTE SUB 5470 TO CP 5502
  30      RK    2800   .0110    .040             TRAP      10       3
          *
  31      KK    5500      SUB
  32      KM         RUNOFF FROM SUB 5500
  33      BA   .0560
  34      LG    .20     .35    3.73    .600       4
  35      UC   .505    .540
  36      UA      0       5      16      30      65      77      84      90      94      97
  37      UA    100
          *
  38      KK    5502      CP
  39      KM         COMBINE SUB 5470 & SUB 5500
  40      HC       2
          *
```

1 HEC-1 INPUT PAGE 2

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
  41      KK    5511      CP
  42      KM         ROUTE CP 5502 TO CP 5512
  43      RK    1700   .0110    .040             TRAP      15       3
          *
  44      KK    5490      SUB
  45      KM         RUNOFF FROM SUB 5490
  46      BA   .1406
  47      LG    .20     .35    3.73    .600       3
  48      UC   .608    .593
  49      UA      0       3       5       8      12      20      43      75      90      96
  50      UA    100
          *
  51      KK    5512      CP
  52      KM         ROUTE SUB 5490 TO CP 5513
  53      RK    3150   .0110    .040             TRAP      15       3
          *
  54      KK    5513      CF
```

TEMPERATURE DEGREES FAHRENHEIT

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	5470	160.	10.67	17.	5.	5.	.13		
ROUTED TO	5501	159.	10.75	17.	5.	5.	.13		
HYDROGRAPH AT	5500	46.	10.75	7.	2.	2.	.06		
2 COMBINED AT	5502	205.	10.75	24.	7.	7.	.19		
ROUTED TO	5511	202.	10.75	24.	7.	7.	.19		
HYDROGRAPH AT	5490	111.	10.92	17.	5.	5.	.14		
ROUTED TO	5512	109.	11.00	17.	5.	5.	.14		
2 COMBINED AT	5513	268.	10.92	41.	12.	12.	.33		
HYDROGRAPH AT	5510B	633.	10.67	45.	13.	13.	.35		
2 COMBINED AT	5514B	802.	10.67	85.	25.	25.	.68		

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	DT	INTERPOLATED TO COMPUTATION INTERVAL PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
5501	MANE	2.45	159.43	644.98	1.29	5.00	159.38	645.00	1.30

CONTINUITY SUMMARY (AC-FT) - INFLOW= .8917E+01 EXCESS= .0000E+00 OUTFLOW= .8913E+01 BASIN STORAGE= .1911E-01 PERCENT ERROR= -.2

5511	MANE	1.49	204.18	647.99	1.26	5.00	201.87	645.00	1.26

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1249E+02 EXCESS= .0000E+00 OUTFLOW= .1246E+02 BASIN STORAGE= .1587E-01 PERCENT ERROR= .0

5512	MANE	3.13	109.10	660.19	1.15	5.00	108.80	660.00	1.15

CONTINUITY SUMMARY (AC-FT) - INFLOW= .8661E+01 EXCESS= .0000E+00 OUTFLOW= .8650E+01 BASIN STORAGE= .1439E-01 PERCENT ERROR= .0

*** NORMAL END OF HEC-1 ***

APPENDIX

A

DRAINAGE CONDITIONS AND CONCEPTUAL DRAINAGE DESIGN

EXISTING DRAINAGE CONDITIONS

The existing drainage patterns along the Grace Neal Parkway alignment from Stockton Hill Road to Mohave Wash are from the northwest to southeast ultimately discharging into Mohave Wash. There are several washes that intersect Grace Neal Parkway. Currently, these washes are crossing the unimproved earth road of Grace Neal Parkway. Some are then intersected by the existing ditch along the westbound side of Jagerson Avenue and discharged into Mohave Wash. Others discharge directly into Mohave Wash.

The next section of the Grace Neal Parkway alignment from Mohave Wash to State Route 66 has existing drainage patterns from the southeast to northwest toward Mohave Wash. Currently, several washes cross the unimproved earth road of Grace Neal Parkway and discharge directly into Mohave Wash.

The drainage along Bank Street from Grace Neal Parkway to Jagerson Avenue is currently managed into the shallow ditch along the western edge of Bank Street. The ditch directs the flow southerly into an existing channel along the north side of Jagerson Avenue. The flow continues through an existing 60” CMP culvert at Bank Street to Mohave Wash. The overflow from the Jagerson channel crosses Bank Street to the adjacent park and the downstream channel.

Grace Neal Parkway is within the Kingman Area Master Drainage Plan Update (AMDU), Mohave County, Arizona dated August 01, 2000. The U.S. Army Corps of Engineers HEC-1 model was obtained from the Mohave County. The model is then modified with the latest precipitation frequency from NOAA ATLAS 14 (See **Appendix A4**). The results of the updated HEC-1 have been provided in the **Appendix A8**. It then used to design the proposed drainage channel along the westbound side of Grace Neal Parkway from Mohave Wash to Stockton Hill Road. It also is used to design the channel along the eastbound direction of Grace Neal Parkway from Mohave Wash to State Route 66 and the drainage condition along Bank Street from Grace Neal Parkway to Jagerson Avenue. **Appendix A2** shows the location and the discharge into the channel based on the HEC-1 model results.

FEMA FLOODPLAINS

Grace Neal Parkway is crossing Flood Zone B and C at varying intervals and Flood Zone AH where it crosses Mohave Wash. This information was obtained from the Flood Insurance Rate Map (FIRM), Panel number 2165 of 3450, Map Number 040058-2165C, dated March 1, 1983 and Panel number 2170 of 3450, Map Number 040058-2170B, dated March 15, 1982, published by Federal Emergency Management Agency (FEMA). Flood Zone B is an area between the limits of the 100 year and 500 year flood event, or subject to less than 1 foot of flooding in a 100-year event. Zone C is an area of minimal flooding. Zone AH is an area of 100-year shallow flooding with a constant water-surface elevation (usually areas of ponding) where average depths are between 1 and 3 feet. **Appendix A5** shows the location of the site on the FEMA map.

OFF-SITE IMPACTS

There are several subdivisions being developed along Grace Neal Parkway. The Eagle View subdivision is located north of Gracie Neal about 3700 feet east of Stockton Hill Road. Due to the increase in post-development flow, the Eagle View subdivision will require approximately 1.0 acre-ft of detention according to the Final Drainage Report for Eagle View date Feb 09, 2006 by Mohave Engineering Associates, Inc. The on-site and off-site flows discharge into the proposed concrete channel along the westbound of Grace Neal Parkway. Due to the different delineation areas and method of calculation, the discharge from the HEC-1 model by Mohave County is 1964 cubic feet per second (cfs) compared to 1711 cfs from HydroCAD estimated by Mohave Engineers Associates, Inc. The discharge of 1964 cfs from HEC-1 by Mohave County will be used for the conceptual design of the concrete channel.

The Prairie Heights Estates subdivision is located at the northwest corner of the Grace Neal Parkway and Bank Street intersection. According to the Revised Amended Final Improvement Plan Drainage Report for Prairie Heights Estates dated August 14, 06 by Mohave Engineering Associates, Inc, detention is not required for this project and the development of this site will not adversely affect adjacent or down stream properties. The on-site and off-site flows discharge into the proposed concrete channel along the westbound direction of Grace Neal Parkway. Due to the different delineation areas and method of calculation, the discharge from the HEC-1 model by Mohave County is 2,324 cfs compared to 2,333 cfs estimated by Mohave Engineers Associates, Inc. The discharge of 2,324 cfs from the HEC-1 model by Mohave County will be used for the conceptual design the concrete channel.

The Cerbat Vistas subdivision is located at the southwest corner of the Grace Neal Parkway and Bank Street intersection. Due to the increase in post-development flow, the Cerbat Vistas subdivision will require approximately 0.92 acre-ft of detention according to the Final Drainage Report for Cerbat Vistas date Dec 08, 05 by Mohave Engineering Associates, Inc. The on-site and off-site flows discharge into the existing channel along the westbound lanes of Jagerson Avenue. Due to the different delineation areas and method of calculation, the discharge from the modified HEC-1 model by Mohave County is 802 cfs compared to 710 cfs estimated by Mohave Engineers Associates, Inc. The discharge of 802 cfs from the HEC-1 model by Mohave County will be used for the conceptual design of the culverts under Bank Street. **Appendix A7** shows the peak run-off in the existing channel along the westbound lanes of Jagerson Avenue.

CONCEPTUAL DRAINAGE DESIGN

Along the westbound lanes of Grace Neal Parkway from Mohave Wash to Stockton Hill Road, the general wash’s flow patterns will be intercepted by the proposed drainage channel and ultimately discharge into Mohave Wash, which runs north to Red Lake. There are generally several options to design drainage channels. However, due to the limitation of the right-of-way, a rectangular concrete channel will be the only option discussed for the conceptual design. The channel design options are presented in **Table 9.**

The rectangular concrete channel will be designed to handle 100-year discharges per the Kingman AMDU HEC-1 model as shown in **Appendix A1**. The concrete channel will be constructed in accordance with Mohave County regulations. It will have two feet of freeboard and have a maximum velocity of 15 feet per second. The widths of the channel are calculated using FlowMaster V6.1 by Haestad Methods, Inc. as shown in **Appendix A6.**

Vertical drop structures in the concrete channel are recommended. Due to the natural steepness of the ground slope along the channel, the conceptual design includes a series of gentle slopes and vertical drops to produce low non-erosive velocities.

Along the eastbound lanes of Grace Neal Parkway from Mohave Wash to State Route 66, the general wash's flow patterns will be intercepted by the proposed drainage channel and ultimately discharge into Mohave Wash, which runs north to Red Lake. There are several options available to design the channel including: trapezoidal earth channel, trapezoidal grouted rock channel, trapezoidal concrete channel and rectangular concrete channel. After reviewing the improvement alternatives, the earthen channel is recommended over the other methods. Although the earth channel is wider than any other method, the finished product typically has a more natural appearance and function, and results in insignificant disturbance of riparian habitat and cultural features. It also has less risk to the public as a result of a lower velocity of water moving through the channel and less potential for structural failure. In addition, the earthen channel has the lowest construction cost. The channel design options are presented in **Appendix A3.**

The trapezoidal earthen channel will be designed to handle the 100-year discharges per the Kingman AMDU HEC-1 model as shown in **Appendix A1** The earthen channel will be constructed in accordance with Mohave County regulations. It will have two feet of freeboard and have a maximum velocity of 6 feet per second. With the velocity higher than 2 fps, there will not be a sediment depositional issue. Riprap toe protection may be used to increase channel stability.

The storm water run-off along Bank Street from Grace Neal Parkway and Jagerson Avenue will be conveyed along the curb and gutter southerly and drain into the existing channel along Jagerson Avenue through the spillway. Based on conceptual analysis it is recommended that the existing 60" CMP culvert at Bank Street be replaced with four 60" CMP culverts to meet the discharge requirement. The culvert calculations are presented in **Appendix A7**.

TEMPORARY DRAINAGE DESIGN

As requested by the Mohave County, the temporary channel is analyzed from Bank Street to Mohave Wash along the westbound lanes of Grace Neal Parkway. There are two options available to design the temporary channel including: trapezoidal earthen channel and trapezoidal grouted rock channel. After reviewing the temporary alternatives, the earthen channel is recommended over the grouted rock. There is not much difference in channel width between the earthen channel and the grouted rock channel. In addition, the earthen channel has the lower construction cost. The channel design options are presented in **Appendix A3.**

The temporary earthen channel will have no freeboard and have a maximum velocity of 6 feet per second. With the velocity higher than 2 fps, there will not be a sediment depositional issue. Riprap toe protection may be used to increase channel stability.

BRIDGE STRUCTURAL DESIGN

The proposed bridge will be located on Grace Neal Parkway at Mohave Wash. It is approximately 5000 feet west of Highway Route 66. At the new bridge location, the Mohave Wash channel is approximately 200 feet wide and has approximately 5 feet of depth. The vegetation in the area of the proposed bridge consists of typical desert grass and shrub.

The proposed bridge will be a four-lane roadway with a raised median and sidewalks. The bridge will be approximately 200 feet long by approximately 80 feet wide. The proposed bridge should be designed to have two feet of freeboard minimum for the 100-year event.

In general, the proposed bridge should be designed to have as little impact as possible to the wash. If possible, the bridge should be designed so that there is no disturbance to the flow whatsoever. If piers are used, they need to be oriented parallel to flow. Impacts upon channels and floodplains created by bridge usually take the form of the increased flow velocities through and downstream of the bridges, increased scour and upstream ponding due to backwater effects. These impacts can cause flood damage to the wash, and to the bridge structure itself. A structural firm should be contacted for review and final recommendations for the bridge structural span as well as the structural loads at abutments and piers.

Per the Preliminary Geotechnical Investigation report (see **Appendix E1)** on Grace Neal Parkway written by Speedie and Associates on September 20, 2006, it is recommended that a maximum allowable bearing capacity of 3,000 psf be utilized for the foundation design. All footing excavations should be level and cleaned of all loose or disturbed materials. The soil engineering recommendation for support of the new bridge is utilizing shallow foundations.

For structures in channel areas, the up stream and down stream edges should have turn-down cut off walls. The cut off walls and the foundations deriving support will be required at least 3 feet below the design scour and/or stream bed degradation elevation. Mohave Wash is intermittent and subject to relatively high flow stages, there is a potential for scour at this site. However, a determination of the design scour level was not available at the time of this investigation.

Estimated settlements under design loads are on the order of ½ to 1-inch, virtually all of which will occur during construction. Post-construction differential settlements will be negligible, under existing and compacted moisture contents. Additional localized settlements of the same magnitude could occur if native supports soils were to experience a significant increase in moisture content.

Note that this geotechnical information was based on a conceptual design. A more detailed geotechnical analysis should be performed at specific structure locations during the final design phase.

APPENDIX

B1

SOUTHWEST TRAFFIC ENGINEERING, LLC

REVISED FINAL TRAFFIC IMPACT ANALYSIS

PRAIRIE HEIGHTS ESTATES
BANK STREET/GRACIE NEAL ROAD

28 JULY 2005
REVISED: 4 APRIL 2006

PREPARED FOR
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SWTE

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SWTE

REVISED FINAL TRAFFIC IMPACT ANALYSIS
PRAIRIE HEIGHTS ESTATES
BANK STREET/GRACIE NEAL ROAD

Executive Summary

The purpose of this traffic study is to evaluate the current and future transportation system within the project study area surrounding the site without and with the project and analyze traffic operations at the intersection of Bank Street/Jagerson Avenue without and with the project.

Existing and Future Traffic Data Without Project

Traffic counts were taken at the existing intersection of Bank Street and Jagerson Avenue. The traffic counts included turning movement counts during the weekday AM and PM peak hours.

The existing intersection of Bank Street/Jagerson Avenue without the project was evaluated for existing and future levels of service. This intersection currently operates at an adequate LOS B or better during the weekday peak hours and will continue to do so in 2007 without the project.

Future Traffic Data With Project

The addition of site-generated trips will affect the level of service at one of the intersections in the study area. The intersection of Jagerson Avenue/Bank Street will operate at an inadequate LOS F during the 2007 weekday PM peak hour with the project. The remaining intersections will operate at an adequate LOS A or better with the project.

Recommendations

Bank Street and Gracie Neal Road will ultimately serve as arterial streets in the area, while No Name Street will serve as a collector street. Once complete east/west and north/south connections are completed with these roadways, the minimum two-lane sections may not be able to handle the increase in capacity. Right of way should be set-aside on these roadways for construction of the ultimate cross sections in the future.

The intersection of Jagerson Avenue and Bank Street will no longer operate at an acceptable LOS with the project, due to the increased northbound and southbound traffic volumes. The operation of this intersection could be improved by changing the intersection to an all-way STOP controlled intersection. An all-way stop control

condition should not be installed until a warrant study has been completed and the required warrants have been met.

After the area is completely developed, cut-through traffic may at times be encouraged to use Prairie Heights Drive between No Name Street and Bank Street. In order to limit this negative impact, either Access #3 or Access #1 could be offset to connect to a different internal street.

The sharp curve leading to Access #1 may limit sight distance at the intersection and immediately north of the intersection. Sight distance should be verified at this intersection, along with the driveways to the homes located along this curve.

REVISED FINAL TRAFFIC IMPACT ANALYSIS
PRAIRIE HEIGHTS ESTATES
BANK STREET/JAGERSON AVENUE

Project Description

Burns Builders proposes to construct a new single-family residence development on the undeveloped property on the northwest corner of Bank Street/Jagerson Avenue in Mohave County, Arizona. The site is located as shown in Figure 1. The project would consist of 420 new single-family homes. Access to the site will be from three new intersections. The first intersection would be located on Gracie Neal Road to the west of Bank Street, the second intersection would be located on Bank Street to the north of Gracie Neal Road and the third intersection would be located west of Bank Street on a new street north of and parallel to Gracie Neal Road. The homes in Prairie Heights Estates are scheduled for occupation in late 2007.

The purpose of this traffic impact analysis is to:

- Evaluate the current and future transportation system within the area surrounding the site.
- Estimate the traffic generation associated with the project and assign that traffic to the roadway system.
- Analyze traffic operations at the intersection of Bank Street/Jagerson Avenue, along with the proposed access points to the project.

The author of this report is a registered professional engineer (civil) in the State of Arizona having specific expertise and experience in the preparation of traffic impact analyses.

Study Methodology

In order to analyze and evaluate the potential traffic impacts of the proposed Cerbat development, the following tasks were undertaken:

- Field observation of the proposed site and surrounding area was conducted to evaluate the existing physical and operational characteristics of the adjacent roadway network.
- A review of the latest available Average Daily Traffic (ADT) volumes in the project area obtained from Public Works Department of Mohave County.
- Site traffic volumes generated by the proposed site were calculated using the *Institute of Transportation Engineers (ITE) Trip Generation Manual, 7th Edition,* 2003.
- Trip distribution assignments were made and used to assign the site traffic to the site access points and the primary roadways within the project study limits.

- Capacity analyses were performed for the existing conditions and future conditions without and with the project based on an opening year of 2007.
- The intersections were analyzed using the methodology presented in the *2000 Highway Capacity Manual (HCM)*.

Existing Conditions

The study location includes the un-signalized intersection of Bank Street/Jagerson Avenue that will serve the site.

The project site is located north of Jagerson Avenue, immediately west of the Bank Street roadway alignment on an undeveloped piece of property. To the west, Jagerson Avenue provides access to Stockton Hill Road, a major arterial street in the area. Cerbat Elementary School is located on the north side of Jagerson Avenue to the west of Bank Street

The County of Mohave designates Bank Street as an arterial street. South of Jagerson Avenue, Bank Street is a two-lane roadway with no curb, gutter, or sidewalk facilities and is posted at 35 mph. North of Jagerson Avenue, Bank Street is a dirt road which is not maintained by the County of Mohave. Bank Street provides north/south access in this area between Jagerson Avenue and Airway Avenue.

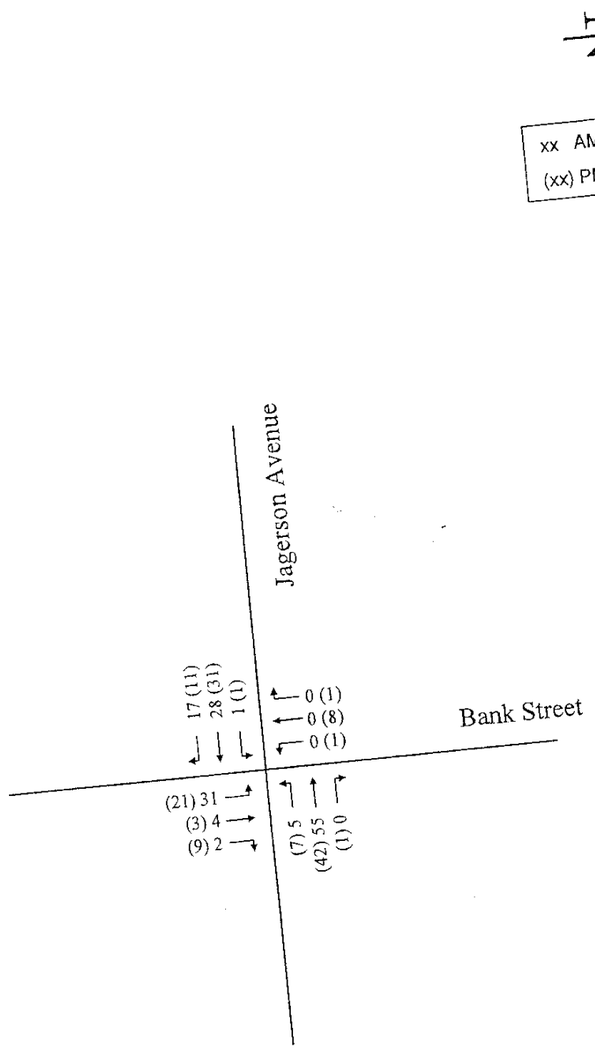
The un-signalized intersection of Bank Street/Jagerson Avenue is controlled by STOP signs on the northbound and southbound approaches. All of the approaches offer a shared left turn/through/right turn lane. No curb, gutter, or sidewalk facilities are located at the intersection. While the north leg of the intersection is a dirt road, it provides the only access to a small park on the northeast corner of the intersection.

Existing Traffic Data

In order to form a basis for analysis of the project impacts, weekday AM and PM peak hour turning movement counts were conducted at the intersection of Bank Street/Jagerson Avenue.

The weekday turning movement counts at Bank Street/Jagerson Avenue were conducted from 7:00 AM to 9:00 AM and 4:00 PM to 6:00 PM. All of the traffic counts were conducted in November 2004.

The estimated existing weekday AM and PM peak hour traffic volumes are shown in Figure 2. The complete traffic volume summaries can be found in the Appendix.



Existing Weekday Peak Hour
Traffic Volumes
(vehicles per hour)
Figure 2

Final Traffic Impact Analysis
Prairie Heights Estates
Bank Street/Gracie Neal Road

SWTE

Trip Generation

Trip generation for the project was developed utilizing nationally agreed upon data contained in the Institute of Transportation Engineers (ITE) publication *Trip Generation, 7th Edition*, 2003. So as to provide analysis for the full build-out of the project, trip generation was estimated for the construction of approximately 420 single-family residential homes based on ITE Land Use Code 210, Single–Family Detached Housing. The result is the expected weekday trip generation for the new Cerbat Vista Development as shown in Table 1. The complete trip generation calculations can be found in the Appendix.

Table 1 – Weekday Project Site Generated Trips

Time Period	Trips
	Weekday
Average Daily, Inbound (vpd)	2,010
Average Daily, Outbound (vpd)	2,010
Total Daily	**4,020**
AM Peak Hour, Inbound (vph)	79
AM Peak Hour, Outbound (vph)	236
Total AM Peak	**315**
PM Peak Hour, Inbound (vph)	268
PM Peak Hour, Outbound (vph)	157
Total PM Peak	**425**

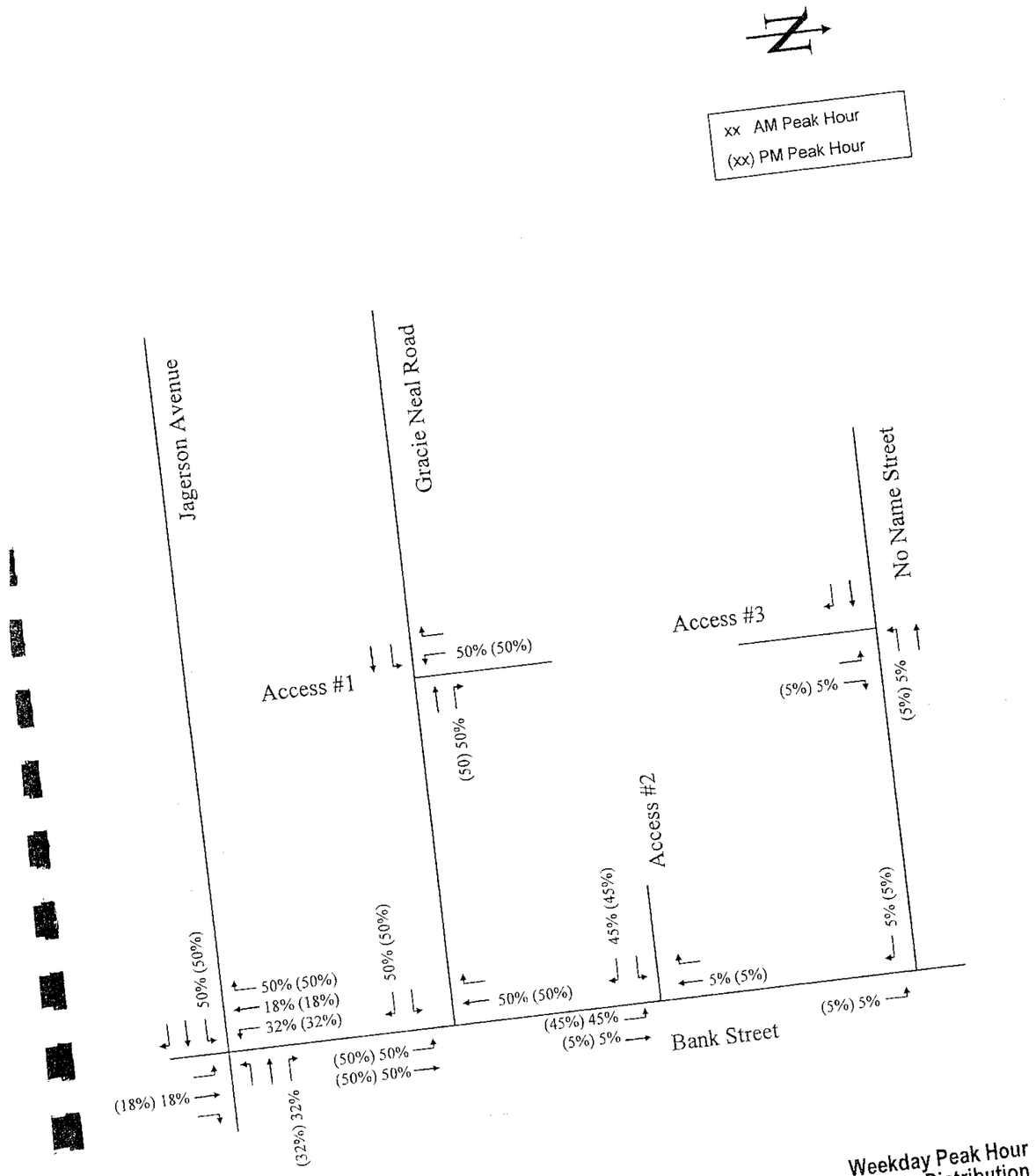
vpd - vehicles per day, vph - vehicles per hour

Trip Distribution & Assignment

Trip distribution for the project was based on current volumes and traffic patterns near the site. Figure 3 shows the weekday trip distribution for the project as a percentage of net new primary trips. Figure 4 shows the assignment of these trips to the existing project intersections and project intersection within the study area.

Access

As mentioned previously, the new project will be constructed on an undeveloped property along the west side of the Bank Street roadway alignment between Gracie Neal Road and No Name Street. Access to the site will be from three new intersections. In addition, Bank Street, north of Gracie Neal Road, and No Name Street, west of Bank Street, will be constructed as two lane paved roadways. Until further development occurs in the area, it is not expected for vehicles from the Prairie Heights Estates residential area to heavily use No Name Street or the new intersection of No Name Street/Bank Street.



Weekday Peak Hour
Trip Distribution
Figure 3

Final Traffic Impact Analysis
Prairie Heights Estates
Bank Street/Gracie Neal Road

SITE

Access #1 will be a 'T' intersection located approximately 1,430 feet west of Bank Street on Gracie Neal Road. The southbound approach will be controlled by a STOP sign. Traffic on Gracie Neal Road will be free-flow. The new southbound approach will provide a shared left turn/right turn lane.

Access #2 will be located approximately 775 feet north of Gracie Neal Road on Bank Street. This new 'T' intersection will be controlled by a STOP sign on the eastbound approach, while traffic on Bank Street will be free-flow. The new eastbound approach will provide a shared left turn/right turn lane.

The final access point, Access #3, will also be a 'T' intersection. Access #3 will be located approximately 1,400 feet west of Bank Street on No Name Street. The new northbound approach will provide a shared left turn/right turn lane. The northbound approach will be controlled by a STOP sign and traffic on No Name Street will be free-flow.

Sight distance at the new access points should be verified during the plan design and review process.

Existing Traffic Operations

Analysis of current intersection operations was conducted for the AM and PM peak hours using the nationally accepted methodology set forth in the *Highway Capacity Manual,* Transportation Research Board, 2000. The computer software HCS (Highway Capacity Software) was utilized to calculate the levels of service for individual movements, approaches, and for the intersections as a whole.

Level of service (LOS) is a qualitative measure of the traffic operations at an intersection or on a roadway segment. Level of service is ranked from LOS A, which signifies little or no congestion and is the highest rank, to LOS F, which signifies congestion and jam conditions. LOS D is typically considered adequate operation at signalized and un-signalized intersections.

At un-signalized intersections, level of service is calculated for those movements which must either stop for or yield to oncoming traffic and is based on average control delay for the particular movement. Control delay is the portion of total delay attributed to traffic control measures such as stop signs and traffic signals. The criteria for level of service at unsignalized intersections are shown below in Table 2.

Existing levels of service were calculated for the adjacent project intersections in the study area. The results of this analysis are shown in Table 3. Complete capacity calculations are included in the Appendix.

Table 2 - Level of Service Criteria – Un-signalized Intersections

Level-of-Service	Delay
A	≤ 10 seconds
B	> 10 and ≤ 15 seconds/vehicle
C	> 15 and ≤ 25 seconds/vehicle
D	> 25 and ≤ 35 seconds/vehicle
E	> 35 and ≤ 50 seconds/vehicle
F	> 50 seconds per vehicle

Table 3 – Existing Peak Hour Levels of Service

Intersection	AM Peak		PM Peak	
	LOS	Delay	LOS	Delay
Bank Street/Jagerson Avenue				
Eastbound Left/Through/Right	A	7.4	A	7.3
Westbound Left/Through/Right	A	7.3	A	7.3
Northbound Left/Through/Right	A	9.7	A	9.4
Southbound Left/Through/Right	A	0.0	A	9.7

Delay - seconds per vehicle

As shown in Table 3, the existing project intersection currently operates at an adequate LOS A during the weekday peak hours.

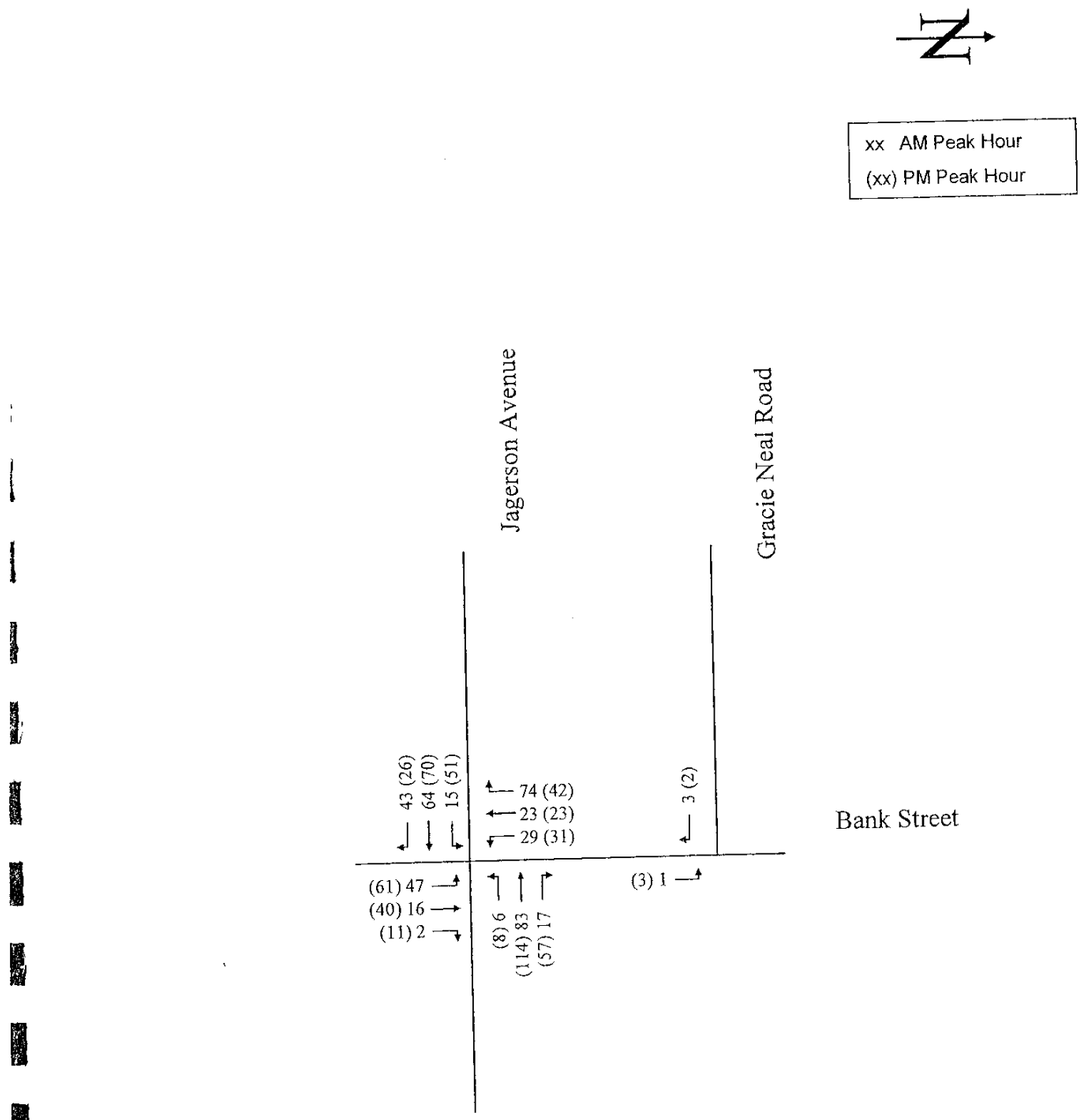
Future Traffic Operations Without Project

In order to assess the impacts of the project on future traffic operations, traffic projections were made for the year 2007, which is the year the project is expected to open.

The projections include volumes on new or improved roads to be built with the Cerbat Vista development. Gracie Neal Road is a new east-west road that will be constructed on the north side of the Cerbat Vista development. Bank Street is an existing dirt road that will be paved from Jagerson Avenue to Gracie Neal Road

Due to lack of detailed historic traffic data in the project area from the County of Mohave a growth rate could not be calculated. In light of this, a six percent growth rate was used to estimate traffic growth in the project area. In addition, projected traffic counts from the *Cerbat Vista Initial Traffic Impact Analysis, December 2004*, were used.

Using the compounded yearly traffic growth rate and the Cerbat Vista development traffic numbers, 2007 weekday peak hour traffic volumes without the project were estimated as shown in Figure 5.



Final Traffic Impact Analysis
Prairie Heights Estates
Bank Street/Gracie Neal Road

2007 Weekday Peak Hour Traffic Volumes
Without Project
(vehicles per hour)
Figure 5

As with the current volumes, levels of service were calculated for each of the intersections in the study area for 2007 without the project. Level of service calculations were completed using the street geometrics assuming completion of the Cerbat Vista development to the south.

Levels of service for 2007 without the project are shown in Table 4. Complete capacity calculations are included in the Appendix.

Table 4 – 2007 Peak Hour Levels of Service Without Project

Intersection	AM Peak		PM Peak	
	LOS	Delay	LOS	Delay
Jagerson Avenue/Bank Street				
Eastbound Left/Through/Right	A	7.5	A	7.8
Westbound Left/Through/Right	A	7.5	A	7.5
Northbound Left/Through/Right	B	14.1	B	17.7
Southbound Left/Through/Right	B	11.6	B	13.8
Gracie Neal Road/Bank Street				
Eastbound Left/Right	A	8.3	A	8.3
Northbound Left/Through	A	7.2	A	7.2
Southbound Through/Right	A	7.2	A	7.2

Delay - seconds per vehicle

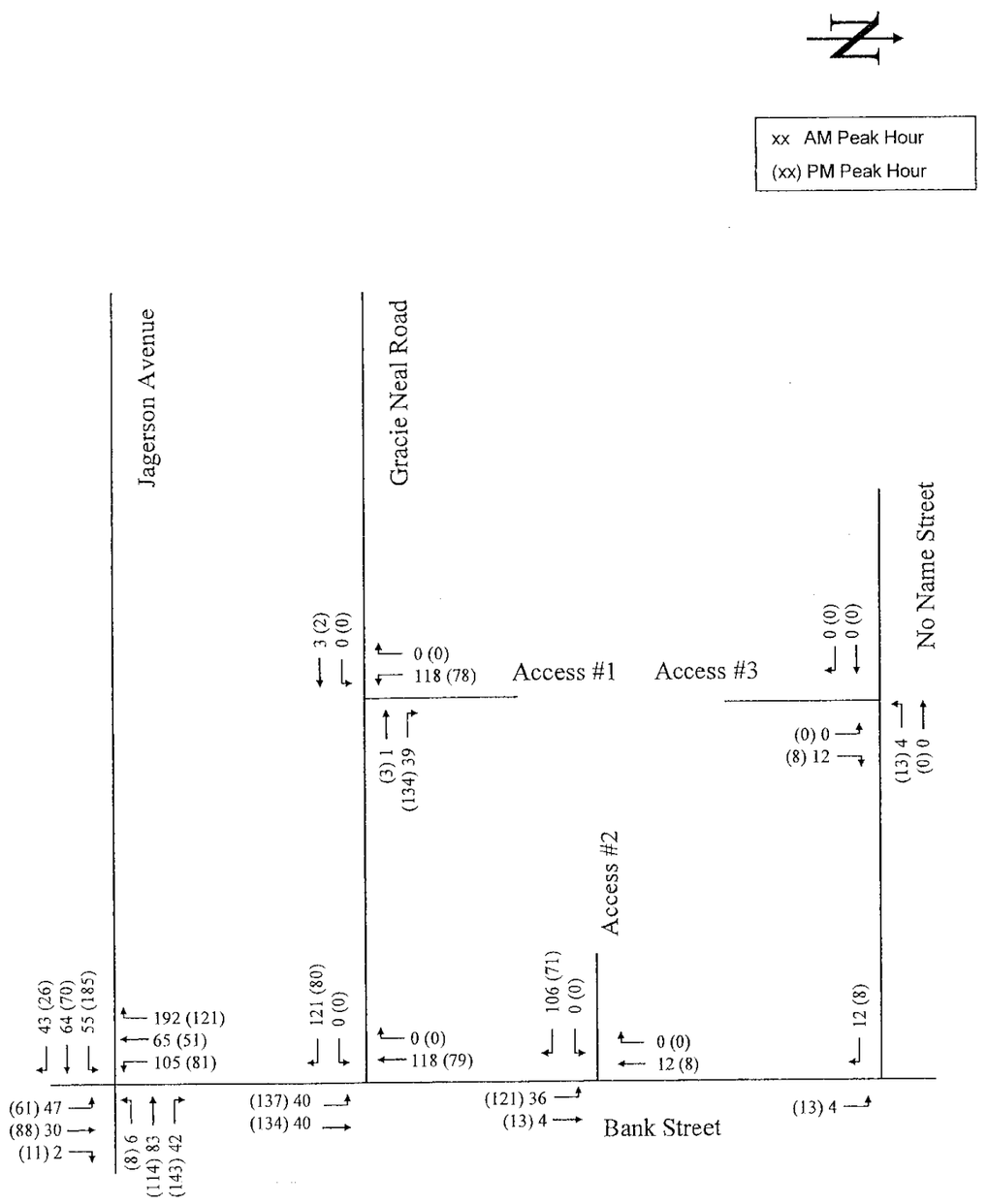
As shown in Table 4, all of the study intersections continue to operate adequately at LOS B or better in 2007 during the AM and PM weekday peak hours without the project.

Future Traffic Operations With Project

In order to assess the impacts of the project on future traffic operations, levels of service were calculated for each project intersection for 2007 with the project. Peak hour traffic volumes for 2007 without the project were combined with the estimated trips generated by the project to yield peak hour traffic volumes with the project as shown in Figure 6. Weekday intersection levels of service for 2007 with the project were then calculated as shown in Table 5. Complete capacity calculations are included in the Appendix.

The projections include volumes on new roads to be built with the Prairie Heights development. No Name Street will be a new east-west road constructed on the north side of Prairie Heights Estates. Bank Street is an existing dirt road that will be paved from Gracie Neal Road to No Name Street

As shown in Table 5, the additional traffic generated by the project will significantly affect only one of the study intersections. The remaining project intersections will operate at an adequate level of service A or better during the weekday peak hours with the project in 2007. The intersection of Jagerson Avenue/Bank Street will operate at a LOS F with the project. This inadequate LOS is due to extra delay caused by high southbound traffic volumes, along with the limited capacity of the northbound and southbound approaches.



Final Traffic Impact Analysis
Prairie Heights Estates
Bank Street/Gracie Neal Road

2007 Weekday Peak Hour Traffic Volumes With Project (vehicles per hour)
Figure 6

Table 5 – 2007 Peak Hour Levels of Service With Project

Intersection	2006 Without Project				2006 With Project			
	AM Peak		PM Peak		AM Peak		PM Peak	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Jagerson Avenue/Bank Street								
Eastbound Left/Through/Right	A	7.5	A	7.8	A	7.7	A	8.8
Westbound Left/Through/Right	A	7.5	A	7.5	A	7.5	A	7.5
Northbound Left/Through/Right	B	14.1	B	17.7	D	30.0	F	>120
Southbound Left/Through/Right	B	11.6	B	13.8	E	46.1	F	>120
Gracie Neal Road/Bank Street								
Eastbound Left/Right	A	8.3	A	8.3	A	9.6	A	9.1
Northbound Left/Through	A	7.2	A	7.2	A	7.6	A	7.7
Southbound Through/Right	A	7.2	A	7.2	A	0.0	A	0.0
No Name Street/Bank Street								
Eastbound Left/Right	n/a				A	6.4	A	6.4
Northbound Left/Through					A	7.1	A	7.2
Southbound Through/Right					A	6.9	A	6.9
Gracie Neal Road/Access #1								
Eastbound Left/Through	n/a				A	0.0	A	0.0
Westbound Through/Right					A	0.0	A	0.0
Southbound Left/Right					A	9.2	A	9.3
Bank Street/Access #2								
Eastbound Left/Right	n/a				A	8.8	A	8.6
Northbound Left/Through					A	0.0	A	0.0
Southbound Through/Right					A	0.0	A	0.0
No Name Street/Access #3								
Eastbound Through/Right	n/a				A	0.0	A	0.0
Westbound Left/Through					A	0.0	A	0.0
Northbound Left/Right					A	8.3	A	8.3

Delay - seconds per vehicle

Traffic Mitigation

While the majority of the intersections will operate at an adequate level of service during the weekday peak hours in 2007 without and with the project, the northbound and southbound approaches at the intersection of Jagerson Avenue/Banks Street will operate at an inadequate LOS F during the PM peak hour with the project. It is possible to propose mitigation measures, or improvements for this intersection.

Jagerson Avenue/Banks Street Intersection. This two-way stop controlled intersection will have its northbound and southbound approaches operate at an inadequate LOS F in 2007 with the project. The northbound and southbound approaches could benefit from changing the intersection to an all-way STOP controlled intersection. With this improvement, the intersection should operate at an adequate LOS C and LOS D during the AM and PM peak hours, respectively. An all-way stop control condition should not

be installed until a warrant study has been completed and the required warrants have been met.

Internal Circulation

As part of this study, the operation of the internal circulation and pedestrian area of the project was reviewed. Design internal site circulation focuses on several items including making pedestrian connections and walkways available between various site uses, sight distances, cut-through traffic possibilities, and traffic calming. These items were both examined individually and as a whole to determine if they function together and reduce conflict points.

The internal street network will consist mostly of residential streets. Prairie Heights Drive and Mountain Vista Drive will serve as collector streets in the neighborhood. Collector streets distribute traffic to the arterial street system. Half-mile or collector streets in Arizona usually carry about 1,200 to 5,000 vehicles per day and provide the main access points into neighborhoods. The remaining streets in the subdivision, residential streets, will function as the connection roadways between the majority of the development and the collector streets and site access points. Local residential streets in Arizona typically carry between four and eight hundred vehicles per day on a typical weekday.

The site plan shows adequate storage capacity for vehicles exiting the site the site onto Bank Street Gracie Neal Road, and No Name Street. The homes and associated driveways along Mountain Vista Drive, immediately north of Gracie Neal Road, may increase vehicle conflicts at this major access point to the project.

Once the area is completely developed, cut-through traffic may be encouraged to use Prairie Heights Drive between No Name Street and Bank Street. In order to limit this negative impact, Access #3 or the Access #2 could be offset to an adjacent street in the development.

Speeding may also be encouraged along the internal perimeter roads. Long, straight streets tend to encourage drivers to travel at higher speeds then posted. This could cause potential accident problems at the intersections of these streets.

Site distances should be verified at Access #2 and Access #3 during the plan design and review process. The sharp curve leading to Access #1 may limit sight distance at the intersection and immediately north of the intersection. Sight distance should be verified at this intersection, along with the driveways to the homes located along this curve.

Pedestrian walkways have been provided throughout the site to ensure safer pedestrian access to Bank Street, Gracie Neal Road, and No Name Street.

Conclusion

When fully completed, the proposed project will generate an additional 2,010 vehicles per day (vpd) on weekdays to the adjacent street system. These vehicles will generate 4,010 additional trips in the area.

Bank Street and Gracie Neal Road will ultimately serve as arterial streets in the area, while No Name Street will serve as a collector street. Once complete east/west and north/south connections are completed with these roadways, the minimum two-lane sections may not be able to handle the increase in capacity. Right of way should be set-aside on these roadways for construction of the ultimate cross sections in the future.

The intersection of Jagerson Avenue and Bank Street will no longer operate at an acceptable LOS with the project, due to the increased northbound and southbound traffic volumes. The operation of this intersection could be improved by changing the intersection to an all-way STOP controlled intersection. An all-way stop control condition should not be installed until a warrant study has been completed and the required warrants have been met.

The remaining project intersections in the project area will operate at an adequate LOS A or better during the 2007 weekday peak hours with the project.

After the area is completely developed, cut-through traffic may at times be encouraged to use Prairie Heights Drive between No Name Street and Bank Street. In order to limit this negative impact, either Access #3 or Access #1 could be offset to connect to a different internal street.

The sharp curve leading to Access #1 may limit sight distance at the intersection and immediately north of the intersection. Sight distance should be verified at this intersection, along with the driveways to the homes located along this curve.

PRAIRIE HEIGHTS ESTATES
BANK STREET/GRACIE NEAL ROAD

REVISED FINAL TRAFFIC IMPACT ANALYSIS

APPENDIX

Traffic Counts

Trip Generation Calculations

Trip Distribution Calculations

Capacity Calculations

APPENDIX

C1

SPEEDIE AND ASSOCIATES
Geotechnical • Environmental • Materials Engineers

REPORT ON PHASE I ENVIRONMENTAL SITE ASSESSMENT

DESIGNATION: Grace Neal Parkway Corridor

LOCATION: Stockton Hill Rd. to State Hwy. 66
Mohave County, Arizona

CLIENT: Durrant Architects

PROJECT NO: 061412EA

DATE: August 8, 2006

SPEEDIE AND ASSOCIATES
Geotechnical • Environmental • Materials Engineers

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1.0 INTRODUCTION

1.1 Purpose and Scope of Report

This report presents the results of a Phase I Environmental Site Assessment (ESA) conducted in conformance with ASTM Standard Practice E 1527-00 (herein denoted ASTM 1527) dated May 2000 to reflect a commercially prudent and reliable inquiry for the subject Property, with respect to the range of contaminants within the scope of Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and petroleum products. The subject Property is identified as the Grace Neal Parkway Corridor and is located between Stockton Hill Road and State Highway 66 in Mohave County, Arizona. Per ASTM 1527, this report is intended to satisfy one of the requirements of the Innocent Landowner Defense to CERCLA liability. The work was authorized by Ms. Dana White of Durrant Architects, and is being performed in accordance with our Proposal No. 27624E dated July 18, 2006.

The objective of a Phase I ESA is to identify, to the extent feasible pursuant to ASTM 1527, Recognized Environmental Conditions (RECs) in connection with the Property. A REC is defined as "the presence or likely presence of any hazardous substances or petroleum products on a Property under conditions that indicate an existing release, a past release, or a material threat of a release of hazardous substances or petroleum products into structures on the Property or into the ground, groundwater, or surface water of the Property. This term includes hazardous substances or petroleum products even under compliance with laws. The term is not intended to include De Minimis conditions that generally do not present a material risk of harm to public health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate government agencies. Conditions determined to be De Minimis are not RECs (ASTM)".

The scope of work for the assessment is in accordance with our above noted proposal and ASTM 1527 and included the following:

- All services were performed by an environmental professional under the direction of a professional engineer or geologist registered in the state of Arizona.
- Interviews (in person, by telephone or in writing) were attempted with owners, occupants, key site managers, and local government officials, as reasonable, regarding RECs on the Property.
- ASTM Federal and State Standard Environmental Record Sources as well as selected additional local Environmental Record Sources, were reviewed (when reasonably ascertainable and to limits equal to or exceeding the minimum ASTM search distances) regarding RECs on the Property.
- Standard Historical Sources were reviewed as reasonably ascertainable to develop a history of the previous uses of the Property and surrounding area in order to identify those uses, which may have led to RECs in connection with the Property.
- A site reconnaissance of the property was conducted including a site visit to visually and physically observe the general physical site setting, as well as the site components and structures for current and past property uses and conditions (so far as these uses and conditions are observable). Additionally, current and past uses of adjoining sites were identified to the extent that these uses were observable during the on-site visit.
- This final report was written to describe indications of RECs observed during this assessment, our professional opinion thereto, and any recommendations for further investigation, as needed.

The scope of work for our Phase I ESA is based on the items identified herein which follow the requirements set forth in ASTM Practice E 1527. The scope of work did not include chemical analyses of site soils, air or groundwater, a Chain-of-Title search or on-site surveys for radon gas, lead, asbestos, or mold. Further, the scope also did not include inquiry into other issues such as wetlands, regulatory compliance, cultural and historic resources, industrial hygiene, health and safety, ecological resources, endangered species, or high voltage power lines (considered by the ASTM Standard to be Business Environmental Risks and outside the standard scope of the ASTM practice). Some substances may be present on a property in quantities and under conditions that may lead to contamination of the property or of nearby properties but are not included in CERCLA's definition of hazardous substances or do not otherwise present potential CERCLA liability.

1.2 Property Background

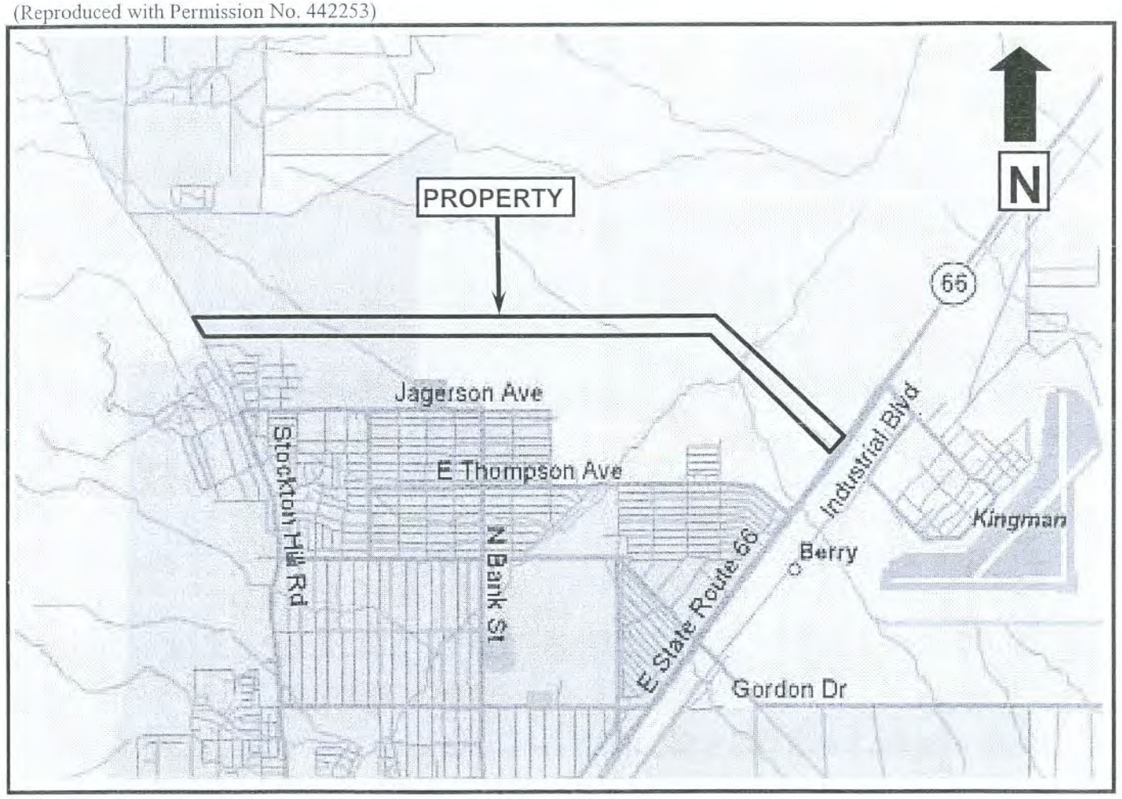
1.2.1 Property Location

The subject Property is situated in portions of Sections 19, 20, 21 and 22, Township 22 North, Range 16 West and Section 24, Township 22 North, Range 17 West, of the Gila and Salt River Base and Meridian, Mohave County, Arizona. The subject Property corridor consists of an approximate 100 to 150 foot wide right-of-way alignment on the north side of Kingman, Arizona that extends from Stockton Hill Road to State Highway 66. At the time of the assessment the roadway centerline and right-of-way had not

been marked in the field. The Property is generally bound on the north and south by vacant land, on the east by State Route 66 and on the west by Stockton Hill Road (See Figure 1.2.1.1).

Figure 1.2.1.1 - Property Location

(Reproduced with Permission No. 442253)



1.2.2 Property Description

At the time of the site visit, the Property Corridor/Alignment consisted of approximately five (5) miles of vacant land approximately 100 to 150 feet in width. The Property was identified based on aerial photographs provided by Durrant Architects and Brooks Engineering with the approximate centerline of the proposed Grace Neal Parkway marked. The Property generally followed unpaved, unnamed, roadways and an overhead power line. No apparent centerline or right-of-way markings were observed in the field. The Property consisted of bare soil or soil with sparse vegetative cover. No other obvious uses were observed. The Property was accessed from State Route 66 and Stockton Hill Road.

2.0 PHYSICAL SETTING

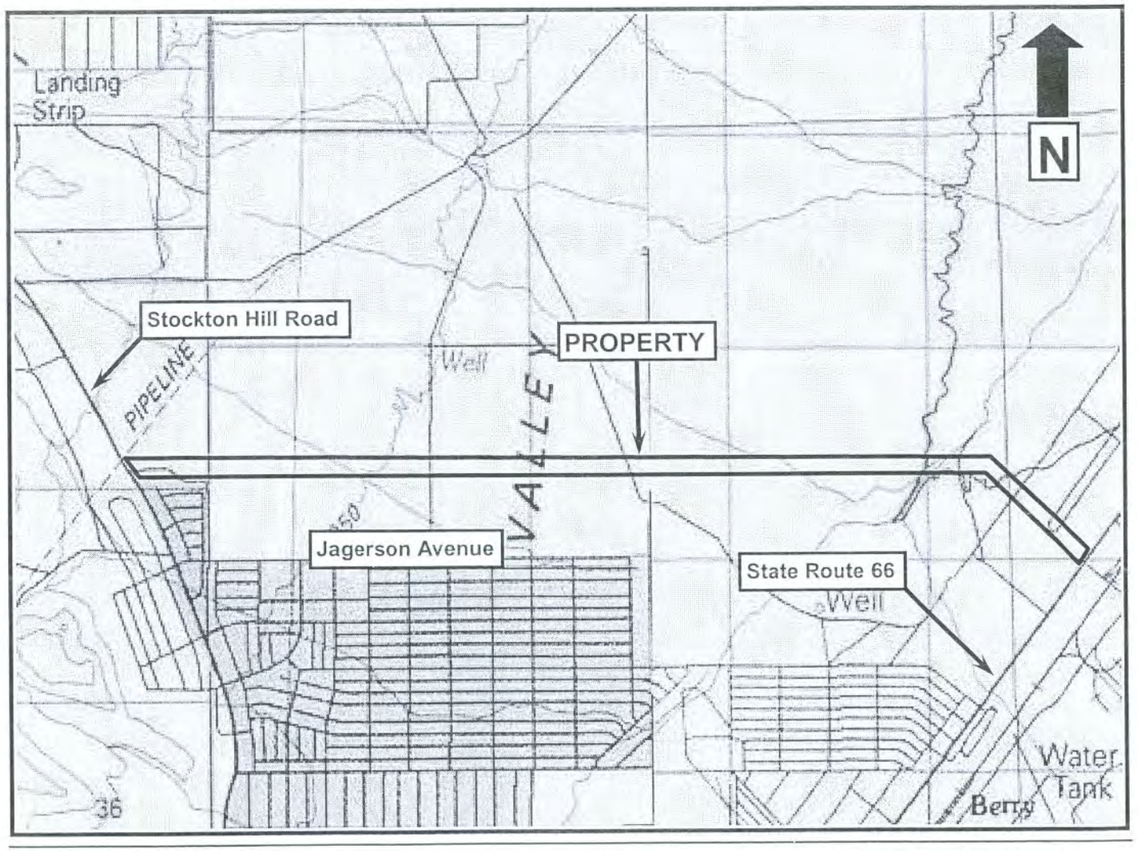
2.1 Topography

Approximate Property elevation: As depicted on the United States Geological Survey (USGS) 7.5 Minute Series Topographical Map (Figure 2.1.1), the Property elevation appears to be approximately 1000 to 1100 feet above mean sea level (USGS).

General down slope contour: East (ibid.).

Flooding zone: Zone B (located along ephemeral washes): Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood; Zone C (remainder of Alignment): Areas of minimal flooding (FEMA).

Figure 2.1.1 – Property Topography



2.2 Geology

Local soils: The Property soils were classified as the Cellar-House Mountain-Rock Outcrop Association with five (5) to 25 percent slopes. These soils are found on alluvium and/or residuum from mixed soil and rock sources. The soil is characterized by slow to moderate permeability and low to high runoff (USDA).

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Site specific conditions: Determination of site-specific geologic conditions was not within the scope of work for this phase of the study; however, a concurrent preliminary geotechnical investigation is being conducted on the Property. The results from the investigation will be issued in a separate report.

2.3 Regional Climatology, Surface Water Hydrology, and Hydrogeology

Average regional temperatures: Mean Annual Temperature of 57 °F to 67 °F (USDA).
Average regional precipitation: 8-12 inches (ibid.).
Regional groundwater elevation: Regional groundwater maps have not been developed by the Arizona Department of Water Resources (ADWR) for the vicinity of the subject Property.
On-site water wells: Well Registry Reports were reviewed at the ADWR by All Lands (AL). One (1) water well was identified in the AL report with coordinates which corresponded to the area encompassing the subject Property. This well was reported to be a test well owned by the City of Kingman and was identified to be located in Section 20, T 22 N, R 16 W (All). A well casing was observed near the Property alignment in Section 20 south of the assumed centerline of the proposed parkway. However, due to the lack of centerline or right-of-way markings, it was not possible to determine if the well was within the parkway right-of-way.
Potable water source: Unknown.
On-site surface water: No surface water was observed on the Property at the time of the site visit. It did not appear that the Property accepts off-site irrigation water. It appeared that excess surface water could migrate across the Property boundaries. Given that the surface area of the Property was contiguous with the adjoining areas, on-site run-on may occur from up-gradient land and off-site discharges to down-gradient land. The washes that traverse the Property may transport off site discharges onto/across the Property.

3.0 HISTORICAL USE

Standard Historical Sources were reviewed as necessary to develop a history of the previous uses of the Property and surrounding area in order to identify those uses that are likely to have led to RECs in connection with the Property. These sources were reviewed in five (or less) year intervals in an attempt to identify all obvious uses of the Property from the present until 1940 or until the Property's first obvious developed use, whichever is earlier. Standard Historical Sources include Aerial Photographs, USGS 7.5 Minute Topographical Maps, Zoning/Land Use Records, Building Department Records, Local Street Directories, Fire Insurance Maps, Property Tax Files, Recorded Land Title Records, Previous Site Studies and Other Historical Sources. The specific sources used to identify the historical use of the subject Property are described in the following sections. The earliest reasonably ascertainable historical source reviewed during this assessment was a topographic map dated 1978. Based on information gathered during this assessment, the Property historically appears to have been native desert land. While historical information prior to 1978 was not reasonably ascertainable, based on the location of the Property as well as the growth and use patterns in the Property area, it is Speedie and Associates opinion that not being able to review historical records prior to 1978 does not impact on our ability to identify RECs on the Property.

3.1 Aerial Photographs

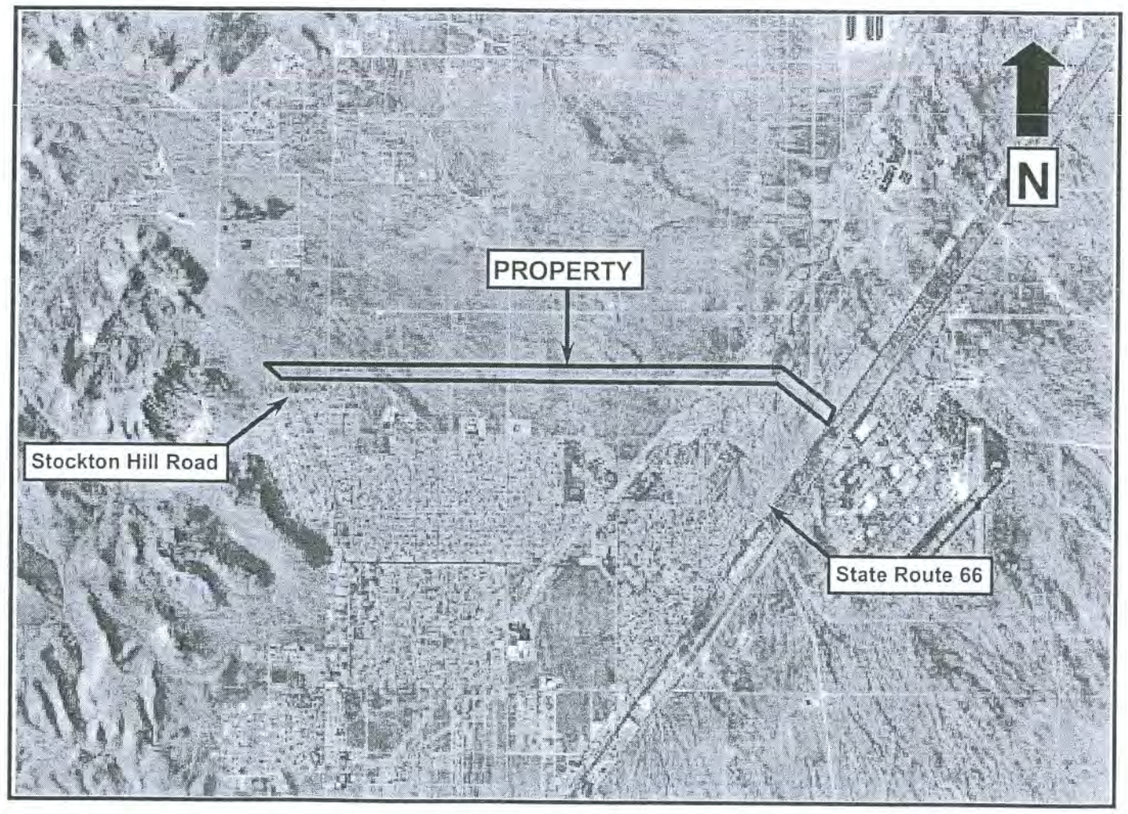
A review of limited available aerial photography from 1986 to 2006 was conducted at Landiscor Aerial Information (Landiscor), Rupp Aerial Photography (Rupp); Cooper Aerial Surveys (Cooper) and the Mohave County Assessor's Office (Mohave) web page to identify past uses and characteristics of the Property, and to determine and evaluate the nature of previous activities existing on-site, on adjoining sites or within the adjacent area. A copy of a selected photograph is included in Figure 3.1.1.

Subject Property: In the 1986 and 1991 aerial photographs, the Property appeared to be desert land with a few unpaved north/south trending roadways crossing the Property and an unpaved roadway generally along the assumed east/west centerline of the Property. There were no aerial photographs available for review at Landiscor, Rupp, Cooper or Mohave between 1991 and 2000. In the 2000 and 2006 aerial photographs, the Property appeared essentially unchanged (Landiscor; Rupp; Cooper; Mohave).

Adjacent Areas: In the 1986 and 1991 aerial photographs, the adjacent areas to the north and south appeared to be undeveloped desert land with some residential development approximately 0.3 miles to the south. The adjacent area to the east was occupied by State Route 66 followed by a railroad track with some commercial development beyond. The adjacent area to the west was occupied by Stockton Hill Road followed by desert land. There were no aerial photographs available for review at Landiscor, Rupp, Cooper

or Mohave between 1991 and 2000. In the 2000 and 2006 aerial photographs, the adjacent areas appeared essentially unchanged, except more residential development appeared to within 0.25 miles to the south, more commercial development was visible east of State Route 66, and an apparent commercial structure was visible west of Stockton Hill Road (Landiscor; Rupp; Cooper; Mohave).

Figure 3.1.1 2000 Aerial Photograph



3.2 Topographic Map

Topographical maps may identify structures, roads and general use of a Property for the year determined by the date of the map. The 1978 (unrevised) map depicted a few unpaved roads on/crossing the subject Property, however no other significant features were identified in the Property area (USGS).

3.3 Zoning/Land Use Records

Zoning/land use records show the uses allowed by the local government in the area encompassing a property. The Mohave County Planning and Zoning Department (MCPZD) was contacted regarding the Property. A counterperson at the MCPZD reported that the Property is currently not zoned since it is County right-of-way. No historical zoning information was provided by the MCPZD (Mohave, Planning). The Property has been part of Mohave County since the County was established in the late-1800s.

3.4 Building Department Records

Building department records are those records associated with the construction, alteration, or demolition improvements on a property. These records are available at the Mohave County Building Records Department, and are sorted by address/parcel. Since no addresses, parcel numbers or previous development were identified for the Property, Building Department records were not reviewed.

3.5 City Street Directories

City street directories can provide ownership information and/or use of a property as referenced by a street address, once identified. Since no physical address or previous development for the Property was identified, city directories were not reviewed.

3.6 Recorded Land Title Records

Recorded land title records are various documents regarding past use of a Property such as fee ownership, leases, land contracts, easements, liens, and other relevant documents that are potentially descriptive. As part of this assessment, AL reviewed appropriate public records in an effort to identify activity and use limitations recorded against the Property's legal description. The activity and use limitations researched included Voluntary Environmental Mitigation Use Restrictions (VEMURs), Declaration of Environmental Use Restriction (DEURs), and/or Environmental Liens. No apparent indications of VEMURs, DEURs or Environmental Liens affecting the subject Property were identified during this document review (All).

3.7 Fire Insurance Maps

Fire insurance maps that show uses of properties at specified dates are produced by private fire insurance companies. The Sanborn Fire Insurance Maps, available at the Arizona State Capital were

reviewed by AL. The subject Property is not located within the boundaries of the Sanborn maps available at the Arizona State Capital (All).

3.8 Property Tax Files

Property tax files identify past owners of a Property and may contain appraisals, maps, sketches, photographs and other information concerning a Property. Property tax files were not provided with the AL report (All).

3.9 Previous Environmental Site Assessments

Previous environmental assessments are obtained, when possible, and reviewed for indications of previously identified RECs that may have existed on or near the Property. No previous environmental assessments were provided to Speedie and Associates and we received no indication that previous assessments had been conducted on the Property.

4.0 INTERVIEWS

Interviews were attempted with owners, occupants, key site managers, and local government officials as necessary, regarding RECs for the Property. These interviews were attempted in person, by telephone, or by a written questionnaire.

4.1 Local Government Officials

Interviews were conducted with local agency personnel and other persons noted in the appropriate sections of this report. Typically, the local fire authority is contacted to determine if documents regarding hazardous materials permits, hazardous materials incidents, or underground storage tank (UST) activities exist for the subject Property. However, since no addresses or indications of previous development were identified, the local fire authority was not contacted.

4.2 Clients, Owners, and Occupants

As part of Speedie and Associates' Phase I ESA procedures, a questionnaire is provided to the client, owner, and key site manager, as necessary to obtain historical and current data about the subject Property prior to the site visit. However, due to the typical brisk period between project initiation and the site visit, it is unusual for all three contacts to have been made prior to the site visit. A questionnaire was

sent to Ms. Dana White of Durrant Architects, the client. A questionnaire was also sent to Mr. Michael P. Hendrix, P.E., the Mohave County Engineer.

As part of the questionnaire, Speedie and Associates requests information regarding environmental conditions, past/current ownership, and site use. The completed questionnaires had not been received by Speedie and Associates as of the writing of this report; however, if the completed questionnaires are received and if they indicate potential RECs in connection with the subject Property, an addendum will be issued to this report.

5.0 CURRENT CONDITIONS

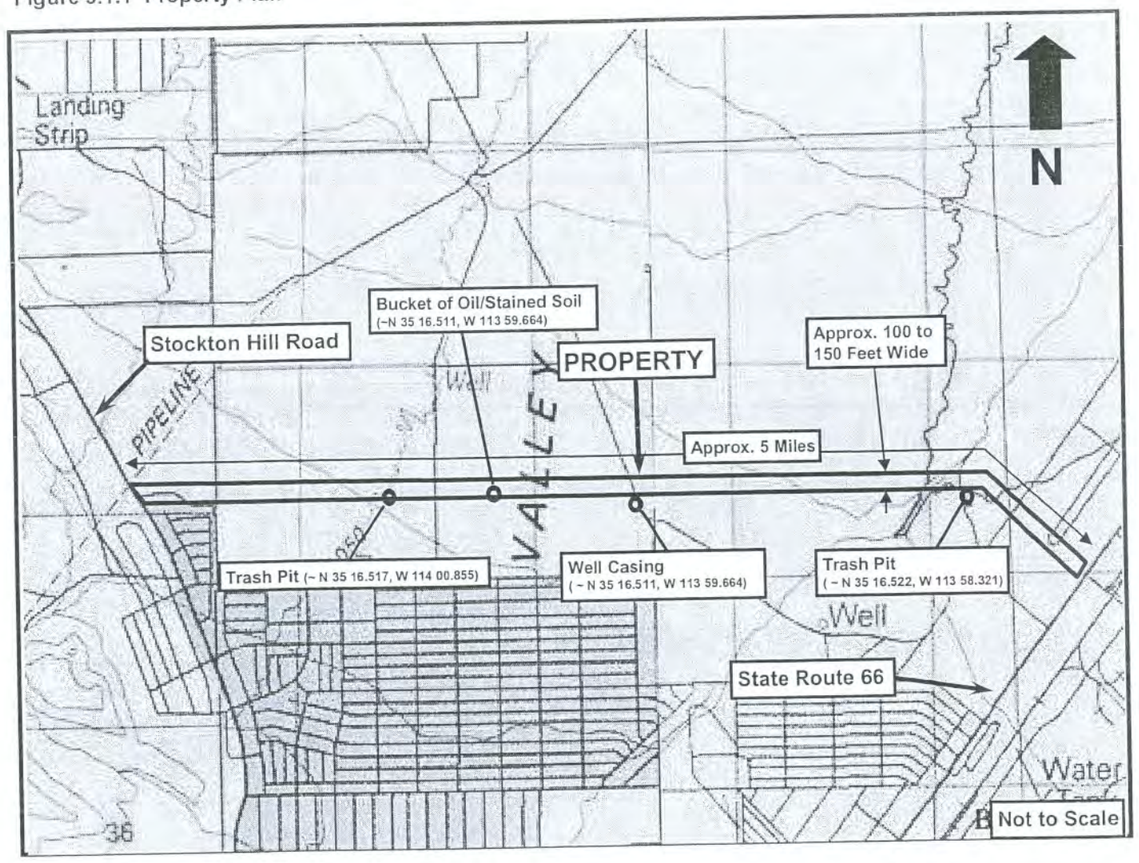
5.1 Current Property Use

A site reconnaissance was conducted to observe and record information concerning present site development, use, and conditions. A visual and physical survey of the existing Property was conducted on July 27, 2006 by Richard A. Schooler and Tim J. Miller of Speedie and Associates. Complete visual assessment of the Property was hindered by vegetation. The site visit was conducted by walking and driving about the Property. Selected photographs, taken on the site visit, are included in Appendix A (Surface Photographs). Figure 5.1.1 identifies Property boundaries.

At the time of the site reconnaissance, the subject Property consisted of a corridor of vacant land approximately five (5) miles long and approximately 100 to 150 feet wide. The Property surface generally consisted of bare soil or soil with low level vegetation. Vegetation included grass, brush and cacti. Several areas of what appeared to be surficial wildcat dumping were observed along the Property alignment. Materials observed in these dumping areas included household trash, concrete, landscaping debris, and appliances. Two (2) potential trash pits were also observed in the vicinity of the right-of-way, one approximately two (2) miles from the west end of the Property and one approximately one (1) mile from the east end of the Property. The trash observed on the surface in these areas appeared to consist of household trash and concrete; however, there appeared to be some buried trash associated with these areas as well. A five (5)-gallon bucket of used oil, an oil filter and a small oil stain on the ground surface were observed in Section 20; however, the amount of used oil appeared to be de minimus. A well casing was also observed south of the approximate Property centerline in Section 20; however, since the right-of-way was not specifically marked, the well casing may not be within the right-of-way area. An unpaved, un-maintained, roadway was present along most of the approximate centerline of the right-of-way and an overhead power line paralleled the roadway for most of its length. In addition, there appeared to be water and sewer lines paralleling the roadway for most of the length of the alignment. No other signs of previous development

were observed and no other unusual stains or odors were detected during the site reconnaissance. No other significant features were observed on the Property at the time of the site visit.

Figure 5.1.1 Property Plan



5.2 Transformers

In the past, oil found in electrical transformers contained Polychlorinated Biphenyls (PCBs), which have been found to be a human carcinogen. Since 1984, manufacturers of transformers have been certifying them "non-PCB", containing less than 50 parts per million (ppm). No (0) transformers were observed on the Property at the time of the site visit.

5.3 Dry Wells

The ADEQ maintains a database of dry wells, the registration of which has been required since 1986. All Lands reviewed this database for dry wells registered within a 0.125-mile radius of the subject Property. Based on this review, no (0) dry wells were identified within the search radius (All). Further, no (0) dry wells were observed on the subject Property at the time of the site visit.

5.4 Asbestos

Asbestos issues are not RECs and therefore are of no consequence regarding Appropriate Inquiry (CERCLA liability) per ASTM 1527. However, as part of Speedie and Associates' due diligence, we believe it is prudent to inform clients of the regulations that govern the asbestos industry and the effects that they have on property owners/managers.

The asbestos industry is one of the most regulated fields in today's market. Both the Occupational Safety & Health Administration (OSHA) and the Environmental Protection Agency (EPA) have rules that govern the asbestos industry. These rules affect our clients because they govern asbestos containing materials (ACMs), which may be found in all buildings, regardless of the size or age of the structure. OSHA regulations govern the identification and management of ACMs within a structure, and the protection of employees who may disturb ACMs. Per the regulations, suspect ACMs are those materials that are other than wood, glass, or steel. The EPA governs ACMs within schools, and the disturbance of ACMs within any other structure that is deemed a "facility." The EPA identifies a "facility" as any institutional, commercial, public, industrial, or residential structure, installation, or building (including any structure, installation, or building containing condominiums or individual dwelling units operated as a residential cooperative, but excluding residential buildings having four or fewer dwelling units).

These regulations affect clients who own or manage a building where people are employed. Building owners are required by OSHA to identify and manage the ACMs located within the structure and to protect employees from asbestos exposures. Further, if a property owner or manager intends to renovate or demolish a "facility," they are required by the EPA to thoroughly inspect the "facility" for ACMs, and to prevent fiber releases from occurring from any identified ACMs. No structures deemed a "facility" were identified on the Property.

5.5 Adjoining Land Use

A visual survey of the adjoining sites and areas was conducted on July 27, 2006 by Richard A. Schooler and Tim J. Miller of Speedie and Associates. The Property is generally bound on the north and south by vacant land, on the east by State Route 66 and on the west by Stockton Hill Road. Some areas both

north and south of the Property alignment appeared to have been cleared for future development. Commercial development was present beyond State Route 66 east of the Property and an Arizona Department of Game and Fish facility was present on the west side of Stockton Hill Road west of the Property.

6.0 FEDERAL AND STATE ENVIRONMENTAL RECORDS

A report of Federal and State Standard Environmental Record Sources located within the ASTM prescribed search parameters was generated by AL. A copy of the AL report is located in Appendix C. Speedie and Associates reviewed this report for indications of RECs affecting the subject Property. The report revealed five (5) facility records within the search parameters. The AL report identified no (0) National Priority List (NPL) sites, no (0) Water Quality Assurance Revolving Fund (WQARF) Registry Sites, no (0) Resource Conservation and Recovery Act (RCRA) CORRACTS Treatment Storage and Disposal (TSD) facilities and three (3) RCRA Compliance Log facilities within 1.0 mile of the Property. The report identified no (0) Delisted NPL sites, no (0) RCRA TSD facilities, no (0) Landfill facilities, one (1) Federal Compensation and Liability Information System (CERCLIS)/No Further Remedial Action Planned (NFRAP) site, no (0) Arizona Superfund sites, and one (1) Leaking Underground Storage Tank (LUST) facility within 0.5 miles of the Property. The report also identified no (0) RCRA generators, no (0) Underground Storage Tank (UST) sites, no (0) Emergency Response Notification System (ERNS) sites and Hazardous Materials Incidents within 0.125 miles of the Property (All). The potential environmental concerns regarding these identified records/facilities are discussed below:

- The AL report identified three (3) Resource Conservation and Recovery Act (RCRA) Compliance facilities within a 1.0 mile radius of the subject Property. The RCRA Compliance Log lists facilities that have been or presently are under investigation for non-compliance with RCRA regulations. Inclusion of any facility on this list indicates a history of compliance problems and RCRA regulatory violation.

  Southwire Kingman/General Cable Company, 4900 Industrial Boulevard, is located approximately 0.3 miles southeast of the east end of the Property alignment. Goodyear Aviation, 4105 Mohave Airport Drive, is located approximately 0.6 miles southeast of the east end of the Property alignment. Laidlaw Corporation, 4545 Interstate Way, is located approximately 0.8 miles southeast of the east end of the Property alignment. None of these facilities are located on or adjacent to the subject Property. Additionally, the RCRA Compliance files for each of these facilities is reported to be closed. No surficial flow paths or indications of impact from these facilities to the subject Property were identified during the site visit. Therefore, the potential environmental impact from these facilities to the subject Property is currently believed to be low.

- The AL report identified one (1) Federal CERCLIS facility within a 0.5 mile radius of the subject Property. Inclusion on this list does not indicate contamination is present at these sites, but that these facilities are subject to investigation under the Federal CERCLA program. The CERCLIS list contains sites, which are either proposed to or on the NPL, and sites, which are in the screening and assessment phase for possible inclusion on the NPL. The NFRAP list is a listing of former CERCLIS sites, which no further remedial action is planned under CERCLA. General Cable Corporation, 4900 Industrial Boulevard, is located approximately 0.3 miles southeast of the east end of the Property alignment. This facility is indicated to be a NFRAP facility. No surficial flow paths or indications of impact from this facility to the subject Property were identified during the site visit. Therefore, the potential environmental impact from this facility to the subject Property is currently believed to be low.

- The AL report identified one (1) LUST facility with one (1) LUST incident within a 0.5 mile radius of the subject Property. The ADEQ maintains a LUST database that enumerates reported facilities having known or suspected releases to the soils or groundwater emanating from USTs located on the site. The LUST facility was identified as Mohave Community College, 1971 East Jagerson Avenue, which is located approximately 0.5 miles south of the Property alignment. This facility is not located on, or adjacent to the subject Property and this facility is reported to have one (1) closed LUST incident that is characterized as being closed with soil levels meeting Risk-Based Corrective Action (RBCA) criteria. Due to the distance from the Property and the closed status of this facility, the potential environmental impact from this facility to the subject Property is currently believed to be low.

7.0 FINDINGS AND CONCLUSIONS

At the time of the site visit, the Property consisted of a proposed roadway alignment measuring approximately five (5) miles in length and approximately 100 to 150 feet in width. The Property was identified based on aerial photographs provided by Durrant Architects and Brooks Engineering with the approximate centerline of the proposed Grace Neal Parkway marked. The Property generally followed unpaved, unnamed, roadways and an overhead powerline. No apparent centerline or right-of-way markings were observed in the field. The Property alignment consisted of bare soil or soil with sparse vegetative cover and no obvious uses were observed. The Property was accessed from State Route 66 and Stockton Hill

Road. Historically, the Property appeared to be vacant desert land with unpaved roads; although, it is likely that the Property has been used for livestock grazing in the past.

Some wildcat dumping of primarily household trash including appliances and furniture was observed along the alignment. In addition, a five (5)-gallon bucket of apparent used oil, an oil filter and a small area of stained soil were observed. The oil stain appeared to be de minimus.

We have performed a Phase I ESA in conformance with the scope and limitations of ASTM Standard Practice E 1527 for the subject Property, identified as the Grace Neal Parkway Corridor located between Stockton Hill Road and State Highway 66 on the north side of Kingman, Arizona in Mohave County. Any exceptions to, or deletions from, this practice are described in Section 1.1 of this report. This assessment has revealed no evidence of RECs in connection with the Property.

8.0 RECOMMENDATIONS

Based on information collected during Phase I ESA procedures and analysis, no further investigation into RECs at the subject Property is recommended. However, areas of wildcat dumping should be removed and properly disposed. If the identified apparent trash pits are located within the right-of-way of the proposed parkway alignment, these areas should also be cleaned and the resultant debris properly disposed. As part of this removal process, should any unusual odors or suspect debris be encountered, a qualified environmental professional should be retained to evaluate the materials encountered.

9.0 LIMITATIONS

Our investigation has been carried out with diligence and detail consistent with prevailing standards and engineering practice. The scope of this investigation was limited to visual and physical observations made during the site visit, interviews with public agency personnel and a review of reasonably ascertainable records and literature. As a result, our conclusions are based largely on information supplied by others. We as environmental professionals are not required to verify the information, but may rely on the information unless actual knowledge concerning the validity of the information is known or is obvious to the professional, based on other collected information. The assessment focus was on identifying the presence or likely presence of any hazardous substances or petroleum products on a Property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the Property or into the ground, groundwater, or surface water of the

Property. We are unable to predict events, which may occur after our site visit and result in Property contamination, such as "midnight" dumping or accidental spillage.

No environmental site assessment can wholly eliminate uncertainty regarding the potential for RECs in connection with a Property. Performance with ASTM Practice environmental 1527 is intended to reduce, but not eliminate uncertainty, in connection with a Property while recognizing reasonable limits of time and cost. It should not be concluded or assumed that an inquiry was not appropriate inquiry merely because the inquiry did not identify RECs in connection with a Property. Additionally, it cannot be assumed that any RECs identified during the assessment are the only conditions to exist for the Property. Any conclusion should not be construed as a guarantee for absence, or an attempt at quantification of materials creating RECs, but merely the results of the assessment.

We have performed our services for this project in accordance with our proposal and the report is solely for the use of Durrant Architects, Brooks Engineering and Mohave County. Any reliance on this report by any other party shall be at such party's sole risk.

Respectfully submitted,
SPEEDIE AND ASSOCIATES, INC.

Richard A. Schooler, R.G., Project Geologist

Tim J. Miller, Project Manager

Registered Professional Engineer (Civil) CERTIFICATE NO. 14724 STEVEN A. GRIESS Date Signed ARIZONA, U.S.A.

Steven A. Griess, P.E.

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APPENDIX A: Surface Photographs

Photo No. 1: East end of the Property alignment at the intersection with State Highway 66 looking northwest along the approximate alignment.

Photo No. 2: East end of the Property alignment at the intersection with State Highway 66 looking northeast across the Property alignment.

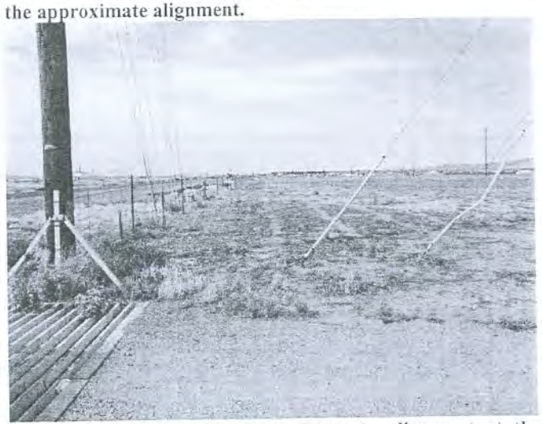


Photo No. 3: East end of the Property alignment at the intersection with State Highway 66 looking southwest across Property alignment.

Photo No. 4: Discarded tires observed along the Property alignment approximately 0.25 miles west of State Highway 66.

Photo No. 5: Approximately 0.5 miles west of the intersection with State Highway 66 looking east approximately along the Property alignment.

Photo No. 6: Approximately 0.5 miles west of the intersection with State Highway 66 looking north across the Property alignment.

Photo No. 7: Approximately 0.5 miles west of the intersection with State Highway 66 looking south across the Property alignment.

Photo No. 8: Approximately 0.5 miles west of the intersection with State Highway 66 looking west along the approximate Property alignment.

Photo No. 9: Debris adjacent to soil berm near on the south side of Property alignment approximately 0.75 miles west of the intersection with State Highway 66.

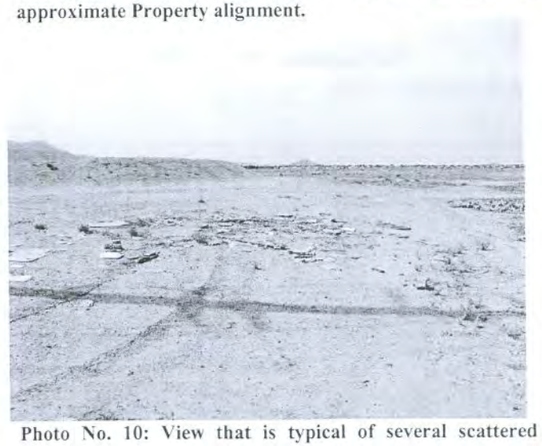


Photo No. 10: View that is typical of several scattered household debris areas along the Property alignment.

Photo No. No. 11: Approximately 1.5 miles west of the intersection with State Highway 66 looking east along the approximate Property alignment.

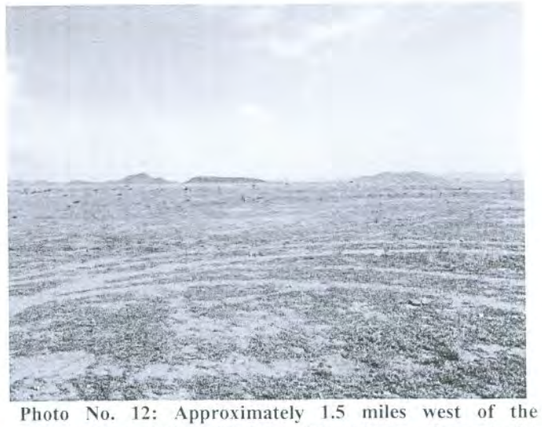


Photo No. 12: Approximately 1.5 miles west of the intersection with State Highway 66 looking north across the Property alignment.

Photo No. 13: Approximately 1.5 miles west of the intersection with State Highway 66 looking south across the Property alignment.

Photo No. 14: Approximately 1.5 miles west of the intersection with State Highway 66 looking west along the approximate Property alignment.

Photo No. 15: View of the typical type of household trash/debris observed at points along the Property alignment.

Photo No. 16: View of the typical type of household trash/debris observed at points along the Property alignment.

Photo No. 17: Well casing located approximately 200 feet south of assumed centerline of the Property alignment approximately 2.0 miles west of State Highway 66.

Photo No. 18: Approximately 2.5 miles west of intersection with State Highway 66 looking east along the approximate Property alignment.

Photo No. 19: Approximately 2.5 miles west of the intersection with State Highway 66 looking north across the Property alignment.

Photo No. 20: Approximately 2.5 miles west of the intersection with State Highway 66 looking south across the Property alignment.

Photo No. 21: Approximately 2.5 miles west of the intersection with State Highway 66 looking west along the approximate Property alignment.

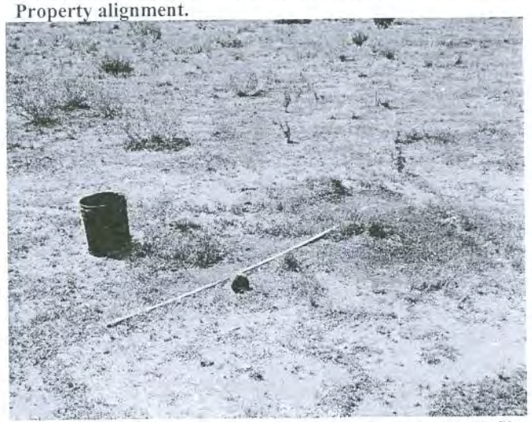


Photo No. 22: Five (5)-gallon bucket of used oil, oil filter and stained soil on the south side of the Property alignment approximately 2.75 miles west of State Highway 66.

Photo No. 23: Household trash/debris located approximately 0.25 miles east of the intersection with Bank Street about 3.0 miles west of State Highway 66.

Photo No. 24: Approximately 3.0 miles west of intersection with State Highway 66 at the intersection with Bank Street looking east along the approximate Property alignment.

Photo No. 25: Approximately 3.0 miles west of the intersection with State Highway 66 at the intersection with Bank Street looking north along Bank Street.

Photo No. 26: Approximately 3.0 miles west of the intersection with State Highway 66 at the intersection with Bank Street looking south along Bank Street.

Photo No. 27: Approximately 3.0 miles west of the intersection with State Highway 66 at the intersection with Bank Street looking west along the Property alignment.

Photo No. 28: Trash pile located along the south side of the Property alignment approximately 0.25 miles west of the intersection with Bank Street.

Photo No. 29: Approximately 3.5 miles west of the intersection with State Highway 66 looking east along the approximate Property alignment.

Photo No. 30: Approximately 3.5 miles west of the intersection with State Highway 66 looking north across the Property alignment.

Photo No. 31: Approximately 3.5 miles west of the intersection with State Highway 66 looking south across the Property alignment.

Photo No. 32: Approximately 3.5 miles west of the intersection with State Highway 66 looking west along the approximate Property alignment.

Photo No. 33: Approximately 4.5 miles west of the intersection with State Highway 66 looking east along the approximate Property alignment.

Photo No. 34: Approximately 4.5 miles west of the intersection with State Highway 66 looking north across the Property alignment.

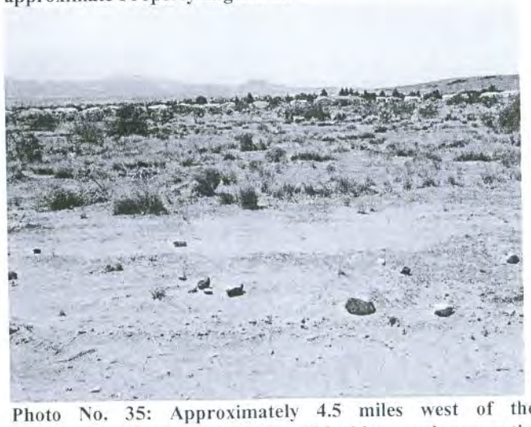


Photo No. 35: Approximately 4.5 miles west of the intersection with State Highway 66 looking south across the Property alignment.

Photo No. 36: Approximately 4.5 miles west of the intersection with State Highway 66 looking west along the approximate Property alignment.

Photo No. 37: Potential southern alternate intersection with Stockton Hill Road looking east along the west end of the Property alignment.

Photo No. 38: Potential southern alternate intersection with Stockton Hill Road looking north across the Property alignment.

Photo No. 39: Potential southern alternate intersection with Stockton Hill Road looking south across the Property alignment.

Photo No. 40: Potential northern alternate intersection with Stockton Hill Road looking east along the approximate Property alignment.

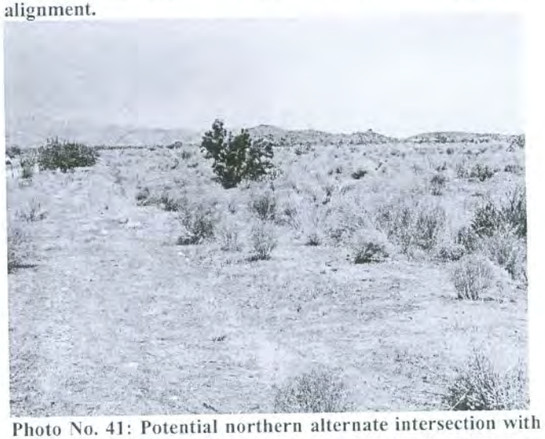


Photo No. 41: Potential northern alternate intersection with Stockton Hill Road looking north across the Property alignment.

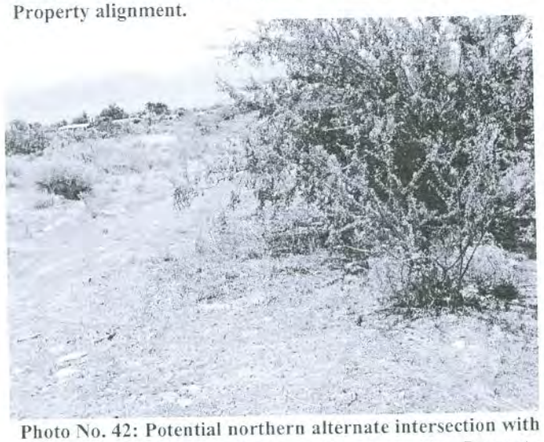


Photo No. 42: Potential northern alternate intersection with Stockton Hill Road looking south across the Property alignment.

APPENDIX B: Project Personnel Credentials

TIM J. MILLER - *Project Manager-Environmental Assessments and Asbestos Services*

Mr. Miller is responsible for directing the efforts of a project team in performing Preliminary Environmental Site Assessments and Asbestos Inspections. In this capacity, Mr. Miller manages and oversees all phases of Phase I Environmental Site Assessments, Transaction Screens, and Asbestos Services. This includes project scope definition, technical resource allotment and assessment, project tracking, client status communications as necessary, and general project oversight. Mr. Miller received his Bachelor degree in Forest Land Management from Northern Arizona University and has over 10 years experience in the field of engineering including environmental site assessments (preliminary, investigative, and remediation), fuel storage management, and asbestos assessments (inspections, operation and maintenance plans, and abatement oversight).

RICHARD A. SCHOOLER, R.G. – *Project Geologist*

Mr. Schooler is a registered geologist in the State of Arizona with more than 30 years of consulting experience and 15 years of experience performing hazardous and non-hazardous waste investigations, soil and groundwater characterizations, and environmental site assessments. Mr. Schooler received his Bachelors and Masters degrees in geology from Bowling Green State University and has performed Phase I and II investigations throughout Arizona.

STEVEN A. GRIESS, P.E. - *Department Manager*

Mr. Griess is a registered professional engineer in the state of Arizona and has over 20 years experience in the field of geotechnical, materials and environmental engineering on a wide variety of projects including government, industrial, residential and manufacturing sites. Mr. Griess' experience in the environmental engineering area ranges from preliminary environmental site assessments to site characterization and remediation. Mr. Griess acts as the Environmental Department Manager and in that capacity is responsible for project review and oversight.

ALL LANDS
14947 W. Piccadilly Road, Goodyear, AZ 85338
(623) 535-7800 FAX (623) 535-7900

REGULATORY DATABASE (ASTM) SEARCH

YOUR FILE NO: 061412EA

ALLANDS FILE NO: 2006-07-079D

DATE: July 28, 2006

ALL LANDS hereby reports the search results of Federal and State Databases according to ASTM standards for Phase I Environmental Site Assessments E 1527-05. This is a confidential, privileged and protected document for the use of Speedie & Associates. All Lands is not responsible for errors in the available records. The total liability is limited to the fee paid for this report.

1. The land referred to in this report is located in Mohave County, Arizona, described as follows:

Property located along the proposed Gracie Neal Parkway, North of Jagerson Avenue, Kingman, Arizona, being in Section 24, Township 22 North, Range 17 West; and Sections 19, 20, 21 & 22, Township 22 North, Range 16 West, Gila and Salt River Base and Meridian.

SUMMARY

FEDERAL & STATE ENVIRONMENTAL RECORDS RECORDS (miles)	<=0.125	0.125 - 0.25	0.25 - 0.5	0.5 - 1.0
NPL	0	0	0	0
DELISTED NPL	0	0	0	-
WQARF	0	0	0	0
RCRA CORRACTS TSD	0	0	0	0
RCRA TSD FACILITES	0	0	0	-
LANDFILLS	0	0	0	-
CERCLIS / NFRAP	0	1	0	-
AZ SUPERFUND	0	0	0	-
LUST	0	0	1	-
RCRA GENERATORS	0	-	-	-
UST	0	-	-	-
ERNS	0	-	-	-

OTHER ENVIRONMENTAL RECORDS RECORDS (miles)	<=0.125	0.125 - 0.25	0.25 - 0.5	0.5 - 1.0
RCRA COMPLIANCE	0	1	0	2
SARA	0	-	-	-
HAZ. MAT. INCIDENTS	0	-	-	-
Dry well	0	-	-	-
RADON	see text			
Environmental Permits	0	-	-	-
State Institutional / Engineering Control Registries	see text			
Brownfields / Voluntary Cleanup Program	see text			
VEMURS / LIENS	see text			
FIRE INSURANCE MAPS	see text			
TOPOGRAPHIC DATA	see text			
ADWR Well Report	see text			

DEFINITIONS:

ADWR	Arizona Department of Water Resources
ADEQ	Arizona Department of Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	Federal CERCLA List
CORRACTS	TSD Facilities subject to Corrective Action under RCRA
EPA	US Environmental Protection Agency, Region IX
ERNS	Emergency Response Notification System
LUST	Leaking Underground Storage Tank
NFRAP	CERCLA Site which has no further remedial action planned
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List (Superfund)
RADIUS	by definition includes subject property measured from exterior boundaries
RCRA	Resource Conservation and Recovery Act
SARA	Superfund Amendment and Reauthorization Act
TSD	Treatment, Storage, Disposal Facility
UST	Underground Storage Tank
WQARF	Water Quality Assurance Revolving Fund

SUPERFUND NATIONAL PRIORITIES LIST (NPL)

Under Section 105 of the Comprehensive Environmental Response, Compensation and Liability Act the Environmental Protection Agency established a National Priorities List (NPL) of Superfund sites. Inclusion on the NPL reflects a significant risk to public health and the environment and indicates a Federal Priority to remediate the site. This database is provided by the Arizona Department of Environmental Quality, dated July, 2004, and searched to identify all NPL sites within a 1.0 mile search distance from subject property exterior boundaries.

No National Priorities List (NPL) Sites were found located within a 1.0 mile search distance from subject property exterior boundaries.

DELISTED NATIONAL PRIORITIES LIST

Site may be delisted from the National Priorities List where no further response is appropriate. This database is provided by the Environmental Projection Agency, dated February 2006, and searched to identify all Delisted NPL Sites within a 0.5 mile search distance from subject property exterior boundaries.

No Delisted National Priorities List (NPL) Sites were found located within a 0.5 mile search distance from subject property exterior boundaries.

WATER QUALITY ASSURANCE REVOLVING FUND (WQARF)

The state of Arizona established a remedial program under A.R.S. 49-282 to facilitate the conservation and clean-up of Arizona drinking water and water sources. Under the authority of the WQARF program, the state actively identifies any actual or potential impact upon state waters, evaluates the extent of contamination, identifies parties responsible, and provides money grants to assist in clean-up activities. This database is provided by the Arizona Department of Environmental Quality dated July, 2004, and searched to identify all WQARF sites within a 1.0 mile search distance from subject property exterior boundaries.

No WQARF Registry List sites were found located within a 1.0 mile search distance from subject property exterior boundaries.

CORRACTS FACILITIES

Under RCRA the Environmental Protection Agency compiles a database of Corrective Action Sites, sites with known contamination. Also known as the RCRA CORRACTS List, this is a list maintained by the EPA of RCRA sites at which contamination has been discovered and where some level of corrective clean-up activity has been undertaken. For example, a site may have been on the RCRA TSD or the RCRA Generators site list, and was placed on the CORRACTS list once contamination was discovered and remediation was underway. This database is dated January, 2006, and checked for facilities which occurred within a 1.0 mile search distance from subject property exterior boundaries.

No Facilities were found which occurred within a 1.0 mile search distance from subject property exterior boundaries.

TSD FACILITIES

Under RCRA the Environmental Protection Agency compiles a database of facilities that are involved in the transportation, treatment, storage, or disposal of hazardous materials. This database is from the Arizona Department of Environmental Quality Arizona Hazardous Waste Treatment, Storage and Disposal Facilities, dated January, 2006, and checked for Facilities which occurred within a 0.5 mile search distance from subject property exterior boundaries.

No TSD Facilities were found which occurred within a 0.5 mile search distance from subject property exterior boundaries.

LANDFILLS

The state of Arizona maintains listings of closed and permitted, operating landfills and solid waste dump sites. Lists of closed facilities are not necessarily complete - older dumping areas may not be documented. This database is from the Arizona Department of Environmental Quality Waste Programs Division; Solid Waste Section Directory of Arizona Active and Inactive Landfills dated May, 1999 and May, 2004, and checked for active and inactive landfills located within a 0.5 mile search distance from subject property exterior boundaries.

No active nor inactive landfills were found located within a 0.5 mile search distance from subject property exterior boundaries.

Codes:

CSWLF: **Closed Solid Waste Landfills**
CSWOD: **Closed Solid Waste Dumps**

FEDERAL CERCLIS / NFRAP LIST

The CERCLIS list contains sites which are either proposed to or on the NPL and sites which are in the screening and assessment phase for possible inclusion on the NPL. Those sites on the NFRAP list have no further remediation action planned. This database is provided by EPA through the Right of Know Net by OMB Watch and Unison Institute dated April, 2005, and searched for facilities within a 0.5 mile search distance from subject property exterior boundaries.

EPA ID	NFRAP	FACILITY	ADDRESS	DISTANCE/ DIRECTION
AZD043844083	X	General Cable Corp	4900 Industrial Blvd.	0.3 mi. Southeast

ARIZONA SUPERFUND PROGRAM LIST

The Arizona Superfund Program List replaces the Arizona CERCLIS Information Data System (ACIDS) This list is more representative of the sites and potential sites within jurisdiction of the Arizona Department of Environmental Quality Superfund Programs Section (SPS). This database is provided by the Arizona Department of Environmental Quality, dated August, 2004, and searched to identify all sites within a 0.5 mile search distance from subject property exterior boundaries.

No facilities were found located within a 0.5 mile search distance from subject property exterior boundaries.

Program Status codes:

Program Status codes:

Pending PI	WQARF Preliminary Investigation (PI) is scheduled or in process
On Registry	PI has resulted in inclusion of a site on the WQARF Registry
ACTIVE	The Department of Defense is presently addressing the site
On NPL	site has been listed on the CERCLA National Priorities List

REGISTERED LEAKING UNDERGROUND STORAGE TANKS (LUST)

Owners of USTs are required to report to the Arizona Department of Environmental Quality any and all releases of tank contents for which ADEQ maintains an ongoing file documenting the nature of contamination and the status of each such incident. This database is from the ADEQ LUST Log dated May, 2005, and searched for LUST sites located within a 0.5 mile search distance from subject property exterior boundaries.

ID	LUST ID NO	FACILITY	ADDRESS	DATE OPEN	DATE CLOSED	P CODE	DIST./ DIREC.
0-002129	2034.01	Mohave Community College	1971 E Jagerson Ave	11/1/1991	1/22/1996	5R1	0.5 mi. S

P CODE (Leaking UST Priority):

5R1	Closed soil levels meet RBCA

RESOURCE CONSERVATION AND RECOVERY ACT FACILITIES (RCRA)

Under RCRA the Environmental Protection Agency compiles a database of facilities that are involved in the generation of hazardous materials. This database is from the Arizona Department of Environmental Quality RCRAInfo Database, dated January, 2006, and checked for Federal RCRA facilities located within a <=0.125 mile search distance from subject property exterior boundaries.

No Federal RCRA handlers were found located within a <=0.125 mile search distance from subject property exterior boundaries.

CODES:

LQG:	Large quantity generator (more than 1000 kg per month)
SQG:	Small quantity generator (100 – 1000 kg per month)
CEG:	Conditionally exempt small quantity generator (less than 100 kg per month)
N :	Not a generator verified or inactive generator

REGISTERED UNDERGROUND STORAGE TANKS (UST)

State (A.R.S. 49-1001 to 1014) and Federal (RCRA Subtitle I) laws require that persons who own or have owned underground storage tanks containing "regulated substances" complete a notification form and register the tank with the state. This database is from the Arizona Department of Environmental Quality UST Log dated May, 2005, and searched for UST sites located within a <=0.125 mile search distance from subject property exterior boundaries.

NOTE: Details section is from the ADEQ 2003 UST list, newer lists do not provide this information.
CG: Closed in Ground
TC: Temporarily Closed

No registered underground storage tanks were found located within a <=0.125 mile search distance from subject property exterior boundaries.

FEDERAL EMERGENCY RESPONSE NOTIFICATION SYSTEM (ERNS) LIST

The ERNS list is a national database used to collect information on reported releases of oil and hazardous substances. This database is provided by EPA through the Right of Know Net by OMB Watch and Unison Institute from 1983 to April, 2005, and checked for incidents located within a <=0.125 mile search distance from subject property exterior boundaries.

No incidents were found located within a <=0.125 mile search distance from subject property exterior boundaries.

OTHER ENVIRONMENTAL RECORDS

RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) COMPLIANCE FACILITIES

The RCRA Compliance Log lists facilities that have been or presently are under investigation for non-compliance with RCRA regulations. Inclusion of any facility on this list indicates a history of compliance problems and RCRA regulatory violation. This database is from the Arizona Department of Environmental Quality RCRA Compliance Log, dated April, 2005, and searched for compliance facilities within a 1.0 mile search distance from subject property exterior boundaries.

ID	EPA ID	FACILITY	ADDRESS	STATUS	DISTANCE/ DIRECTION
	AZD043844083	Southwire Kingman / General Cable Co	4900 Industrial Blvd	CLOSED	0.3 mi. SE
	AZD983483512	Goodyear Aviation Pr	4105 Mohave Airport Dr	CLOSED	0.6 mi. SE
2292	AZD980892558	Laidlaw Corp	4545 Interstate Wy	CLOSED	0.8 mi. SE

SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) TITLE III EXTREMELY HAZARDOUS SUBSTANCES SITES

Under the Community Right-To-Know portion of SARA, facilities which must prepare, or have available, material safety data sheets (MSDS) and must submit either copies of the MSDS or a list of the chemicals to the State Emergency Response Commission. This Database is from the SARA Title III List dated April, 2005, and searched to identify all SARA sites within a <=0.125 mile search distance from subject property exterior boundaries.

No SARA facilities were found located within a <=0.125 mile search distance from subject property exterior boundaries.

HAZARDOUS MATERIAL INCIDENTS

The Arizona Department of Environmental Quality (ADEQ) Response Team documents spills and incidents involving hazardous materials that are reported to the unit. This database is from the Arizona Department of Environmental Quality Emergency Response Log from 1984 through June, 2001, and checked for hazardous material incidents located within a <=0.125 mile search distance from subject property exterior boundaries.

No hazardous material incidents were found located within a <=0.125 mile search distance from subject property exterior boundaries.

ADEQ DRY WELL REGISTRATION DATA BASE

Dry wells are constructed for the purpose of collecting storm waters. Dry wells are required to be registered with ADEQ. This database is from the ADEQ dry well registration database dated April, 2005, and searched for dry wells located within a <=0.125 mile search distance from subject property exterior boundaries.

No registered dry wells were found located within a <=0.125 mile search distance from subject property exterior boundaries.

ARIZONA RADIATION REGULATORY AGENCY HOME RADON SURVEY

The Arizona Radiation Regulatory Agency, in cooperation with the EPA, initiated a program to measure radon concentrations with the primary goal of determining the statewide distribution of radon and identify areas of potentially high concentrations. This database is from the ARRA Home Radon Survey revised June 16, 1993, for the subject property zipcode.

ZIPCODE	HIGH VALUE in picoCuries/liter	NO. OF TESTS	TESTS <4.0 pCi/L	TESTS at 4.0+ pCi/L
86401	1.8	22	22	0

ENVIRONMENTAL PERMITS

These lists include Groundwater Permits, Reuse Permits; National Pollutant Discharge Elimination System (NPDES) Permitted Facilities and Aquifer Protection Permits. Any facility which discharges a material that directly or indirectly adds any pollutant to the waters of the state may be required to obtain a permit as required by the Aquifer Protection Permit Rules. These databases are from the Arizona Department of Environmental Quality and the Environmental Protection Agency and updated to May, 2001, and checked for inclusion of subject property. **

**Note: these records are sorted by name without address or location information. Only those entity names provided for this report and/or as shown on Assessor's records will be researched.

This list was not researched.

CONTROL REGISTRIES

Under ASTM E 1527-05, Federal, State and Tribal institutional control / engineering control registries need to be researched. The Arizona Department of Environmental Quality has developed the AZURITE Tracking System, which retrieves any institutional or engineering controls, dated March, 2006, and searched for sites which occurred at subject property or adjoining properties.

No institutional or engineering controls were found which occurred at subject property or adjoining properties.

BROWNFIELDS / VOLUNTARY CLEANUP PROGRAM

The Arizona Department of Environmental Quality has developed the AZURITE Tracking System, which includes the ADEQ Voluntary Remediation Program and the ADEQ Brownfields Program, dated November, 2005, and searched for sites which occurred within a 0.5 mile search distance from subject property exterior boundaries.

No brownfield sites were found which occurred within a 0.5 mile search distance from subject property exterior boundaries.

VOLUNTARY ENVIRONMENTAL MITIGATION USE RESTRICTIONS BY OWNERS (VEMUR'S); DECLARATION OF ENVIRONMENTAL USE RESTRICTIONS (DEUR); AND ENVIRONMENTAL LIENS

A.R.S. 49-152. This states that the Director of the Arizona Department of Environmental Quality shall allow property owners, who have voluntarily elected to remediate their property for nonresidential uses, to record in the applicable county recorders office a VEMUR limiting, by legal description, the area necessary to protect public health and the environment to nonresidential uses if contamination remains on the property at or above certain levels. In accordance with Arizona Administrative Code (A.A.C.) R18-7-201 et. Seq., a Declaration of Environmental Use Restriction (DEUR) is a voluntary notice to deed which restricts the use of a property to non-residential use.

No VEMUR'S, DEUR'S; Environmental Liens, or activity and use limitations, if any, was not researched

FIRE INSURANCE MAPS

A review was made at the Arizona State Capital Archives for Fire Insurance Maps, more commonly known as Sanborn Maps, which covered the area in which the subject property is located. There are no maps available for county areas. Subject property is not located within the boundaries of available maps.

USGS 7.5 MINUTE TOPOGRAPHICAL MAPS AERIAL PHOTOS

The United States Geological Survey Topographic maps and Aerial Photos are derived from Terrain Navigator Software from Maptech, Inc. (www.maptech.com) and are for informational purposes only.

NAME	TYPE	DATE	REVISION	CONTOUR
Stockton Hill	Topo	1968	1980	40 feet
Stockton Hill SE	Aerial	5-31-1997		
Kingman Airport	Topo	1968	1980	10 feet
Kingman Airport SW	Aerial	7-3-1997		

ARIZONA DEPARTMENT OF WATER RESOURCES
WELL REPORT

This database is from the Arizona Department of Water Resources Well Report Operations Division Report, dated September, 2005. This report identifies existing wells sequenced by legal description and checked for inclusion of subject site and adjacent properties within 10 Acres.

Imaged Records are available at: http://www.water.az.gov/adwr/Content/ImagedRecords/default.htm

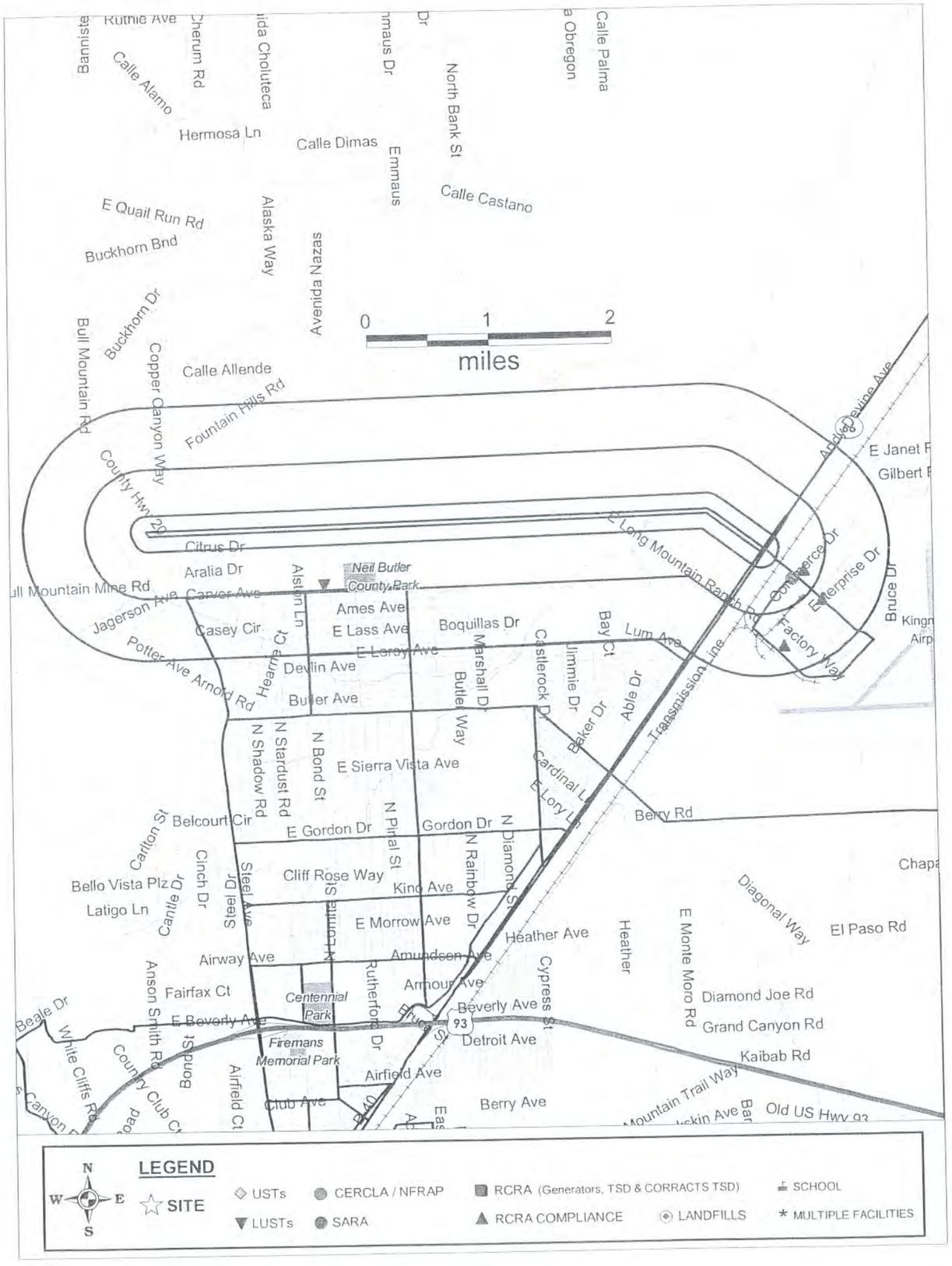
Water Uses (WU)

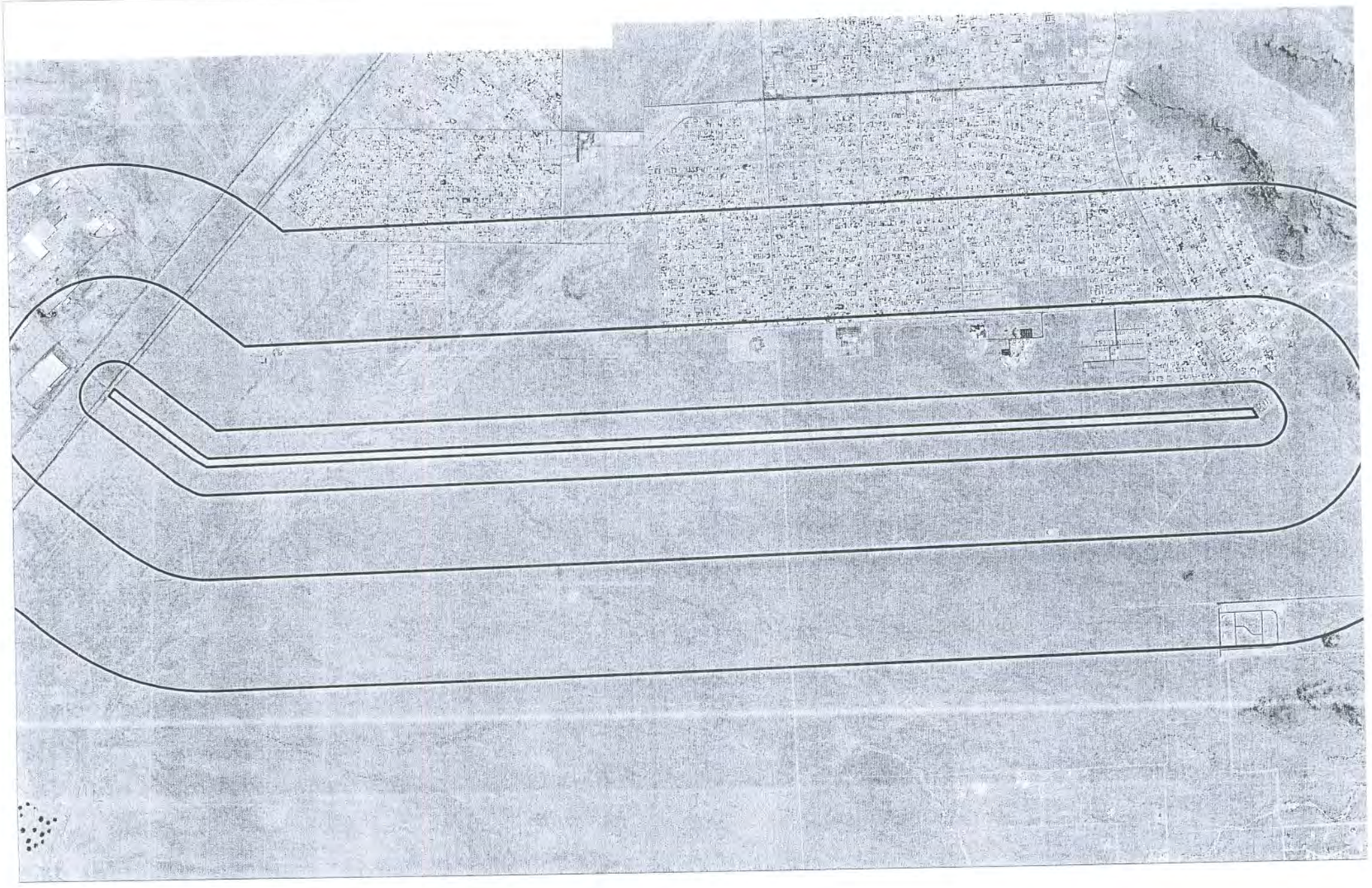
A	Irrigation
B	Utility (Water Co.)
C	Commercial
D	Domestic
E	Municipal
F	Industrial
G	Recreational
H	Subdivision
I	Mining
J	Stock
K	Other - Exploration
L	Drainage
M	Monitoring
N	None
O	Other - Non-Production
R	Recharge
T	Test
V	dewatering

Legal Description

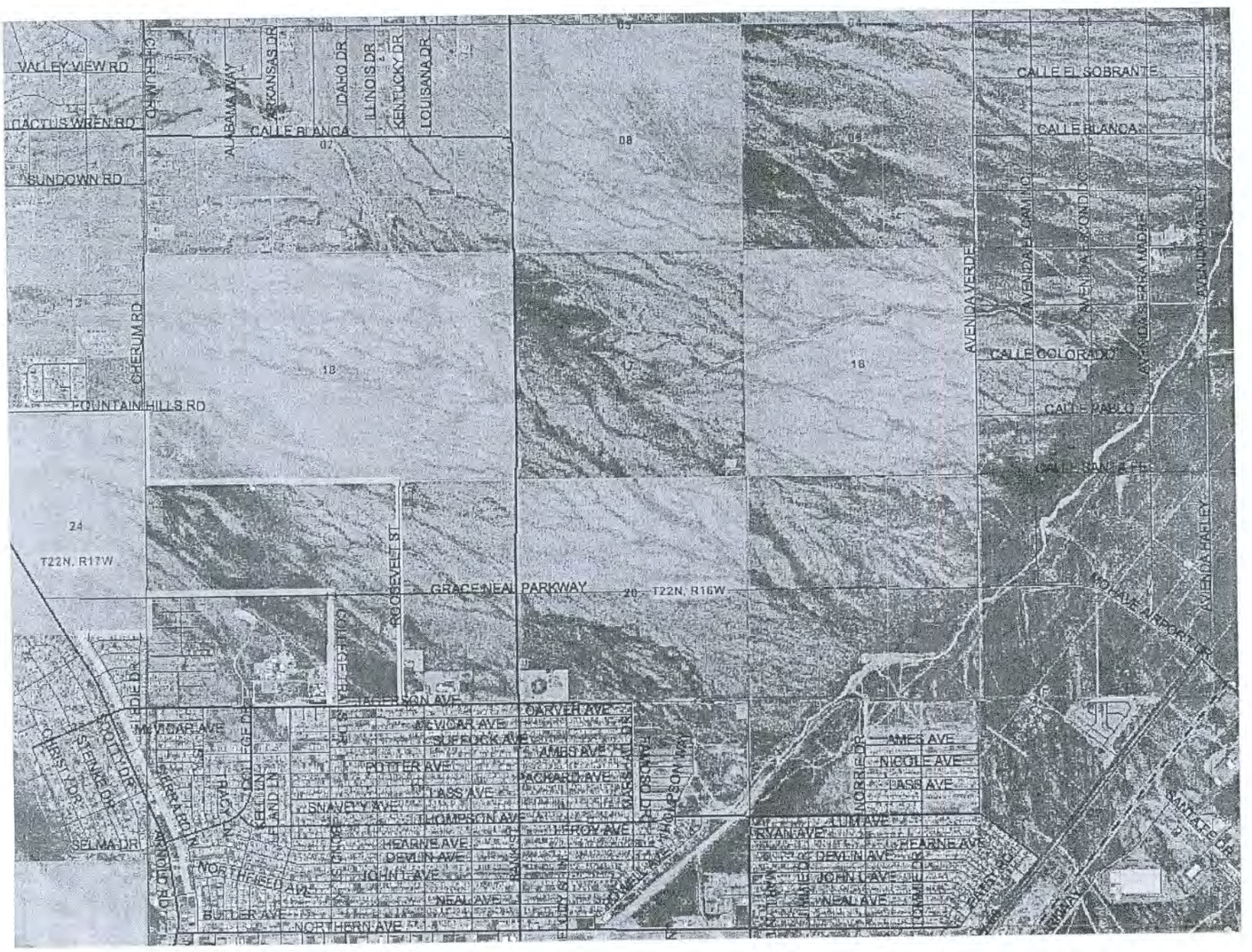
T	Township
N/S	North or South
R	Range
E/W	East or West
S	Section
Q1	Quarter of Section (160 Acres)
Q2	Quarter Quarter of Section (40 Acres)
Q3	Quarter Quarter Quarter of Section (10 acres)
ID	Well Registration Number
WD	Well Depth
WL	Water Level
DIA	Casing width

ID	T	N/S	R	E/W	S	Q1	Q2	Q3	WU	WD	WL	DIA	NAME
571222	22	N	16	W	20	SE	NE	NE	T	1200	580	4	CITY OF KINGMAN






HUALAPAI
VALLEY
CANYON



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7/24/2006

APPENDIX

D1

SPEEDIE AND ASSOCIATES
Geotechnical • Environmental • Materials Engineers

REPORT ON PRELIMINARY GEOTECHNICAL INVESTIGATION

DESIGNATION: Grace Neal Parkway

LOCATION: Stockton Hill Rd. to State Hwy. 66
Mohave County, Arizona

CLIENT: Durrant Architects

PROJECT NO: 061412SA

DATE: September 20, 2006

SPEEDIE AND ASSOCIATES
Geotechnical • Environmental • Materials Engineers

TABLE OF CONTENTS

1.0 INTRODUCTION

This report presents the results of a subsoil investigation carried out for improvements on Grace Neal Parkway that extends from Stockton Hill Road to State Highway 66. The road section is currently a dirt road. The subject Property is situated in portions of Sections 19, 20, 21 and 22, Township 22 North, Range 16 West and Section 24, Township 22 North, Range 17 West, of the Gila and Salt River Base and Meridian, Mohave County, Arizona. The Property consisted of bare soil or soil with sparse vegetative cover. The purpose of this investigation is to provide data for preliminary roadway design and pavement design requirements.

On August 14, 2006, five soil borings were drilled at the approximate locations shown on the attached Soil Boring Location Plan. All exploration work was carried out under the supervision of our geologist, who recorded subsurface conditions and obtained samples for laboratory testing. The soil borings were advanced utilizing a CME-75 rotary auger drill rig. Detailed information regarding the borings and samples obtained can be found on an individual Log of Test Boring prepared for each drilling location included in the Appendix of this report.

Laboratory testing consisted of moisture content, dry density, R-value, grain-size distribution, and plasticity (Atterberg Limits), pH, resistivity, sulfate and chloride tests for classification and pavement design parameters.

A Phase I Environmental Site Assessment has been conducted by this office and should be reviewed for additional site details on historical uses. Reference may be made to the report No. 061412EA dated August 8, 2006.

The proposed development plans are still preliminary, as of the writing of this report. Until near final plans are established providing more detail, the recommendations made in this report should be considered preliminary. Once site and grading plans are established, it is recommended that the information presented in this report be reviewed and if necessary, supplemented with additional investigation as deemed necessary by the Geotechnical Engineer to confirm subsurface conditions.

2.0 GENERAL ROUTE AND SOIL CONDITIONS

2.1 Route Conditions

The alignment is depicted by a dirt road through native desert land, and land that is currently being developed. The alignment is generally flat with some ephemeral streams (washes). It is apparent that

during rainfall events, stormwater flows across the roadway alignment. Utilities run parallel and cross the alignment.

2.2 General Subsurface Conditions

The existing subsoil conditions consist of silty and clayey sands with subordinate amounts of gravel and varying degrees of calcareous cementation to the depths drilled, approximately 15 feet below grade.

Laboratory testing indicates liquid limits that range from non-plastic to 26 percent with plasticity indices that range from non-plastic to 10 percent. R-values and Correlated R-values (from ADOT tables) range from 31 to 67. Laboratory minimum resistivity test results were on the order of 2,350 ohm-cm and a soil pH around 8.3. Sulfate concentrations in the soil are on the order of 11 ppm with chloride concentrations on the order of 15 ppm.

3.0 ANALYSIS AND RECOMMENDATIONS

3.1 Analysis

Analysis of the field and laboratory data indicates that subsoils at the site are generally favorable for the support of new pavement construction. Groundwater is not expected to be a factor in the design or construction of the roadway. Shallow excavation operations should be relatively straight forward (although hard in places) using conventional equipment. One outcrop was observed north of the alignment. Rock is not expected to be encountered although it should be noted that rock may exist at depth on the western edge near Stockton Hill Road. Adequate drainage will be critical for long-term performance of the roadway. Attention must be paid to provide proper drainage to limit the potential for water infiltrating under pavement systems.

3.2 Shallow Foundations

It is recommended that culvert structures be founded on the standard mat type floor foundation bearing on dense native soil, or properly compacted fill if dictated by grading plans, at a minimum depth of 24 inches below lowest, finished exterior grade within 5 feet of the structure. For structures in channel areas, the up stream and down stream edges should have turn-down cut off walls that extend at least 36 inches below the design scour and/or stream bed degradation elevation. If site preparation is carried out as set forth herein, a recommended maximum allowable bearing capacity of 3,000 psf can be

utilized for design. These bearing capacities refer to the total of all loads, dead and live, and are net pressures. They may be increased one-third for wind, seismic or other loads of short duration. All footing excavations should be level and cleaned of all loose or disturbed materials.

Estimated settlements under design loads are on the order of ½ to 1-inch, virtually all of which will occur during construction. Post-construction differential settlements will be negligible, under existing and compacted moisture contents. Additional localized settlements of the same magnitude could occur if native supporting soils were to experience a significant increase in moisture content.

3.3 Site Preparation

Depending on time of year of construction and flow in the washes, the soils may be wet and require time to dry and/or stabilize prior to their re-use. If the soils are still wet when construction begins, the exposed grade may become unstable under excavating/paving equipment. Additional time may be required to allow the exposed soils to dry, or alternative methods such as lime stabilization or rock fill may be required to stabilize the exposed grade.

The entire area to be occupied by the proposed construction should be stripped of all vegetation, debris, rubble and obviously loose surface soils. Prior to placing fill in roadways, the exposed grade should be scarified to a depth of 12 inches, moisture- conditioned to optimum (±2 percent) and compacted to at least 95 percent of maximum dry density as determined by ASTM D-698.

The silts and fine sands may be sensitive to excessive moisture content and become unstable at elevated moisture content. Accordingly, it may be necessary to compact soils on the dry side of optimum, especially in asphalt pavement areas. The reduced moisture content should only be used upon approval of the engineer in the field.

3.4 Fill and Backfill

Native soils are considered suitable for use as roadway grading fills provided particles greater than three (3) inches in size are first removed.

If imported common fill for use in grading is required, it should be examined by a Soils Engineer to ensure that it is of low swell potential and free of organic or otherwise deleterious material. In general, the fill should have 100 percent passing the three (3)-inch sieve and no more than 30 percent passing the 200 sieve. For the fine fraction (passing the 40 sieve), the liquid limit and plasticity index should not exceed 30 percent and 10 percent, respectively, and yield a minimum R-value of 30. It should exhibit less

than 1.5 percent swell potential when compacted to 95 percent of maximum dry density (ASTM D-698) at a moisture content of two (2) percent below optimum, confined under a 100 psf surcharge, and inundated.

Fill should be placed on subgrade which has been properly prepared and approved by a Soils Engineer. Fill must be wetted and thoroughly mixed to achieve optimum moisture content, ±2 percent. Fill should be placed in horizontal lifts of 8-inch thickness (or as dictated by compaction equipment) and compacted to the percent of maximum dry density per ASTM D-698 set forth as follows or to City of Kingman standards, whichever is more stringent:

A.	Pavement Subgrade or Fill	95
B.	Utility Trench Backfill	
1.	More than 2.0' below finish subgrade	95
2.	Within 2.0' of finish subgrade (non-granular)	95
3.	Within 2.0' of finish subgrade (granular)	100
C.	Aggregate Base Course	
1.	Below asphalt paving	100
D.	Landscape Areas	
1.	Miscellaneous fill	90
2.	Utility trench - more than 1.0' below finish grade	85
3.	Utility trench - within 1.0' of finish grade	90

3.5 Asphalt Pavement

For discussion purposes, we have included sections of roadway assumed to be classified as 'collector' or 'minor arterial' and major arterial. No traffic information is available at this time. The designer should choose the appropriate section to meet the anticipated traffic volume.

Table 3.5.1 Pavement Design

Daily 18k ESALs		Flexible Section	
Total	**Daily**	**AC (0.39)**	**ABC (0.12)**
42,400	6	2.0"	4.0"
418,700	57	3.0"	6.0"
877,100	120	3.0"	8.0"
1,883,500	258	4.0"	6.0"
3,528,000	483	4.0"	8.0"
3,028,000	415	5.0"	4.0"
5,500,000	750	5.0"	6.0"
9,600,000	1,300	5.0"	8.0"

Notes:
1. Designs are based on AASHTO design equations and ADOT correlated R-values.

Pavement Design Parameters:

Assume: One 18 kip Equivalent Single Axle Load (ESAL)/Truck
Life: 20 years
Subgrade Soil Profile:
R-value: 48
M_R: 26,000 (per ASHTO formula)
Initial Serviceability 5
Terminal Serviceability 2.5

This assumes that all subgrades are properly prepared. Pavement base course material should be Aggregate Base (A.B.C.) per M.A.G. Section 702 Specifications. Asphalt concrete materials and mix design should conform to local specifications, if any. Pavement installation should be carried out under applicable portions of M.A.G. Section 321 and municipality standards. The asphalt supplier should be informed of the pavement use and required to provide a mix that will provide stability and be aesthetically acceptable. Some of the newer M.A.G. mixes are very coarse and could cause placing and finish problems. A mix design should be submitted for review to determine if it will be acceptable for the intended use.

3.6 Soil Corrosion

Laboratory resistivity in the area indicates a moderate degree of corrosiveness depending on location and materials used. Accordingly, suitable pipe wall thickness and corrosion protection should be selected per the trench/traffic load and lifetime requirements of the project. Subsurface concrete should use Type I or II cement, readily available and used in the area. Type C flyash is not recommended unless further testing is conducted.

3.7 Utilities Installation

Trench excavations for utilities can be accomplished by conventional trenching equipment. Waist-high trench walls should stand near-vertical for the relatively short periods of time required to install shallow utilities although some sloughing may occur in looser and/or sandier soils requiring laying back of side slopes and/or temporary shoring. Adequate precautions must be taken to protect workmen in accordance with all current governmental regulations.

Backfill of trenches may be carried out with native excavated material provided particles greater than three (3) inches in size are first removed. This material should be moisture-conditioned, placed in eight (8)-inch lifts and mechanically compacted. Water settling is not recommended. Compaction requirements are summarized in the "Fill And Backfill" section of this report.

4.0 GENERAL

The scope of this investigation and report does not include regional considerations such as seismic activity and ground fissures resulting from subsidence due to groundwater withdrawal, nor any considerations of hazardous releases or toxic contamination of any type.

Our analysis of data and the recommendations presented herein are based on the assumption that soil conditions do not vary significantly from those found at our specific sample locations. Our work has been performed in accordance with generally accepted engineering principles and practice; this warranty is in lieu of all other warranties expressed or implied.

We recommend that a representative of the Soils Engineer observe and test the earthwork and paving portions of this project to ensure compliance to project specifications and the field applicability of subsurface conditions which are the basis of the recommendations presented in this report. If any significant changes are made in the scope of work or type of construction that was assumed in this report, we must review such revised conditions to confirm our findings if the conclusions and recommendations presented herein are to apply.

Respectfully submitted,
SPEEDIE & ASSOCIATES, INC.

REGISTERED GEOLOGIST
CERTIFICATE NO
32166
TIMOTHY J.
RHEINSCHMIDT
Date Signed 9-20-06
ARIZONA, U.S.A.

Timothy J. Rheinschmidt, R.G.

Registered Professional Engineer (Civil)
CERTIFICATE NO
14388
GREGG ALAN
CREASER
Date Signed 9.20.06
ARIZONA, U.S.A.

Gregg A. Creaser, P.E.

APPENDIX

SOIL BORING LOCATION PLAN

SOIL LEGEND

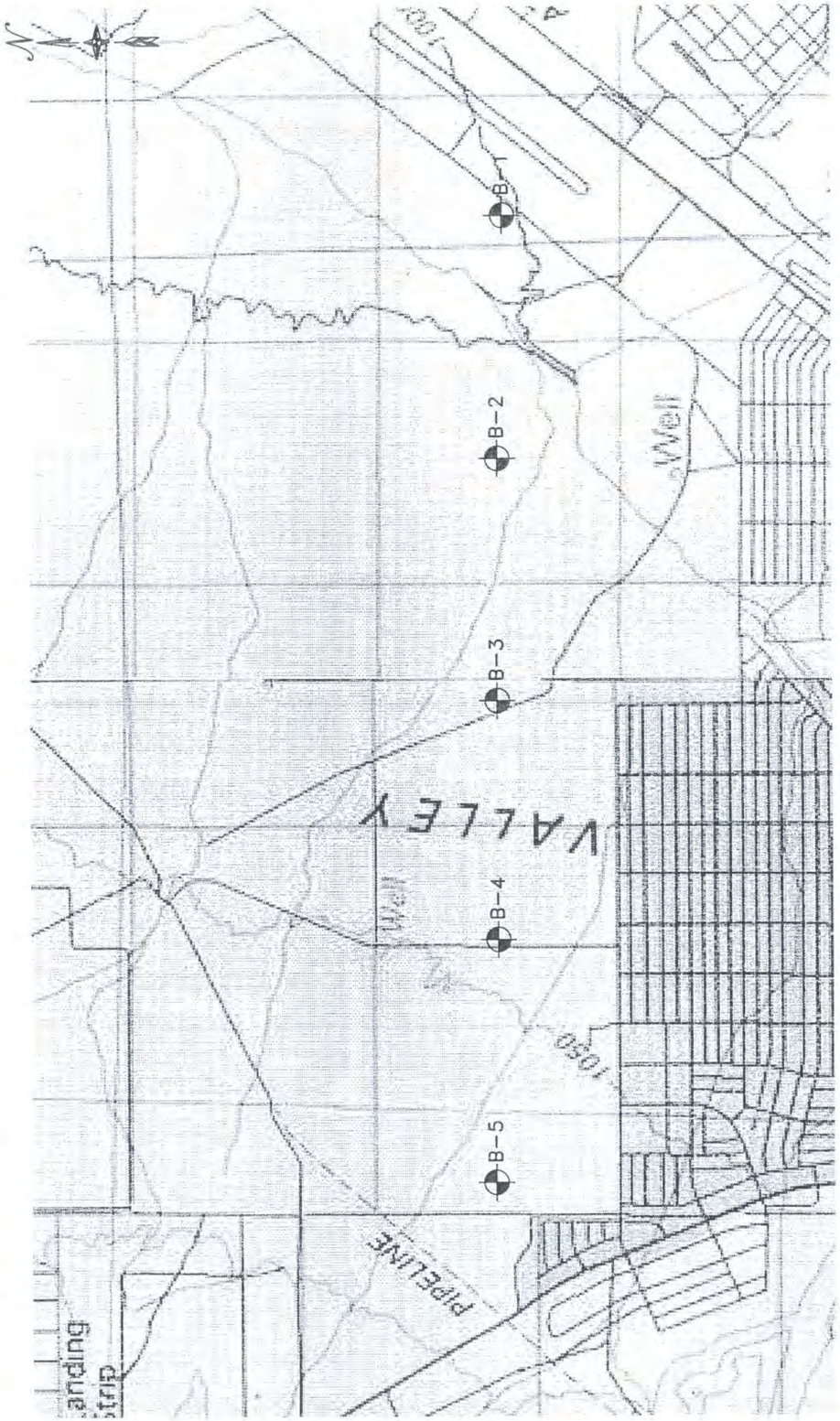
LOG OF TEST BORINGS

TABULATION OF TEST DATA

MOISTURE DENSITY RELATIONS

SOIL ANALYSIS REPORT (IAS)

R-VALUE



◆ - APPROXIMATE SOIL BORING LOCATIONS

SOIL BORING LOCATION PLAN

GRACE NEAL PARKWAY
GRACE NEAL PKWY, STOCKTON HILL RD. TO
MOHAVE AIRPORT DR.
KINGMAN, ARIZONA

SPEEDIE AND ASSOCIATES
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS ENGINEERS
3331 E. WOOD STREET PHOENIX, ARIZONA 85040 (602) 997-6391

DR:	CHK:	REV:	DATE:	PROJECT NO.
SES	SES		8-17-06	061412SA

SOIL LEGEND

SAMPLE DESIGNATION		DESCRIPTION	
	AS	Auger Sample	A grab sample taken directly from auger flights.
	BS	Large Bulk Sample	A grab sample taken from auger spoils or from bucket of backhoe.
	S	Spoon Sample	Standard Penetration Test (ASTM D-1586) Driving a 2.0 inch outside diameter split spoon sampler into undisturbed soil for three successive 6-inch increments by means of a 140 lb. weight free falling through a distance of 30 inches. The cumulative number of blows for the final 12 inches of penetration is the Standard Penetration Resistance.
	RS	Ring Sample	Driving a 3.0 inch outside diameter spoon equipped with a series of 2.42-inch inside diameter, 1-inch long brass rings, into undisturbed soil for one 12-inch increment by the same means of the Spoon Sample. The blows required for the 12 inches of penetration are recorded.
	LS	Liner Sample	Standard Penetration Test driving a 2.0-inch outside diameter split spoon equipped with two 3-inch long, 3/8-inch inside diameter brass liners, separated by a 1-inch long spacer, into undisturbed soil by the same means of the Spoon Sample.
	ST	Shelby Tube	A 3.0-inch outside diameter thin-walled tube continuously pushed into the undisturbed soil by a rapid motion, without impact or twisting (ASTM D-1587).
	--	Continuous Penetration Resistance	Driving a 2.0-inch outside diameter "Bullnose Penetrometer" continuously into undisturbed soil by the same means of the spoon sample. The blows for each successive 12-inch increment are recorded.

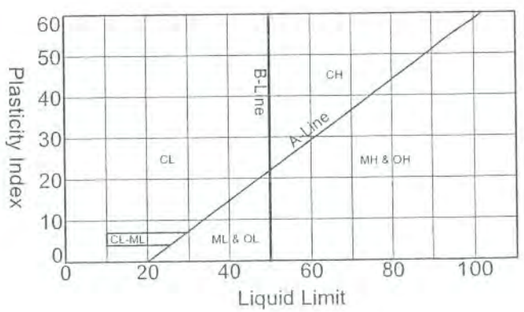
CONSISTENCY			RELATIVE DENSITY	
Clays & Silts	Blows/Foot	Strength (tons/sq ft)	Sands & Gravels	Blows/Foot
Very Soft	0 - 2	0 - 0.25	Very Loose	0 - 4
Soft	2 - 4	0.25 - 0.5	Loose	5 - 10
Firm	5 - 8	0.5 - 1.0	Medium Dense	11 - 30
Stiff	9 - 15	1 - 2	Dense	31 - 50
Very Stiff	16 - 30	2 - 4	Very Dense	> 50
Hard	> 30	> 4		

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS (MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE)	GRAVEL AND GRAVELLY SOILS (MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE)	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS (MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE)	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS (MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE)	SILTS AND CLAYS (LIQUID LIMIT LESS THAN 50)			ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS (LIQUID LIMIT GREATER THAN 50)			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL OR MODIFIED SYMBOLS MAY BE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS OR TO PROVIDE A BETTER GRAPHICAL PRESENTATION OF THE SOIL

MATERIAL SIZE	PARTICLE SIZE			
	Lower Limit		Upper Limit	
	mm	Sieve Size ◆	mm	Sieve Size ◆
SANDS				
Fine	0.075	#200	0.42	#40
Medium	0.420	#40	2.00	#10
Coarse	2.000	#10	4.75	#4
GRAVELS				
Fine	4.75	#4	19	0.75" ×
Coarse	19	0.75" ×	75	3" ×
COBBLES	75	3" ×	300	12" ×
BOULDERS	300	12" ×	900	36" ×

◆U.S. Standard ×Clear Square Openings



Rig Type: CME-75
Boring Type: Hollow Stem Auger
Surface Elevation: N/A

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 25 50)
0	Medium Dense Brown SILTY CLAYEY SAND with GRAVEL (SC/SM-Dry to Moist)	S-1	2.5	NT	NT	
5		BS-2	5.0	NT	NT	
		RS-3	6.0	2.2	117.2	
10		S-4	11.5	NT	NT	
	12.5 Hard Brown SANDY CLAY (CL-Moist to Dry)					
15						
	16.5 End of Boring	S-5	16.5	NT	NT	66/12"
20						

Boring Date: 8-14-06
Field Engineer/Technician: T. Rheinschmidt
Driller: J. Gomez
Contractor: Envirodrill

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: B-1

Grace Neal Parkway

Grace Neal Pkwy, Stockton Hill Rd. to Mohave Airport Dr

Kingman, Arizona

Project No.: 061412SA

_SPEEDIE 061412SA.GPJ GENGEO.GDT 9/7/06

Rig Type: CME-75
Boring Type: Hollow Stem Auger
Surface Elevation: N/A

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 25 50)
0	Medium Dense Brown CLAYEY SAND (SC-Dry)	RS-1	2.0	5.5	91.3	
5		BS-2	5.0	NT	NT	
	6.0 Stiff to Hard Brown SANDY CLAY (CL-Dry)	S-3	6.5	NT	NT	
10	Hard Brown SANDY CLAY with Weak Calcareous Cementation	S-4	11.5	NT	NT	54/12"
15						
	16.5 End of Boring	S-5	16.5	NT	NT	
20						

Boring Date: 8-14-06
Field Engineer/Technician: T. Rheinschmidt
Driller: J. Gomez
Contractor: Envirodrill

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: B-2

Grace Neal Parkway

Grace Neal Pkwy, Stockton Hill Rd. to Mohave Airport Dr

Kingman, Arizona

Project No.: 061412SA

_SPEEDIE 061412SA.GPJ GENGEO.GDT 9/7/06

Rig Type: **CME-75**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0	Loose to Medium Dense Brown SILTY SAND (SM-Dry) with Trace Gravel	S-1	2.5	NT	NT	
		BS-2	5.0	NT	NT	
5		RS-3	6.0	2.3	107.2	
10	Medium Dense Brown SILTY SAND with Clay Layers	S-4	11.5	NT	NT	
15	Medium Dense Brown SILTY SAND					
	End of Boring	S-5	16.5	NT	NT	
20						

Boring Date: **8-14-06**
Field Engineer/Technician: **T. Rheinschmidt**
Driller: **J. Gomez**
Contractor: **Envirodrill**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-3**

Grace Neal Parkway

Grace Neal Pkwy, Stockton Hill Rd. to Mohave Airport Dr

Kingman, Arizona

Project No.: **061412SA**

_SPEEDIE 061412SA.GPJ GENGEO.GDT 9/7/06

Rig Type: **CME-75**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0	Medium Dense Brown CLAYEY SAND (SC-Dry)	RS-1	2.0	5.8	99.1	
		BS-2	5.0	NT	NT	
5		S-3	6.5	NT	NT	
6.0	Stiff to Hard Brown SANDY CLAY (CL-Dry)					
10	Hard Light Brown SANDY CLAY with Moderate Calcareous Cementation	S-4	11.5	NT	NT	65/12"
13.0	Very Dense Brown CLAYEY SAND (SC-Dry)					
15						
	End of Boring	S-5	16.5	NT	NT	56/12"
20						

Boring Date: **8-14-06**
Field Engineer/Technician: **T. Rheinschmidt**
Driller: **J. Gomez**
Contractor: **Envirodrill**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-4**

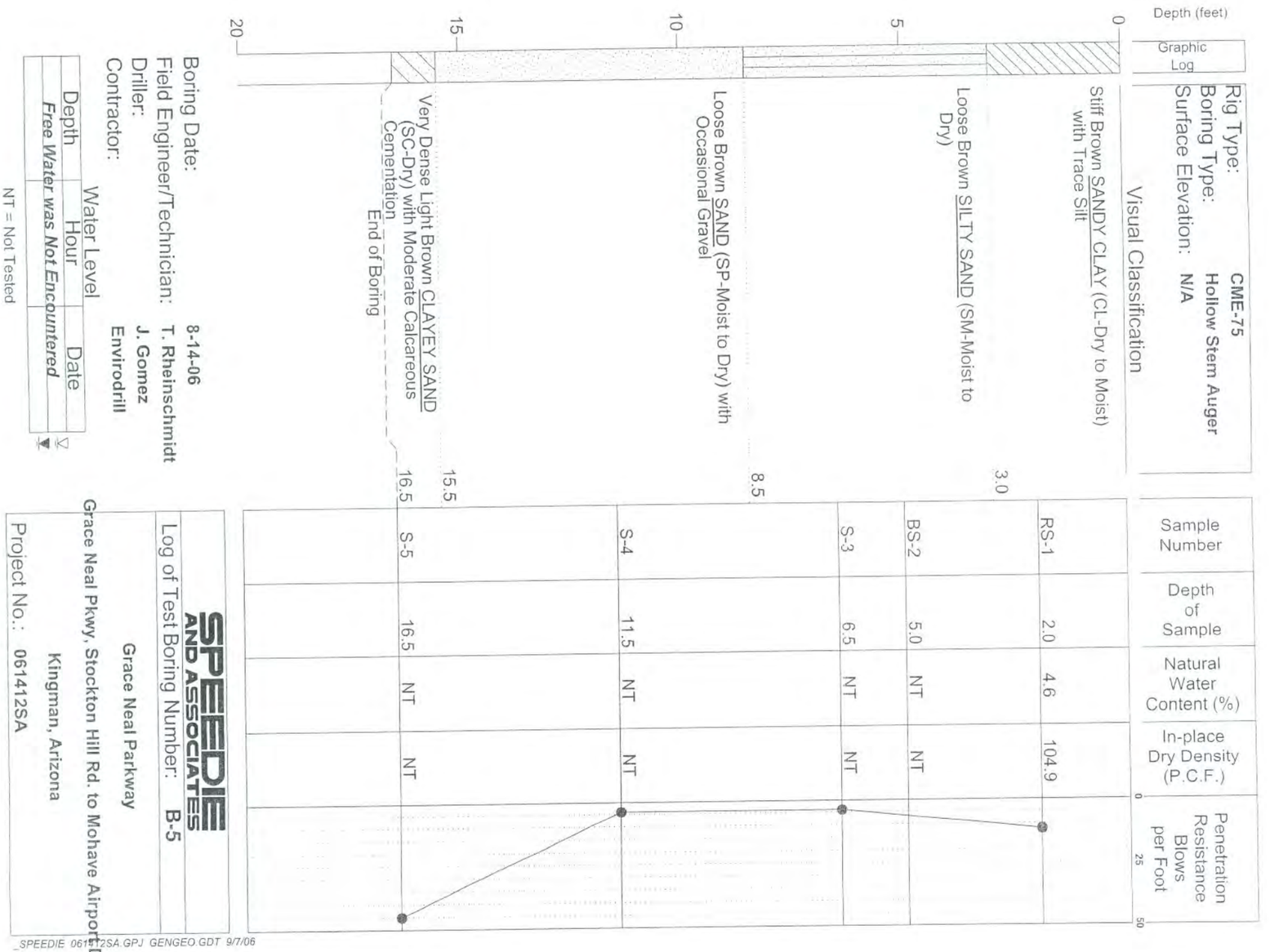
Grace Neal Parkway

Grace Neal Pkwy, Stockton Hill Rd. to Mohave Airport Dr

Kingman, Arizona

Project No.: **061412SA**

_SPEEDIE 061412SA.GPJ GENGEO.GDT 9/7/06



TABULATION OF TEST DATA

SOIL BORING or TEST PIT NUMBER	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE INTERVAL (ft)	NATURAL WATER CONTENT (Percent of Dry Weight)	IN-PLACE DRY DENSITY (Pounds Per Cubic Foot)	PARTICLE SIZE DISTRIBUTION (Percent Finer)					ATTERBERG LIMITS			R VALUE at 300 PSI	CORRELATED R VALUE	pH	RESISTIVITY (Ohm-Centimeters)	% SULFATE (SO4)	% CHLORIDE (CL)	UNIFIED SOIL CLASSIFICATION
						#200 SIEVE	#40 SIEVE	#10 SIEVE	#4 SIEVE	3" SIEVE	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX							
B-1	BS-2	BULK	0.0 - 5.0	NT	NT	29	49	73	92	100	22	13	9	NT	48	NT	NT	NT	NT	SC
B-1	RS-3	RING	5.0 - 6.0	2.2	117.2	NT	NT	NT	NT	NT	NT	NT	NT	NT		NT	NT	NT	NT	
B-2	BS-2	BULK	0.0 - 5.0	NT	NT	48	84	97	99	100	23	14	9	31	37	8.3	2349	0.0011	0.0015	SC
B-2	RS-1	RING	1.0 - 2.0	5.5	91.3	NT	NT	NT	NT	NT	NT	NT	NT	NT		NT	NT	NT	NT	
B-3	BS-2	BULK	0.0 - 5.0	NT	NT	33	65	91	98	100	16	14	2	NT	59	NT	NT	NT	NT	SM
B-3	RS-3	RING	5.0 - 6.0	2.3	107.2	NT	NT	NT	NT	NT	NT	NT	NT	NT		NT	NT	NT	NT	
B-4	BS-2	BULK	0.0 - 5.0	NT	NT	50	71	89	94	100	26	16	10	NT	33	NT	NT	NT	NT	SC
B-4	RS-1	RING	1.0 - 2.0	5.8	99.1	NT	NT	NT	NT	NT	NT	NT	NT	NT		NT	NT	NT	NT	
B-5	BS-2	BULK	0.0 - 5.0	NT	NT	30	63	85	93	100	NP	NP	NP	67	67	NT	NT	NT	NT	SM
B-5	RS-1	RING	1.0 - 2.0	4.6	104.9	NT	NT	NT	NT	NT	NT	NT	NT	NT		NT	NT	NT	NT	

Sieve analysis results do not include material greater than 3". Refer to the actual boring logs for the possibility of cobble and boulder sized materials.

NT=Not Tested

Sheet 1 of 1

Grace Neal Parkway
Grace Neal Pkwy, Stockton Hill Rd. to Mohave Airport Dr
Kingman, Arizona
Project No. 061412SA

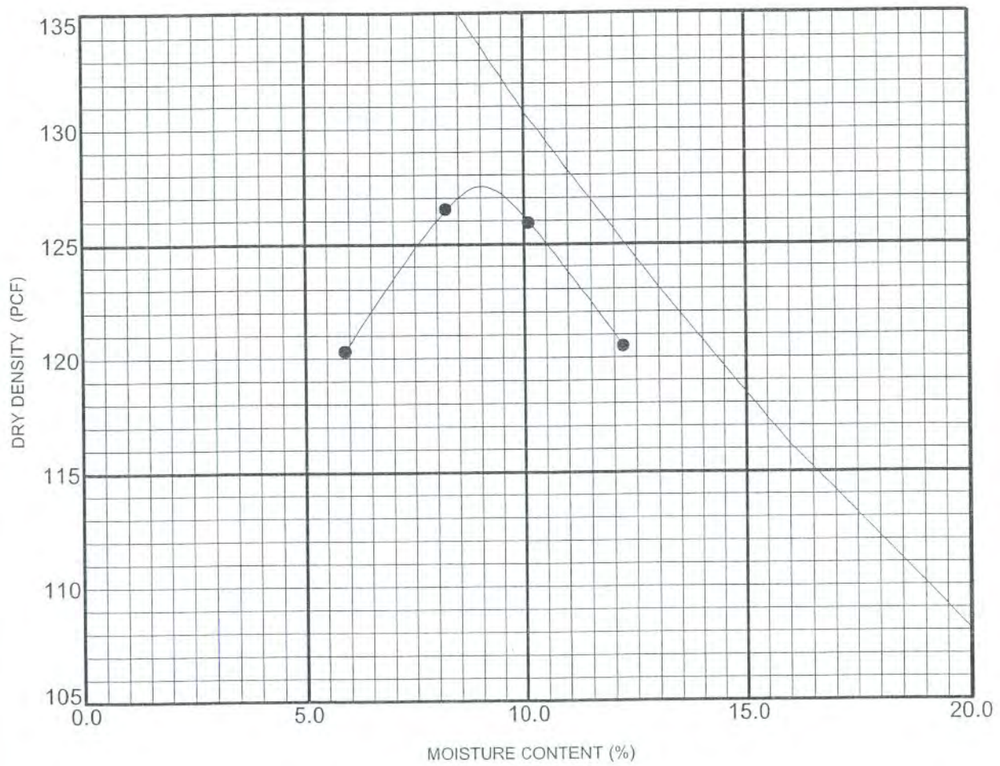
SPEEDIE AND ASSOCIATES

TABOFLAB R VALUE 061412SA.GPJ GENGEO.GDT 9/7/06

MOISTURE-DENSITY RELATIONS

PROJECT: Grace Neal Parkway
PROJECT NO.: 061412SA
LOCATION: Grace Neal Pkwy, Stockton Hill Rd. to Mohave Airport Dr.
DATE: 8/14/06
BORING NO.: B-1 SAMPLE NO.: BS-2 SAMPLE DEPTH: 0 to 5
LABORATORY NO.: X7169
METHOD OF COMPACTION: D698A
LIQUID LIMIT: 22 PLASTIC LIMIT: 13 PLASTICITY INDEX: 9
CLASSIFICATION: SC ASTM SOIL DESCRIPTION: CLAYEY SAND

MAXIMUM DRY DENSITY: **127.6 PCF**
OPTIMUM MOISTURE CONTENT: **9.0%**



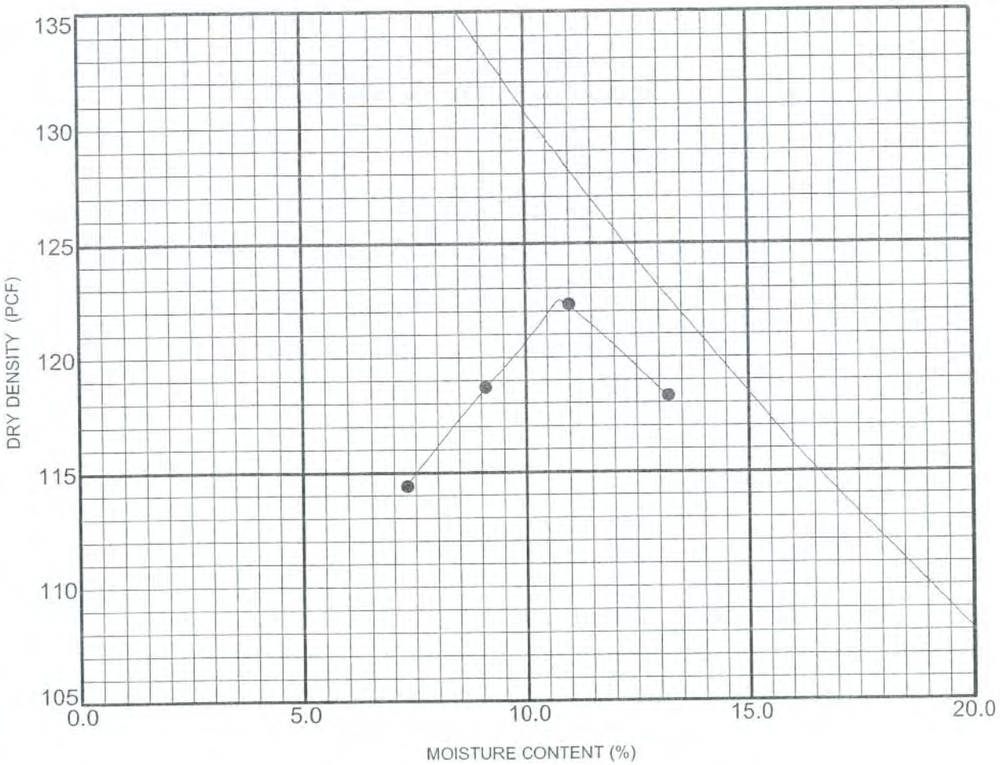
GEOTECH PROCTOR 061412SA.GPJ 9/1/06

SPEEDIE AND ASSOCIATES

MOISTURE-DENSITY RELATIONS

PROJECT: Grace Neal Parkway
PROJECT NO.: 061412SA
LOCATION: Grace Neal Pkwy, Stockton Hill Rd. to Mohave Airport Dr.
DATE: 8/14/06
BORING NO.: B-4 SAMPLE NO.: BS-2 SAMPLE DEPTH: 0 to 5
LABORATORY NO.: X7175
METHOD OF COMPACTION: D698A
LIQUID LIMIT: 26 PLASTIC LIMIT: 16 PLASTICITY INDEX: 11
CLASSIFICATION: SC ASTM SOIL DESCRIPTION: CLAYEY SAND

MAXIMUM DRY DENSITY: **122.5 PCF**
OPTIMUM MOISTURE CONTENT: **10.8%**



GEOTECH PROCTOR 061412SA.GPJ 9/1/06

SPEEDIE AND ASSOCIATES

IAS Laboratories

2515 East University Drive
Phoenix, Arizona 85034
(602) 273-7248

Today's Date: 9/5/2006
Project #: 061412SA
Submitted By: Dave Rath
Send Report To: Speedie & Associates
Report Number: 6628879
Date Received: 9/1/2006

Soil Analysis Report

Sender Sample ID	Depth	Lab #	[1] Sulfate ppm	[2] Chloride ppm	[3] Soluble Salts ppm	[3] pH	Other
X7171		476	11	15			

Comments:

Reference:

[1] ADOT Method ARIZ 733
[2] ADOT Method ARIZ 736
[3] ADOT Method ARIZ 237b

Resistance R-Value and Expansion Pressure of Compacted Soils

CLIENT: Grace Neal Parkway
ATTN:

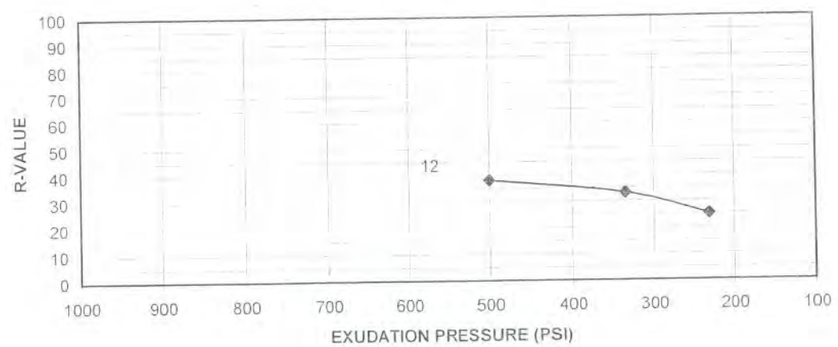
JOB NO: 061412 SA
LAB NO: X7171
REPORT DATE:

PROJECT: Grace Neal Parkway
LOCATION:
MATERIAL: Soil
SAMPLE LOCATION: B-2 BS-2 0'

SAMPLED BY:
DATE:
SUBMITTED BY:
DATE:

R-VALUE CALCULATION - AASHTO T190

SPECIMEN I.D.	A	B	C
Moisture Content	10.1%	11.3%	11.9%
Compaction Pressure (psi)	350	200	125
Specimen Height (inches)	2.46	2.52	2.52
Dry Density (pcf)	129.8	128.1	124.9
Ph @ 1000 (lb)	41.0	51.0	31.0
Ph @ 2000 (lb)	84.0	88.0	102.0
Displacement	3.75	4.12	4.25
Expansion Pressure (psi)	-0.2	-0.2	-0.3
Exudation Pressure (psi)	500	334	231
R Value	38	33	25
Corrected R-Value	38	33	25



R-VALUE AT 300 PSI = 31

Resistance R-Value and Expansion Pressure of Compacted Soils

CLIENT: Grace Neal Parkway
ATTN:

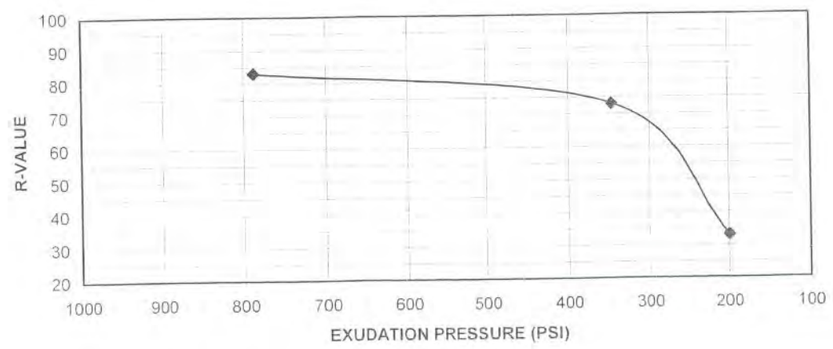
JOB NO: 61412
LAB NO: X7177
REPORT DATE:

PROJECT: Grace Neal Parkway
LOCATION:
MATERIAL: Soil
SAMPLE LOCATION: B-5 BS-2 0'

SAMPLED BY:
DATE:
SUBMITTED BY:
DATE:

R-VALUE CALCULATION - AASHTO T190

SPECIMEN I.D.	A	B	C
Moisture Content	8.0%	8.6%	9.4%
Compaction Pressure (psi)	350	350	325
Specimen Height (inches)	2.49	2.56	2.54
Dry Density (pcf)	130.4	130.0	129.4
Ph @ 1000 (lb)	7.0	14.0	38.0
Ph @ 2000 (lb)	17.0	29.0	71.0
Displacement	4.38	4.51	6.32
Expansion Pressure (psi)	0.2	0.0	-0.4
Exudation Pressure (psi)	788	346	199
R Value	83	71	33
Corrected R-Value	83	73	33



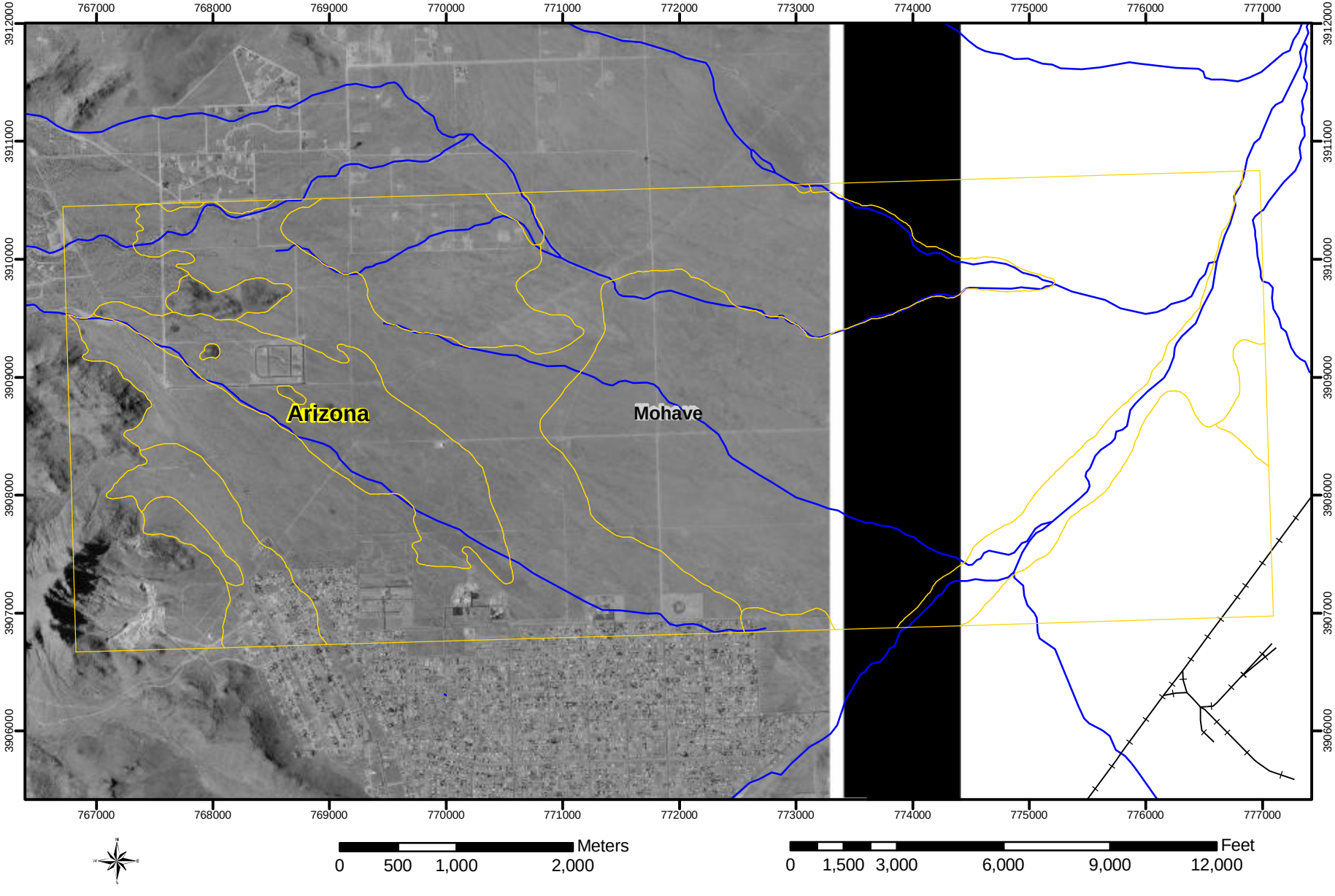
R-VALUE AT 300 PSI = 67

APPENDIX

D2

SOIL SURVEY OF MOHAVE COUNTY, ARIZONA, CENTRAL PART

Grace Neal Area



Grace Neal Area

MAP LEGEND

- Soil Map Units
- Cities
- Detailed Counties
- Detailed States
- Interstate Highways
- Rails
- Water
- Hydrography
- Oceans
- Escarpment, bedrock
- Escarpment, non-bedrock
- Gulley
- Levee
- Slope
- Blowout
- Borrow Pit
- Clay Spot
- Depression, closed
- Eroded Spot
- Gravel Pit
- Gravelly Spot
- Gulley
- Lava Flow
- Landfill
- Marsh or Swamp
- Miscellaneous Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Slide or Slip
- Sinkhole
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Perennial Water
- Wet Spot

MAP INFORMATION

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov

Coordinate System: UTM Zone 11

Soil Survey Area: Mohave County, Arizona, Central Part
Spatial Version of Data: 1
Soil Map Compilation Scale: 1:24000

Map comprised of aerial images photographed on these dates:
5/31/1997; 7/3/1997; 5/24/1998

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend Summary

Mohave County, Arizona, Central Part

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
6	Arizo-Franconia-Riverwash complex, 1 to 3 percent slopes	2.0	0.0
19	Circular complex, 1 to 3 percent slopes	967.4	10.0
32	Dutchflat sandy loam, 0 to 2 percent slopes	2,899.1	29.9
35	Fig-Blind-Nodman complex, 30 to 70 percent slopes	577.1	5.9
59	House Mountain family-Calvista family-Rock outcrop complex, 10 to 35 percent slopes	5.3	0.1
70	Jagerson very gravelly loam, 0 to 4 percent slopes	519.4	5.3
76	Lostman gravelly sandy loam, moist, 1 to 5 percent slopes	4,009.4	41.3
90	Mutang-Dutchflat complex, 0 to 3 percent slopes	195.4	2.0
91	Mutang-Wikieup-Rock outcrop complex, 3 to 30 percent slopes	4.1	0.0
120	Rift silty clay loam, 0 to 1 percent slopes	529.7	5.5