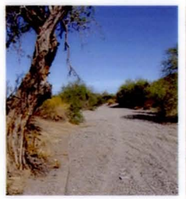

163rd Avenue • Jomax Road to Dove Valley Road

Final Design Concept Report

Volume 2 of 2

June 2008

prepared for

MARICOPA COUNTY ARIZONA

SURPRISE ARIZONA

Flood Control District of Maricopa County

prepared by

PB 100 YEARS®

A344.603

Appendix F
Traffic Analysis

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Traffic Analysis

HCM Signalized Intersection Capacity Analysis
1: Jomax Rd & 163rd Ave

4/8/2008

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1226	898	0	1583	64	0	886	362	0	371	522
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor		0.86	0.86		0.91	1.00		0.91	1.00		0.86	0.86
Frt		0.96	0.85		1.00	0.85		1.00	0.85		0.94	0.85
Flt Protected		1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)		4624	1362		5085	1583		5085	1583		4508	1362
Flt Permitted		1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)		4624	1362		5085	1583		5085	1583		4508	1362
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1333	976	0	1721	70	0	963	393	0	403	567
RTOR Reduction (vph)	0	94	95	0	0	8	0	0	31	0	12	12
Lane Group Flow (vph)	0	1688	432	0	1721	62	0	963	362	0	675	271
Turn Type			Perm			Perm			Perm			Perm
Protected Phases		4			8			2			6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)		37.5	37.5		37.5	37.5		24.5	24.5		24.5	24.5
Effective Green, g (s)		37.5	37.5		37.5	37.5		24.5	24.5		24.5	24.5
Actuated g/C Ratio		0.54	0.54		0.54	0.54		0.35	0.35		0.35	0.35
Clearance Time (s)		4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		2477	730		2724	848		1780	554		1578	477
v/s Ratio Prot		c0.36			0.34			0.19			0.15	
v/s Ratio Perm			0.32			0.04			c0.23			0.20
v/c Ratio		0.68	0.59		0.63	0.07		0.54	0.65		0.43	0.57
Uniform Delay, d1		11.9	11.1		11.4	7.9		18.2	19.2		17.4	18.5
Progression Factor		1.00	1.00		1.00	1.71		1.00	1.00		1.00	1.54
Incremental Delay, d2		0.8	1.3		0.5	0.0		1.2	5.9		0.9	4.6
Delay (s)		12.7	12.3		11.9	13.5		19.4	25.1		18.2	32.9
Level of Service		B	B		B	B		B	C		B	C
Approach Delay (s)		12.6			11.9			21.1			22.5	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM Average Control Delay	15.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	59.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
20: North of Jomax Rd & 163rd Ave

4/8/2008

Movement	EBL	EBR	NBU	NBL	NBT	SBT	SBR
Lane Configurations							
Volume (veh/h)	0	0	362	0	588	531	0
Sign Control	Stop				Free	Free	
Grade	0%				0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	639	577	0
Pedestrians							
Lane Width (ft)							
Walking Speed (ft/s)							
Percent Blockage							
Right turn flare (veh)							
Median type					Raised	Raised	
Median storage veh)					1	1	
Upstream signal (ft)					755		
pX, platoon unblocked			0.00				
vC, conflicting volume	790	192	0	577			
vC1, stage 1 conf vol	577						
vC2, stage 2 conf vol	213						
vCu, unblocked vol	790	192	0	577			
tC, single (s)	6.8	6.9	0.0	4.1			
tC, 2 stage (s)	5.8						
tF (s)	3.5	3.3	0.0	2.2			
p0 queue free %	100	100	0	100			
cM capacity (veh/h)	426	817	0	992			

Direction, Lane #	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3
Volume Total	213	213	213	0	192	192	192
Volume Left	0	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.13	0.13	0.13	0.00	0.11	0.11	0.11
Queue Length 95th (ft)	0	0	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS							
Approach Delay (s)	0.0				0.0		
Approach LOS							

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	37.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
77: Jomax Rd & West of 163rd Ave

4/8/2008

Movement	EBT	EBR	WBU	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑		⮌		↑↑↑		
Volume (vph)	1592	0	532	0	1573	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0		4.0		
Lane Util. Factor	0.91		1.00		0.91		
Frt	1.00		1.00		1.00		
Flt Protected	1.00		0.95		1.00		
Satd. Flow (prot)	5085		1770		5085		
Flt Permitted	1.00		0.95		1.00		
Satd. Flow (perm)	5085		1770		5085		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1730	0	578	0	1710	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0
Lane Group Flow (vph)	1730	0	578	0	1710	0	0
Turn Type			Prot				
Protected Phases	4		3		8		
Permitted Phases							
Actuated Green, G (s)	20.5		16.5		45.0		
Effective Green, g (s)	20.5		16.5		45.0		
Actuated g/C Ratio	0.46		0.37		1.00		
Clearance Time (s)	4.0		4.0		4.0		
Vehicle Extension (s)	3.0		3.0		3.0		
Lane Grp Cap (vph)	2317		649		5085		
v/s Ratio Prot	c0.34		c0.33		0.34		
v/s Ratio Perm							
v/c Ratio	0.75		0.89		0.34		
Uniform Delay, d1	10.1		13.4		0.0		
Progression Factor	1.00		1.00		1.00		
Incremental Delay, d2	1.3		14.4		0.0		
Delay (s)	11.5		27.8		0.0		
Level of Service	B		C		A		
Approach Delay (s)	11.5				7.1	0.0	
Approach LOS	B				A	A	

Intersection Summary			
HCM Average Control Delay	8.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
75: Jomax Rd & East of 163rd Ave

4/8/2008

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	⮌		↑↑↑	↑↑↑			
Volume (veh/h)	32	0	1556	1615	0	0	0
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	1691	1755	0	0	0
Pedestrians							
Lane Width (ft)							
Walking Speed (ft/s)							
Percent Blockage							
Right turn flare (veh)							
Median type			Raised	Raised			
Median storage veh)			1	1			
Upstream signal (ft)			878				
pX, platoon unblocked	0.00					0.89	
vC, conflicting volume	0	1755				2319	585
vC1, stage 1 conf vol						1755	
vC2, stage 2 conf vol						564	
vCu, unblocked vol	0	1755				2059	585
tC, single (s)	0.0	4.1				6.8	6.9
tC, 2 stage (s)						5.8	
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	100				100	100
cM capacity (veh/h)	0	353				106	454

Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3
Volume Total	564	564	564	0	585	585	585
Volume Left	0	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.33	0.33	0.33	0.00	0.34	0.34	0.34
Queue Length 95th (ft)	0	0	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS							
Approach Delay (s)	0.0				0.0		
Approach LOS							

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	34.5%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
22: South of Dynamite Blvd & 163rd Ave

4/8/2008

Movement	WBL	WBR	NBT	NBR	SBU	SBL	SBT
Lane Configurations			↑↑↑		⇃		↑↑↑
Volume (vph)	0	0	509	0	446	0	601
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0		4.0		4.0
Lane Util. Factor			0.91		1.00		0.91
Frt			1.00		1.00		1.00
Flt Protected			1.00		0.95		1.00
Satd. Flow (prot)			5085		1770		5085
Flt Permitted			1.00		0.95		1.00
Satd. Flow (perm)			5085		1770		5085
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	553	0	485	0	653
RTOR Reduction (vph)	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	553	0	485	0	653
Turn Type					Prot		
Protected Phases			2		1		6
Permitted Phases							
Actuated Green, G (s)			17.6		14.4		40.0
Effective Green, g (s)			17.6		14.4		40.0
Actuated g/C Ratio			0.44		0.36		1.00
Clearance Time (s)			4.0		4.0		4.0
Vehicle Extension (s)			3.0		3.0		3.0
Lane Grp Cap (vph)			2237		637		5085
v/s Ratio Prot			c0.11		c0.27		0.13
v/s Ratio Perm							
v/c Ratio			0.25		0.76		0.13
Uniform Delay, d1			7.0		11.3		0.0
Progression Factor			1.00		1.00		1.00
Incremental Delay, d2			0.3		5.4		0.1
Delay (s)			7.3		16.6		0.1
Level of Service			A		B		A
Approach Delay (s)	0.0		7.3				7.1
Approach LOS	A		A				A

Intersection Summary			
HCM Average Control Delay	7.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	41.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
2: Dynamite Blvd & 163rd Ave

4/8/2008

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↳			↑↑↳			↑↑↑	↱		↑↑↑	↱
Volume (vph)	0	633	258	0	785	290	0	629	326	0	789	254
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0	4.0		4.0	4.0
Lane Util. Factor		0.95			0.95			0.91	1.00		0.91	1.00
Frt		0.96			0.96			1.00	0.85		1.00	0.85
Flt Protected		1.00			1.00			1.00	1.00		1.00	1.00
Satd. Flow (prot)		3386			3396			5085	1583		5085	1583
Flt Permitted		1.00			1.00			1.00	1.00		1.00	1.00
Satd. Flow (perm)		3386			3396			5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	688	280	0	853	315	0	684	354	0	858	276
RTOR Reduction (vph)	0	30	0	0	58	0	0	0	85	0	0	51
Lane Group Flow (vph)	0	938	0	0	1110	0	0	684	269	0	858	225
Turn Type									Perm			Perm
Protected Phases		4			8			2			6	
Permitted Phases									2			6
Actuated Green, G (s)		18.8			18.8			18.2	18.2		18.2	18.2
Effective Green, g (s)		18.8			18.8			18.2	18.2		18.2	18.2
Actuated g/C Ratio		0.42			0.42			0.40	0.40		0.40	0.40
Clearance Time (s)		4.0			4.0			4.0	4.0		4.0	4.0
Vehicle Extension (s)		3.0			3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		1415			1419			2057	640		2057	640
v/s Ratio Prot		0.28			c0.33			0.13			0.17	
v/s Ratio Perm									c0.17			0.14
v/c Ratio		0.66			0.78			0.33	0.42		0.42	0.35
Uniform Delay, d1		10.5			11.3			9.2	9.6		9.6	9.3
Progression Factor		1.00			1.00			1.00	1.00		1.01	1.06
Incremental Delay, d2		1.2			2.9			0.4	2.0		0.6	1.5
Delay (s)		11.7			14.2			9.7	11.6		10.3	11.4
Level of Service		B			B			A	B		B	B
Approach Delay (s)		11.7			14.2			10.3			10.6	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	11.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	53.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
26: North of Dynamite Blvd & 163rd Ave

4/8/2008

Movement	EBL	EBR	NBU	NBL	NBT	SBT	SBR
Lane Configurations							
Volume (veh/h)	0	0	151	0	768	892	0
Sign Control	Stop				Free	Free	
Grade	0%				0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	835	970	0
Pedestrians							
Lane Width (ft)							
Walking Speed (ft/s)							
Percent Blockage							
Right turn flare (veh)							
Median type					Raised	Raised	
Median storage veh)					1	1	
Upstream signal (ft)					741		
pX, platoon unblocked			0.00				
vC, conflicting volume	1248	323	0	970			
vC1, stage 1 conf vol	970						
vC2, stage 2 conf vol	278						
vCu, unblocked vol	1248	323	0	970			
tC, single (s)	6.8	6.9	0.0	4.1			
tC, 2 stage (s)	5.8						
tF (s)	3.5	3.3	0.0	2.2			
p0 queue free %	100	100	0	100			
cM capacity (veh/h)	267	673	0	706			

Direction, Lane #	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3
Volume Total	278	278	278	0	323	323	323
Volume Left	0	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.16	0.16	0.16	0.00	0.19	0.19	0.19
Queue Length 95th (ft)	0	0	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS							
Approach Delay (s)	0.0				0.0		
Approach LOS							

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	32.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
38: South of Dixileta Dr & 163rd Ave

4/8/2008

Movement	WBL	WBR	NBT	NBR	SBU	SBL	SBT
Lane Configurations							
Volume (veh/h)	0	0	892	0	222	0	840
Sign Control	Stop		Free				Free
Grade	0%		0%				0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	970	0	0	0	913
Pedestrians							
Lane Width (ft)							
Walking Speed (ft/s)							
Percent Blockage							
Right turn flare (veh)							
Median type			Raised				Raised
Median storage veh)			1				1
Upstream signal (ft)							942
pX, platoon unblocked					0.00		
vC, conflicting volume	1274	323			0	970	
vC1, stage 1 conf vol	970						
vC2, stage 2 conf vol	304						
vCu, unblocked vol	1274	323			0	970	
tC, single (s)	6.8	6.9			0.0	4.1	
tC, 2 stage (s)	5.8						
tF (s)	3.5	3.3			0.0	2.2	
p0 queue free %	100	100			0	100	
cM capacity (veh/h)	264	673			0	706	

Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3	SB 4
Volume Total	323	323	323	304	304	304	0
Volume Left	0	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.19	0.19	0.19	0.18	0.18	0.18	0.00
Queue Length 95th (ft)	0	0	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS							
Approach Delay (s)	0.0			0.0			
Approach LOS							

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	36.2%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
3: Dixileta Dr & 163rd Ave

4/8/2008

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	631	234	0	775	301	0	862	252	0	828	252
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0	4.0		4.0	4.0
Lane Util. Factor		0.95			0.95			0.91	1.00		0.91	1.00
Frt		0.96			0.96			1.00	0.85		1.00	0.85
Flt Protected		1.00			1.00			1.00	1.00		1.00	1.00
Satd. Flow (prot)		3396			3391			5085	1583		5085	1583
Flt Permitted		1.00			1.00			1.00	1.00		1.00	1.00
Satd. Flow (perm)		3396			3391			5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	686	254	0	842	327	0	937	274	0	900	274
RTOR Reduction (vph)	0	32	0	0	28	0	0	0	67	0	0	39
Lane Group Flow (vph)	0	908	0	0	1141	0	0	937	207	0	900	235
Turn Type									Perm			Perm
Protected Phases		4			8			2			6	
Permitted Phases									2			6
Actuated Green, G (s)		15.8			15.8			16.2	16.2		16.2	16.2
Effective Green, g (s)		15.8			15.8			16.2	16.2		16.2	16.2
Actuated g/C Ratio		0.40			0.40			0.40	0.40		0.40	0.40
Clearance Time (s)		4.0			4.0			4.0	4.0		4.0	4.0
Vehicle Extension (s)		3.0			3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		1341			1339			2059	641		2059	641
v/s Ratio Prot		0.27			c0.34			c0.18			0.18	
v/s Ratio Perm									0.13			0.15
v/c Ratio		0.68			0.85			0.46	0.32		0.44	0.37
Uniform Delay, d1		10.0			11.0			8.7	8.1		8.6	8.3
Progression Factor		1.00			1.00			0.88	0.82		1.06	1.21
Incremental Delay, d2		1.4			5.4			0.7	1.3		0.7	1.5
Delay (s)		11.4			16.5			8.4	8.0		9.8	11.6
Level of Service		B			B			A	A		A	B
Approach Delay (s)		11.4			16.5			8.3			10.2	
Approach LOS		B			B			A			B	

Intersection Summary			
HCM Average Control Delay	11.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	54.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
46: North of Dixileta Dr & 163rd Ave

4/8/2008

Movement	EBL	EBR	NBU	NBL	NBT	SBT	SBR
Lane Configurations							
Volume (veh/h)	0	0	295	0	868	785	0
Sign Control	Stop				Free	Free	
Grade	0%				0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	943	853	0
Pedestrians							
Lane Width (ft)							
Walking Speed (ft/s)							
Percent Blockage							
Right turn flare (veh)							
Median type					Raised	Raised	
Median storage veh)					1	1	
Upstream signal (ft)					738		
pX, platoon unblocked			0.00				
vC, conflicting volume	1168	284	0	853			
vC1, stage 1 conf vol	853						
vC2, stage 2 conf vol	314						
vCu, unblocked vol	1168	284	0	853			
tC, single (s)	6.8	6.9	0.0	4.1			
tC, 2 stage (s)	5.8						
tF (s)	3.5	3.3	0.0	2.2			
p0 queue free %	100	100	0	100			
cM capacity (veh/h)	298	712	0	782			

Direction, Lane #	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3
Volume Total	314	314	314	0	284	284	284
Volume Left	0	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.18	0.18	0.18	0.00	0.17	0.17	0.17
Queue Length 95th (ft)	0	0	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS							
Approach Delay (s)	0.0				0.0		
Approach LOS							

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	38.2%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
53: South of Lone Mountain Rd & 163rd Ave

4/8/2008

Movement	WBL	WBR	NBT	NBR	SBU	SBL	SBT
Lane Configurations							
Volume (vph)	0	0	785	0	425	0	899
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0		4.0		4.0
Lane Util. Factor			0.91		1.00		0.91
Frt			1.00		1.00		1.00
Flt Protected			1.00		0.95		1.00
Satd. Flow (prot)			5085		1770		5085
Flt Permitted			1.00		0.95		1.00
Satd. Flow (perm)			5085		1770		5085
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	853	0	462	0	977
RTOR Reduction (vph)	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	853	0	462	0	977
Turn Type					Prot		
Protected Phases			2		1		6
Permitted Phases							
Actuated Green, G (s)			17.9		14.1		40.0
Effective Green, g (s)			17.9		14.1		40.0
Actuated g/C Ratio			0.45		0.35		1.00
Clearance Time (s)			4.0		4.0		4.0
Vehicle Extension (s)			3.0		3.0		3.0
Lane Grp Cap (vph)			2276		624		5085
v/s Ratio Prot			c0.17		c0.26		0.19
v/s Ratio Perm							
v/c Ratio			0.37		0.74		0.19
Uniform Delay, d1			7.3		11.3		0.0
Progression Factor			1.00		1.00		1.00
Incremental Delay, d2			0.5		4.7		0.1
Delay (s)			7.8		16.1		0.1
Level of Service			A		B		A
Approach Delay (s)	0.0		7.8				5.2
Approach LOS	A		A				A

Intersection Summary			
HCM Average Control Delay	6.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	45.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
4: Lone Mountain Rd & 163rd Ave

4/8/2008

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1158	346	0	1338	377	0	893	317	0	978	306
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0	4.0		4.0	4.0
Lane Util. Factor		0.95			0.95			0.91	1.00		0.91	1.00
Frt		0.97			0.97			1.00	0.85		1.00	0.85
Flt Protected		1.00			1.00			1.00	1.00		1.00	1.00
Satd. Flow (prot)		3417			3422			5085	1583		5085	1583
Flt Permitted		1.00			1.00			1.00	1.00		1.00	1.00
Satd. Flow (perm)		3417			3422			5085	1583		5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1259	376	0	1454	410	0	971	345	0	1063	333
RTOR Reduction (vph)	0	2	0	0	3	0	0	0	48	0	0	31
Lane Group Flow (vph)	0	1633	0	0	1861	0	0	971	297	0	1063	302
Turn Type									Perm			Perm
Protected Phases		4			8			2			6	
Permitted Phases									2			6
Actuated Green, G (s)		35.8			35.8			16.2	16.2		16.2	16.2
Effective Green, g (s)		35.8			35.8			16.2	16.2		16.2	16.2
Actuated g/C Ratio		0.60			0.60			0.27	0.27		0.27	0.27
Clearance Time (s)		4.0			4.0			4.0	4.0		4.0	4.0
Vehicle Extension (s)		3.0			3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		2039			2042			1373	427		1373	427
v/s Ratio Prot		0.48			c0.54			0.19			c0.21	
v/s Ratio Perm									0.19			0.19
v/c Ratio		0.80			0.91			0.71	0.70		0.77	0.71
Uniform Delay, d1		9.3			10.7			19.8	19.7		20.2	19.8
Progression Factor		1.00			1.00			1.00	1.00		1.00	1.01
Incremental Delay, d2		2.4			6.7			3.1	9.0		4.3	9.5
Delay (s)		11.7			17.4			22.9	28.7		24.6	29.4
Level of Service		B			B			C	C		C	C
Approach Delay (s)		11.7			17.4			24.4			25.7	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM Average Control Delay	19.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
58: North of Lone Mountain Rd & 163rd Ave

4/8/2008

Movement	EBL	EBR	NBU	NBL	NBT	SBT	SBR
Lane Configurations							
Volume (veh/h)	0	0	238	0	1032	1046	0
Sign Control	Stop				Free	Free	
Grade	0%				0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	1122	1137	0
Pedestrians							
Lane Width (ft)							
Walking Speed (ft/s)							
Percent Blockage							
Right turn flare (veh)							
Median type					Raised	Raised	
Median storage veh)					1	1	
Upstream signal (ft)					751		
pX, platoon unblocked	0.90		0.00				
vC, conflicting volume	1511	379	0	1137			
vC1, stage 1 conf vol	1137						
vC2, stage 2 conf vol	374						
vCu, unblocked vol	1188	379	0	1137			
tC, single (s)	6.8	6.9	0.0	4.1			
tC, 2 stage (s)	5.8						
tF (s)	3.5	3.3	0.0	2.2			
p0 queue free %	100	100	0	100			
cM capacity (veh/h)	233	619	0	610			

Direction, Lane #	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3
Volume Total	374	374	374	0	379	379	379
Volume Left	0	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.22	0.22	0.22	0.00	0.22	0.22	0.22
Queue Length 95th (ft)	0	0	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS							
Approach Delay (s)	0.0				0.0		
Approach LOS							

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	40.1%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
8: Dove Valley Rd & 163rd Ave

4/8/2008

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	225	483	125	160	638	266	76	926	87	353	906	276
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	245	525	136	174	693	289	83	1007	95	384	985	300
RTOR Reduction (vph)	0	0	104	0	0	215	0	0	70	0	0	198
Lane Group Flow (vph)	245	525	32	174	693	74	83	1007	25	384	985	103
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	5.0	13.9	13.9	6.4	15.3	15.3	3.2	16.0	16.0	7.7	20.5	20.5
Effective Green, g (s)	5.0	13.9	13.9	6.4	15.3	15.3	3.2	16.0	16.0	7.7	20.5	20.5
Actuated g/C Ratio	0.08	0.23	0.23	0.11	0.26	0.26	0.05	0.27	0.27	0.13	0.34	0.34
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	286	820	367	366	902	404	183	1356	422	441	1737	541
v/s Ratio Prot	c0.07	0.15		0.05	c0.20		0.02	c0.20		c0.11	0.19	
v/s Ratio Perm			0.02			0.05			0.02			0.06
v/c Ratio	0.86	0.64	0.09	0.48	0.77	0.18	0.45	0.74	0.06	0.87	0.57	0.19
Uniform Delay, d1	27.1	20.8	18.1	25.2	20.7	17.5	27.6	20.1	16.4	25.7	16.1	13.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	21.5	1.7	0.1	1.0	4.0	0.2	1.8	3.7	0.3	16.9	1.3	0.8
Delay (s)	48.6	22.5	18.2	26.2	24.7	17.7	29.3	23.8	16.7	42.5	17.5	14.7
Level of Service	D	C	B	C	C	B	C	C	B	D	B	B
Approach Delay (s)		28.9			23.2			23.6			22.7	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	24.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	65.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Appendix G

Pavement Memorandum

Appendix G
Pavement Memorandum

MARICOPA COUNTY
Department of Transportation

PAVEMENT DESIGN MEMORANDUM

Date: February 13, 2008

To: Renee Probst, Project Manager

From: Marty Robbins, EIT
Training Associate Engineer at Materials Technology
Project Management & Construction Division

Yugantha Perera, PhD, PE
Pavement Design Engineer, Materials Technology Branch
Project Management & Construction Division

Subject: Roadway Improvement, 163rd Ave (Sarival Rd.) from Jomax Rd to Dove Valley Rd
MCDOT Project Number: TT 005

I. Introduction

A. Project location: 163rd Ave (Sarival Rd.) from Jomax Rd to Dove Valley Rd

B. Description of project and proposed improvements:
163rd Ave from Jomax Rd to Dove Valley Rd is currently an existing four-mile long, two-lane undivided roadway. The proposed configuration is a four-lane divided parkway. This is an interim design for a future six-lane parkway.

II. Existing Pavement History and Observations

A. Existing pavement structure:
3/8-inch chip seal (SC2 M) over 2-inch penetration chip and an acid based soil stabilizer base.

B. Existing pavement condition:
The current PCR for this road is 68, the IRI is 202, and Rutting is 0.14. There are some block, longitudinal, and transverse cracks with some shoving reported on the pavement as described on the attached Road Summary Report.

C. Observed geological features, terrain and drainage conditions:
163rd Ave turns into Dove Valley Rd, which curves west, at the north terminal location. The north most 200-feet of the 4-mile stretch of 163rd Ave is unpaved. If 163rd Ave were to continue on to the north, it should bridge over a wash running in a NW-SE direction. While 163rd Ave is mostly flat over the four-mile stretch, it is rolling gently with some washes running in a skew across. There are washes at ¼ mile south of Dove Valley Rd, just south of White Wing Rd, south of Dixileta Dr, and south of Dale Rd. There is a major wash north of Wild Cat Dr. The Central Arizona Project canal crosses 163rd Ave south of Montgomery Rd. We observed the soil as mostly silty sand (SM) with some rocks. The ground surface is generally sloping from north to south. The elevation varies from 1633 to 1422-feet. See attached topographical map. (3 sheets)

D. No unusual conditions were observed.

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III. Pavement Design Data

A. Traffic information:
According to Roadrunner and Table 2.1 in the MCDOT Roadway Design Guide, Jomax Rd to Dove Valley Rd is currently classified as a Minor Arterial with a proposed future classification as an Enhanced Arterial in five years. The 2007 ADT was 4,442 with 6% of trucks.

B. Proposed roadway:
The proposed roadway classification will be a Principle Arterial of the four-lane divided parkway. The design life is 20 years. The projected ADT according to MCDOT Roadway Management System is 27,757 in 2025. Data supplied by Parsons Brinckerhoff projects the ADT as 26,700 in 2030. The projected ADT of 27,757 (2025) and current ADT of 4,442 (2007) were used for design. The corresponding traffic growth rate is approximately 10.7%.

C. Soil test data

Test Type	Number of Tests Performed	Result Range	Value Used in Design
Minus # 200 Sieve	9	6.3-20.1	16
PI	9	NP	NP
Correlated R-Value	9	70	70
Tested R-Value	--	--	--
Weighted Average R-Value	--	--	--
Swell Potential (PI >15)	--	--	--

IV. Pavement Design Calculations and Discussion (all calculation provided as Attachments)

A. Pavement design parameters

Design Parameter	Symbol	Value	Source
Cumulative Design Lane 18-kip ESALs	W_{18}	3,260,888	Darwin
Number of Lanes in each Direction	--	2	Design
Directional Distribution Factor	D_D	50%	MCDOT RDM Section 10.2.1.2
Lane Distribution Factor	D_L	90%	MCDOT RDM Table 10.2.1
Reliability		95%	MCDOT RDM Table 10.2.3
Standard Deviation	S_0	0.45	MCDOT RDM Table 10.2.3
Initial Serviceability	P_0	4.5	MCDOT RDM Table 10.2.4
Terminal Serviceability	P_t	2.5	MCDOT RDM Table 10.2.4

B. Layer coefficient and drainage coefficient

Layer	Layer Coeff. (a)	Drainage Coeff. (m)	Resilient Modulus/ Elastic Modulus (psi)
Asphalt Rubber (AR)or Rubberized Asphalt Concrete (RAC)	0.61	1.00	450,000
Asphalt Concrete (AC)	0.42	1.00	450,000
Base (AB)	0.12	1.00	32,000
Subbase	N/A	--	--
Subgrade	--	1.00	26000

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Discussion on the selected layer coefficient and resilient modulus:
The layer coefficients were determined from the MCDOT RDM Table 10.2.5. The roadbed resilient modules were determined according to the MCDOT RDM section 10.2.2.1.1.2 and 10.2.2.1.1.3. Since subgrade soils were non-plastic, the Sieve-PI factor (SPF) was high enough to give correlated-R values greater than 70 for each test location. Since, the standard deviation for the correlated-R values was less than 10, and the average was greater than 50, no actual R-Value tests were required. The R-mean was determined from the correlated R-Values. The calculated resilient modulus was at 48,875 psi. However, the maximum allowed resilient modulus, 26,000 psi, was used for design. No segmentation was necessary as no significant variation of subgrade soils was observed along the road section.

C. Required pavement structural number and pavement alternatives
The calculated structural number (SN) was 2.74.
The minimum required pavement SN, 2.88, was used for design.

Layers	Alternative 1	Alternative 2	Alternative 3
AR or RAC; High Traffic	1.5" AR	---	1.5" AR
AC (12.5 mm); Superpave; High Traffic	--	2.0"	2.0"
AC (19.0 mm); Superpave; High Traffic	4.0"	4.0"	3.0"
Base-1 (AB)	4.0"	4.0"	--
Base-2 or subbase (Type)	--	--	--
Treated subgrade (Type)	--	--	--
Subgrade (compacted)	6"	6"	6"
Corresponding SN	3.08	3.00	3.02
Estimated Cost ($/SY)	$25.57	$27.10	$26.07

The above pavement sections considered layered analysis as specified in MCDOT PDG section 10.2.4.3, and the Alternatives are presented in Figure 1.

V. Recommendations
A. Recommended pavement section and reason for selection
Alternative 1 is the most economical compared with Alternative 2 and 3 due to the increased cost of oil. Alternative 1 also provides for increased rider comfort and a reduction in noise. Alternative three may present issues on achieving proper density when constructing. Therefore, alternative 1 is recommend.

VI. Signatures

Designed By: Marty Robbins

Marty Robbins, EIT

Checked and Approved By: 2/13/08

Yugantha Perera, PhD, PE

Attachments:

Attachment 1 DARWin Outputs

Attachment 2 MCDOT Roadway Management System Reports

Attachment 3 USGS Topographic Maps

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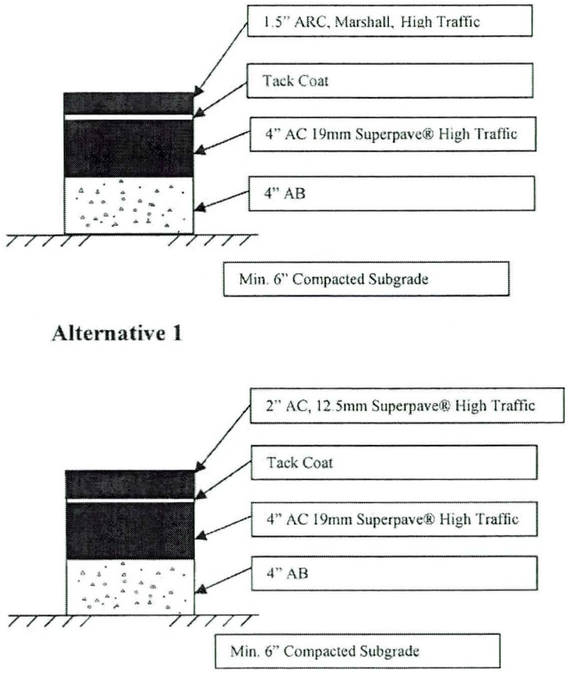
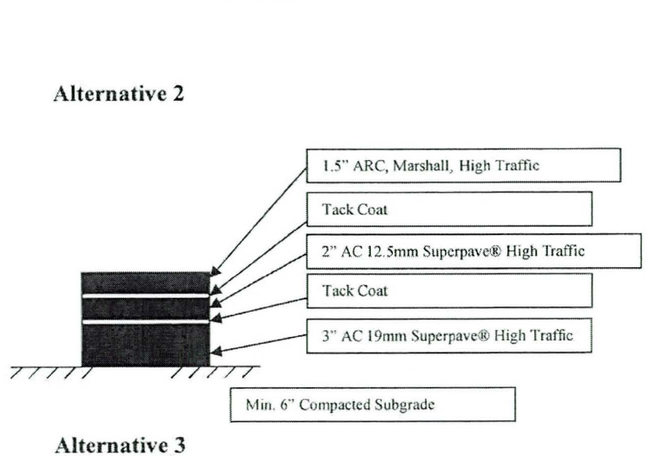


Alternative 1



Alternative 2

Alternative 3

Figure 1. Pavement Structural Section Alternatives

Attachment 1

DARWin Outputs

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1993 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

A Proprietary AASHTOWare
Computer Software Product

Flexible Structural Design Module

163rd Ave Alternative 1

Flexible Structural Design

18-kip ESALs Over Initial Performance Period	3,260,888
Initial Serviceability	4.5
Terminal Serviceability	2.5
Reliability Level	95 %
Overall Standard Deviation	0.45
Roadbed Soil Resilient Modulus	26,000 psi
Stage Construction	1
Calculated Design Structural Number	2.74 in

Effective Roadbed Soil Resilient Modulus

Period	Description	Roadbed Resilient Modulus (psi)
Calculated Effective Modulus	- psi*	

*Note: This value is not represented by the inputs or an error occurred in calculation.

Simple ESAL Calculation

Performance Period (years)	20
Two-Way Traffic (ADT)	4,442
Number of Lanes in Design Direction	2
Percent of All Trucks in Design Lane	90 %
Percent Trucks in Design Direction	50 %
Percent Heavy Trucks (of ADT) FHWA Class 5 or Greater	6 %
Average Initial Truck Factor (ESALs/truck)	1.2
Annual Truck Factor Growth Rate	0 %
Annual Truck Volume Growth Rate	10.7 %
Growth	Compound
Total Calculated Cumulative ESALs	3,260,888

Rigorous ESAL Calculation

Performance Period (years)	20
Two-Way Traffic (ADT)	4,442
Number of Lanes in Design Direction	2
Percent of All Trucks in Design Lane	90 %

Percent Trucks in Design Direction			50 %		
Vehicle Class	Percent of ADT	Annual % Growth	Average Initial Truck Factor (ESALs/ Truck)	Annual % Growth in Truck Factor	Accumulated 18-kip ESALs over Performance Period
Total	-	-	-	-	-
Growth			Simple		
Total Calculated Cumulative ESALs			- *		

*Note: This value is not represented by the inputs or an error occurred in calculation.

Specified Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di)(in)	Width (ft)	Calculated SN (in)
1	ARSurface	0.61	1	1.5	38	0.92
2	AC	0.42	1	4	38	1.68
3	AB	0.12	1	4	38	0.48
Total	-	-	-	9.50	-	3.08

Layered Thickness Design

Thickness precision Actual

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Spec Thickness (Di)(in)	Min Thickness (Di)(in)	Elastic Modulus (psi)	Width (ft)	Calculated Thickness (in)	Calculated SN (in)
1	AR Surface	0.61	1	1.5	-	450,000	28	1.50	0.92
2	AC Base	0.42	1	-	-	450,000	28	3.87	1.63
3	AB	0.12	1	-	4	32,000	28	4.00	0.48
Total	-	-	-	-	-	-	-	9.37	3.02

Optimized Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Cost (sq yd/in)	Min Thick (Di)(in)	Max Thick (in)	Width (ft)	Optimum Thick (in)	Calculated SN (in)	Calculated Cost (sq yd)
Total	-	-	-	-	-	-	-	-	-	-

*Note: This value is not represented by the inputs or an error occurred in calculation.

1993 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

A Proprietary AASHTOWare
Computer Software Product

Flexible Structural Design Module

163rd Ave Alternative 2

Flexible Structural Design

18-kip ESALs Over Initial Performance Period	3,260,888
Initial Serviceability	4.5
Terminal Serviceability	2.5
Reliability Level	95 %
Overall Standard Deviation	0.45
Roadbed Soil Resilient Modulus	26,000 psi
Stage Construction	1
Calculated Design Structural Number	2.74 in

Effective Roadbed Soil Resilient Modulus

Period	Description	Roadbed Resilient Modulus (psi)
Calculated Effective Modulus	- psi*	

*Note: This value is not represented by the inputs or an error occurred in calculation.

Simple ESAL Calculation

Performance Period (years)	20
Two-Way Traffic (ADT)	4,442
Number of Lanes in Design Direction	2
Percent of All Trucks in Design Lane	90 %
Percent Trucks in Design Direction	50 %
Percent Heavy Trucks (of ADT) FHWA Class 5 or Greater	6 %
Average Initial Truck Factor (ESALs/truck)	1.2
Annual Truck Factor Growth Rate	0 %
Annual Truck Volume Growth Rate	10.7 %
Growth	Compound
Total Calculated Cumulative ESALs	3,260,888

Rigorous ESAL Calculation

Performance Period (years)	20
Two-Way Traffic (ADT)	4,442
Number of Lanes in Design Direction	2

Percent of All Trucks in Design Lane	90 %
Percent Trucks in Design Direction	50 %

Vehicle Class	Percent of ADT	Annual % Growth	Average Initial Truck Factor (ESALs/ Truck)	Annual % Growth in Truck Factor	Accumulated 18-kip ESALs over Performance Period
Total	-	-	-	-	-

Growth	Simple
Total Calculated Cumulative ESALs	- *

*Note: This value is not represented by the inputs or an error occurred in calculation.

Specified Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di)(in)	Width (ft)	Calculated SN (in)
1	AC	0.42	1	6	38	2.52
2	AB	0.12	1	4	38	0.48
Total	-	-	-	10.00	-	3.00

Layered Thickness Design

Thickness precision Actual

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Spec Thickness (Di)(in)	Min Thickness (Di)(in)	Elastic Modulus (psi)	Width (ft)	Calculated Thickness (in)	Calculated SN (in)
1	AC Base	0.42	1	-	-	450,000	28	6.05	2.54
2	AB	0.12	1	-	4	32,000	28	4.00	0.48
Total	-	-	-	-	-	-	-	10.05	3.02

Optimized Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Cost (sq yd/in)	Min Thick (Di)(in)	Max Thick (in)	Width (ft)	Optimum Thick (in)	Calculated SN (in)	Calculated Cost (sq yd)
Total	-	-	-	-	-	-	-	-	-	-

*Note: This value is not represented by the inputs or an error occurred in calculation.

1993 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

A Proprietary AASHTOWare
Computer Software Product

Flexible Structural Design Module

163rd Ave Alternative 3

Flexible Structural Design

18-kip ESALs Over Initial Performance Period	3,260,888
Initial Serviceability	4.5
Terminal Serviceability	2.5
Reliability Level	95 %
Overall Standard Deviation	0.45
Roadbed Soil Resilient Modulus	26,000 psi
Stage Construction	1
Calculated Design Structural Number	2.74 in

Effective Roadbed Soil Resilient Modulus

Period	Description	Roadbed Resilient Modulus (psi)
Calculated Effective Modulus	- psi*	

*Note: This value is not represented by the inputs or an error occurred in calculation.

Simple ESAL Calculation

Performance Period (years)	20
Two-Way Traffic (ADT)	4,442
Number of Lanes in Design Direction	2
Percent of All Trucks in Design Lane	90 %
Percent Trucks in Design Direction	50 %
Percent Heavy Trucks (of ADT) FHWA Class 5 or Greater	6 %
Average Initial Truck Factor (ESALs/truck)	1.2
Annual Truck Factor Growth Rate	0 %
Annual Truck Volume Growth Rate	10.7 %
Growth	Compound
Total Calculated Cumulative ESALs	3,260,888

Rigorous ESAL Calculation

Performance Period (years)	20
Two-Way Traffic (ADT)	4,442
Number of Lanes in Design Direction	2
Percent of All Trucks in Design Lane	90 %

Percent Trucks in Design Direction 50 %

Vehicle Class	Percent of ADT	Annual % Growth	Average Initial Truck Factor (ESALs/ Truck)	Annual % Growth in Truck Factor	Accumulated 18-kip ESALs over Performance Period
Total	-	-	-	-	-

Growth Simple

Total Calculated Cumulative ESALs - *

*Note: This value is not represented by the inputs or an error occurred in calculation.

Specified Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di)(in)	Width (ft)	Calculated SN (in)
1	ARSurface	0.61	1	1.5	38	0.92
2	AC	0.42	1	5	38	2.10
Total	-	-	-	6.50	-	3.02

Layered Thickness Design

Thickness precision Actual

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Spec Thickness (Di)(in)	Min Thickness (Di)(in)	Elastic Modulus (psi)	Width (ft)	Calculated Thickness (in)	Calculated SN (in)
1	AR Surface	0.61	1	1.5	-	450,000	28	1.50	0.92
2	AC Base	0.42	1	-	-	450,000	28	4.68	1.96
Total	-	-	-	-	-	-	-	6.18	2.88

Optimized Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Cost (sq yd/in)	Min Thick (Di)(in)	Max Thick (in)	Width (ft)	Optimum Thick (in)	Calculated SN (in)	Calculated Cost (sq yd)
Total	-	-	-	-	-	-	-	-	-	-

*Note: This value is not represented by the inputs or an error occurred in calculation.

Attachment 2

MCDOT Roadway Management System Reports

2901 West Durango Street Phoenix, Arizona 85009 Phone: 602-506-4634 Fax: 602-506-3939

Maricopa County Department of Transportation 1/29/2008

Road Management System - Road Summary Report

On: Sarival Ave **From:** Dixileta Dr **Offset:** 0 **To:** White Wing Rd **Offset:** 0

Maint District: Northwest **Subdivision/Unit:**

Jurisdiction: Road Designated or Declared

Classification: 04 - Minor Arterial

Classification (Future): 06 - Enhanced Arterial

Lanes	Width	Sq Yds	Miles	Date
2	30	17703	1.01	6/4/1992

Miles: 1.01 **Curb Gutter:** No

Left Shoulder	Median	Right Shoulder
Type: Dirt Native	**Type:**	**Type:** Dirt Native
Width: 10	**Width:** 0	**Width:** 10

SURFACE

Type: Penetration Chip
Thickness: 2
Begin Date: 06/04/1992
Base Type: Acid Based Soil Stabilizer
Thickness: 0
Last Work: 5/25/1995
Type of Work: Chip Seal 3/8 inch - SC2 M

TRAFFIC

ADT: 4442
ADT Date: 9/19/2007
Truck Percent: 6
Truck Date: 9/19/2007
Projected ADT: 27757 (2025)

PCR: 68	IRI: 202	Rutt: 0.14	SUFF 100
Type: Field	**Type:** Annual		**Type:**
Date: 07/10/2007	**Date:** 10/29/2007		**Date:** 01/01/1994
By: gbutch	**By:** gbutch		**By:** Stephen Shewak

PCR DETAIL

CONDITION	RATING	EXTENT	SEVERITY	DEDUCT
Block Cracks:	3	Block size < 6 sf	Width < 3/8"	7
Excess Asphalt:	0	NONE	NONE	0
Fatigue Cracks:	0	NONE	NONE	0
Longitudinal Cracks:	3	Multiples	Width < 3/8"	7
Patching:	1	Number < 5 repairs	Quality of repair good	1
Raveling:	0	NONE	NONE	0
Rutting:	1	Laser Average 0.13 - 0.25	NONE	4
Shoving/ Pushing/Corr:	3	Laser Average IRI 171 - 220	NONE	8
Transverse Cracks:	2	Spacing 12 feet to 50 feet	Width < 3/8"	5

SUFF DETAIL

CONDITION	RATING	SEVERITY	DEDUCT
Bottleneck:	0	Low	0
Drainage:	0	Low	0
Horizontal Sight:	0	Low	0
Lane:	0	Lane width= ADT=	0
Shoulder:	0	LS= RS= Curb=	0
Vertical Sight:	0	Low	0

On: Sarival Ave From: Dixileta Dr Offset: 0 To: White Wing Rd Offset: 0

Maint District: Northwest **Classification:** 04 - Minor Arterial
Jurisdiction: Road Designated or Declared **Subdivision/Unit:**

Miles: 1.01 **Curb Gutter:** No

Work History

Work Date	Type Of Work
5/25/1995	Chip Seal 3/8 inch - SC2 M

SUFF History

Suff	Begin Date	Rated By
100	1/1/1994	Stephen Shewak

Maricopa County Department of Transportation 1/29/2008
Road Management System - Road Summary Report

On: Sarival Ave From: Dixileta Dr Offset: 0 To: White Wing Rd Offset: 0

Maint District: Northwest **Classification:** 04 - Minor Arterial
Jurisdiction: Road Designated or Declared **Subdivision/Unit:**

Miles: 1.01 **Curb Gutter:** No

PCR History

PCR	Begin Date	Rated By	Type
68	7/10/2007	gbutch	Field
72	6/27/2006	gbutch	Field
72	4/21/2005	gbutch	Field
87	6/18/2003	Gary Butch	Field
95	6/26/2002	Gary Butch	Field
95	3/29/2001	David Dray	Field
80	8/19/1999	Gary Butch	Field
89	1/9/1997	Gary Butch	Field
95	10/4/1995	Stephen Shewak	Field

IRI History

IRI	Begin Date	Rated By	Type
202	10/29/2007	gbutch	Annual
208	9/20/2006	gbutch	Annual
209	8/24/2005	gbutch	Annual
167	1/15/2002	Gary Butch	Annual
159	1/13/2000	Gary Butch	Annual
167.48	1/21/1998	Gary Butch	Annual

On: Sarival Ave From: White Wing Rd Offset: 0 To: Dove Valley Rd Offset: 0

Maint District: Northwest **Subdivision/Unit:** DOVE VALLEY
Jurisdiction: Road Designated or Declared
Classification: 04 - Minor Arterial
Classification (Future): 06 - Enhanced Arterial

Lanes	Width	Sq Yds	Miles	Date
2	30	17483	0.99	6/4/1992

Miles: 0.99 **Curb Gutter:** No

Left Shoulder	Median	Right Shoulder
Type: Dirt Native	**Type:**	**Type:** Dirt Native
Width: 10	**Width:** 0	**Width:** 10

SURFACE

Type: Penetration Chip
Thickness: 2
Begin Date: 06/04/1992
Base Type: Acid Based Soil Stabilizer
Thickness: 0
Last Work: 5/25/1995
Type of Work: Chip Seal 3/8 inch - SC2 M

TRAFFIC

ADT: 4442
ADT Date: 9/19/2007
Truck Percent: 6
Truck Date: 9/19/2007
Projected ADT: 27757
(2025)

PCR: 73	IRI: 202 Rutt: 0.14	SUFF 100
Type: Field	**Type:** Annual	**Type:**
Date: 07/10/2007	**Date:** 10/29/2007	**Date:** 01/01/1994
By: gbutch	**By:** gbutch	**By:** Stephen Shewak

PCR DETAIL

CONDITION	RATING	EXTENT	SEVERITY	DEDUCT
Block Cracks:	3	Block size < 6 sf	Width < 3/8"	7
Excess Asphalt:	0	NONE	NONE	0
Fatigue Cracks:	0	NONE	NONE	0
Longitudinal Cracks:	3	Multiples	Width < 3/8"	7
Patching:	1	Number < 5 repairs	Quality of repair good	1
Raveling:	0	NONE	NONE	0
Rutting:	0	NONE	NONE	0
Shoving/ Pushing/Corr:	3	Laser Average IRI 171 - 220	NONE	8
Transverse Cracks:	2	Spacing 12 feet to 50 feet	Width < 3/8"	5

SUFF DETAIL

CONDITION	RATING	SEVERITY	DEDUCT
Bottleneck:	0	Low	0
Drainage:	0	Low	0
Horizontal Sight:	0	Low	0
Lane:	0	Lane width= ADT=	0
Shoulder:	0	LS= RS= Curb=	0
Vertical Sight:	0	Low	0

Maricopa County Department of Transportation 1/29/2008
Road Management System - Road Summary Report

On: Sarival Ave From: White Wing Rd Offset: 0 To: Dove Valley Rd Offset: 0

Maint District: Northwest **Classification:** 04 - Minor Arterial
Jurisdiction: Road Designated or Declared **Subdivision/Unit:** DOVE VALLEY

Miles: 0.99 **Curb Gutter:** No

Work History

Work Date	Type Of Work
5/25/1995	Chip Seal 3/8 inch - SC2 M

SUFF History

Suff	Begin Date	Rated By
100	1/1/1994	Stephen Shewak

Maricopa County Department of Transportation 1/29/2008

Road Management System - Road Summary Report

On: Sarival Ave From: White Wing Rd Offset: 0 To: Dove Valley Rd Offset: 0

Maint District: Northwest **Classification:** 04 - Minor Arterial

Jurisdiction: Road Designated or Declared **Subdivision/Unit:** DOVE VALLEY

Miles: 0.99 **Curb Gutter:** No

PCR History

PCR	Begin Date	Rated By	Type
73	7/10/2007	gbutch	Field
75	6/27/2006	gbutch	Field
88	6/18/2003	Gary Butch	Field
95	6/26/2002	Gary Butch	Field
95	3/29/2001	David Dray	Field
80	8/19/1999	Gary Butch	Field
95	1/9/1997	Gary Butch	Field
95	10/4/1995	Stephen Shewak	Field

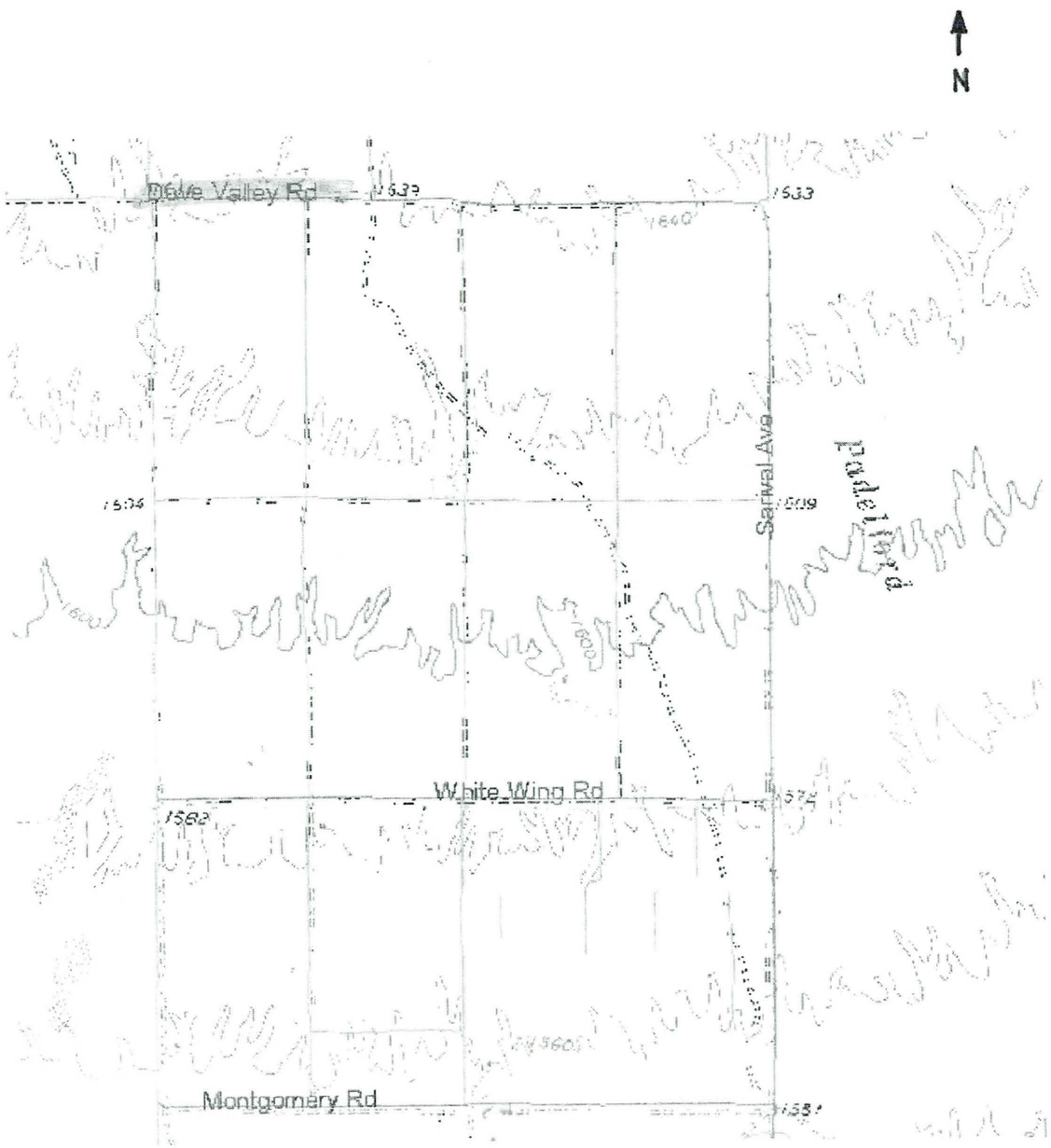
IRI History

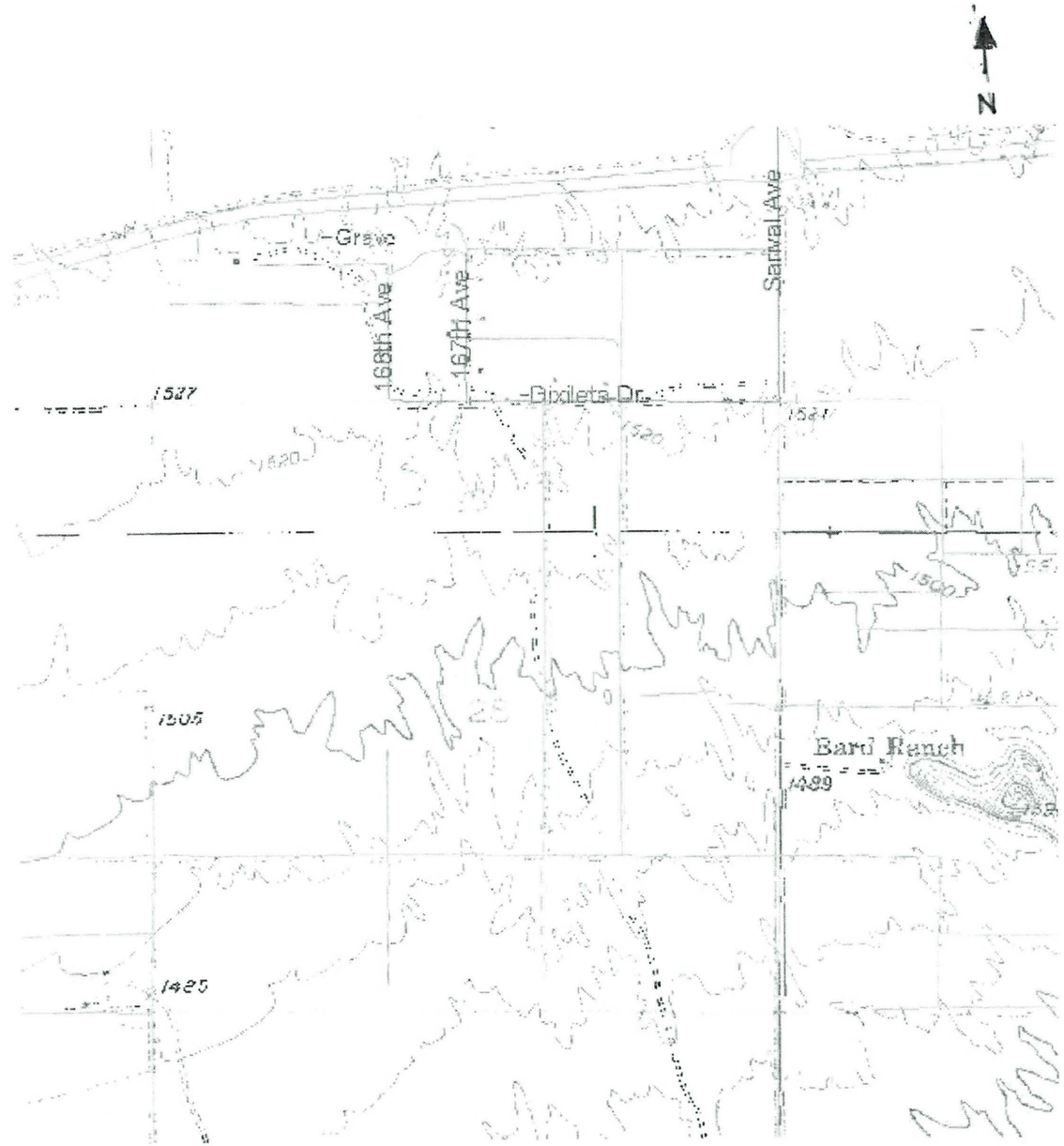
IRI	Begin Date	Rated By	Type
202	10/29/2007	gbutch	Annual
172	9/20/2006	gbutch	Annual
164	8/24/2005	gbutch	Annual
133	1/15/2002	Gary Butch	Annual
130	1/13/2000	Gary Butch	Annual
121.59	1/21/1998	Gary Butch	Annual

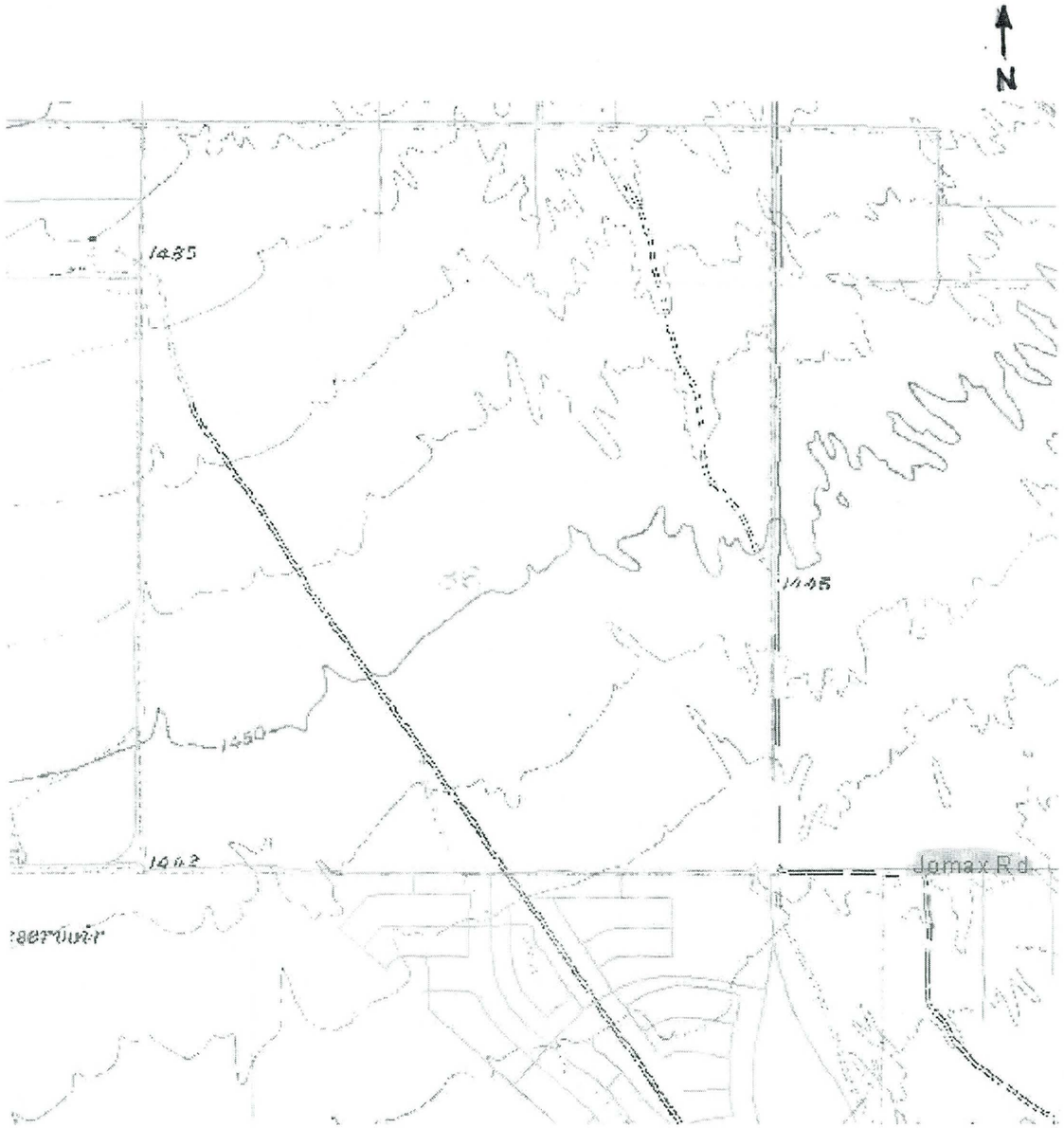
Attachment 3

USGS Topographic Maps

2901 West Durango Street Phoenix, Arizona 85009 Phone: 602-506-4634 Fax: 602-506-3939


N
Dove Valley Rd
1533
1640
1533
1534
1519
Sarival Ave
Podelford
1600
1580
White Wing Rd
1572
1562
1560
Montgomery Rd
1551


N
Grove
168th Ave
167th Ave
Sarival Ave
1527
Bixileta Dr
1521
1520
1500
1505
25
Bard Ranch
1489
1425


N
1485
1445
1450
1442
Jomax Rd.

Appendix H

Drainage Concept Report

Appendix H
Drainage Concept Report

DRAINAGE CONCEPT REPORT

163rd Avenue Design Concept Report
Jomax Road to Dove Valley Road

APRIL 2008

Prepared by:

Andes Engineering
11811 North Tatum Boulevard
Suite 3090
Phoenix, Arizona 85028

Registered Professional Engineer (Civil)
CERTIFICATE NO. 32316
JAVIER O. GUANA
Date Signed 06-03-08
ARIZONA, U.S.A.
Expires 03/31/2010

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TABLES

2.1 DESIGN FLOW DATA
2.2 PROPOSED CULVERTS SUMMARY
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Registered Professional Engineer (Civil)
CERTIFICATE NO. 32316
JAVIER O. GUANA
Date Signed 06-03-08
ARIZONA, U.S.A.
Expires 03/31/2010

FIGURES

1.1 LOCATION MAP
1.2 CITY OF SURPRISE PARKWAY TYPICAL SECTION
1.3 INTERIM PARKWAY TYPICAL SECTION
2.1 PROPOSED BRIDGE ELEVATION – UPSTREAM FACE
2.2 PROPOSED DRAINAGE IMPROVEMENTS

APPENDICES

A. HYDRAULIC MODELS
B. RAINFALL DATA
C. ON-SITE DATA AND DRAINAGE AREAS
D. NATIONWIDE PERMIT REQUIREMENTS
E. ORIGINAL FLOODPLAIN DATA

Registered Professional Engineer (Civil)
CERTIFICATE NO. 32316
JAVIER O. GUANA
Date Signed 06-03-08
ARIZONA, U.S.A.
Expires 03/31/2010

1 INTRODUCTION

1.1 Project Description

The 163rd Avenue Corridor Improvement Study (CIS), Jomax Road to SR 74, concluded with the recommendation for development of a new parkway within the project limits. The proposed parkway would have horizontal and vertical alignments different from the existing 163rd Avenue, as required to meet design standards for an all weather facility of the kind. See the location map in Figure 1.1.

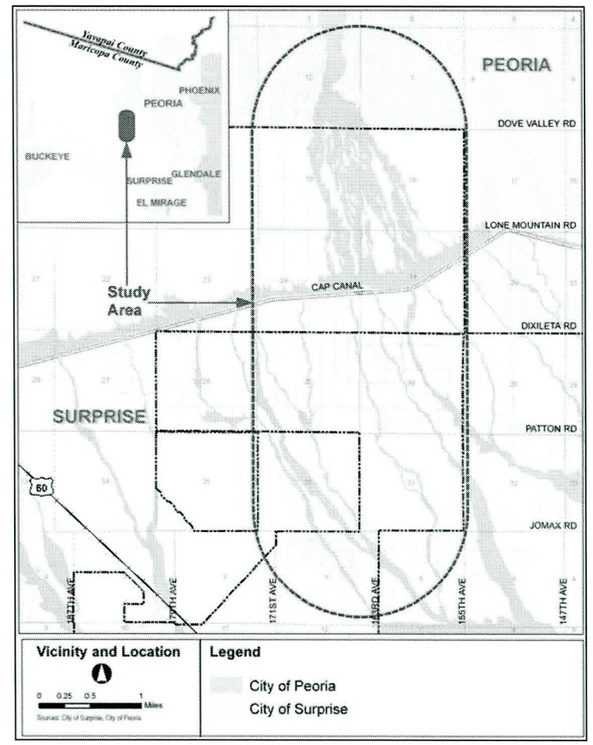


Figure 1.1 - Location Map

The segment of the parkway between Jomax Road and Dove Valley Road is approximately 4 miles long. The ultimate typical section of the preferred alternative includes 3 travel lanes in each direction, raised median, right turn lanes and indirect left turns at major intersections, vertical curb and multi-use paths on both sides of the road. See the City of Surprise parkway typical section in Figure 1.2. The figure is a representation of the roadway configuration that does not include roadside channels; for detailed typical cross sections see the plan/profile sheets in the DCR.

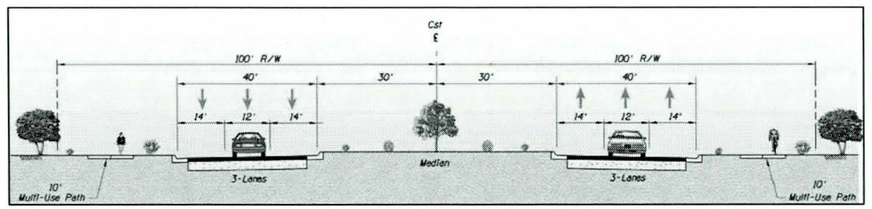


Figure 1.2 – City of Surprise Parkway Typical Section

The ultimate roadway section accommodates build-out traffic demands. However, an interim facility with sufficient capacity for year 2030 traffic volumes is recommended in the project's Design Concept Report (DCR). The interim facility includes the exterior 2 lanes, vertical curb and multi-use paths, but has a wider recessed median instead of a raised median. See Figure 1.3.

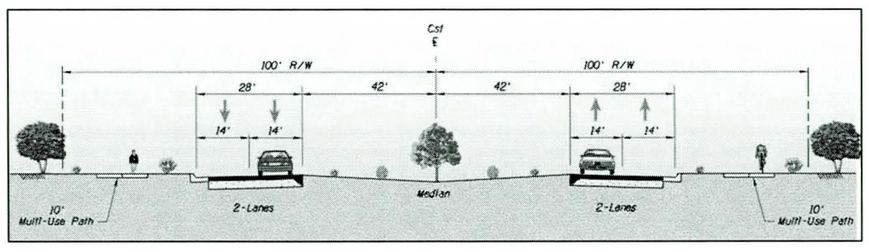


Figure 1.3 – Interim Parkway Typical Section

1.2 Purpose

This report documents the procedures, methodologies, criteria and computations utilized in the conceptual design of proposed drainage improvements for the preferred alternative of the 163rd Avenue Parkway. Tables, calculation sheets, and drawings are included in this report to provide the necessary detail.

1.3 Available Data

1.3.1 Padelford Wash Floodplain Delineation Study (FDS)

The FCDMC completed the "Padelford Wash Floodplain Delineation Study" (FDS) in 2002. Subsequently, a Letter of Map Revision was issued with an effective date of October 12, 2005, by which FEMA accepted the proposed floodplain delineation for the reach of Padelford Wash between the CAP Canal and SR 74. Flow data from the Padelford Wash FDS was used in the Conceptual Drainage Report completed for the CIS for the estimation of peak flows at roadway wash crossings.

1.3.2 Wittmann Area Drainage Master Study (ADMS) Update

The Wittmann ADMS Update was completed in 2004. The study covered the area bounded by the Hieroglyphic Mountains to the north and northeast, the White Tank Mountains and McMicken Dam and its outlet channel to the south, the Agua Fria River to the east, and the Hassayampa River basin to the west. The 163rd Avenue DCR project area is a subset of the ADMS' area. Basin delineation and flow data from the ADMS were used in the Conceptual Drainage Report completed for the CIS to estimate peak flows at roadway wash crossings.

1.3.3 163rd Avenue, Jomax Road to Dove Valley Road, Draft Design Concept Report (DCR)

The recommended alternative of the CIS is further developed in the Draft DCR completed in December of 2007. Improvements in the recommended alternative include the typical section described above, drainage infrastructure and bridges over the CAP canal. Horizontal and vertical alignment information for the design of drainage facilities has been taken from the DCR>

1.3.4 163rd Avenue CIS, Final Conceptual Drainage Report (CDR)

Technical Memorandum No.3 – Final Conceptual Drainage Report – was completed in February of 2008 as part of the 163rd Avenue CIS. The hydrology analysis in the report used original data from the above referenced FCDMC studies to estimate 50-year and 100-year peak flows for points of concentration along the preferred alternative presented in the DCR. Hydrologic data has been taken from the CIS' Final Conceptual Drainage Report for the hydraulic modeling of drainage structures proposed at the DCR stage. See the CIS Final Conceptual Drainage Report for discussion about existing conditions, hydrology, and original data from the FCDMC studies.

1.4 Drainage Design Criteria

The design of drainage improvements follows criteria included in: Chapter 4 of the MCDOT Roadway Design Manual, Revised April 2004; Maricopa County Drainage Policies and Standards, July 26, 2006 (Draft); including the following:

- Offsite Drainage
  - 50-year design event (minimum).
  - Maximum 6 inches of depth over roadway for 100-year peak flow.
  - Maximum design water surface elevation no greater than lowest adjacent road subgrade.
  - Minimum preferred height of box culverts is 5 feet with invert set 6 inches below streambed flow lines in desert wash areas.
  - Minimum pipe culvert diameter for roadway crossings is 24 inches.
  - Minimum cover over box culverts is 12 inches, and 18 inches for pipe culverts.
  - Maximum culvert outlet velocity is 15 feet per second.

- Onsite Drainage
  - 10-year design event.
  - One 12-foot dry driving lane maintained in each direction, and flow depths not to exceed curb height.
  - Onsite hydrology shall be analyzed using the Rational Method for all pavement areas, using a runoff coefficient, "C", of 0.95 for pavement. A value of 0.70 shall be assigned to median and undeveloped roadside areas.

Design procedures follow guidelines presented in the Drainage Design Manual for Maricopa County, September 2003 (Draft).

2 OFF-SITE DRAINAGE

2.1 Design Flows

The proposed alignment of the 163rd Avenue Parkway intersects several washes that generally flow from north-west to south-east. Most of the washes are in Zone AE delineated FEMA floodplains for which flows and base flood elevations have been estimated in studies completed by the FCDMC. Flow data for the area south of the CAP Canal has been taken or derived from information in the Wittmann ADMS Update. Flow data for the area north of the CAP Canal has been taken or derived from information in the Padelford Wash FDS.

The 100-year event is used in this project for design of culverts in order to maintain variance in base flood elevations to less than 1 ft as a result of roadway improvements. See Figure 2.2 for location of proposed drainage crossings. Table 2.1 is a summary of design flow data.

Table 2.1 – Design Flow Data

Crossing ID	Stream and Source of Data	100-year Flow (cfs)	Source	50-year Flow (cfs)	Source
1	Wash 8 East Wittmann ADMSU	1,080	X-Section 0.426 Sheet O-14	864	80% of Q_{100}
2	Unnamed Wash 163rd Ave. CDR	197	16% of Basin PI609	158	80% of Q_{100}
3	Wash 9 East Wittmann ADMSU	390	X-Section 3.998 Sheet O-16	312	80% of Q_{100}
4	Padelford Wash Split 2 HEC-RAS Exst Model	1,487	DS subcritical depth of 4'	1,190	80% of Q_{100}
5	Padelford Wash Split 2 HEC-RAS Exst Model	400	Match FDS WSEL X-Section 20.760	320	80% of Q_{100}
6	Padelford Wash Split 2 HEC-RAS Exst Model	750	Match FDS WSEL X-Section 20.853	600	80% of Q_{100}
7	Padelford Wash Split 2 HEC-RAS Exst Model	390	Match FDS WSEL X-Section 20.950	312	80% of Q_{100}
8	Padelford Wash Split 2 HEC-RAS Exst Model	480	Match FDS WSEL X-Section 21.248	384	80% of Q_{100}
9	Padelford Wash Split 2 Padelford Wash FDS	3,149	FDS X-Section 21.631	2,515	80% of Q_{100}
10	Padelford Wash Split 2 Padelford Wash FDS				
11	Padelford Wash Split 3 HEC-RAS Exst Model	150	Channel Capacity at Dove Valley Rd.	100	80% of Q_{100}
Bridges	Padelford Wash Split 3 Padelford Wash FDS	4,660	FDS X-Section 31.809 100% of Split 3 Flow	3,728	80% of Q_{100}

The hydraulic model in the Padelford Wash FDS uses a single cross section for the entire width of each one of the 6 splits: Splits 1 through 5 and the main channel. Only splits 2 and 3 are intersected by the proposed parkway alignment. Of the crossings listed in table 2.1, crossings 4 through 8 are intersections with separate channels within Split 2 for which flow information was not determined in the Padelford Wash FDS. The following assumptions apply to the estimation of flows for crossings 4 through 8:

- Crossing 4: It's the last roadway crossing of Split 2. The capacity of the existing channel corresponds to the flow for which the normal depth at the downstream cross section is equal to 4', which is the approximate depth at most FDS cross sections. The FDS water surface elevation at the upstream cross section criteria was not used because it returns a flow much greater than expected, considering that the crossings to the north combined take more than 2,000 cfs of Split 2 flow to the east side of the proposed parkway.
- Crossings 5 thorough 8: The 100-year capacity of the channels was calculated by running iterations of HEC-RAS models of the existing condition until the water surface elevation at the upstream cross section equaled the water surface elevation for the corresponding Split 2 cross section of the FDS.

Crossings 9 and 10 were combined into a single model that uses the entire Split 2 flow.

It should be noted that the vertical datum for the FDS is NAVD 29 while the datum for the DTM developed for this project is NAVD 88. As indicated in the Padelford Wash FDS floodplain delineation maps included in Appendix E, an adjustment factor of 1.96 ft is added to the NAVD 29 elevations to match NAVD 88 within the project limits.

2.2 Hydraulic Modeling

HEC-RAS models of the existing and the proposed conditions were created for each one of the crossings. Profiles, cross sections and result tables are included in Appendix A.

For consistency, the roughness coefficients used in the models for main channels and overbanks are the same as what was used in the FCDMC studies: 0.037 for the channel and 0.065 for the overbanks. Different culvert and bridge configurations were evaluated at each crossing with the objective of finding sizes for which the proposed structure does not increase the upstream water surface elevation as compared to the existing condition.

Under the existing condition, flow depths for all channels rarely exceed the minimum preferred culvert height of 5 feet. For this reason culvert capacities were increased by adding total span to proposed culverts while maintaining a constant 5-foot height. This also allows the roadway profile to be as low as possible and minimize the amount of borrow required for the project.

The intention of the design is to preserve as closely as possible existing drainage patterns, provide continuity to administrative floodways and minimize the need for outlet erosion protection associated with channel bends. As a result, most culverts have significant skew angles with the proposed roadway centerline. This approach could be revisited during final design in order to evaluate the use of shorter structures depending on compatibility with future improvements included in the development of land in the vicinity of the project.

Table 2.2 is a summary of proposed culvert data. The 100-year water surface elevation for the cross section upstream of the culvert is presented for the proposed and existing condition. Consequently, significant increases in base flood elevations are not expected as a result of the construction of roadway improvements.

Table 2.2: Proposed Culverts Summary

Culvert ID	Station	Skew	Barrels	Size	Type	Length (ft)	Prop HW Elev. US (ft)	Exst HW Elev. US (ft)
1	100+00	45° RT	5	8'x5'	CBC	340	1425.98	1427.62
2	156+15	54° RT	3	6'x5'	CBC	331	1474.42	1474.91
3	184+74	64° RT	3	8'x5'	CBC	437	1504.90	1504.72
4	249+41	47° RT	5	8'x5'	CBC	285	1574.61	1574.77
5	258+20	22° RT	3	8'x5'	CBC	224	1584.51	1584.23
6	263+70	25° RT	3	10'x5'	CBC	217	1589.62	1591.76
7	267+54	23° RT	3	6'x5'	CBC	215	1597.79	1597.88
8	283+25	34° RT	3	6'x5'	CBC	254	1613.47	1614.25
9	301+86	62° LT	4	48"	CMP	385	1645.14	1645.12
10	306+40	54° LT	5	10'x5'	CBC	280		
11	316+00	27° LT	1	10'x5'	CBC	185	1644.13	1645.79

2.3 Open Channels

Four channels are proposed along 163rd Avenue. Channel 1 runs along the western side of the roadway from Patton Road to Jomax Road, intercepting off-site runoff and conveying it to the CBC at Jomax Road. This channel serves the same purpose of a ditch on the west side and a berm on the east side of the existing road, improving existing capacity in order to provide all-weather access.

Channel 2 replaces the section of the existing wash that would be obliterated by the construction of the roadway and conveys flows to the existing culvert at Dale Road.

Channel 3 replaces the section of Wash 9 East in conflict with the roadway embankment on the upstream side of the proposed CBC, south of Dixileta Drive.

Channel 4 conveys flows from three proposed roadway crossings of Padelford Wash Split 2 to the location where the major existing Split 2 channel turns away from 163rd Avenue. In the current condition a low flow channel runs along the same section of the road, flooding the pavement during storm events.

All channels are designed with 3:1 side slopes, n value of 0.025 and longitudinal slope of 0.0090 feet/foot in order to provide sufficient capacity to convey the 100-year event.

Table 2.3: Proposed Channels Summary

Channel	Length (ft)	Bottom Width (ft)	Top Width (ft)	Depth of Flow (ft)	Capacity (cfs)
1	4,735	4	34	3	300
2	680	4	34	3	300
3	460	12	38	3	570
4a	530	30	54	3	1,200
4b	900	30	54	3	1,200
4c	1,400	45	75	4	2,400

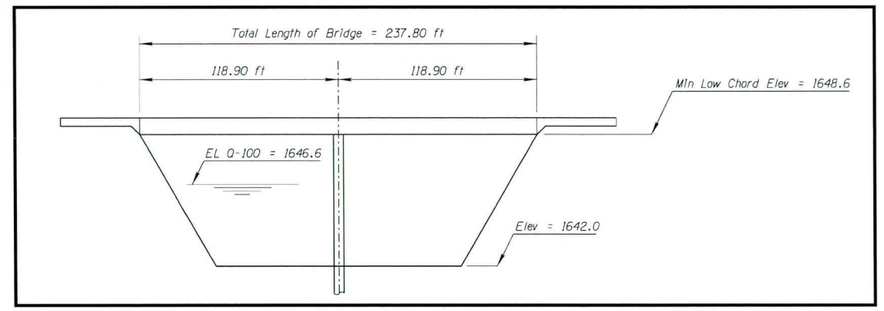
2.4 Split 3 Bridges

Twin 240'-long bridges at the intersection of the roadway with the Padelford Wash Split 3 are proposed to allow passage of the entire Split 3 100-year peak of 4,660 cfs with minimal adverse impact to water surface elevations as compared with Padelford Wash FDS base flood elevations. Grading of the wash upstream and downstream of the structures should be considered during final design in order to provide adequate transitions and improve hydraulic efficiency. Guide banks may be required for conveyance upstream and protection of existing structures downstream of the bridges.

The preliminary hydraulic model of the bridge uses the FDS cross sections with additional trapezoidal cross sections upstream and downstream of the bridges, assuming channel modifications. 1:1 contraction and 2:1 expansion flow transition ratios are assumed. The bridge opening in the model is the clear span perpendicular to the direction of flow, although the proposed bridges are highly skewed.

Figure 2.1 shows the preliminary main dimensions for a two-span configuration. Alternative configurations can be considered during final design. Additional hydraulic modeling will be required during final design to better reflect proposed channel improvements upstream and downstream of the structures, as well as to include the geometry of the selected bridges. The development of regional flood control solutions under consideration

Figure 2.1: Proposed Bridge Elevation Upstream Face



A map of all proposed off-site drainage facilities is provided in Figure 2.2.

PROPOSED DRAINAGE IMPROVEMENTS

163rd Avenue, Jomax Road to Dove Valley Road
Design Concept Report

FIGURE 2.2

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3 ON-SITE DRAINAGE

3.1 Hydrology

Peak flows from all on-site drainage areas were calculated using the rational equation:

$$Q=CiA$$

Q: Peak flow in cfs
C: Runoff coefficient (0.85 for paved, 0.7 for unpaved roadside)
i: Rainfall intensity in in/hr
A: Contributing area in Acres

Site-specific I-D-F values were obtained from the Point Precipitation Frequency Data Server, which uses frequency estimates from the NOAA Atlas 14. Data and results are included in Appendix B. The time of concentration for all sub-basins was set at 10 minutes considering the small size of the drainage areas, resulting in a 10-year intensity value of 3.96 in/hr.

Design data, delineation of drainage areas and location of concentration points are included in Appendix C.

3.2 Gutter and Inlet Hydraulics

The on-site system is designed for the interim parkway section seen in Figure 1.3, with two 14' lanes, right and left turn bays, outside curb and gutter, and recessed open median. The design concept utilizes to the greatest extent possible the spread and ponding depth allowed by the design guidelines defined by the height of the curb (6") and 12' of "dry" pavement during the design event.

Inlet design and spacing follows County guidelines and procedures described in the Drainage Design Manual. Spreadsheets with the pertinent calculations are included in Appendix C.

Flows intercepted by curb opening and median inlets are routed to the outside ditches created by the typical roadway cross section or the offsite open channels. On-site flows ultimately discharge to existing washes.

4 DELINEATED FLOODPLAINS AND WATERS OF THE US

The proposed parkway intersects and affects several delineated floodplains, especially in the section north of the CAP Canal. Regulations related to construction within floodplains should be considered during design of roadway improvements. Conditional Letters of Map Revision (CLOMR) and Letters of Map Revision (LOMR) should be initiated as part of the design and construction of the proposed improvements.

Most natural channels in the project area may be considered to fit the criteria for designation as jurisdictional waters of the United States, and would therefore be regulated by the United States Army Corps of Engineers (USACOE). In recent times, streams that are tributaries to waterways of regional significance, such as the Agua Fria River, have been given "Jurisdictional Waters of the US" (jurisdictional waters) designation. Construction of roadway improvements within delineated jurisdictional waters will require permits issued by the USACOE. A summary of requirements for nationwide permits is included in Appendix D.

5 CONSIDERATIONS FOR FUTURE DEVELOPMENT

Several elements of design not included in this report and that should be considered during final design include erosion protection at inlets and outlets, guide banks and armoring of the roadway embankment as needed. Handrail should be provided at all headwalls considering the multimodal character of the Parkway. Retaining walls can be used in several areas in order to avoid encroachment of the roadway embankment into parallel wash segments.

A regional approach to the development of drainage improvements within the Padelford Wash area north of the CAP Canal has been discussed with representatives of MCDOT, FCDMC and the City of Surprise. Future expansion of the transportation grid in this area will also conflict with the Padelford Wash alluvial fan and will require drainage improvements similar to those being proposed for this project. It is possible that development of regional flood control structural solutions for Padelford Wash could bring savings to transportation projects and an increased level of flood protection and management for residents in the cities of Surprise and Peoria.

The FCDMC is currently evaluating alternatives for regional solutions as part of the Wittmann Area Drainage Master Plan (ADMP). Solutions include off-line or on-line basins for Padelford Wash in close proximity to the alluvial fan apex, control levees upstream of Dove Valley Road, and channelization of split washes. Selection of preferred alternatives and completion of the ADMP is expected by the end of the year or early 2009.

It should be noted that proposed regional structural solutions should maintain the existing distribution of flows to the CAP Canal protection levees and overchutes.

The hydraulic design of drainage structures in this report is preliminary. Development of more precise hydraulic models will be required during final design that would include other proposed structures such as guide banks. Remodeling of the Padelford Wash segment from the alluvial fan apex to the CAP Canal levees is recommended in order to more precisely identify flow splits and set a baseline for existing conditions that can better be used to compare to proposed head water elevations.

6 REFERENCES

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Andes Engineering
February, 2008

163rd Ave. DCR, Jomax Rd. To Dove Valley Rd.
Drainage Concept Report

APPENDIX A

HYDRAULIC MODELS

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163rd Avenue DCR
Jomax Rd. to Dove Valley Rd.

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163rd Ave DCR & CIS

Jomax Rd. to Dove Valley Rd.
Culvert Data

5/30/2008

Culvert No.	Station	Skew	Barrels	Size	Type	Length	Q-50 (cfs)	Q-100 (cfs)	Inlet Elevations (ft)			Outlet Elevations (ft)	
									Invert	HW 100	Existing HW	Invert	HW 100
1	100+00	45° RT	5	8'x5'	CBC	340	864	1,080	1422.00	1425.98	1427.62	1420.25	1423.89
2	156+15	54° RT	3	6'x5'	CBC	331	158	197	1472.12	1474.42	1474.91	1469.65	1470.87
3	184+74	64° RT	3	8'x5'	CBC	437	312	390	1500.74	1504.90	1504.72	1496.71	1498.56
4	249+41	47° RT	5	8'x5'	CBC	285	1,190	1,487	1569.00	1574.61	1574.47	1567.00	1571.31
5	258+20	22° RT	3	8'x5'	CBC	224	320	400	1581.81	1584.51	1584.23	1579.63	1582.53
6	263+70	25° RT	3	10'x5'	CBC	217	600	750	1585.90	1589.62	1591.76	1583.95	1586.34
7	267+54	23° RT	3	6'x5'	CBC	215	312	390	1594.22	1597.79	1597.88	1591.66	1596.69
8	283+25	34° RT	3	6'x5'	CBC	254	384	480	1609.60	1613.47	1614.25	1607.34	1610.34
9	301+86	62° LT	4	48"	CMP	385	2,519	3,149	1638.58	1645.14	1645.12	1633.58	1636.45
10	306+40	54° LT	5	10'x5'	CBC	280			1636.36			1632.86	
11	316+00	27° LT	1	10'x5'	CBC	185	100	150	1641.24	1644.13	1643.85	1638.04	1640.77

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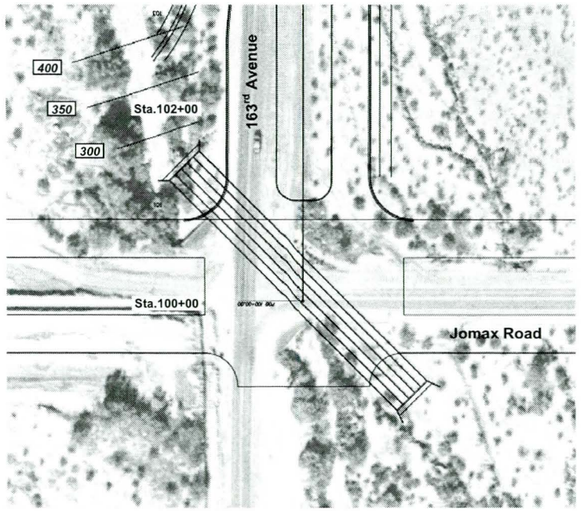
163rd Ave DCR
Jomax Road to Dove Valley Road

Water Surface Elevations for Estimation of 100-Year Peak Flows in HEC-RAS

5/30/2008

	Upstream FDS Cross Section			Distance to HEC-RAS Cross Section	Elevation Adjustment	Upstream HEC-RAS Cross Section	
Crossing ID	ID	NGVD 29 WSEL (ft)	NAVD 88 WSEL (ft)	(ft)	(ft)	ID	Match WSEL (ft)
5	20.760	1585.69	1587.65	252	-2.52	450	1585.13
6	20.853	1591.54	1593.50	50	-0.50	687	1593.00
7	20.950	1597.50	1599.46	61	-0.61	600	1598.85
8	21.248	1614.84	1616.80	0	0.00	632	1616.80

Notes:
- 1.96' added to NGVD 29 Elevations to convert to NAVD 88 Elevations
- FDS Cross Section IDs correspond to the HEC-2 run of Split 2 of Padelford Wash
- Elevation Adjustment with average flowline slope of 0.01 '/ft



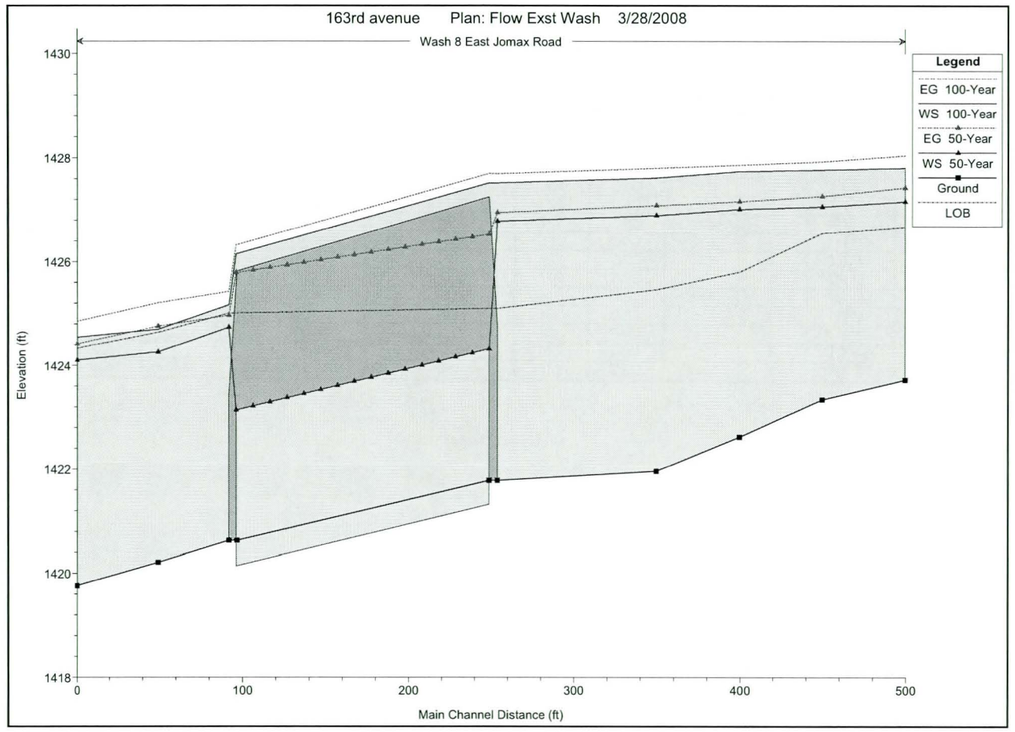
Culvert 1
5-8'x5' CBC

Legend

300 Cross Section ID

Source: HEC-RAS Model

Not to Scale



163rd Avenue DCR
Jomax Road to Dove Valley Road

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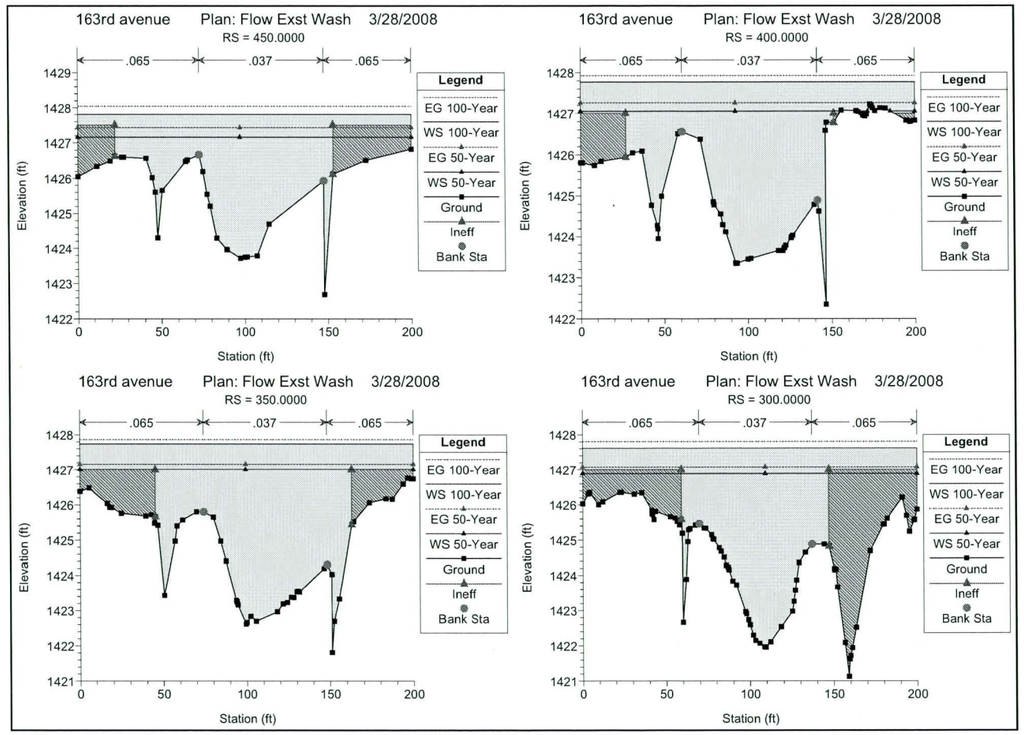
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Station (ft)
Legend
EG 100-Year
WS 100-Year
EG 50-Year
WS 50-Year
Ground
Ineff
Bank Sta
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Station (ft)
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WS 50-Year
Ground
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Bank Sta
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EG 50-Year
WS 50-Year
Ground
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163rd avenue Plan: Flow Exst Wash 3/28/2008
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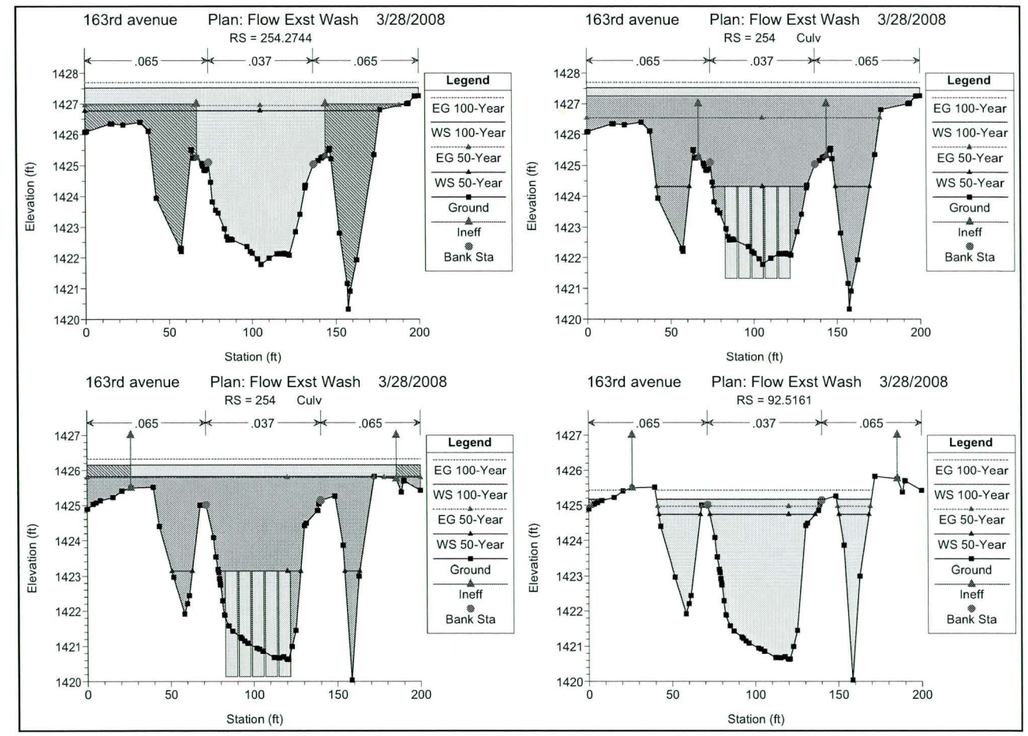
WS 100-Year
EG 50-Year
WS 50-Year
Ground
Ineff
Bank Sta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Ineff
Bank Sta
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Ground
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Bank Sta
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Station (ft)
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Ineff
Bank Sta
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Station (ft)
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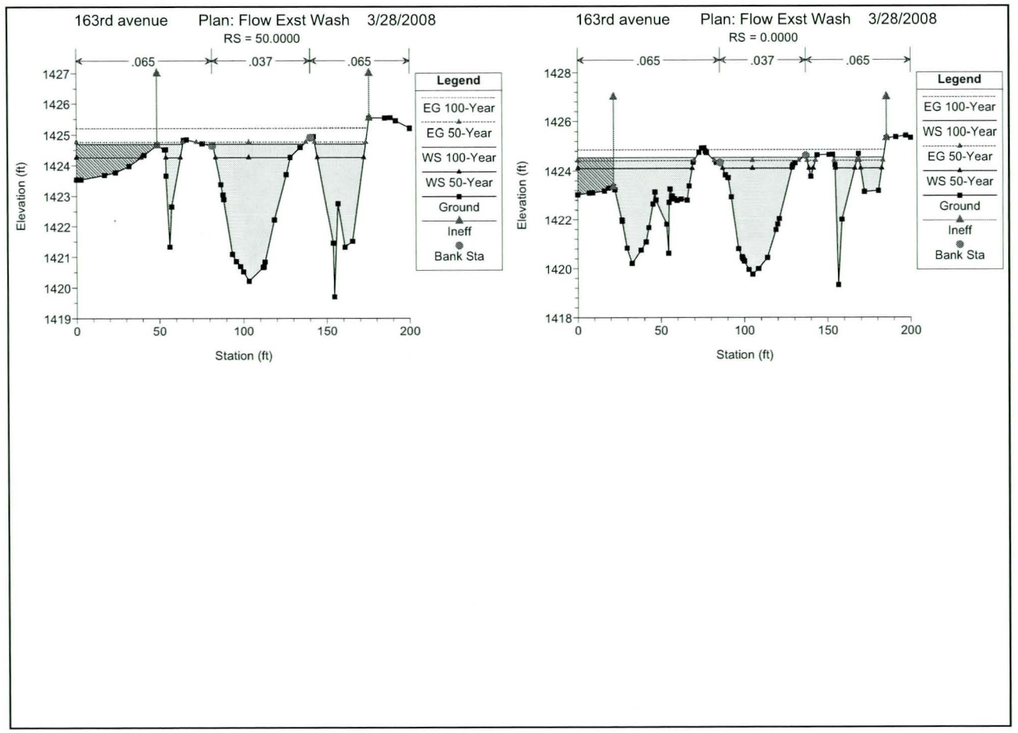
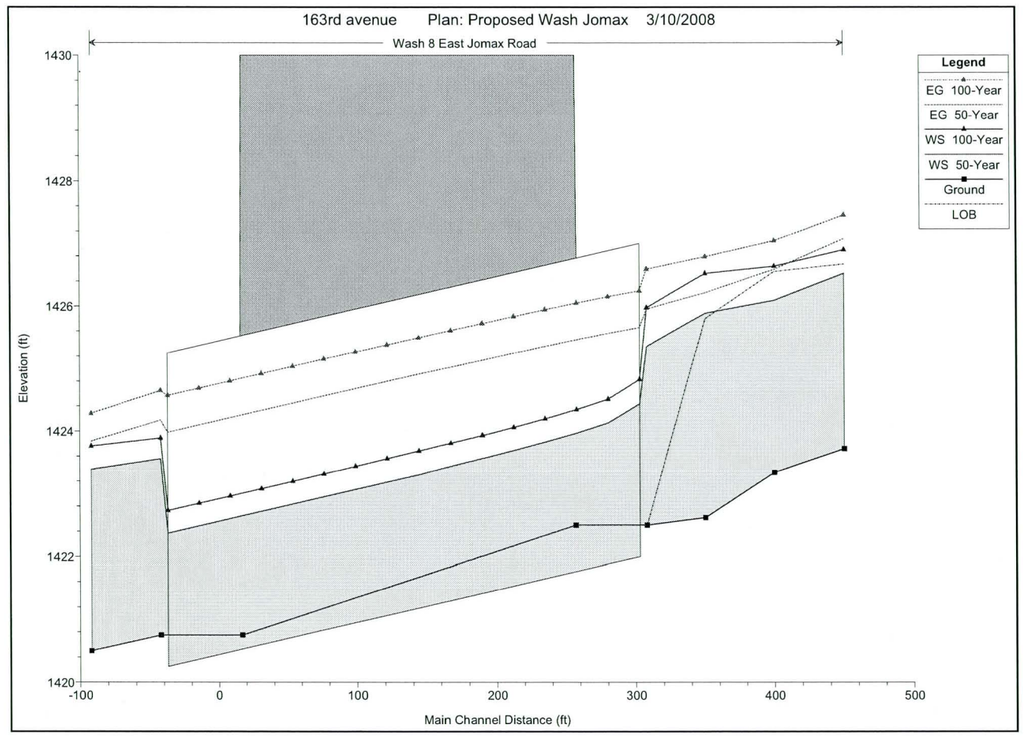
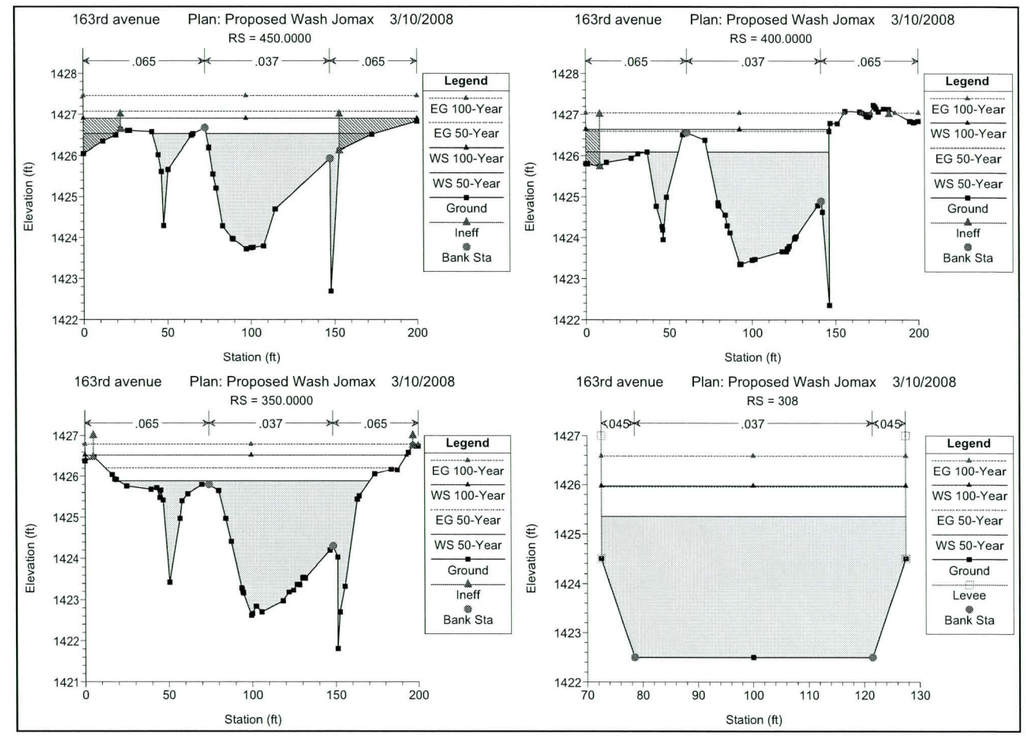
WS 50-Year
Ground
Ineff
Bank Sta



HEC-RAS Plan: EW8EJ River: Wash 8 East Reach: Jomax Road

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Jomax Road	450.0000	100-Year	1080.00	1423.72	1427.81	1426.51	1428.05	0.002484	4.18	345.08	200.00	0.42
Jomax Road	450.0000	50-Year	864.00	1423.72	1427.16	1426.29	1427.43	0.003692	4.35	239.47	200.00	0.50
Jomax Road	400.0000	100-Year	1080.00	1423.34	1427.77		1427.93	0.001461	3.43	423.12	200.00	0.33
Jomax Road	400.0000	50-Year	864.00	1423.34	1427.06		1427.26	0.002393	3.74	282.39	176.81	0.41
Jomax Road	350.0000	100-Year	1080.00	1422.62	1427.74		1427.86	0.000892	3.04	492.20	200.00	0.27
Jomax Road	350.0000	50-Year	864.00	1422.62	1427.01		1427.16	0.001312	3.23	346.38	200.00	0.31
Jomax Road	300.0000	100-Year	1080.00	1421.96	1427.62		1427.80	0.001277	3.62	397.88	200.00	0.32
Jomax Road	300.0000	50-Year	864.00	1421.96	1426.89		1427.08	0.001658	3.62	265.12	200.00	0.35
Jomax Road	254.2744	100-Year	1080.00	1421.78	1427.52	1424.82	1427.69	0.000931	3.43	395.83	200.00	0.28
Jomax Road	254.2744	50-Year	864.00	1421.78	1426.78	1424.48	1426.95	0.001091	3.32	276.10	176.70	0.29
Jomax Road	254		Culvert									
Jomax Road	92.5161	100-Year	1080.00	1420.63	1425.17		1425.43	0.002723	4.37	304.80	133.64	0.44
Jomax Road	92.5161	50-Year	864.00	1420.63	1424.74		1424.97	0.002632	4.10	255.53	106.75	0.43
Jomax Road	50.0000	100-Year	1080.00	1420.21	1424.70		1425.21	0.007644	6.29	216.91	154.47	0.71
Jomax Road	50.0000	50-Year	864.00	1420.21	1424.26		1424.76	0.007153	6.19	177.25	120.48	0.69
Jomax Road	0.0000	100-Year	1080.00	1419.76	1424.54	1423.65	1424.85	0.005006	5.25	291.97	161.69	0.58
Jomax Road	0.0000	50-Year	864.00	1419.76	1424.10	1423.06	1424.42	0.005004	5.28	236.04	137.61	0.58


163rd avenue Plan: Proposed Wash Jomax 3/10/2008
Wash 8 East Jomax Road
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
LOB
Elevation (ft)
Main Channel Distance (ft)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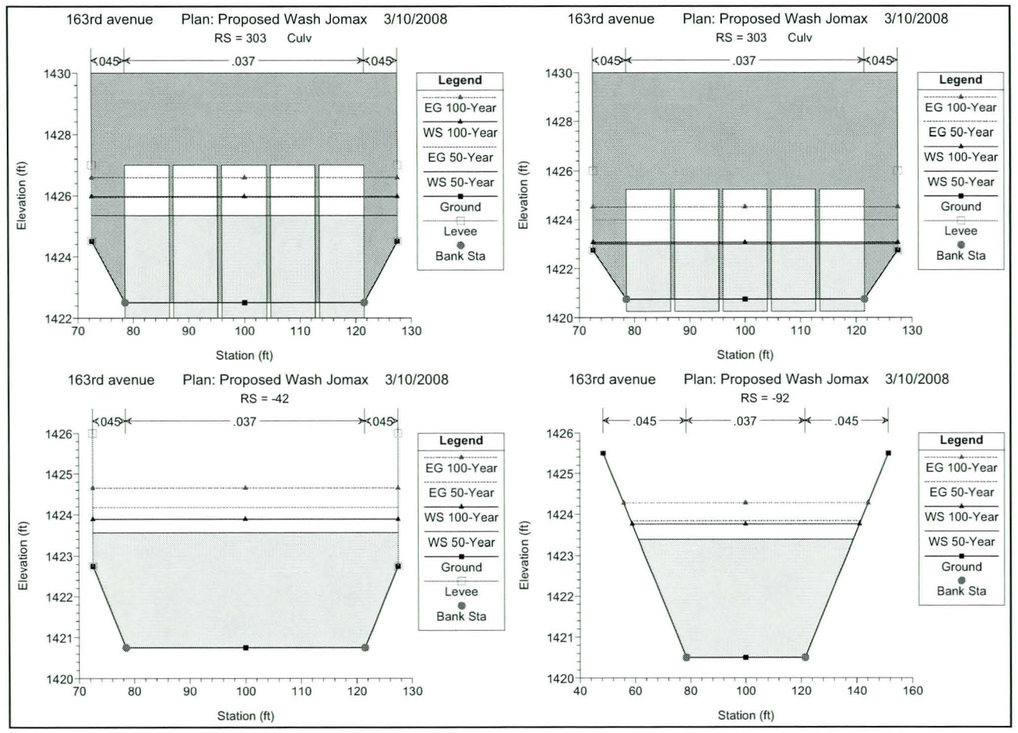
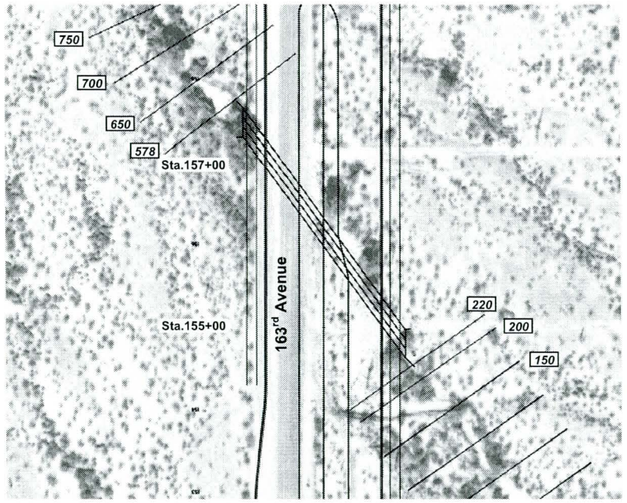
WS 100-Year
EG 50-Year
WS 50-Year
Ground
Ineff
Levee
Bank Sta
Elevation (ft)
Station (ft)



HEC-RAS Plan: PW8EJomax River: Wash 8 East Reach: Jomax Road

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Jomax Road	450.0000	50-Year	864.00	1423.72	1426.52	1426.29	1427.08	0.011007	6.15	158.04	145.12	0.81
Jomax Road	450.0000	100-Year	1080.00	1423.72	1426.90	1426.51	1427.46	0.008822	6.22	205.44	200.00	0.75
Jomax Road	400.0000	50-Year	864.00	1423.34	1426.09		1426.59	0.008192	5.81	173.10	128.97	0.72
Jomax Road	400.0000	100-Year	1080.00	1423.34	1426.64		1427.04	0.006268	5.39	242.36	146.58	0.64
Jomax Road	350.0000	50-Year	864.00	1422.62	1425.89		1426.21	0.005031	4.80	219.14	150.32	0.57
Jomax Road	350.0000	100-Year	1080.00	1422.62	1426.52		1426.79	0.003056	4.43	327.84	192.98	0.46
Jomax Road	308	50-Year	864.00	1422.50	1425.36	1424.75	1425.95	0.006267	6.40	145.08	55.00	0.67
Jomax Road	308	100-Year	1080.00	1422.50	1425.98	1425.07	1426.59	0.005000	6.52	179.12	55.00	0.62
Jomax Road	303		Culvert									
Jomax Road	-42	50-Year	864.00	1420.75	1423.56	1423.00	1424.18	0.006638	6.51	142.49	55.00	0.68
Jomax Road	-42	100-Year	1080.00	1420.75	1423.89	1423.31	1424.65	0.007077	7.24	160.65	55.00	0.72
Jomax Road	-92	50-Year	864.00	1420.50	1423.39	1422.65	1423.84	0.005005	5.76	174.30	77.67	0.60
Jomax Road	-92	100-Year	1080.00	1420.50	1423.76	1422.97	1424.28	0.005001	6.24	203.99	82.13	0.61



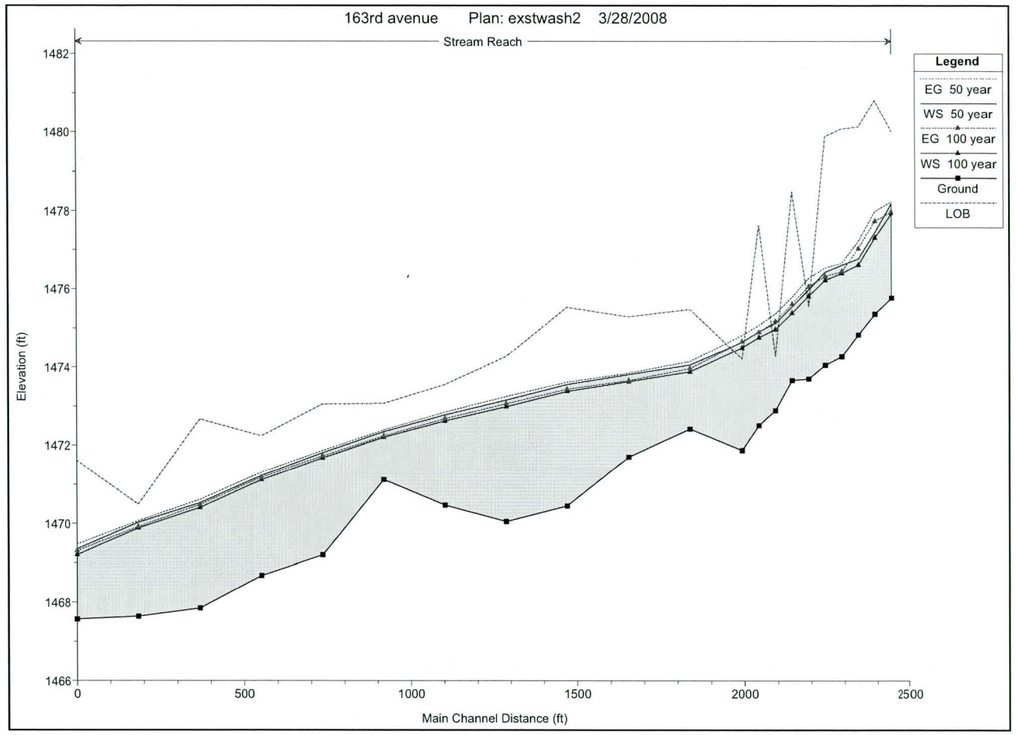
Culvert 2
3-6'x5' CBC

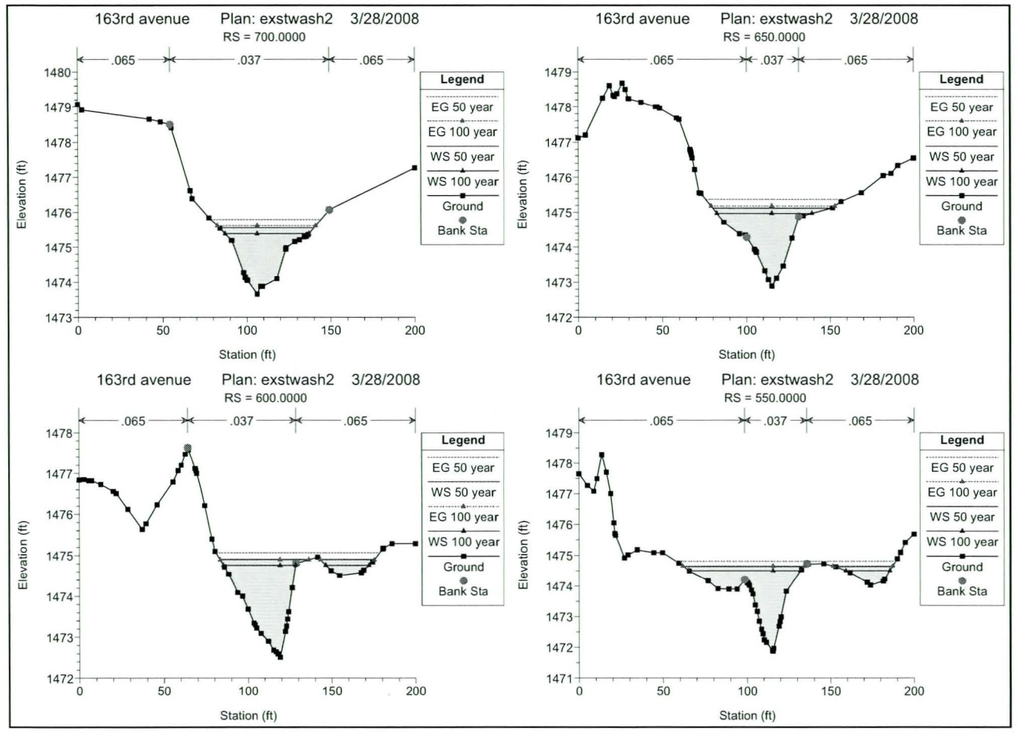
Legend

300 Cross Section ID

Source: HEC-RAS Model

Not to Scale

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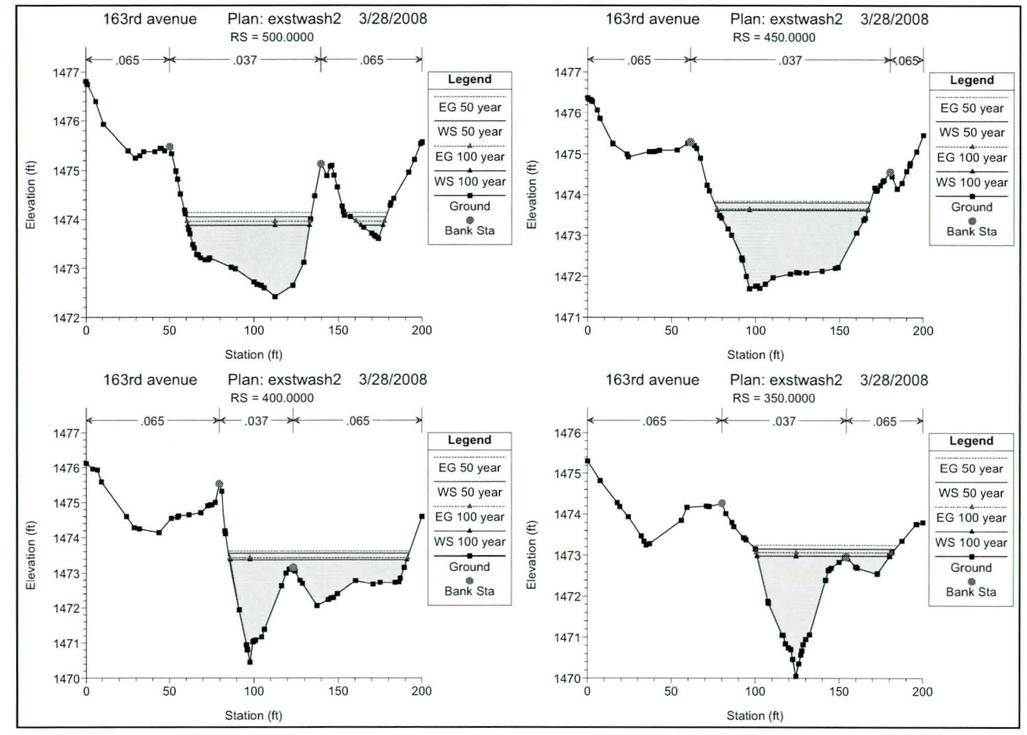
RS = 700.0000
163rd avenue Plan: exstwash2 3/28/2008
RS = 650.0000
163rd avenue Plan: exstwash2 3/28/2008
RS = 600.0000
163rd avenue Plan: exstwash2 3/28/2008
RS = 550.0000
.065
.037
Legend
EG 50 year
EG 100 year
WS 50 year
WS 100 year
Ground
Bank Sta
Elevation (ft)
Station (ft)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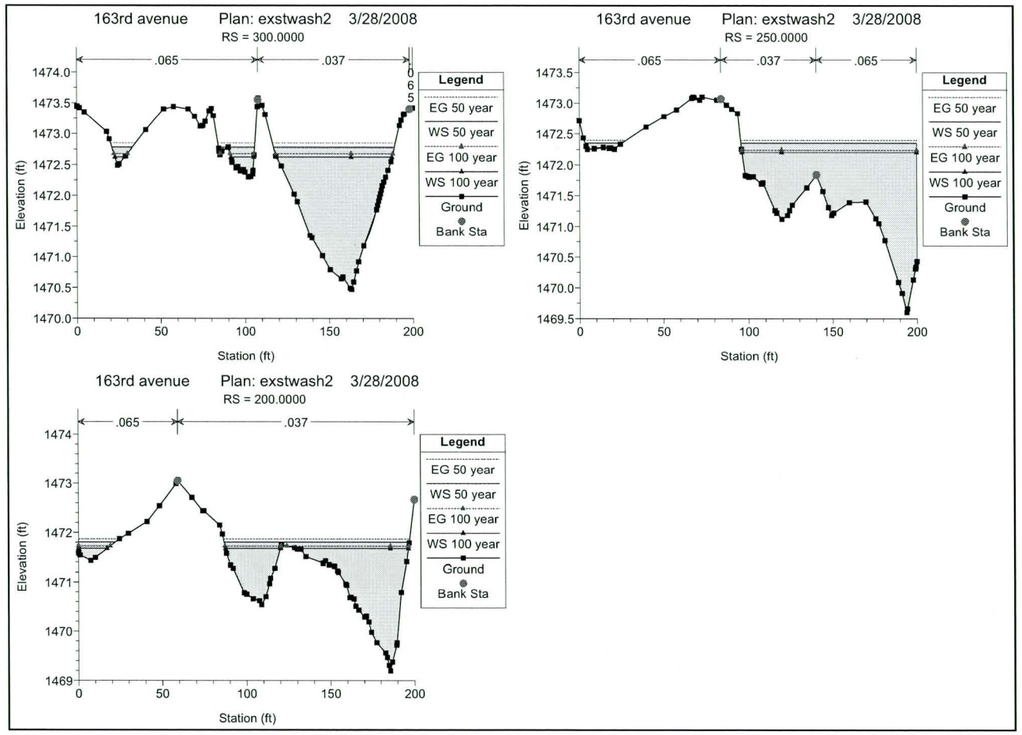
RS = 400.0000
163rd avenue Plan: exstwash2 3/28/2008
RS = 350.0000
.065
.037
Legend
EG 50 year
WS 50 year
EG 100 year
WS 100 year
Ground
Bank Sta
Elevation (ft)
Station (ft)

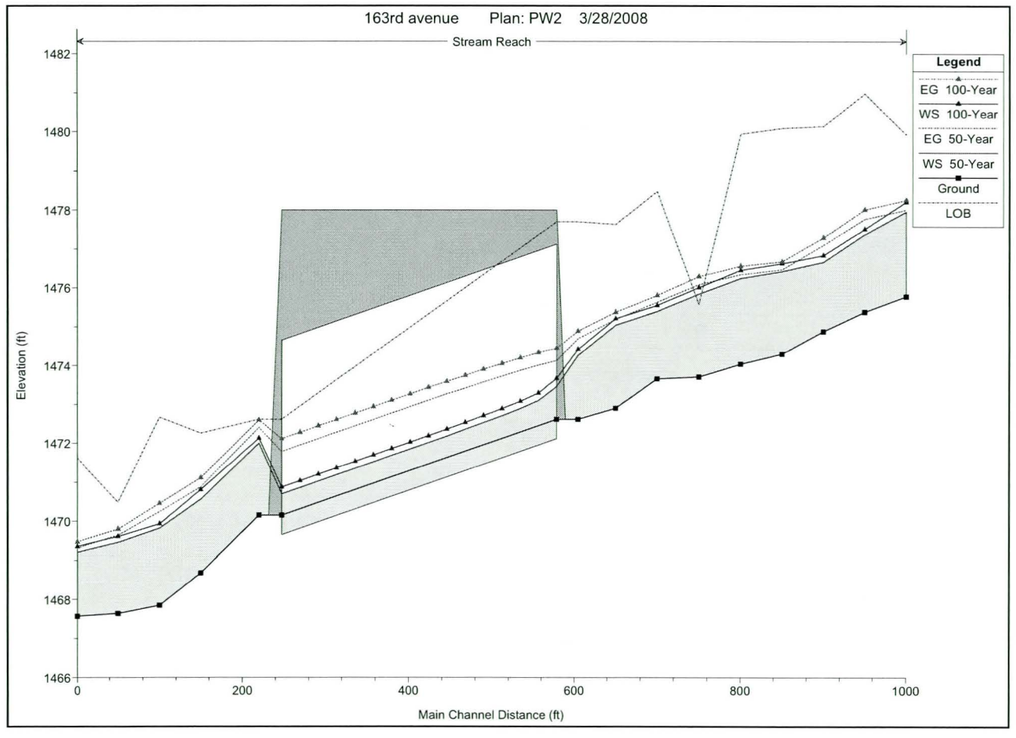


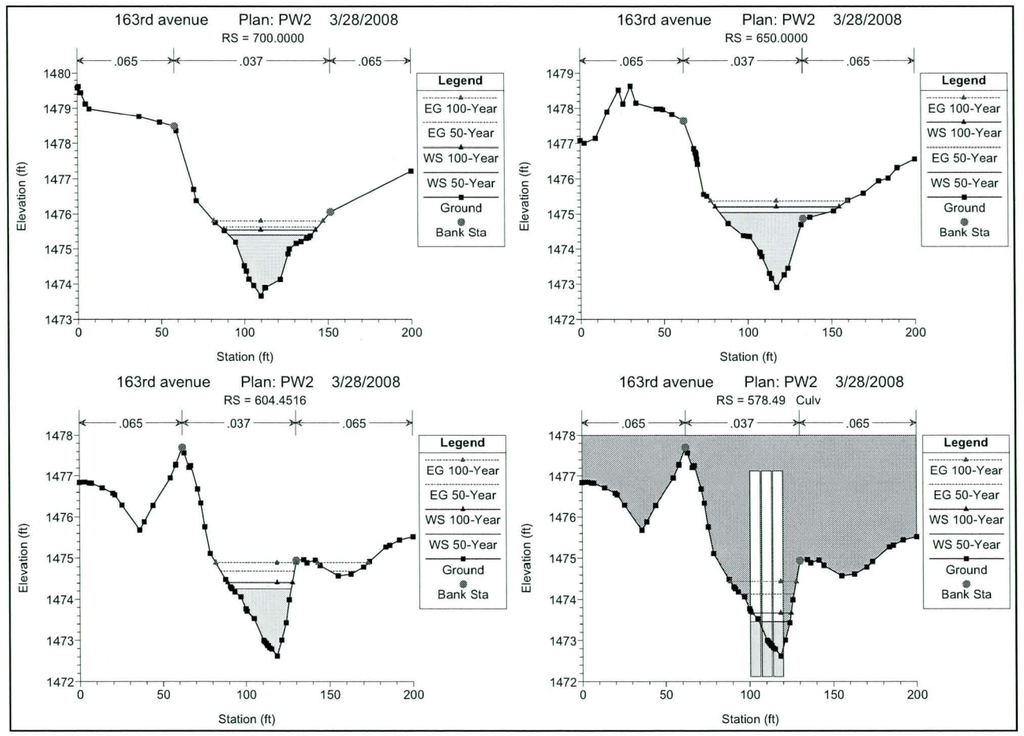
HEC-RAS Plan: ExstWash2 River: Stream Reach: Reach

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	1000.000	50 year	197.00	1475.77	1478.19	1477.23	1478.24	0.001795	2.01	136.21	106.92	0.31
Reach	1000.000	100 year	158.00	1475.77	1477.93	1477.12	1477.98	0.001939	2.07	109.96	94.84	0.32
Reach	950.0000	50 year	197.00	1475.36	1477.45	1477.33	1477.99	0.014895	5.92	33.29	24.59	0.90
Reach	950.0000	100 year	158.00	1475.36	1477.30	1477.13	1477.74	0.013174	5.30	29.79	23.67	0.83
Reach	900.0000	50 year	197.00	1474.83	1476.77	1476.77	1477.22	0.015344	5.75	46.21	60.92	0.90
Reach	900.0000	100 year	158.00	1474.83	1476.61	1476.61	1477.03	0.015390	5.46	37.28	52.83	0.89
Reach	850.0000	50 year	197.00	1474.27	1476.61	1475.76	1476.66	0.001545	1.78	110.61	92.05	0.29
Reach	850.0000	100 year	158.00	1474.27	1476.40	1475.65	1476.45	0.001678	1.71	92.21	86.51	0.29
Reach	800.0000	50 year	197.00	1474.05	1476.44		1476.54	0.003485	2.60	75.86	65.88	0.43
Reach	800.0000	100 year	158.00	1474.05	1476.22		1476.32	0.003675	2.52	62.62	59.07	0.43
Reach	750.0000	50 year	197.00	1473.70	1475.98		1476.27	0.007691	4.37	48.20	50.11	0.65
Reach	750.0000	100 year	158.00	1473.70	1475.82		1476.06	0.006877	3.99	40.78	40.51	0.61
Reach	700.0000	50 year	197.00	1473.66	1475.55		1475.79	0.011243	3.93	50.09	56.24	0.73
Reach	700.0000	100 year	158.00	1473.66	1475.38		1475.61	0.011902	3.84	41.11	49.85	0.75
Reach	650.0000	50 year	197.00	1472.89	1475.12		1475.37	0.006518	4.10	57.44	71.20	0.60
Reach	650.0000	100 year	158.00	1472.89	1474.97		1475.18	0.006433	3.77	47.42	56.71	0.59
Reach	600.0000	50 year	197.00	1472.51	1474.91		1475.07	0.004643	3.24	68.39	87.26	0.50
Reach	600.0000	100 year	158.00	1472.51	1474.76		1474.90	0.004303	2.98	56.64	68.75	0.48
Reach	550.0000	50 year	197.00	1471.87	1474.64	1474.29	1474.81	0.005607	3.57	76.73	107.35	0.55
Reach	550.0000	100 year	158.00	1471.87	1474.50	1474.03	1474.66	0.005310	3.37	62.12	92.94	0.53
Reach	500.0000	50 year	197.00	1472.42	1474.06		1474.15	0.003163	2.40	86.09	95.34	0.40
Reach	500.0000	100 year	158.00	1472.42	1473.88		1473.96	0.003548	2.30	70.15	85.44	0.42
Reach	450.0000	50 year	197.00	1471.70	1473.81		1473.85	0.000911	1.52	130.03	92.86	0.23
Reach	450.0000	100 year	158.00	1471.70	1473.63		1473.66	0.000881	1.39	113.45	89.64	0.22
Reach	400.0000	50 year	197.00	1470.45	1473.56		1473.62	0.001768	2.28	124.80	106.83	0.32
Reach	400.0000	100 year	158.00	1470.45	1473.38		1473.43	0.001793	2.15	105.87	104.83	0.32

HEC-RAS Plan: ExstWash2 River: Stream Reach: Reach (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	350.0000	50 year	197.00	1470.05	1473.16		1473.24	0.002294	2.44	89.59	83.32	0.36
Reach	350.0000	100 year	158.00	1470.05	1472.98		1473.06	0.002259	2.25	75.69	79.08	0.35
Reach	300.0000	50 year	197.00	1470.47	1472.78		1472.85	0.001982	2.10	99.50	105.75	0.33
Reach	300.0000	100 year	158.00	1470.47	1472.62		1472.68	0.001880	1.93	84.36	88.74	0.31
Reach	250.0000	50 year	197.00	1471.12	1472.35		1472.39	0.003056	1.90	120.64	126.53	0.38
Reach	250.0000	100 year	158.00	1471.12	1472.20		1472.24	0.003106	1.69	103.97	103.81	0.37
Reach	200.0000	50 year	197.00	1469.20	1471.81		1471.87	0.002620	1.93	106.13	132.65	0.36
Reach	200.0000	100 year	158.00	1469.20	1471.67		1471.73	0.002497	1.82	89.02	116.84	0.34
Reach	150.0000	50 year	197.00	1468.68	1471.23		1471.31	0.003599	2.28	86.39	92.79	0.42
Reach	150.0000	100 year	158.00	1468.68	1471.11		1471.18	0.003499	2.08	75.98	91.80	0.40
Reach	100.0000	50 year	197.00	1467.85	1470.53		1470.62	0.003998	2.40	91.05	119.04	0.44
Reach	100.0000	100 year	158.00	1467.85	1470.41		1470.48	0.004100	2.24	76.88	111.73	0.43
Reach	50.0000	50 year	197.00	1467.64	1470.03		1470.07	0.002208	1.88	139.40	149.14	0.33
Reach	50.0000	100 year	158.00	1467.64	1469.88		1469.92	0.002319	1.78	117.72	142.10	0.33
Reach	0.0000	50 year	197.00	1467.57	1469.35	1468.89	1469.47	0.005004	2.73	72.07	75.97	0.49
Reach	0.0000	100 year	158.00	1467.57	1469.20	1468.77	1469.31	0.005001	2.59	61.03	69.74	0.49




163rd avenue Plan: PW2 3/28/2008
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.065 .037 .065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: PW2 3/28/2008
RS = 650.0000
.065 .037 .065
Legend
EG 100-Year
WS 100-Year
EG 50-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: PW2 3/28/2008
RS = 604.4516
.065 .037 .065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: PW2 3/28/2008
RS = 578.49 Culv
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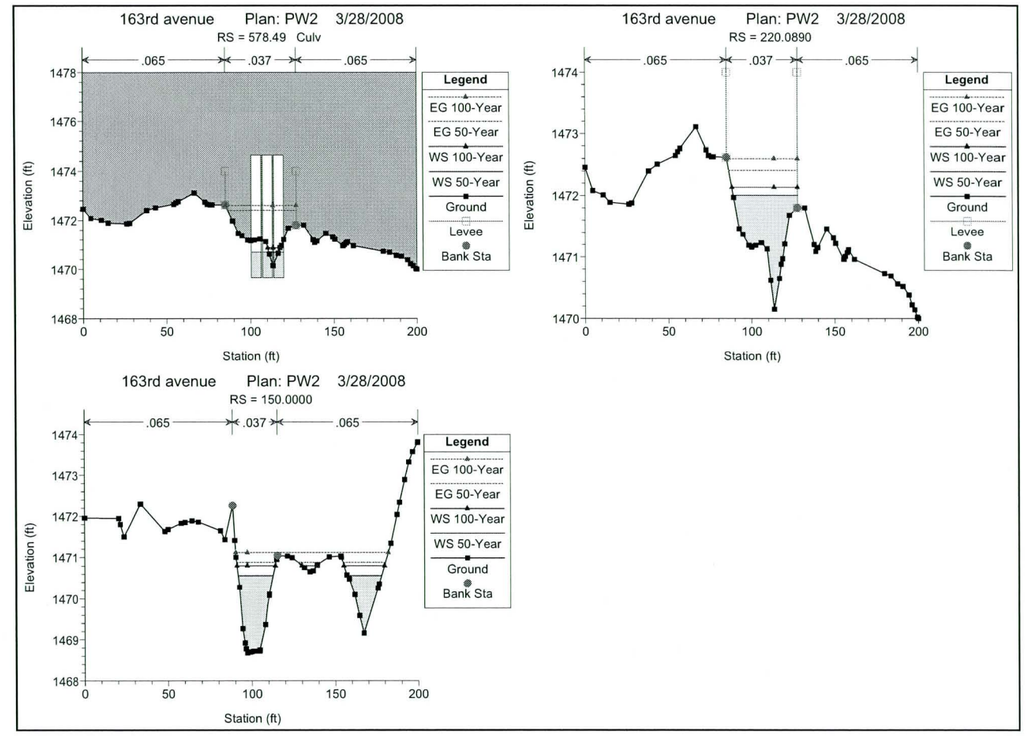
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

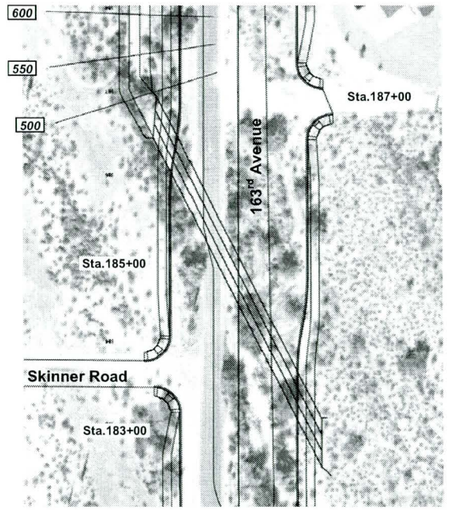

163rd avenue Plan: PW2 3/28/2008
RS = 578.49 Culv
.065 .037 .065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: PW2 3/28/2008
RS = 220.0890
.065 .037 .065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: PW2 3/28/2008
RS = 150.0000
.065 .037 .065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

HEC-RAS Plan: PW2 River: Stream Reach: Reach

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	1000.000	50-Year	158.00	1475.78	1477.96	1477.04	1478.01	0.002038	2.13	103.57	85.77	0.33
Reach	1000.000	100-Year	197.00	1475.78	1478.21	1477.17	1478.26	0.001929	2.14	126.48	95.97	0.32
Reach	950.0000	50-Year	158.00	1475.38	1477.37	1477.15	1477.77	0.011761	5.07	31.17	24.39	0.79
Reach	950.0000	100-Year	197.00	1475.38	1477.51	1477.35	1478.01	0.013598	5.69	34.62	25.37	0.86
Reach	900.0000	50-Year	158.00	1474.88	1476.66	1476.66	1477.10	0.015638	5.49	35.29	49.47	0.90
Reach	900.0000	100-Year	197.00	1474.88	1476.83	1476.83	1477.29	0.015194	5.73	44.41	57.68	0.90
Reach	850.0000	50-Year	158.00	1474.30	1476.42	1475.68	1476.47	0.001737	1.72	91.90	88.05	0.30
Reach	850.0000	100-Year	197.00	1474.30	1476.62	1475.79	1476.67	0.001592	1.79	110.28	93.44	0.29
Reach	800.0000	50-Year	158.00	1474.04	1476.25		1476.34	0.003611	2.50	63.32	59.98	0.43
Reach	800.0000	100-Year	197.00	1474.04	1476.45		1476.56	0.003441	2.58	76.50	66.66	0.42
Reach	750.0000	50-Year	158.00	1473.71	1475.84		1476.08	0.006859	3.95	41.36	42.30	0.61
Reach	750.0000	100-Year	197.00	1473.71	1476.01		1476.29	0.007618	4.30	49.05	51.11	0.65
Reach	700.0000	50-Year	158.00	1473.66	1475.40		1475.63	0.012316	3.90	40.48	49.20	0.76
Reach	700.0000	100-Year	197.00	1473.66	1475.55		1475.81	0.012161	4.06	48.49	55.00	0.76
Reach	650.0000	50-Year	158.00	1472.90	1475.04		1475.19	0.005991	3.13	51.67	63.94	0.55
Reach	650.0000	100-Year	197.00	1472.90	1475.21		1475.37	0.005791	3.29	63.41	74.00	0.55
Reach	604.4516	50-Year	158.00	1472.62	1474.26	1474.26	1474.69	0.021782	5.26	30.02	35.65	1.01
Reach	604.4516	100-Year	197.00	1472.62	1474.42	1474.42	1474.89	0.021195	5.51	35.77	38.89	1.01
Reach	578.49		Culvert									
Reach	220.0890	50-Year	158.00	1470.15	1472.01	1472.01	1472.41	0.021867	5.11	30.94	38.31	1.00
Reach	220.0890	100-Year	197.00	1470.15	1472.13	1472.13	1472.60	0.021441	5.49	35.89	39.17	1.01
Reach	150.0000	50-Year	158.00	1468.68	1470.56	1470.35	1470.88	0.010656	4.85	41.34	42.12	0.75
Reach	150.0000	100-Year	197.00	1468.68	1470.81	1470.53	1471.12	0.009516	4.86	53.11	56.96	0.72
Reach	100.0000	50-Year	158.00	1467.85	1469.82		1470.24	0.014901	5.64	35.99	38.39	0.88
Reach	100.0000	100-Year	197.00	1467.85	1469.93	1469.93	1470.46	0.017805	6.36	40.54	46.64	0.96

HEC-RAS Plan: PW2 River: Stream Reach: Reach (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	50.0000	50-Year	158.00	1467.64	1469.46		1469.64	0.007955	4.24	66.70	102.25	0.65
Reach	50.0000	100-Year	197.00	1467.64	1469.61	1469.42	1469.80	0.007581	4.40	83.18	114.83	0.64
Reach	0.0000	50-Year	158.00	1467.57	1469.20	1468.77	1469.31	0.005000	2.59	61.04	69.74	0.49
Reach	0.0000	100-Year	197.00	1467.57	1469.35	1468.89	1469.47	0.005003	2.73	72.09	76.01	0.49



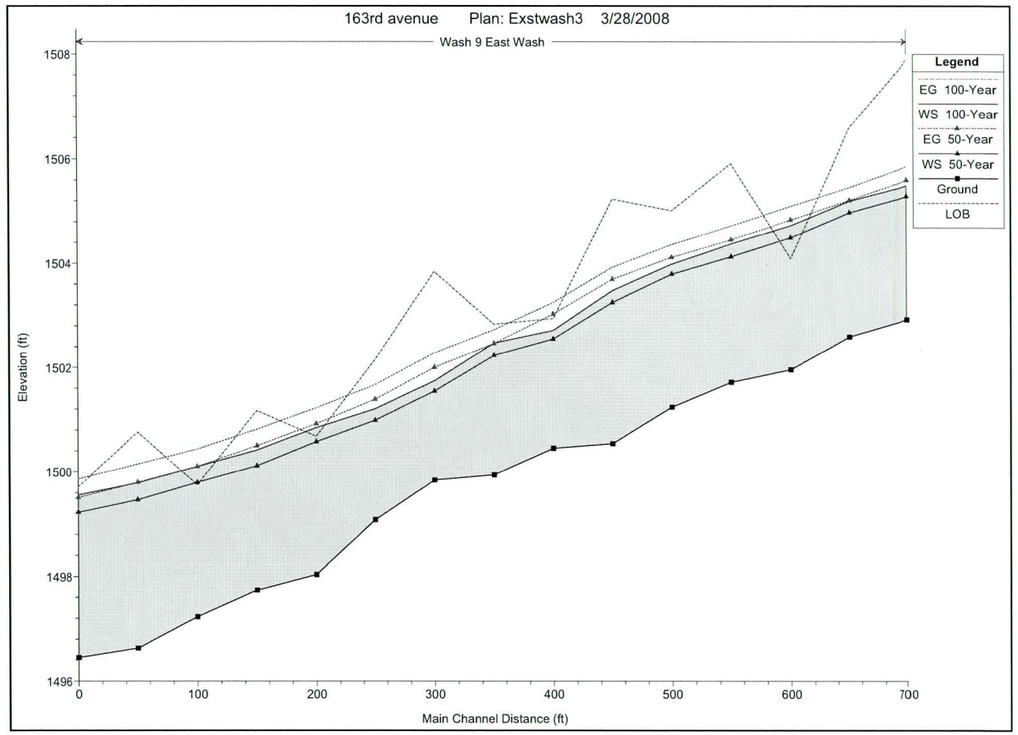
Culvert 3
3-8'x5' CBC

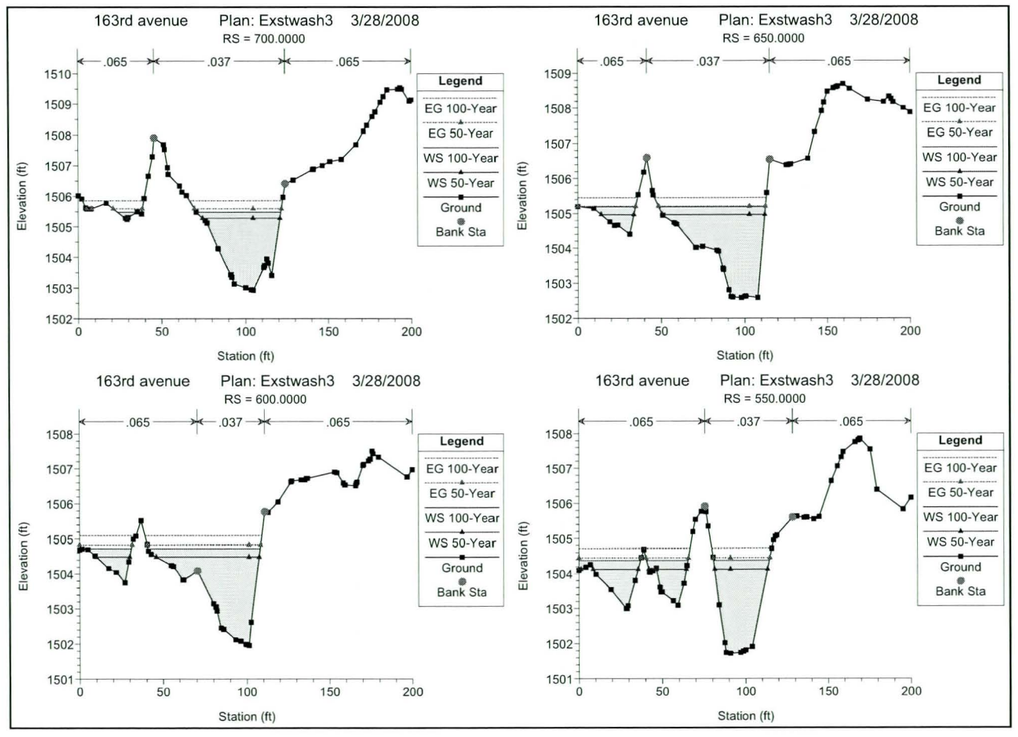
Legend

300 Cross Section ID

Source: HEC-RAS Model

Not to Scale




163rd avenue Plan: Exstwash3 3/28/2008
RS = 700.0000
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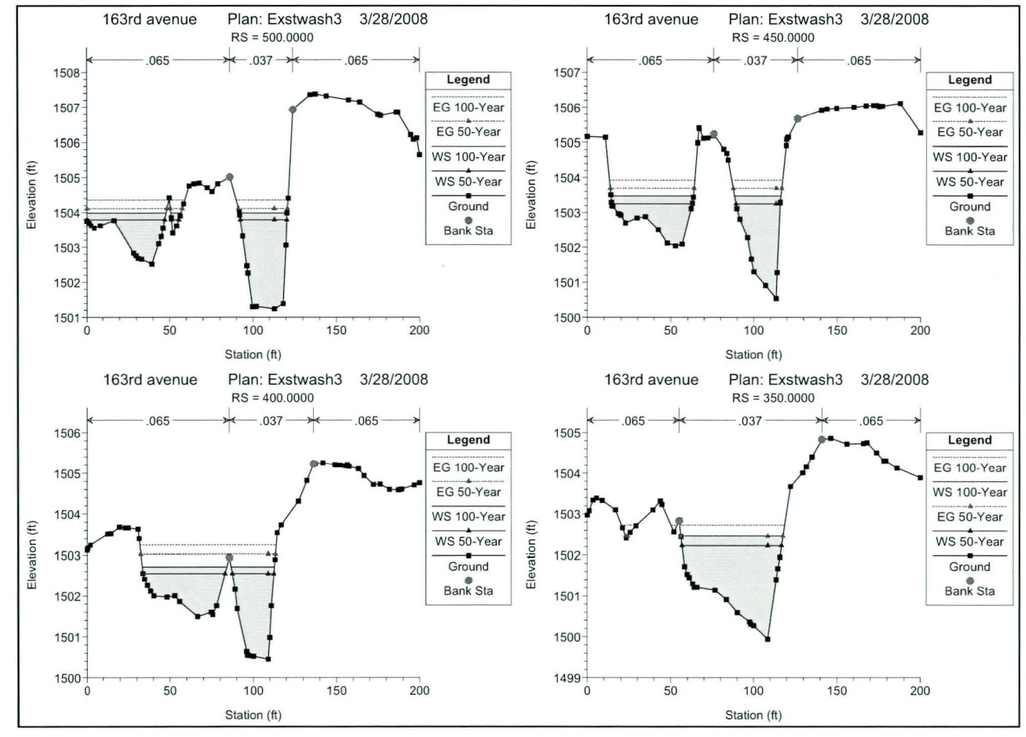
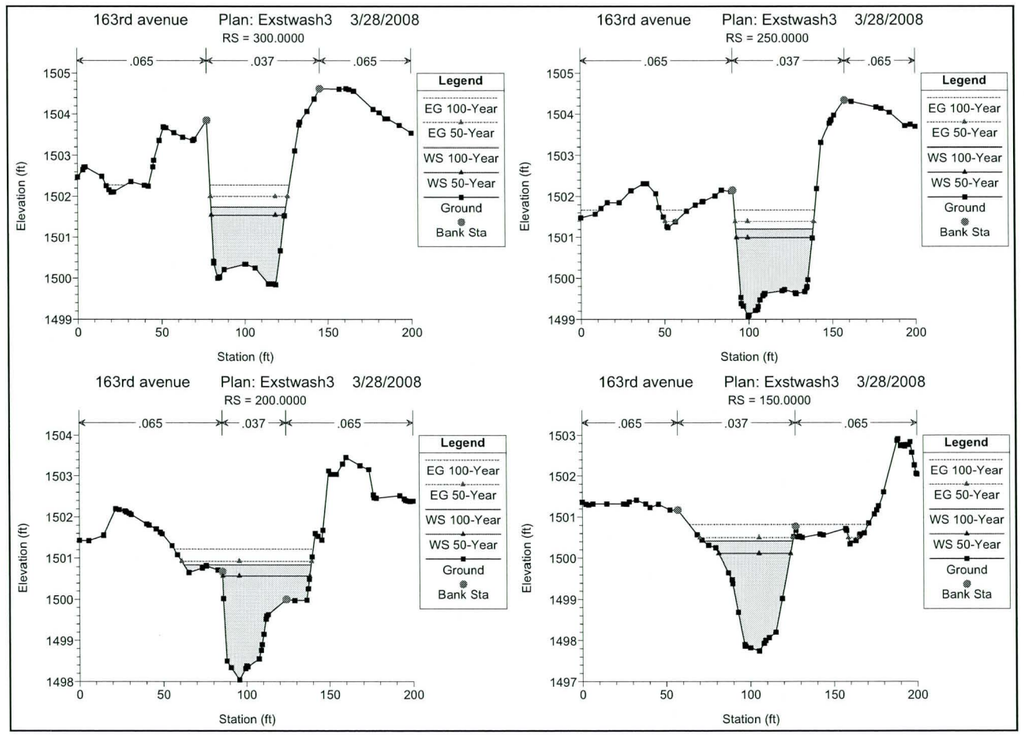
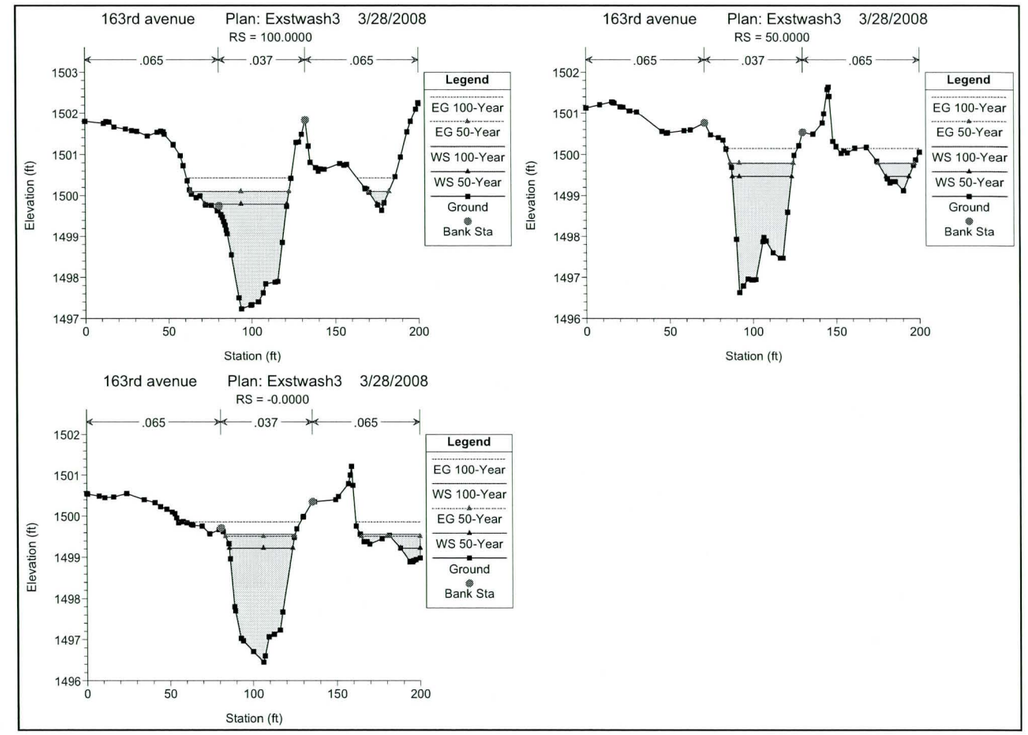
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: Exstwash3 3/28/2008
RS = 650.0000
.065 .037 .065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: Exstwash3 3/28/2008
RS = 600.0000
.065 .037 .065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: Exstwash3 3/28/2008
RS = 550.0000
.065 .037 .065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


163rd avenue Plan: Exstwash3 3/28/2008
RS = 500.0000
.065 .037 .065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: Exstwash3 3/28/2008
RS = 450.0000
.065 .037 .065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: Exstwash3 3/28/2008
RS = 400.0000
.065 .037 .065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: Exstwash3 3/28/2008
RS = 350.0000
.065 .037 .065
Legend
EG 100-Year
WS 100-Year
EG 50-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


163rd avenue Plan: Exstwash3 3/28/2008
RS = 300.0000
163rd avenue Plan: Exstwash3 3/28/2008
RS = 250.0000
163rd avenue Plan: Exstwash3 3/28/2008
RS = 200.0000
163rd avenue Plan: Exstwash3 3/28/2008
RS = 150.0000
.065
.037
.065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

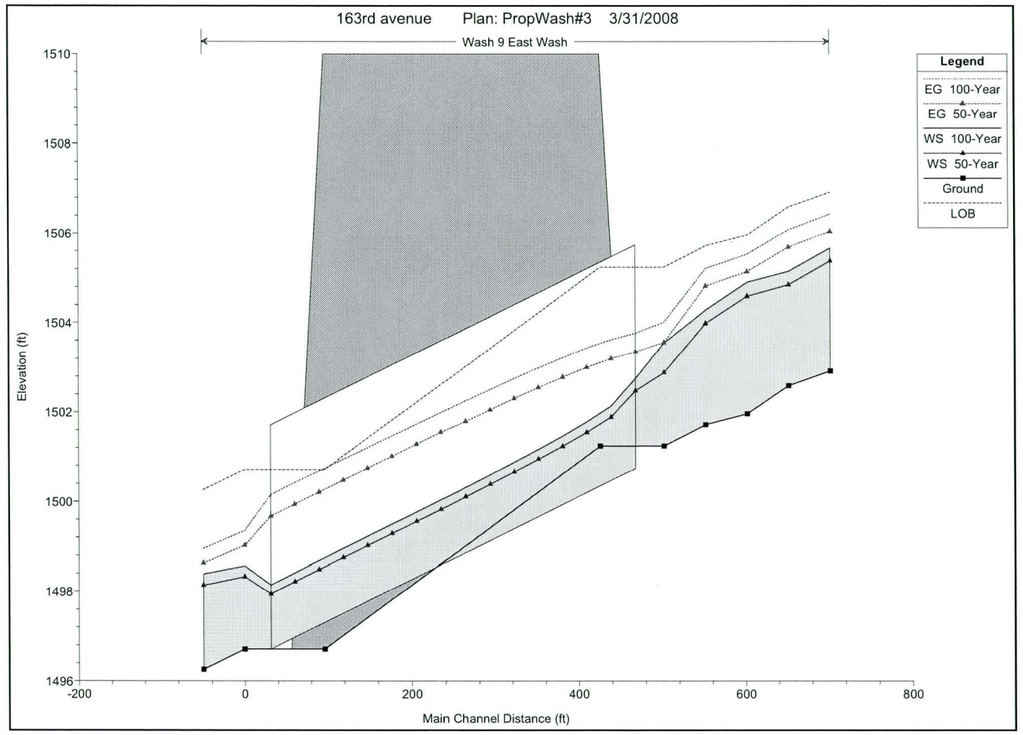

163rd avenue Plan: Exstwash3 3/28/2008
RS = 100.0000
163rd avenue Plan: Exstwash3 3/28/2008
RS = 50.0000
163rd avenue Plan: Exstwash3 3/28/2008
RS = -0.0000
.065
.037
.065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

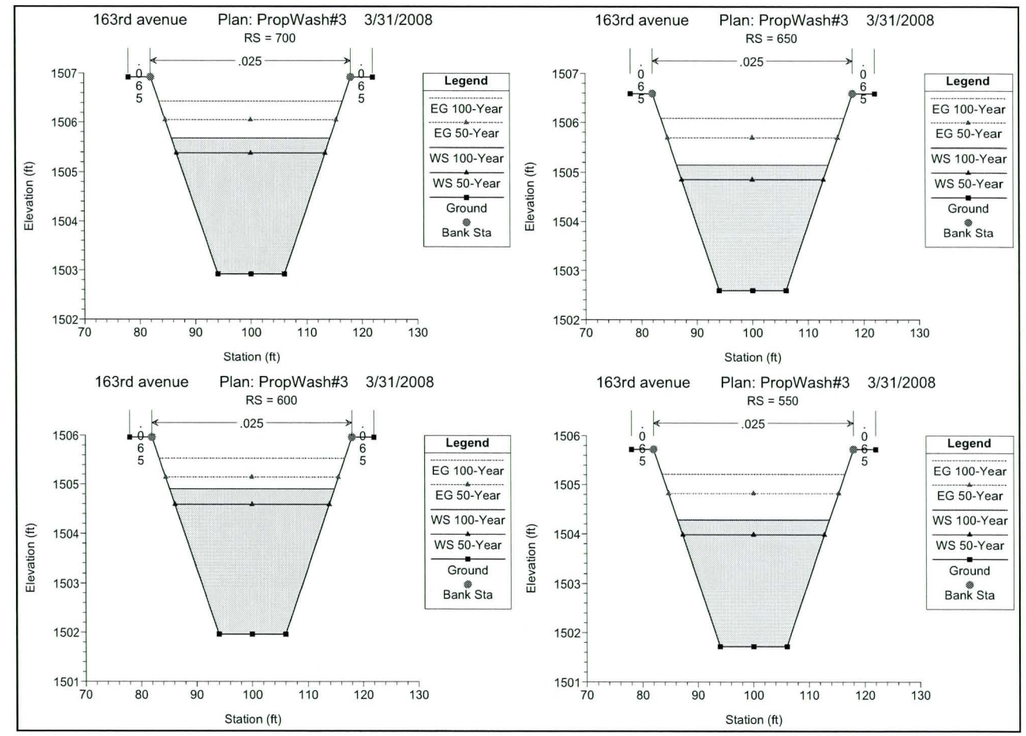
HEC-RAS Plan: EXSTWASH3 River: Wash 9 East Reach: Wash

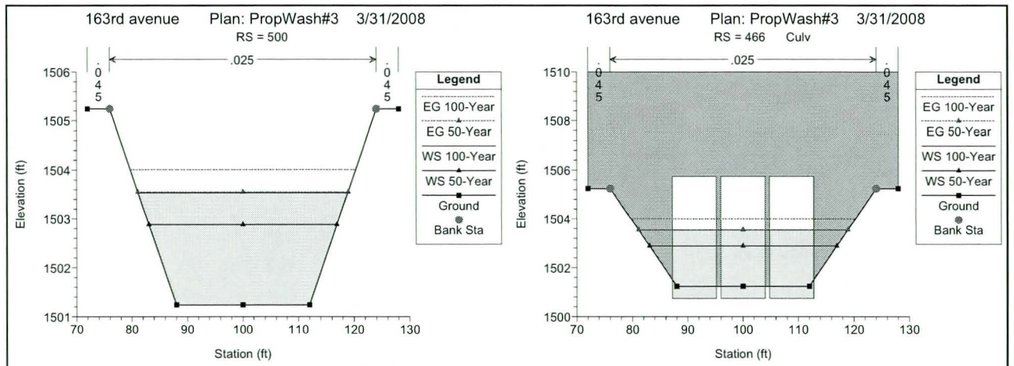
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Wash	700.0000	100-Year	390.00	1502.92	1505.49	1505.02	1505.86	0.008343	4.90	80.78	64.60	0.69
Wash	700.0000	50-Year	312.00	1502.92	1505.28	1504.81	1505.60	0.007416	4.49	69.53	47.85	0.65
Wash	650.0000	100-Year	390.00	1502.59	1505.19		1505.45	0.006723	4.15	102.78	97.43	0.61
Wash	650.0000	50-Year	312.00	1502.59	1504.97		1505.21	0.007202	3.95	83.53	81.27	0.62
Wash	600.0000	100-Year	390.00	1501.96	1504.72		1505.09	0.007109	5.08	98.28	98.40	0.65
Wash	600.0000	50-Year	312.00	1501.96	1504.49		1504.83	0.007407	4.80	77.51	81.86	0.66
Wash	550.0000	100-Year	390.00	1501.72	1504.37		1504.72	0.007019	5.09	106.68	95.52	0.65
Wash	550.0000	50-Year	312.00	1501.72	1504.13		1504.45	0.007147	4.86	84.23	81.95	0.65
Wash	500.0000	100-Year	390.00	1501.24	1503.98		1504.36	0.006345	5.26	101.10	82.85	0.62
Wash	500.0000	50-Year	312.00	1501.24	1503.79		1504.12	0.005784	4.81	85.34	79.74	0.59
Wash	450.0000	100-Year	390.00	1500.54	1503.48	1503.38	1503.92	0.011005	6.00	91.92	77.28	0.79
Wash	450.0000	50-Year	312.00	1500.54	1503.25	1503.19	1503.69	0.011688	5.84	74.47	74.83	0.80
Wash	400.0000	100-Year	390.00	1500.45	1502.71		1503.25	0.014687	6.66	85.10	77.10	0.91
Wash	400.0000	50-Year	312.00	1500.45	1502.55	1502.55	1503.03	0.013781	6.19	72.70	74.58	0.88
Wash	350.0000	100-Year	390.00	1499.94	1502.47		1502.73	0.005759	4.06	96.02	63.37	0.57
Wash	350.0000	50-Year	312.00	1499.94	1502.23	1501.78	1502.46	0.006145	3.83	81.45	60.24	0.58
Wash	300.0000	100-Year	390.00	1499.84	1501.75		1502.28	0.013132	5.87	66.42	45.21	0.85
Wash	300.0000	50-Year	312.00	1499.84	1501.55		1502.00	0.013069	5.42	57.61	44.20	0.84
Wash	250.0000	100-Year	390.00	1499.08	1501.21		1501.67	0.010623	5.47	71.33	46.20	0.78
Wash	250.0000	50-Year	312.00	1499.08	1500.99		1501.39	0.010941	5.09	61.32	45.32	0.77
Wash	200.0000	100-Year	390.00	1498.04	1500.85		1501.22	0.006958	5.06	87.32	76.66	0.65
Wash	200.0000	50-Year	312.00	1498.04	1500.58		1500.92	0.007642	4.80	70.68	52.44	0.66
Wash	150.0000	100-Year	390.00	1497.74	1500.42		1500.82	0.009879	5.07	77.06	57.14	0.74
Wash	150.0000	50-Year	312.00	1497.74	1500.11		1500.50	0.009410	4.98	62.59	42.84	0.73
Wash	100.0000	100-Year	390.00	1497.23	1500.10		1500.43	0.005566	4.66	89.77	71.39	0.59
Wash	100.0000	50-Year	312.00	1497.23	1499.79		1500.10	0.006082	4.45	70.90	53.22	0.60

HEC-RAS Plan: EXSTWASH3 River: Wash 9 East Reach: Wash (Continued)

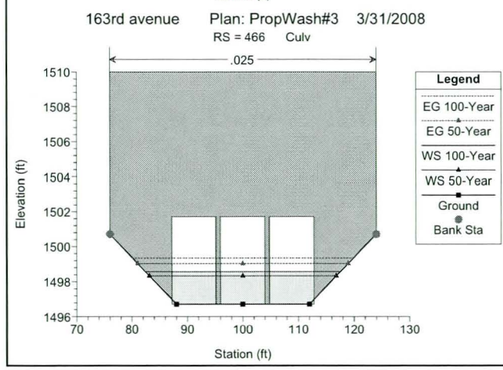
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Wash	50.0000	100-Year	390.00	1496.63	1499.79		1500.15	0.005753	4.85	86.98	59.47	0.59
Wash	50.0000	50-Year	312.00	1496.63	1499.46		1499.80	0.006039	4.63	69.44	49.52	0.60
Wash	-0.0000	100-Year	390.00	1496.45	1499.56	1498.74	1499.86	0.005009	4.48	95.82	78.39	0.56
Wash	-0.0000	50-Year	312.00	1496.45	1499.22	1498.50	1499.51	0.005001	4.30	74.91	50.02	0.55

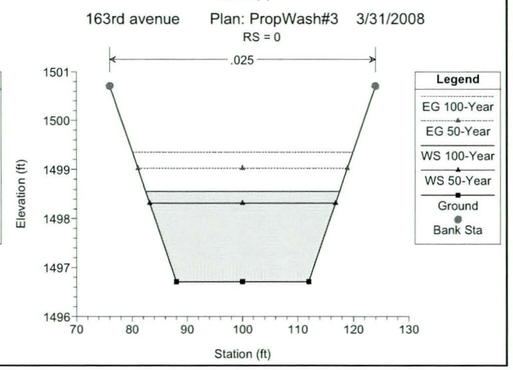

163rd avenue Plan: PropWash#3 3/31/2008
Wash 9 East Wash
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
LOB
Elevation (ft)
Main Channel Distance (ft)

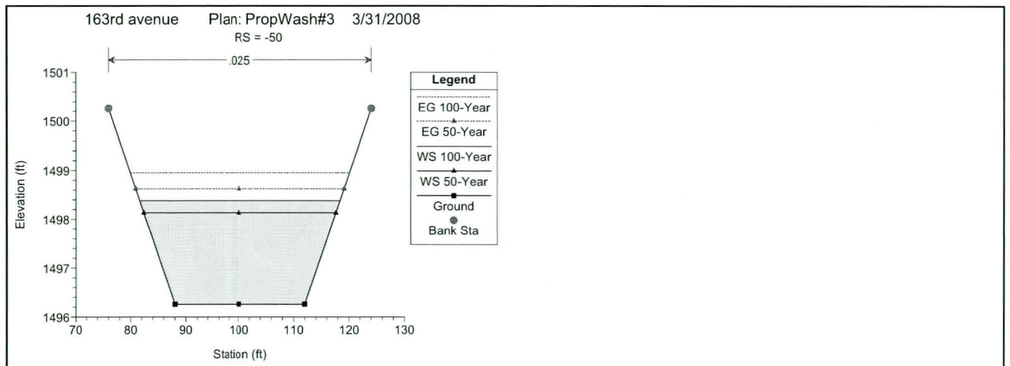

163rd avenue Plan: PropWash#3 3/31/2008
RS = 700
RS = 650
RS = 600
RS = 550
.025
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


163rd avenue Plan: PropWash#3 3/31/2008
RS = 500
.025
0.45
0.45
Elevation (ft)
Station (ft)
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta

163rd avenue Plan: PropWash#3 3/31/2008
RS = 466 Culv
.025
0.45
0.45
Elevation (ft)
Station (ft)
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta

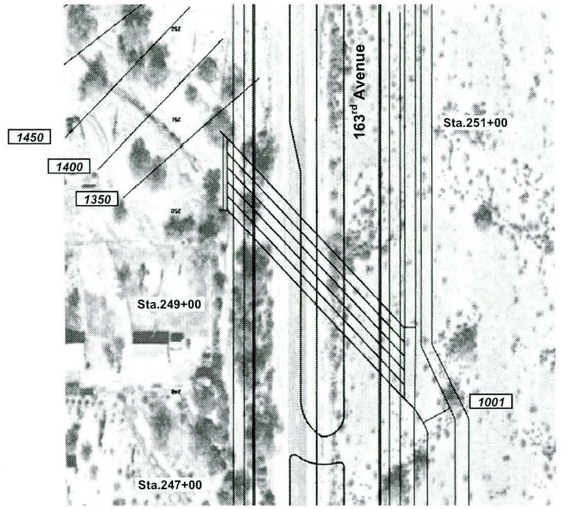

163rd avenue Plan: PropWash#3 3/31/2008
RS = 466 Culv
.025
Elevation (ft)
Station (ft)
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta


163rd avenue Plan: PropWash#3 3/31/2008
RS = 0
.025
Elevation (ft)
Station (ft)
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta


163rd avenue Plan: PropWash#3 3/31/2008
RS = -50
.025
Elevation (ft)
Station (ft)
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta

HEC-RAS Plan: propwash#3 River: Wash 9 East Reach: Wash

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Wash	700	100-Year	390.00	1502.92	1505.67	1505.48	1506.43	0.005919	7.00	55.70	28.50	0.88
Wash	700	50-Year	312.00	1502.92	1505.38	1505.18	1506.05	0.005841	6.55	47.66	26.76	0.86
Wash	650	100-Year	390.00	1502.59	1505.15	1505.15	1506.08	0.007838	7.75	50.34	27.35	1.01
Wash	650	50-Year	312.00	1502.59	1504.85	1504.85	1505.69	0.008103	7.36	42.40	25.55	1.01
Wash	600	100-Year	390.00	1501.96	1504.90	1504.52	1505.53	0.004534	6.36	61.33	29.66	0.78
Wash	600	50-Year	312.00	1501.96	1504.59		1505.14	0.004513	5.97	52.29	27.78	0.77
Wash	550	100-Year	390.00	1501.72	1504.28	1504.28	1505.21	0.007802	7.73	50.43	27.37	1.00
Wash	550	50-Year	312.00	1501.72	1503.98	1503.98	1504.82	0.008048	7.34	42.50	25.57	1.00
Wash	500	100-Year	390.00	1501.24	1503.54	1503.09	1504.01	0.003774	5.49	71.05	37.80	0.71
Wash	500	50-Year	312.00	1501.24	1502.88	1502.85	1503.55	0.007949	6.57	47.48	33.85	0.98
Wash	466		Culvert									
Wash	0	100-Year	390.00	1496.71	1498.56	1498.56	1499.35	0.008138	7.13	54.72	35.11	1.01
Wash	0	50-Year	312.00	1496.71	1498.32	1498.32	1499.02	0.008468	6.71	46.49	33.67	1.01
Wash	-50	100-Year	390.00	1496.26	1498.38	1498.11	1498.95	0.005006	6.05	64.52	36.74	0.80
Wash	-50	50-Year	312.00	1496.26	1498.13	1497.87	1498.62	0.005001	5.62	55.48	35.24	0.79



Culvert 4
5-8'x5' CBC

Legend

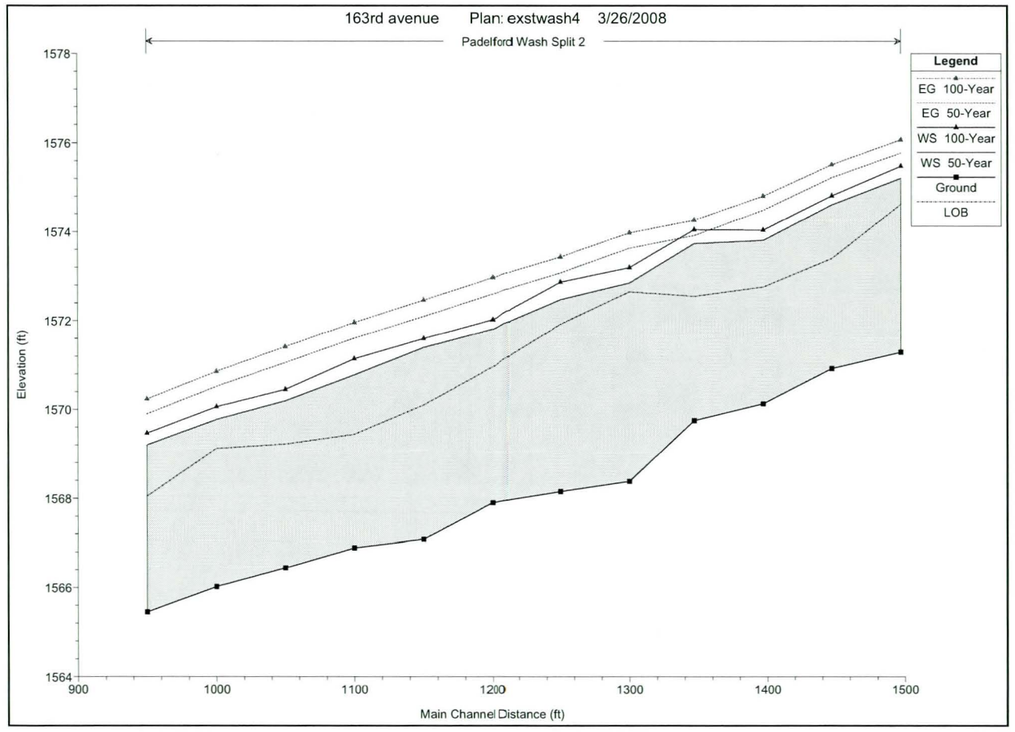
300 Cross Section ID

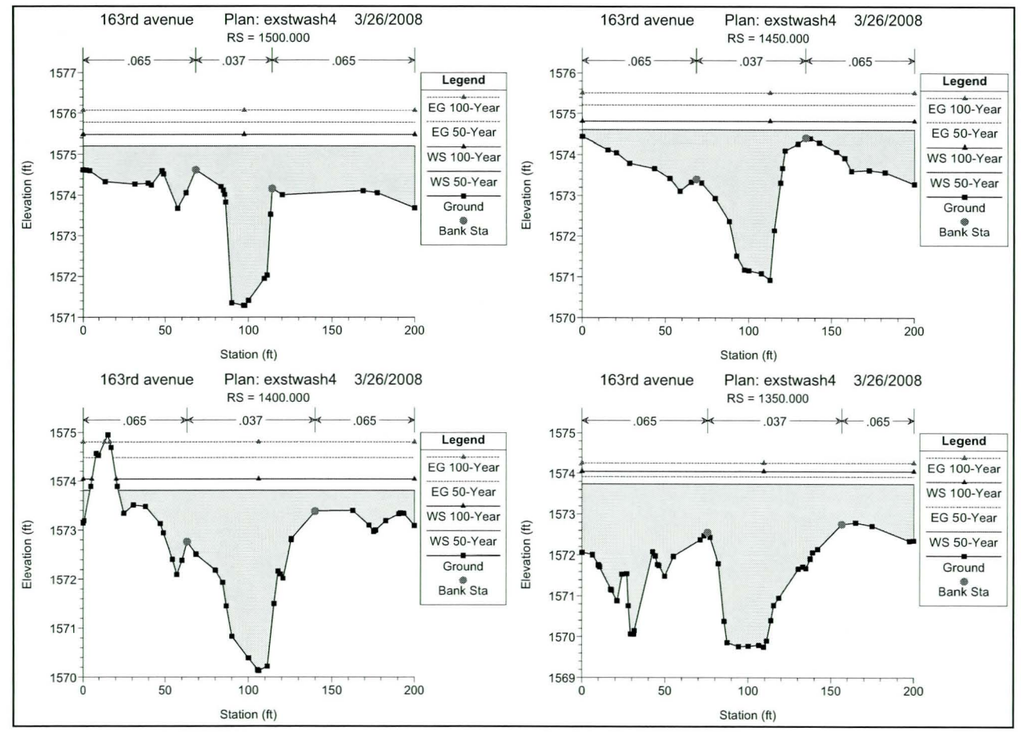
Source: HEC-RAS Model

Not to Scale

163rd Avenue DCR
Jomax Road to Dove Valley Road

Andes Engineering


163rd avenue
Plan: exstwash4 3/26/2008
Padelford Wash Split 2
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
LOB
Elevation (ft)
Main Channel Distance (ft)


163rd avenue
Plan: exstwash4 3/26/2008
RS = 1500.000
.065
.037
.065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue
Plan: exstwash4 3/26/2008
RS = 1450.000
.065
.037
.065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue
Plan: exstwash4 3/26/2008
RS = 1400.000
.065
.037
.065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue
Plan: exstwash4 3/26/2008
RS = 1350.000
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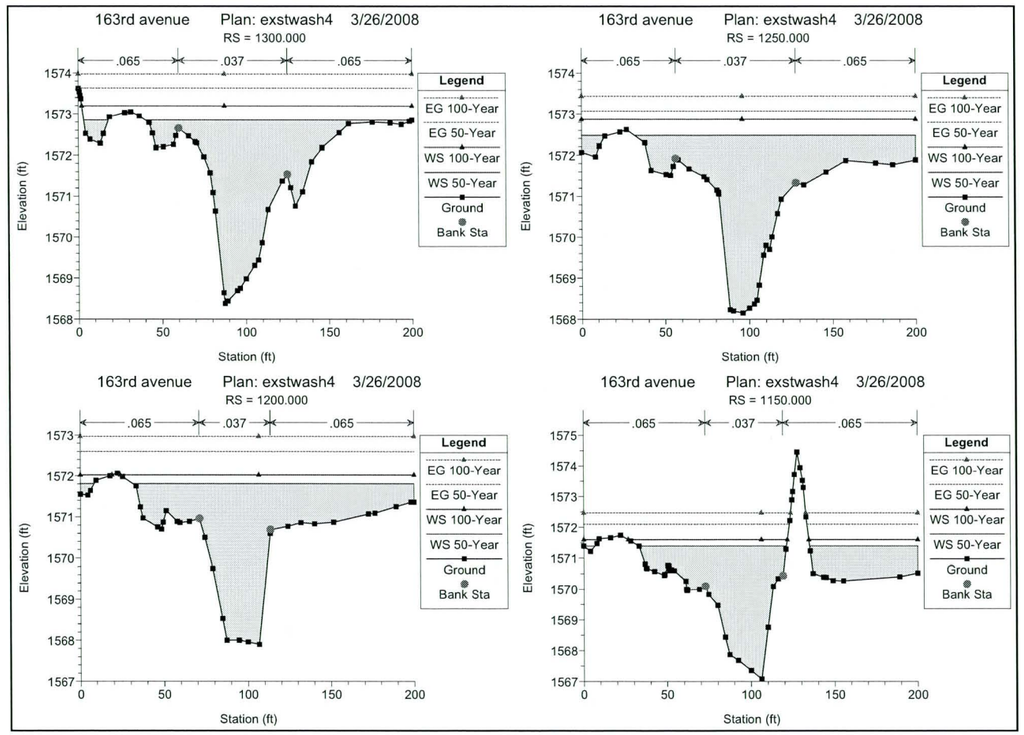
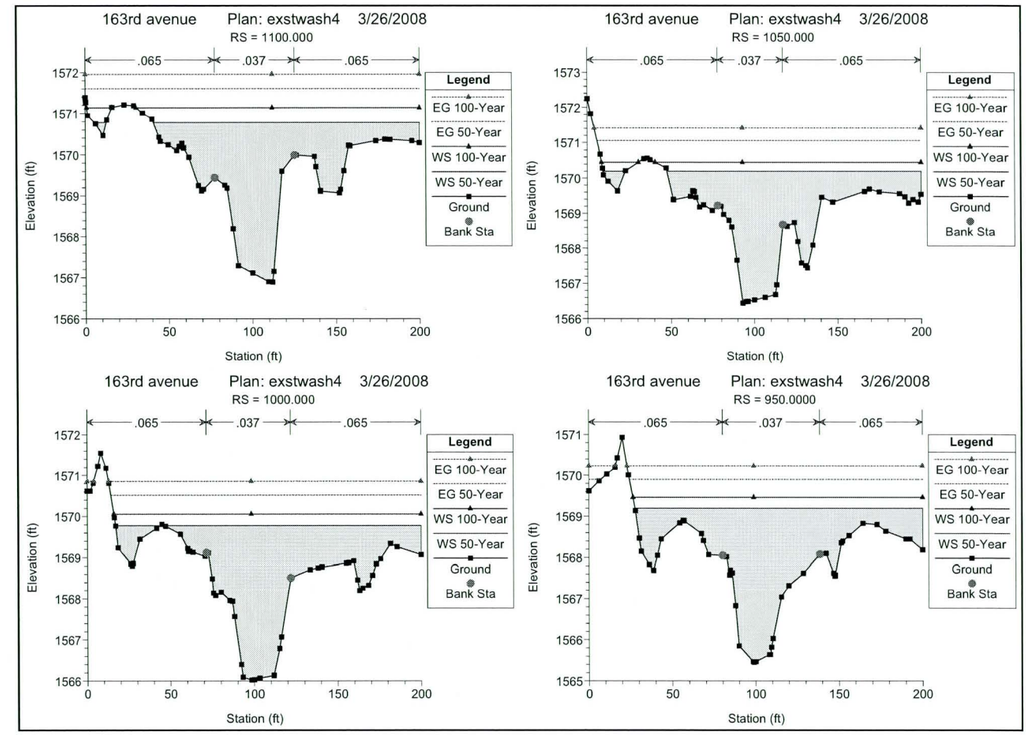
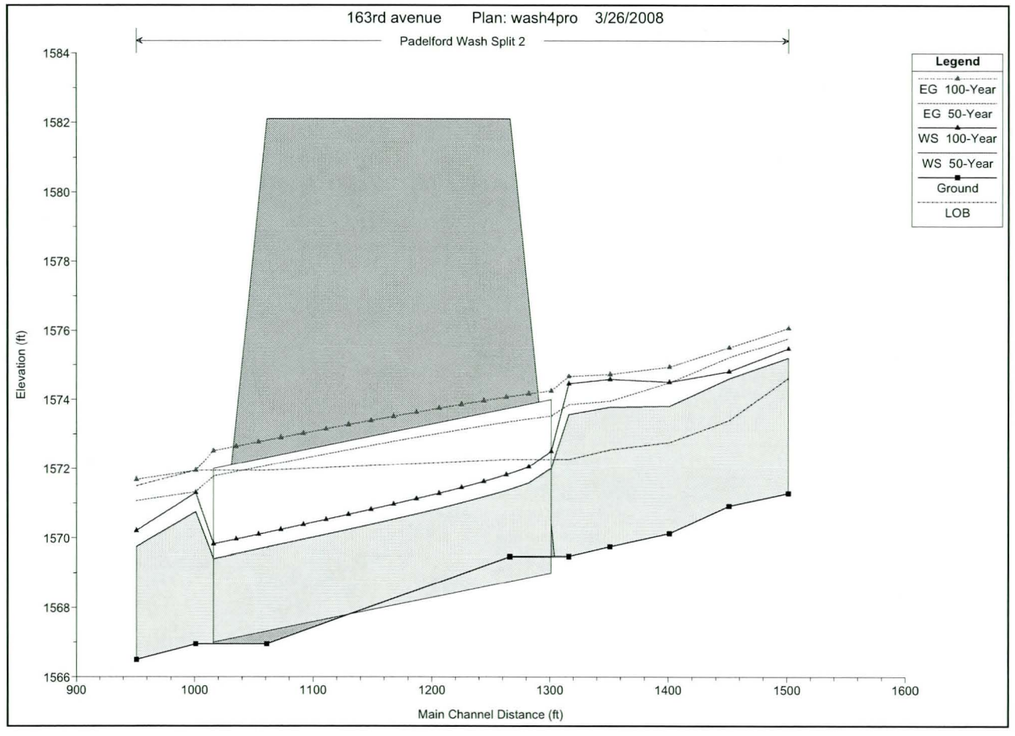
.037
.065
Legend
EG 100-Year
WS 100-Year
EG 50-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

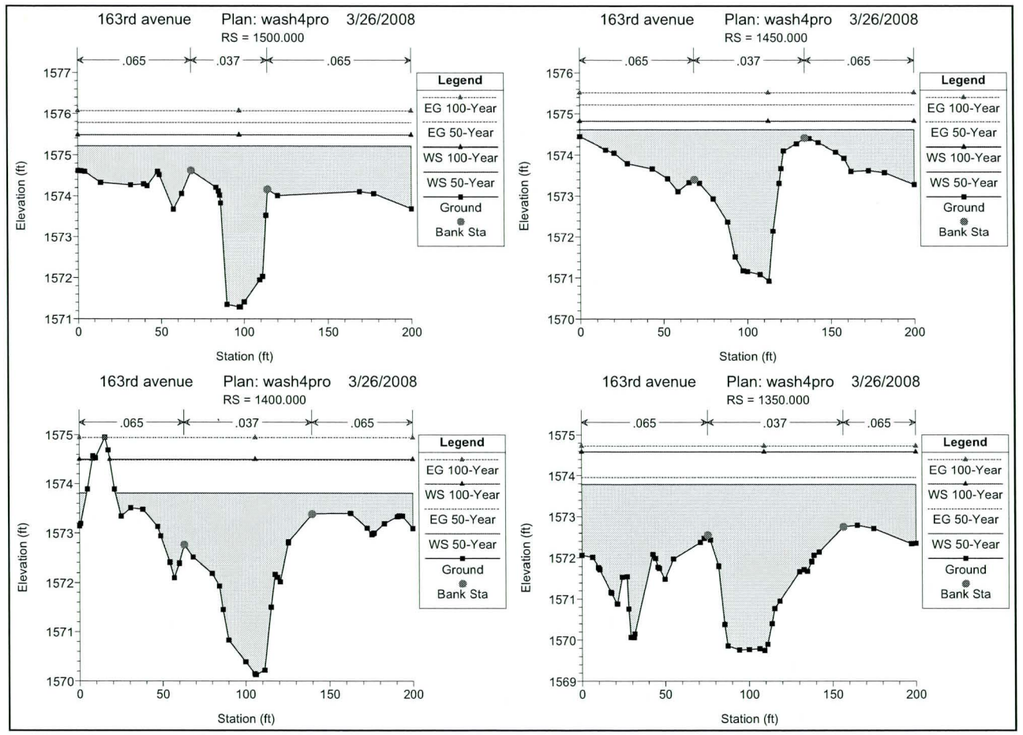

163rd avenue Plan: exstwash4 3/26/2008
RS = 1300.000
163rd avenue Plan: exstwash4 3/26/2008
RS = 1250.000
163rd avenue Plan: exstwash4 3/26/2008
RS = 1200.000
163rd avenue Plan: exstwash4 3/26/2008
RS = 1150.000
.065
.037
.065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

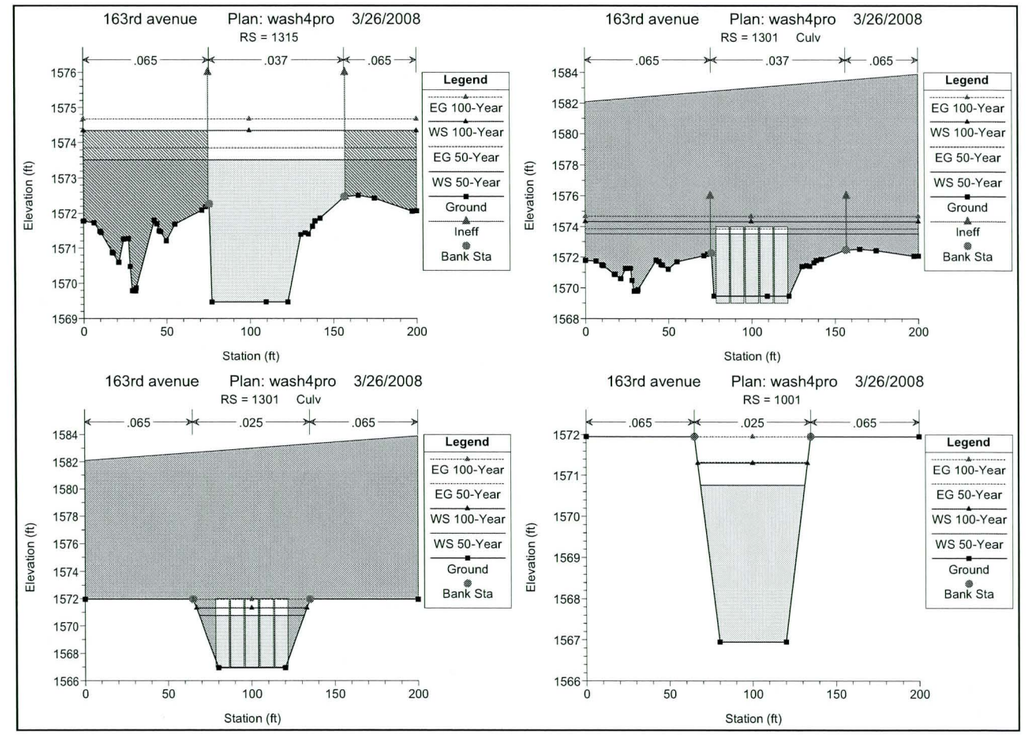

163rd avenue Plan: exstwash4 3/26/2008
RS = 1100.000
163rd avenue Plan: exstwash4 3/26/2008
RS = 1050.000
163rd avenue Plan: exstwash4 3/26/2008
RS = 1000.000
163rd avenue Plan: exstwash4 3/26/2008
RS = 950.0000
.065
.037
.065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

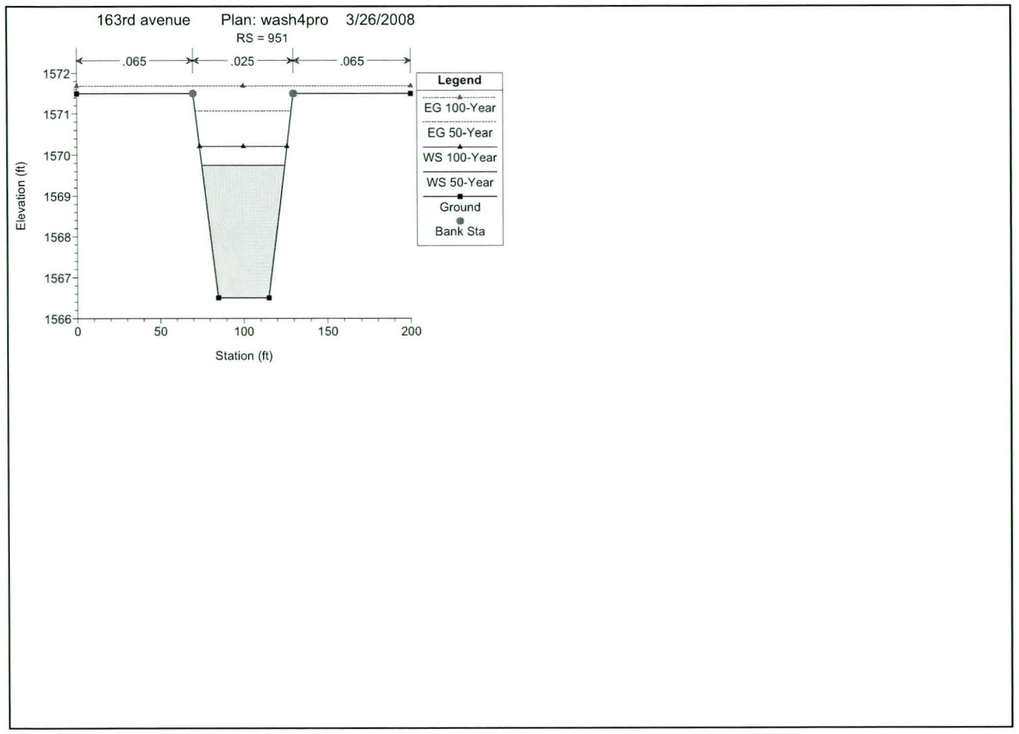
HEC-RAS Plan: exstwash4 River: Padelford Wash Reach: Split 2

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Split 2	1500.000	50-Year	1190.00	1571.29	1575.21		1575.77	0.010653	7.23	272.85	200.00	0.83
Split 2	1500.000	100-Year	1487.00	1571.29	1575.48		1576.07	0.010074	7.56	327.36	200.00	0.82
Split 2	1450.000	50-Year	1190.00	1570.92	1574.61	1574.61	1575.22	0.011539	6.95	248.31	200.00	0.85
Split 2	1450.000	100-Year	1487.00	1570.92	1574.81	1574.81	1575.51	0.012022	7.55	289.13	200.00	0.88
Split 2	1400.000	50-Year	1190.00	1570.13	1573.81	1573.81	1574.49	0.011667	6.92	219.44	182.85	0.86
Split 2	1400.000	100-Year	1487.00	1570.13	1574.04	1574.04	1574.80	0.011760	7.46	262.12	185.38	0.88
Split 2	1350.000	50-Year	1190.00	1569.75	1573.74		1573.92	0.002646	3.91	419.44	200.00	0.43
Split 2	1350.000	100-Year	1487.00	1569.75	1574.05		1574.26	0.002712	4.27	481.99	200.00	0.44
Split 2	1300.000	50-Year	1190.00	1568.38	1572.85	1572.69	1573.63	0.010920	7.33	205.03	174.56	0.84
Split 2	1300.000	100-Year	1487.00	1568.38	1573.19	1573.19	1573.98	0.009599	7.53	270.20	197.99	0.81
Split 2	1250.000	50-Year	1190.00	1568.15	1572.47	1572.33	1573.08	0.009231	6.57	237.19	183.44	0.77
Split 2	1250.000	100-Year	1487.00	1568.15	1572.87	1572.65	1573.43	0.007395	6.55	314.97	200.00	0.71
Split 2	1200.000	50-Year	1190.00	1567.90	1571.81	1571.81	1572.60	0.008892	7.78	233.40	177.10	0.79
Split 2	1200.000	100-Year	1487.00	1567.90	1572.02		1572.97	0.010108	8.68	272.36	194.94	0.85
Split 2	1150.000	50-Year	1190.00	1567.08	1571.40		1572.09	0.008498	7.35	237.64	160.01	0.77
Split 2	1150.000	100-Year	1487.00	1567.08	1571.60		1572.46	0.009906	8.31	270.63	169.51	0.84
Split 2	1100.000	50-Year	1190.00	1566.89	1570.78		1571.61	0.010982	7.92	218.69	166.29	0.86
Split 2	1100.000	100-Year	1487.00	1566.89	1571.14		1571.96	0.009697	8.11	282.44	184.79	0.83
Split 2	1050.000	50-Year	1190.00	1566.44	1570.20		1571.06	0.011150	8.35	225.20	165.99	0.88
Split 2	1050.000	100-Year	1487.00	1566.44	1570.45		1571.41	0.011666	9.05	269.14	181.57	0.91
Split 2	1000.000	50-Year	1190.00	1566.02	1569.77	1569.77	1570.52	0.009506	7.47	229.77	180.17	0.81
Split 2	1000.000	100-Year	1487.00	1566.02	1570.06	1570.06	1570.86	0.009362	7.94	282.14	184.05	0.81
Split 2	950.0000	50-Year	1190.00	1565.45	1569.20	1569.18	1569.90	0.010002	7.20	229.90	172.28	0.81
Split 2	950.0000	100-Year	1487.00	1565.45	1569.46	1569.41	1570.23	0.010003	7.71	275.64	173.53	0.83



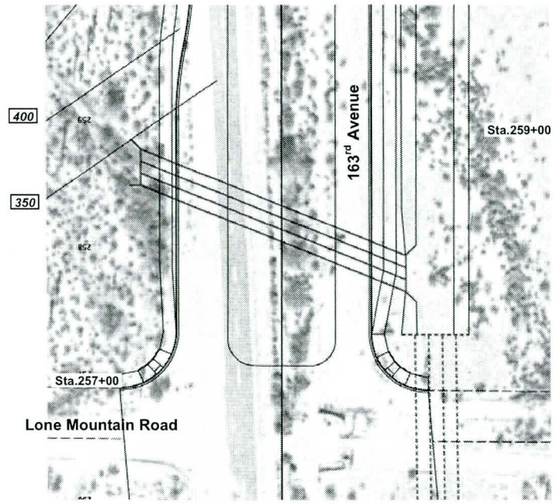

163rd avenue Plan: wash4pro 3/26/2008
RS = 1500.000
.065 .037 .065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: wash4pro 3/26/2008
RS = 1450.000
.065 .037 .065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: wash4pro 3/26/2008
RS = 1400.000
.065 .037 .065
Legend
EG 100-Year
WS 100-Year
EG 50-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: wash4pro 3/26/2008
RS = 1350.000
.065 .037 .065
Legend
EG 100-Year
WS 100-Year
EG 50-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


163rd avenue Plan: wash4pro 3/26/2008
RS = 1315
.065 .037 .065
Legend
EG 100-Year
WS 100-Year
EG 50-Year
WS 50-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: wash4pro 3/26/2008
RS = 1301 Culv
.065 .037 .065
Legend
EG 100-Year
WS 100-Year
EG 50-Year
WS 50-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: wash4pro 3/26/2008
RS = 1301 Culv
.065 .025 .065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: wash4pro 3/26/2008
RS = 1001
.065 .025 .065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)



HEC-RAS Plan: prowash4 River: Padelford Wash Reach: Split 2

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Split 2	1500.000	50-Year	1190.00	1571.29	1575.21		1575.77	0.010653	7.23	272.85	200.00	0.83
Split 2	1500.000	100-Year	1487.00	1571.29	1575.48		1576.07	0.010105	7.57	327.00	200.00	0.82
Split 2	1450.000	50-Year	1190.00	1570.92	1574.61	1574.61	1575.22	0.011539	6.95	248.31	200.00	0.85
Split 2	1450.000	100-Year	1487.00	1570.92	1574.81	1574.81	1575.51	0.012022	7.55	289.13	200.00	0.88
Split 2	1400.000	50-Year	1190.00	1570.13	1573.81	1573.81	1574.49	0.011667	6.92	219.44	182.85	0.86
Split 2	1400.000	100-Year	1487.00	1570.13	1574.53		1574.96	0.005333	5.73	354.13	190.08	0.61
Split 2	1350.000	50-Year	1190.00	1569.75	1573.80		1573.97	0.002430	3.81	431.45	200.00	0.41
Split 2	1350.000	100-Year	1487.00	1569.75	1574.61		1574.75	0.001424	3.48	594.10	200.00	0.33
Split 2	1315	50-Year	1190.00	1569.47	1573.52	1572.19	1573.86	0.003044	4.68	255.36	200.00	0.47
Split 2	1315	100-Year	1487.00	1569.47	1574.33	1572.57	1574.67	0.002192	4.63	322.46	200.00	0.41
Split 2	1301		Culvert									
Split 2	1001	50-Year	1190.00	1566.95	1570.75		1571.33	0.002365	6.08	195.60	62.83	0.61
Split 2	1001	100-Year	1487.00	1566.95	1571.31		1571.95	0.002273	6.43	231.11	66.13	0.61
Split 2	951	50-Year	1190.00	1566.50	1569.75	1569.75	1571.07	0.006894	9.22	129.07	49.49	1.01
Split 2	951	100-Year	1487.00	1566.50	1570.21	1570.21	1571.69	0.006642	9.75	152.58	52.26	1.01



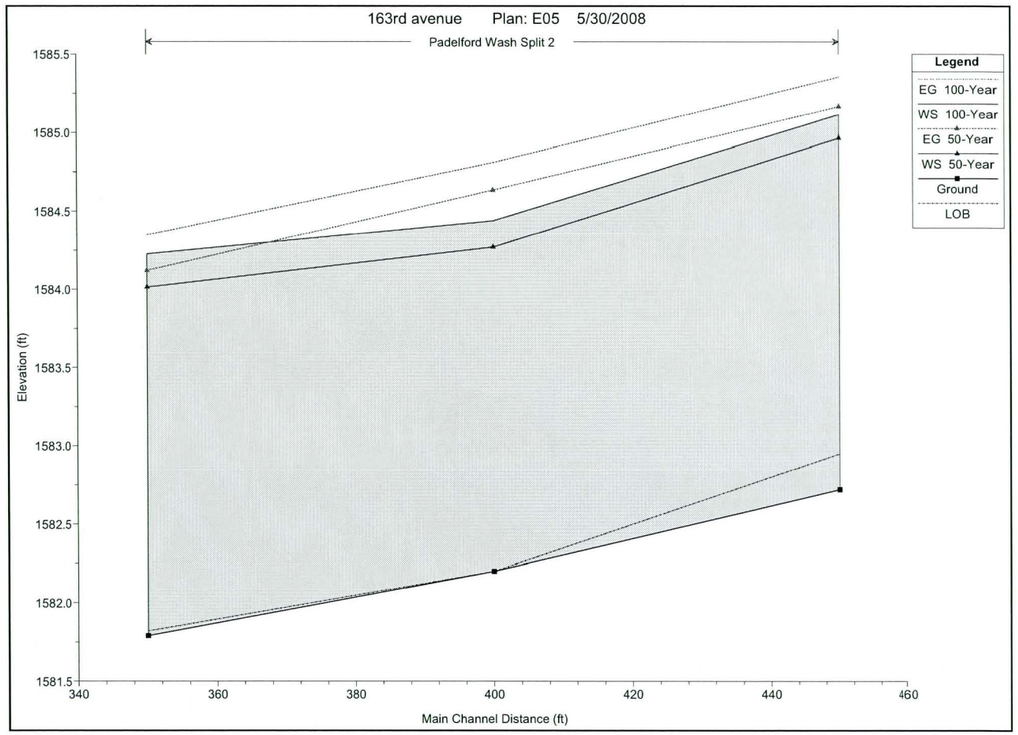
Culvert 5
3-8'x5' CBC

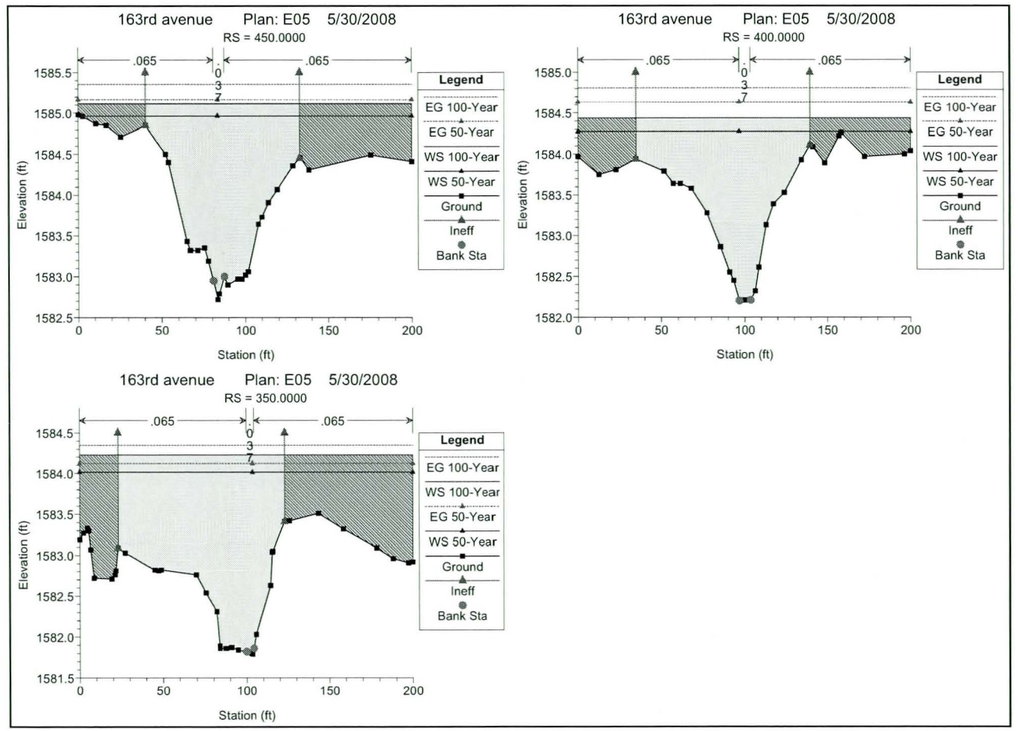
Legend

300 Cross Section ID

Source: HEC-RAS Model

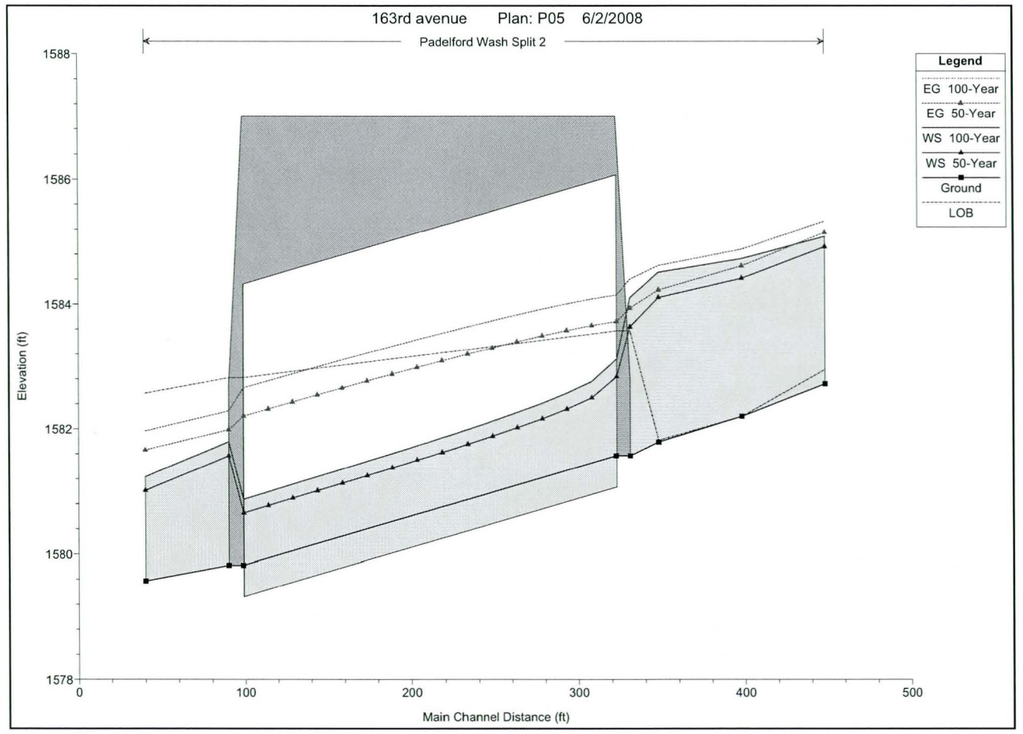
Not to Scale

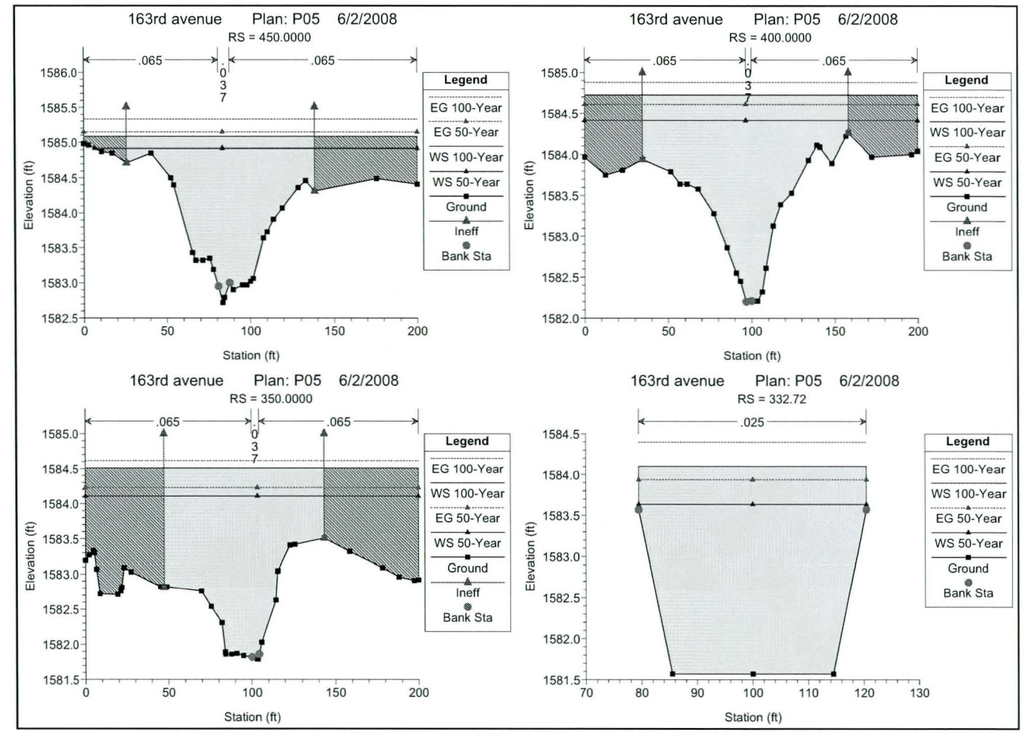


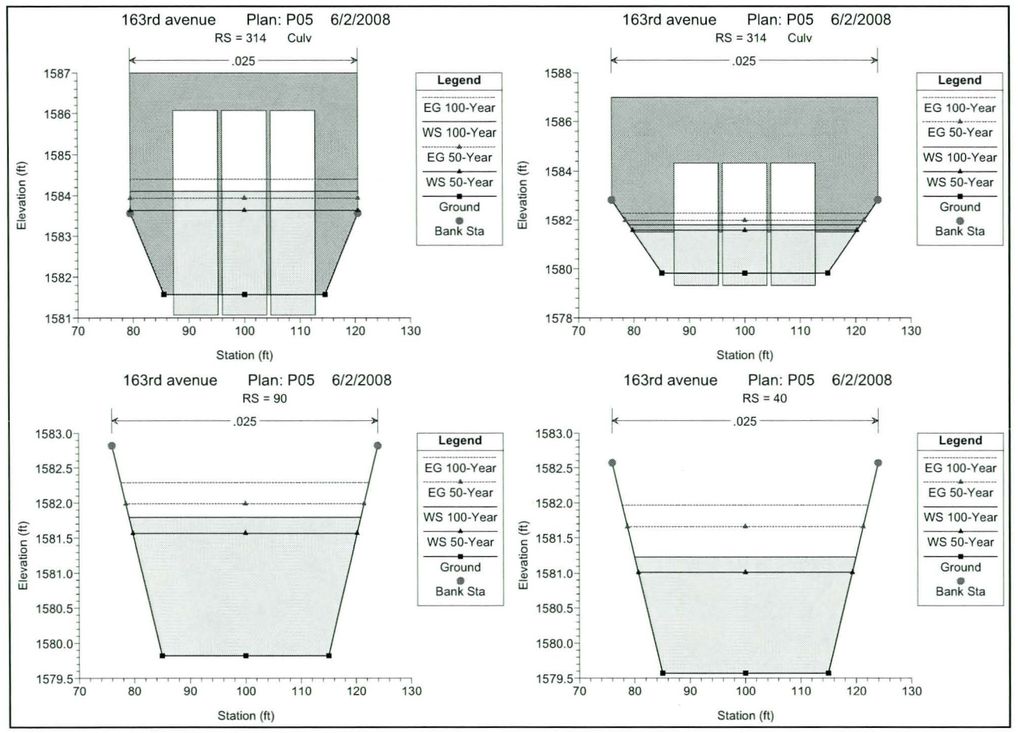


HEC-RAS Plan: wash5 River: Padelford Wash Reach: Split 2

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Split 2	450.0000	100-Year	400.00	1582.72	1585.12	1584.73	1585.36	0.008727	6.45	130.49	200.00	0.76
Split 2	450.0000	50-Year	320.00	1582.72	1584.97	1584.56	1585.17	0.007932	5.87	116.60	197.92	0.71
Split 2	400.0000	100-Year	400.00	1582.20	1584.44	1584.40	1584.81	0.013282	7.90	118.12	200.00	0.93
Split 2	400.0000	50-Year	320.00	1582.20	1584.27	1584.27	1584.63	0.013737	7.63	100.51	200.00	0.94
Split 2	350.0000	100-Year	400.00	1581.79	1584.23	1583.58	1584.35	0.005004	5.11	165.56	200.00	0.58
Split 2	350.0000	50-Year	320.00	1581.79	1584.01	1583.46	1584.12	0.005000	4.81	144.31	200.00	0.57

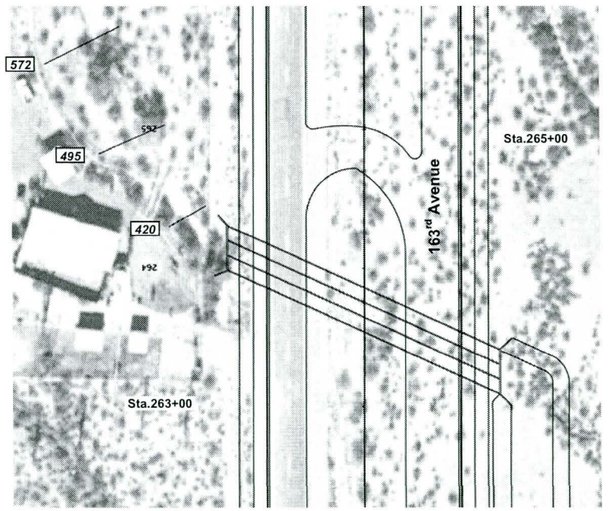

163rd avenue Plan: P05 6/2/2008
Padelford Wash Split 2
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
LOB
Elevation (ft)
Main Channel Distance (ft)


163rd avenue Plan: P05 6/2/2008
RS = 450.0000
163rd avenue Plan: P05 6/2/2008
RS = 400.0000
163rd avenue Plan: P05 6/2/2008
RS = 350.0000
163rd avenue Plan: P05 6/2/2008
RS = 332.72
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)



HEC-RAS Plan: P05 River: Padelford Wash Reach: Split 2

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Split 2	450.0000	100-Year	400.00	1582.72	1585.08		1585.33	0.009520	6.67	136.03	200.00	0.79
Split 2	450.0000	50-Year	320.00	1582.72	1584.92		1585.15	0.009483	6.33	117.36	193.55	0.78
Split 2	400.0000	100-Year	400.00	1582.20	1584.73		1584.88	0.007164	6.30	161.23	200.00	0.70
Split 2	400.0000	50-Year	320.00	1582.20	1584.41		1584.61	0.011045	7.15	122.07	200.00	0.85
Split 2	350.0000	100-Year	400.00	1581.79	1584.51		1584.62	0.003652	4.70	177.11	200.00	0.50
Split 2	350.0000	50-Year	320.00	1581.79	1584.11		1584.23	0.005097	4.98	138.30	200.00	0.58
Split 2	332.72	100-Year	400.00	1581.57	1584.10	1583.27	1584.40	0.001933	4.35	91.87	41.00	0.51
Split 2	332.72	50-Year	320.00	1581.57	1583.64	1583.04	1583.94	0.002620	4.40	72.70	41.00	0.58
Split 2	314		Culvert									
Split 2	90	100-Year	400.00	1579.82	1581.79	1581.48	1582.29	0.004552	5.64	70.89	41.84	0.76
Split 2	90	50-Year	320.00	1579.82	1581.57		1581.99	0.004454	5.20	61.57	40.48	0.74
Split 2	40	100-Year	400.00	1579.57	1581.23	1581.23	1581.97	0.008251	6.87	58.20	39.98	1.00
Split 2	40	50-Year	320.00	1579.57	1581.01	1581.01	1581.66	0.008617	6.46	49.55	38.66	1.01



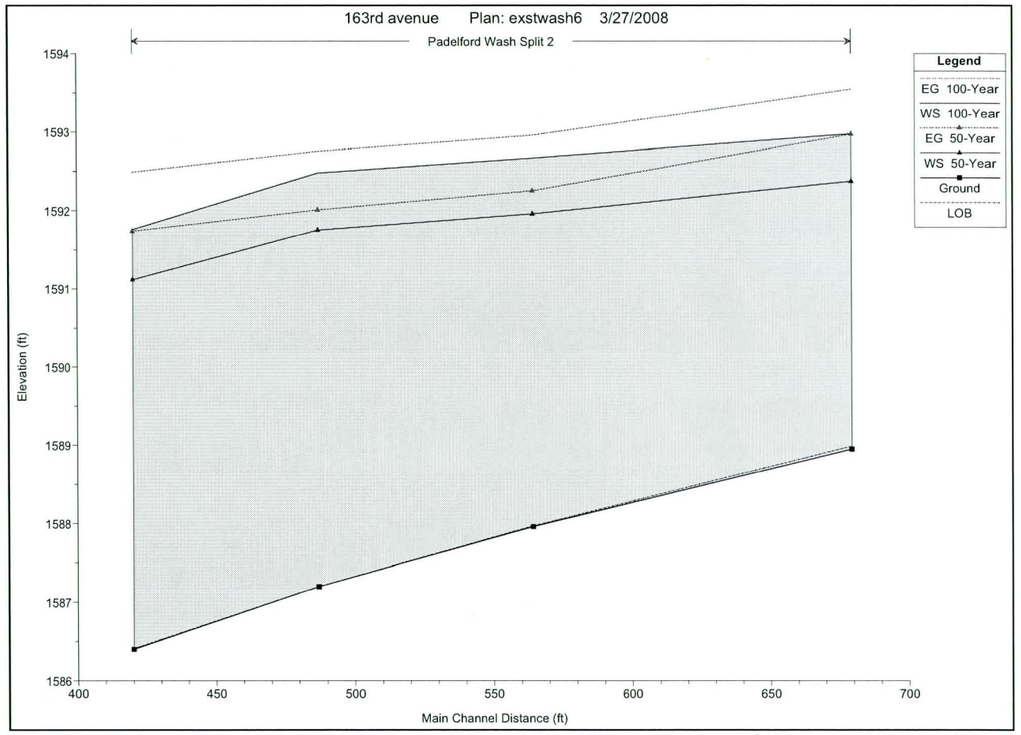
Culvert 6
3-10'x5' CBC

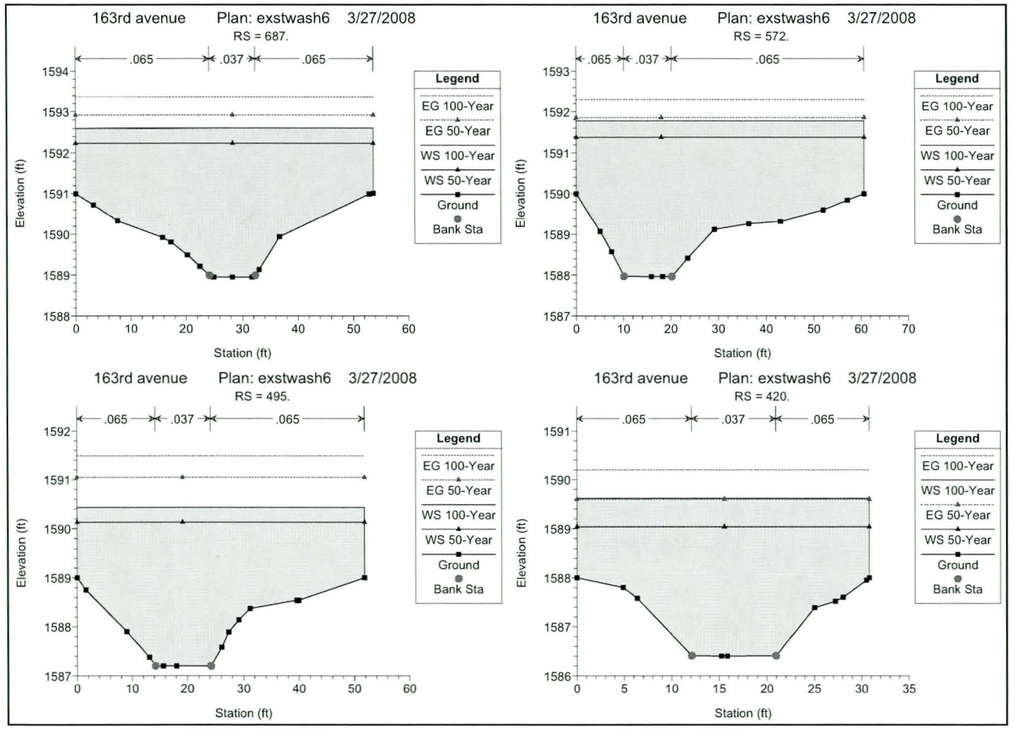
Legend

300 Cross Section ID

Source: HEC-RAS Model

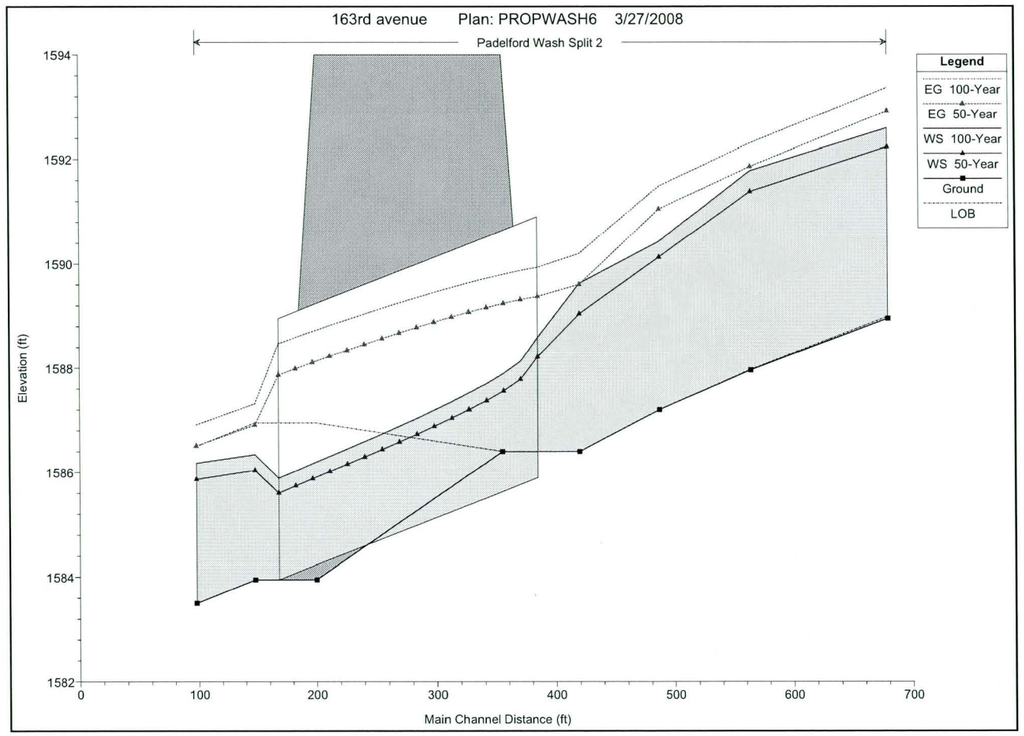
Not to Scale

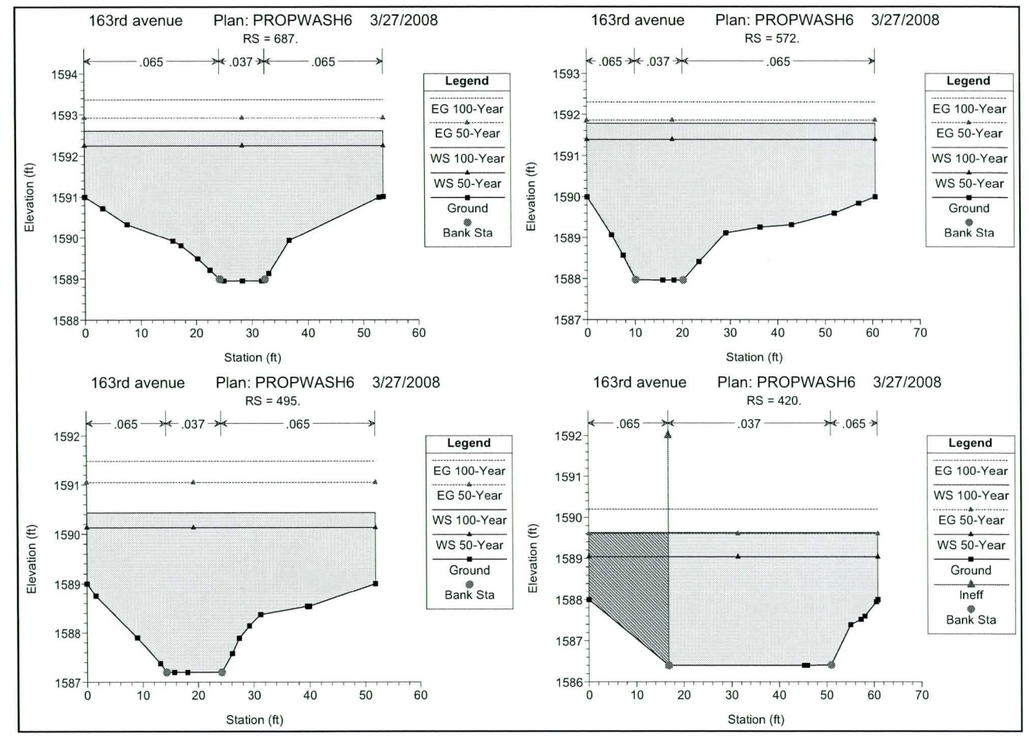


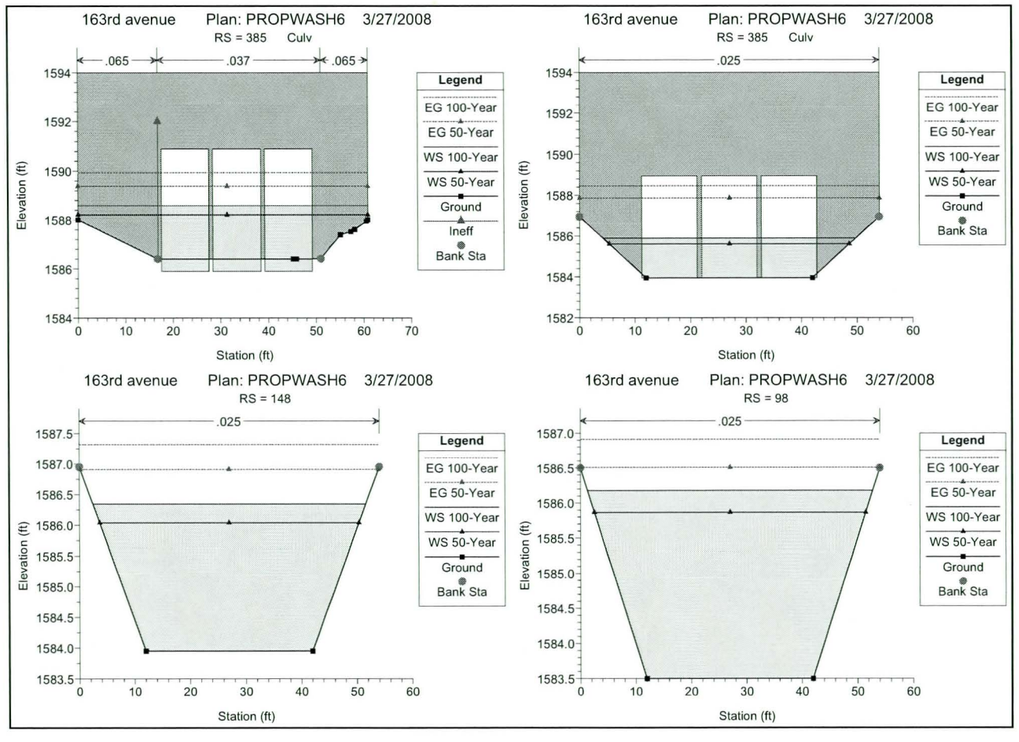


HEC-RAS Plan: exstwash6 River: Padelford Wash Reach: Split 2

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Split 2	687.	100-Year	750.00	1588.95	1592.98		1593.55	0.007243	8.64	160.39	53.63	0.76
Split 2	687.	50-Year	600.00	1588.95	1592.38		1592.97	0.009156	8.72	128.11	53.63	0.83
Split 2	572.	100-Year	750.00	1587.96	1592.67		1592.96	0.002924	6.10	222.21	60.65	0.50
Split 2	572.	50-Year	600.00	1587.96	1591.96		1592.25	0.003616	6.08	179.20	60.65	0.54
Split 2	495.	100-Year	750.00	1587.20	1592.48		1592.75	0.002303	5.84	226.43	51.86	0.45
Split 2	495.	50-Year	600.00	1587.20	1591.75		1592.01	0.002570	5.59	188.79	51.86	0.46
Split 2	420.	100-Year	750.00	1586.40	1591.76	1590.25	1592.49	0.005000	8.69	143.28	30.83	0.66
Split 2	420.	50-Year	600.00	1586.40	1591.12	1589.83	1591.74	0.005001	7.98	123.49	30.83	0.65

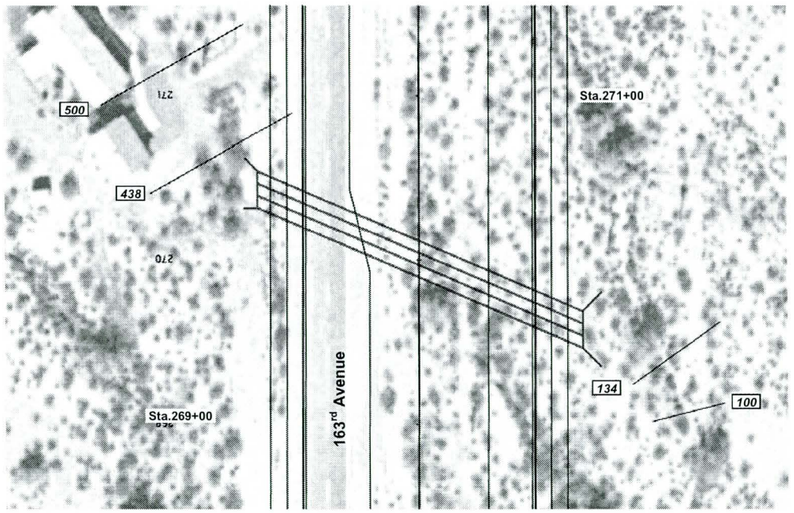

163rd avenue Plan: PROPWASH6 3/27/2008
Padelford Wash Split 2
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
LOB
Elevation (ft)
Main Channel Distance (ft)


163rd avenue Plan: PROPWASH6 3/27/2008
RS = 687.
.065 .037 .065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: PROPWASH6 3/27/2008
RS = 572.
.065 .037 .065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: PROPWASH6 3/27/2008
RS = 495.
.065 .037 .065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: PROPWASH6 3/27/2008
RS = 420.
.065 .037 .065
Legend
EG 100-Year
WS 100-Year
EG 50-Year
WS 50-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)



HEC-RAS Plan: propwash6 River: Padelford Wash Reach: Split 2

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Split 2	687.	100-Year	750.00	1588.95	1592.60		1593.36	0.010966	9.95	139.90	53.63	0.92
Split 2	687.	50-Year	600.00	1588.95	1592.23		1592.92	0.011020	9.30	120.44	53.63	0.91
Split 2	572.	100-Year	750.00	1587.96	1591.78		1592.31	0.006856	8.12	168.15	60.65	0.73
Split 2	572.	50-Year	600.00	1587.96	1591.38		1591.86	0.006990	7.62	144.13	60.65	0.73
Split 2	495.	100-Year	750.00	1587.20	1590.43	1590.43	1591.49	0.015748	11.01	120.25	51.86	1.08
Split 2	495.	50-Year	600.00	1587.20	1590.13	1590.13	1591.05	0.015256	10.15	104.60	51.86	1.05
Split 2	420.	100-Year	750.00	1586.40	1589.62	1588.77	1590.20	0.005151	6.29	132.70	60.83	0.62
Split 2	420.	50-Year	600.00	1586.40	1589.04	1588.47	1589.60	0.006535	6.20	106.99	60.83	0.67
Split 2	385		Culvert									
Split 2	148	100-Year	750.00	1583.95	1586.34	1586.34	1587.32	0.007531	7.92	94.66	49.14	1.01
Split 2	148	50-Year	600.00	1583.95	1586.04	1586.04	1586.91	0.007841	7.49	80.14	46.71	1.01
Split 2	98	100-Year	750.00	1583.50	1586.18	1585.89	1586.91	0.005006	6.88	109.00	51.42	0.83
Split 2	98	50-Year	600.00	1583.50	1585.87	1585.59	1586.51	0.005002	6.42	93.47	48.94	0.82



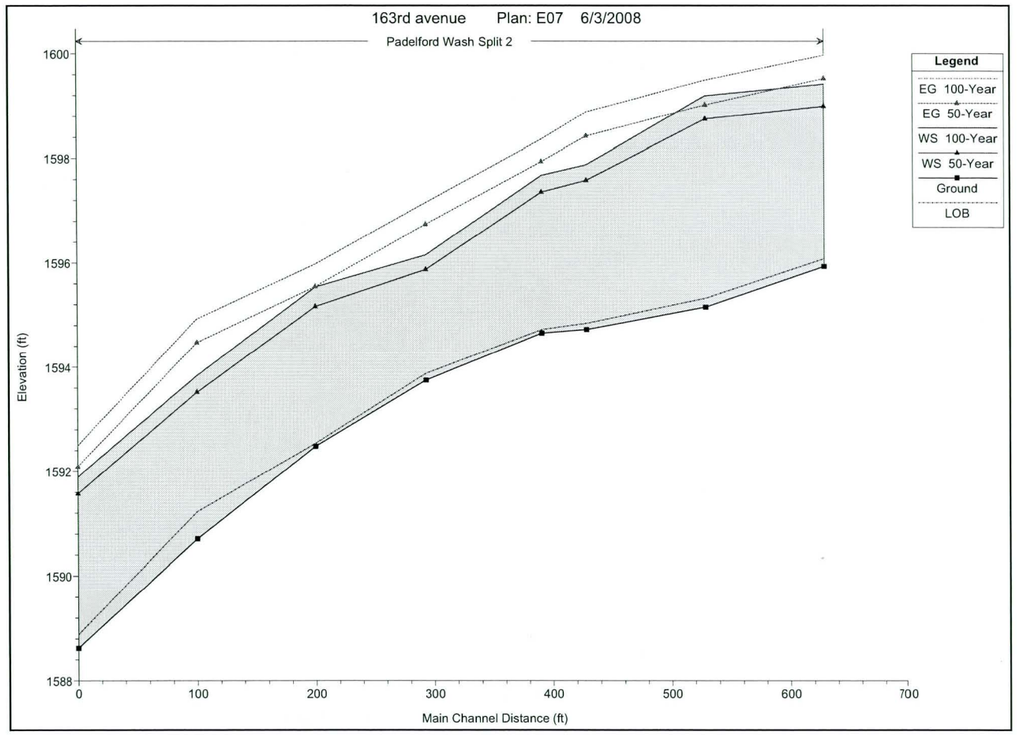
Culvert 7
3-6'x5' CBC

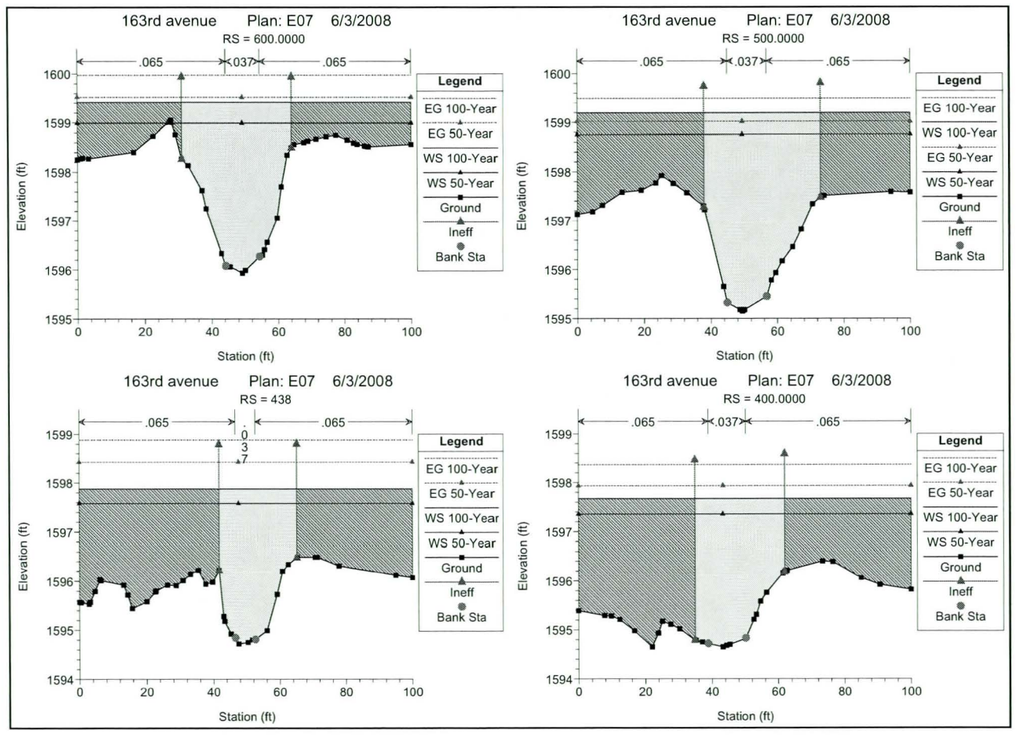
Legend

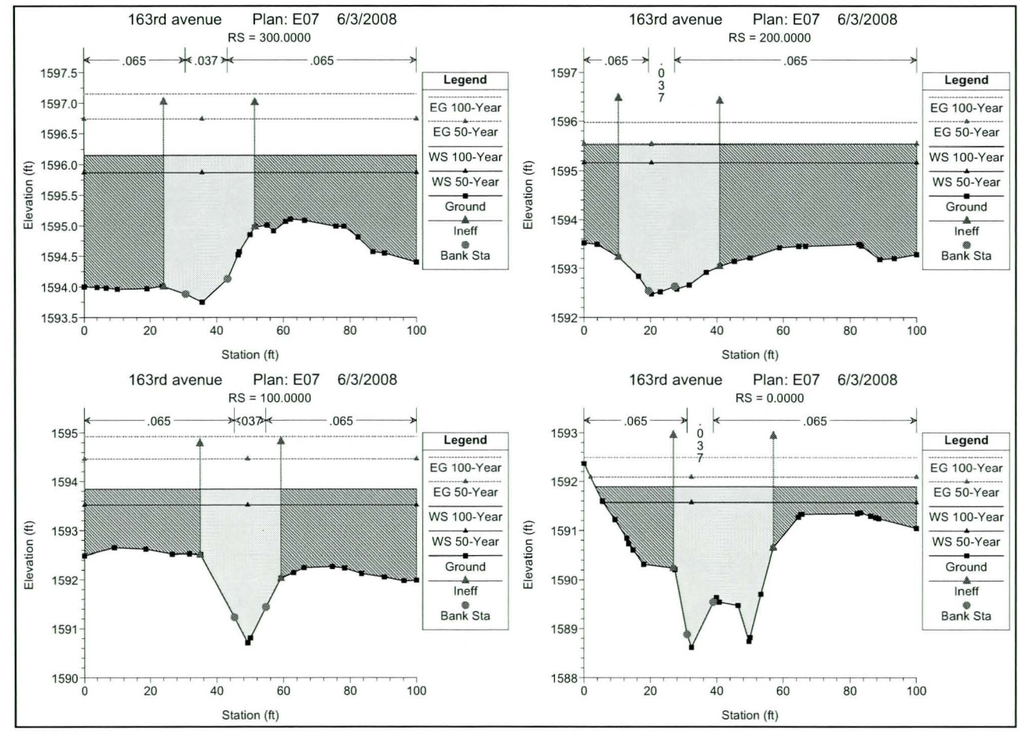
300 Cross Section ID

Source: HEC-RAS Model

Not to Scale

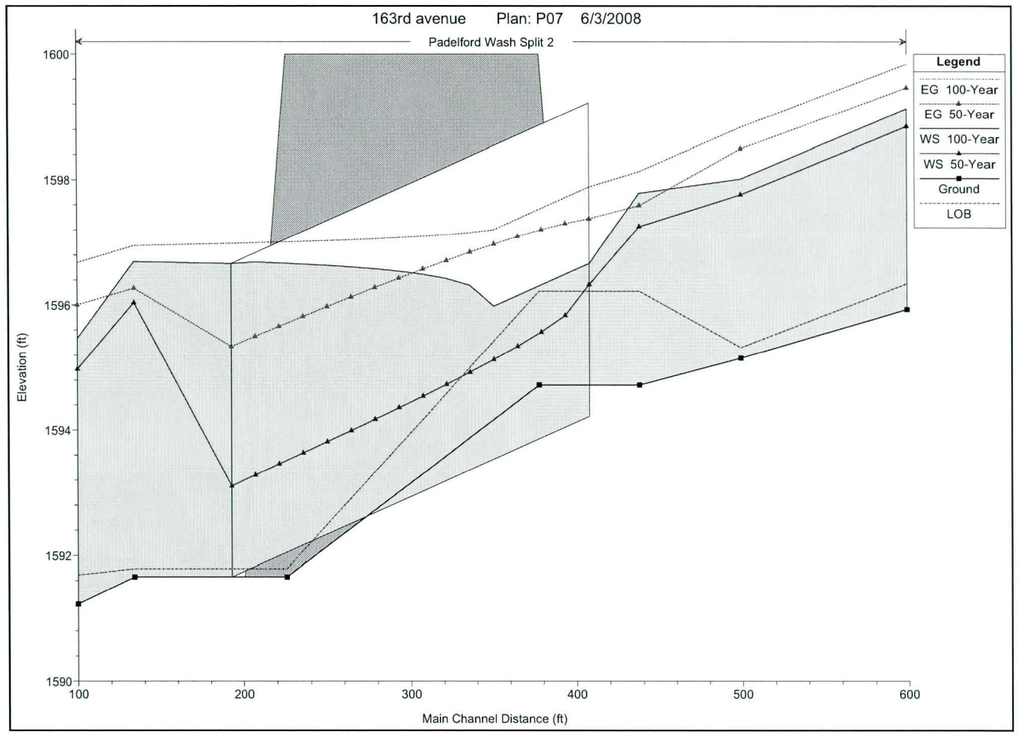


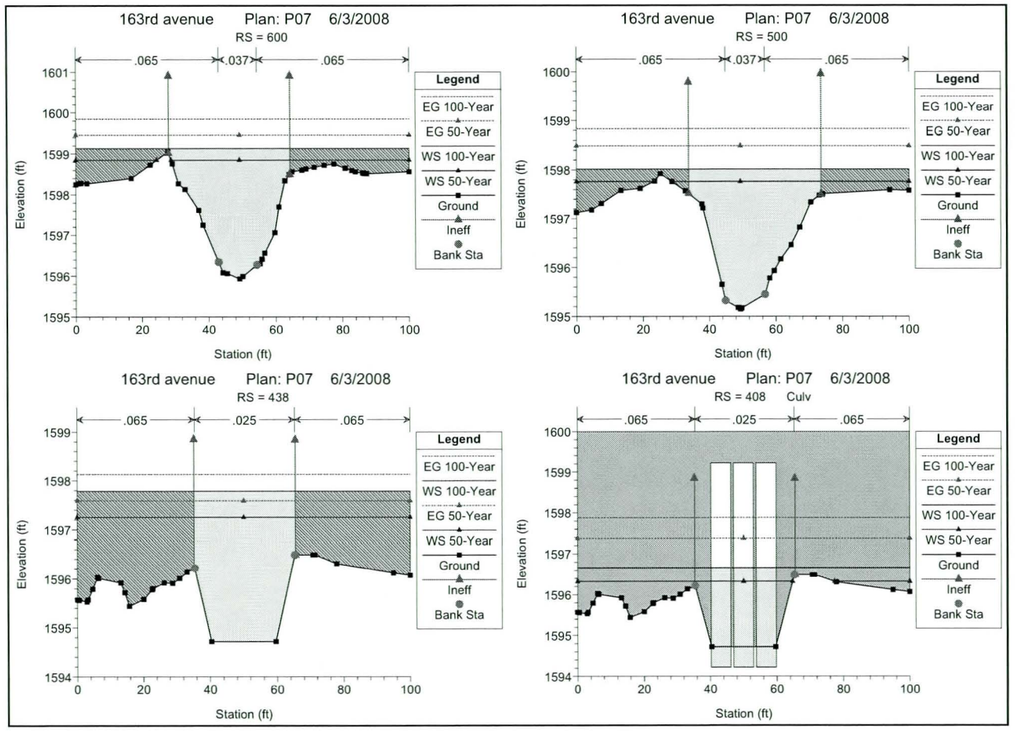

163rd avenue Plan: E07 6/3/2008
RS = 600.0000
163rd avenue Plan: E07 6/3/2008
RS = 500.0000
163rd avenue Plan: E07 6/3/2008
RS = 438
163rd avenue Plan: E07 6/3/2008
RS = 400.0000
.065
.037
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

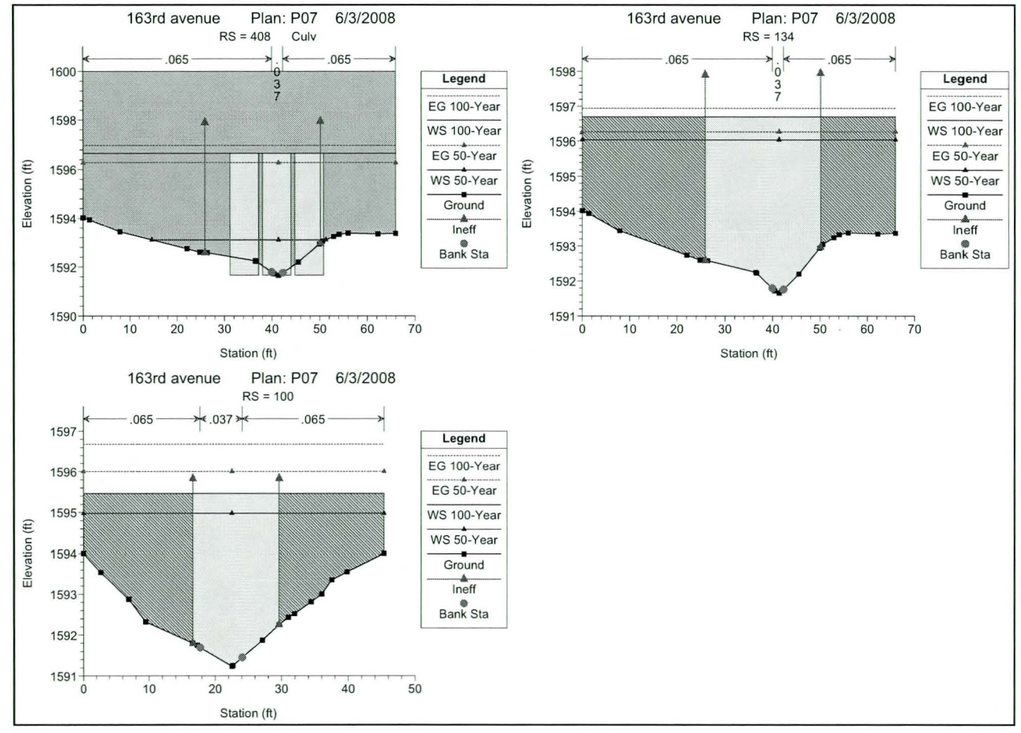

163rd avenue Plan: E07 6/3/2008
RS = 300.0000
163rd avenue Plan: E07 6/3/2008
RS = 200.0000
163rd avenue Plan: E07 6/3/2008
RS = 100.0000
163rd avenue Plan: E07 6/3/2008
RS = 0.0000
.065
.037
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

HEC-RAS Plan: ExstWash7 River: Padelford Wash Reach: Split 2

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Split 2	600.0000	100-Year	390.00	1595.93	1599.42	1598.90	1599.97	0.006373	7.18	82.85	100.00	0.69
Split 2	600.0000	50-Year	312.00	1595.93	1598.99	1598.64	1599.52	0.007105	6.93	68.79	98.77	0.71
Split 2	500.0000	100-Year	390.00	1595.15	1599.19	1597.96	1599.49	0.002771	5.25	109.38	100.00	0.47
Split 2	500.0000	50-Year	312.00	1595.15	1598.75	1597.70	1599.02	0.002832	4.90	93.92	100.00	0.46
Split 2	438	100-Year	390.00	1594.72	1597.88	1597.76	1598.88	0.014592	10.33	59.59	100.00	1.03
Split 2	438	50-Year	312.00	1594.72	1597.58	1597.43	1598.42	0.013818	9.41	52.62	100.00	0.99
Split 2	400.0000	100-Year	390.00	1594.65	1597.67	1597.23	1598.36	0.008725	7.73	68.81	100.00	0.79
Split 2	400.0000	50-Year	312.00	1594.65	1597.35	1596.95	1597.94	0.008495	7.06	60.20	100.00	0.77
Split 2	300.0000	100-Year	390.00	1593.75	1596.15	1596.15	1597.15	0.017731	9.21	55.83	100.00	1.08
Split 2	300.0000	50-Year	312.00	1593.75	1595.87	1595.87	1596.74	0.018216	8.54	48.12	100.00	1.07
Split 2	200.0000	100-Year	390.00	1592.48	1595.53	1594.71	1595.98	0.007016	6.98	84.54	100.00	0.71
Split 2	200.0000	50-Year	312.00	1592.48	1595.16	1594.45	1595.54	0.007217	6.48	73.14	100.00	0.71
Split 2	100.0000	100-Year	390.00	1590.71	1593.84	1593.84	1594.92	0.015109	9.77	56.19	100.00	1.03
Split 2	100.0000	50-Year	312.00	1590.71	1593.52	1593.52	1594.47	0.015368	9.08	48.39	100.00	1.02
Split 2	0.0000	100-Year	390.00	1588.62	1591.89	1591.43	1592.49	0.010007	8.05	74.86	96.59	0.84
Split 2	0.0000	50-Year	312.00	1588.62	1591.57	1591.15	1592.09	0.010005	7.43	65.17	94.22	0.82




163rd avenue Plan: P07 6/3/2008
RS = 600
.065 .037 .065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: P07 6/3/2008
RS = 500
.065 .037 .065
163rd avenue Plan: P07 6/3/2008
RS = 438
.065 .025 .065
163rd avenue Plan: P07 6/3/2008
RS = 408 Culv
.065 .025 .065


163rd avenue Plan: P07 6/3/2008
RS = 408 Culv
.065 .065
0
3
7
Legend
EG 100-Year
WS 100-Year
EG 50-Year
WS 50-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: P07 6/3/2008
RS = 134
.065 .065
163rd avenue Plan: P07 6/3/2008
RS = 100
.065 .037 .065

HEC-RAS Plan: propwash7 River: Padelford Wash Reach: Split 2

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Split 2	600	100-Year	390.00	1595.93	1599.13	1598.87	1599.84	0.008667	7.85	74.80	100.00	0.79
Split 2	600	50-Year	312.00	1595.93	1598.85	1598.61	1599.46	0.008264	7.19	64.67	95.72	0.76
Split 2	500	100-Year	390.00	1595.15	1598.01	1598.01	1598.83	0.011576	8.44	70.79	100.00	0.90
Split 2	500	50-Year	312.00	1595.15	1597.76	1597.76	1598.49	0.011283	7.82	60.75	94.46	0.87
Split 2	438	100-Year	390.00	1594.72	1597.79	1596.74	1598.13	0.001644	4.70	83.30	100.00	0.50
Split 2	438	50-Year	312.00	1594.72	1597.25	1596.52	1597.59	0.002153	4.67	67.12	100.00	0.55
Split 2	408		Culvert									
Split 2	134	100-Year	390.00	1591.66	1596.69	1594.55	1596.95	0.002959	6.35	107.21	65.95	0.50
Split 2	134	50-Year	312.00	1591.66	1596.04	1594.25	1596.27	0.003215	6.02	91.30	65.95	0.51
Split 2	100	100-Year	390.00	1591.23	1595.47	1594.96	1596.68	0.010002	10.14	49.85	45.36	0.89
Split 2	100	50-Year	312.00	1591.23	1594.98	1594.50	1596.00	0.010004	9.30	43.50	45.36	0.87

Culvert 8

3-6'x5' CBC

Legend

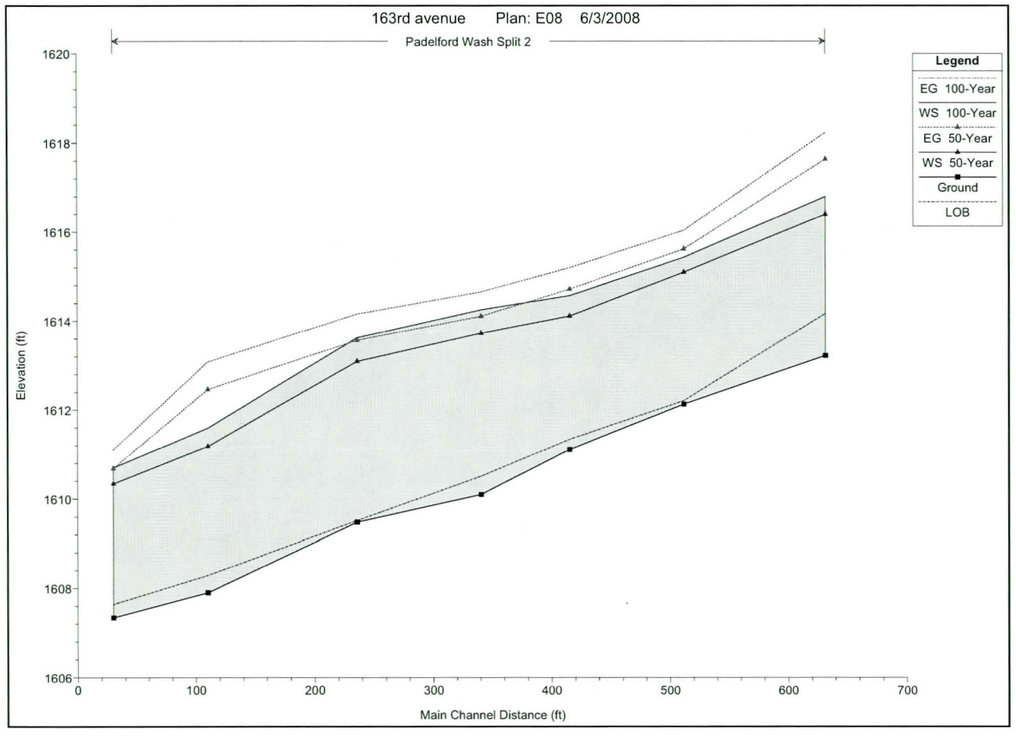
300 Cross Section ID

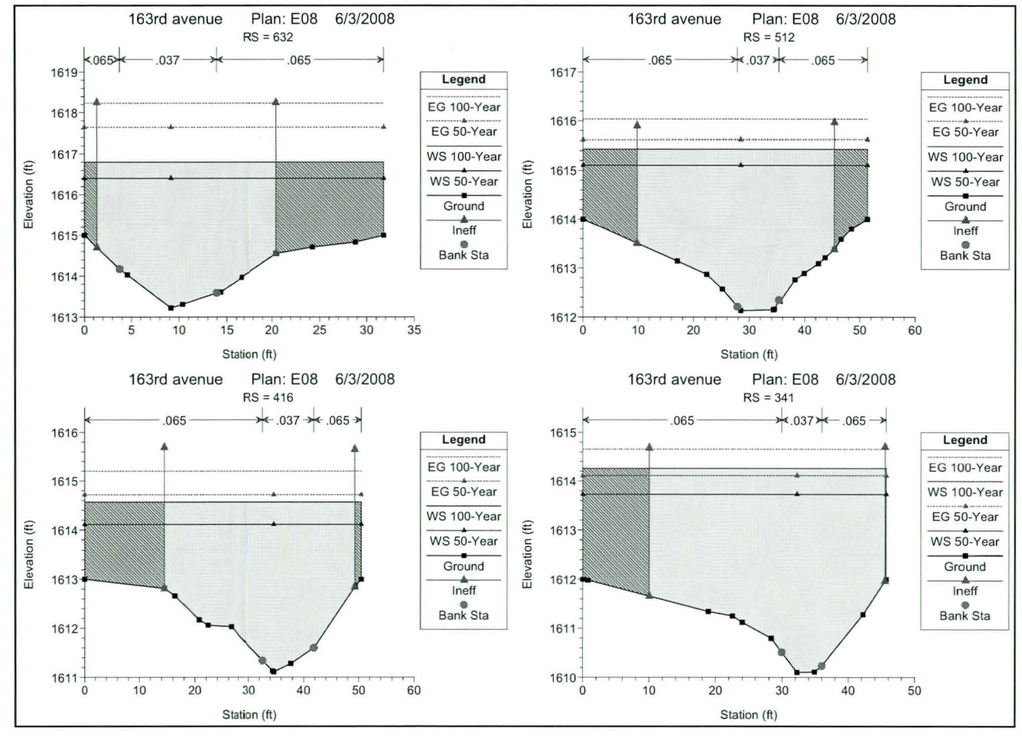
Source: HEC-RAS Model

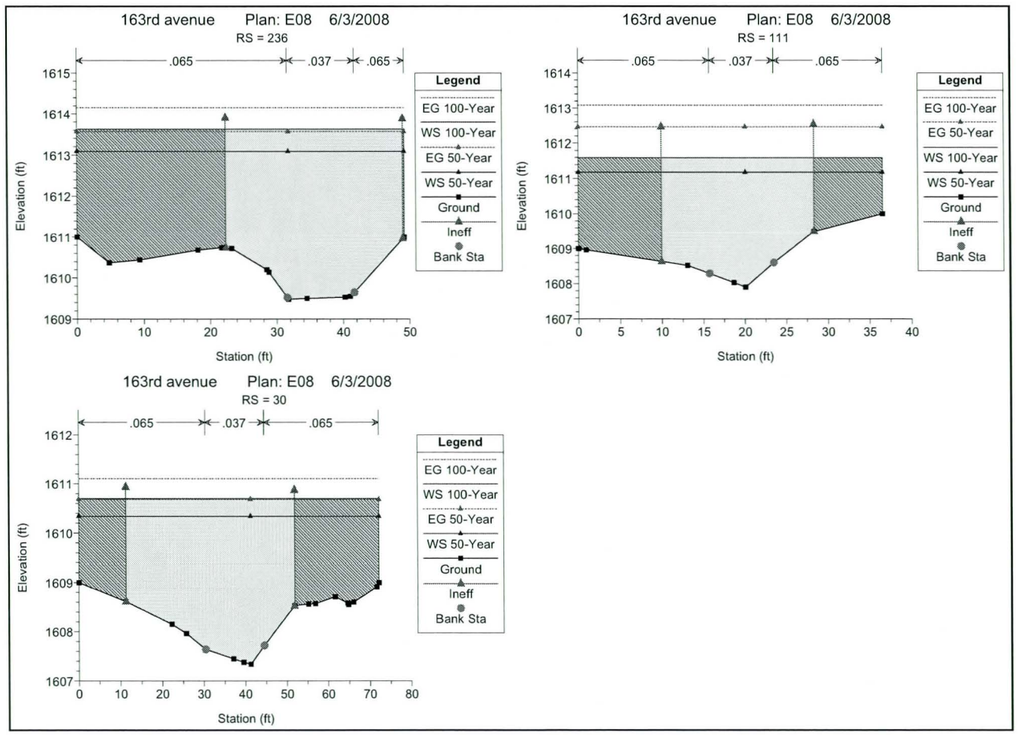
Not to Scale

163rd Avenue DCR
Jomax Road to Dove Valley Road

Andes Engineering

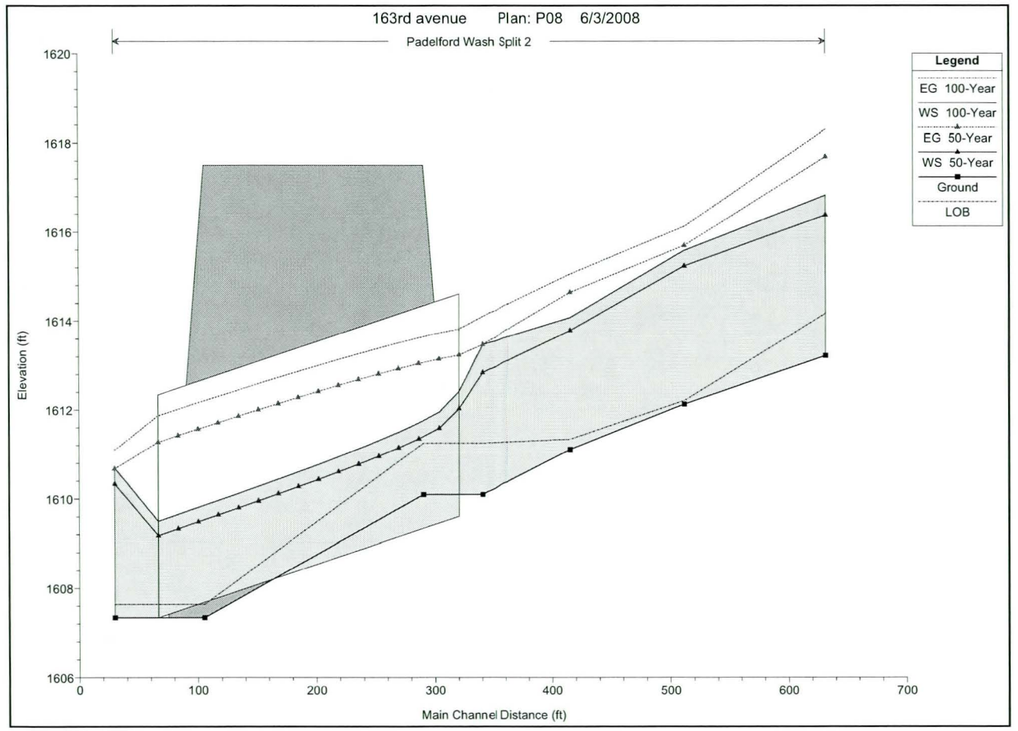

163rd avenue Plan: E08 6/3/2008
Padelford Wash Split 2
Legend
EG 100-Year
WS 100-Year
EG 50-Year
WS 50-Year
Ground
LOB
Elevation (ft)
Main Channel Distance (ft)

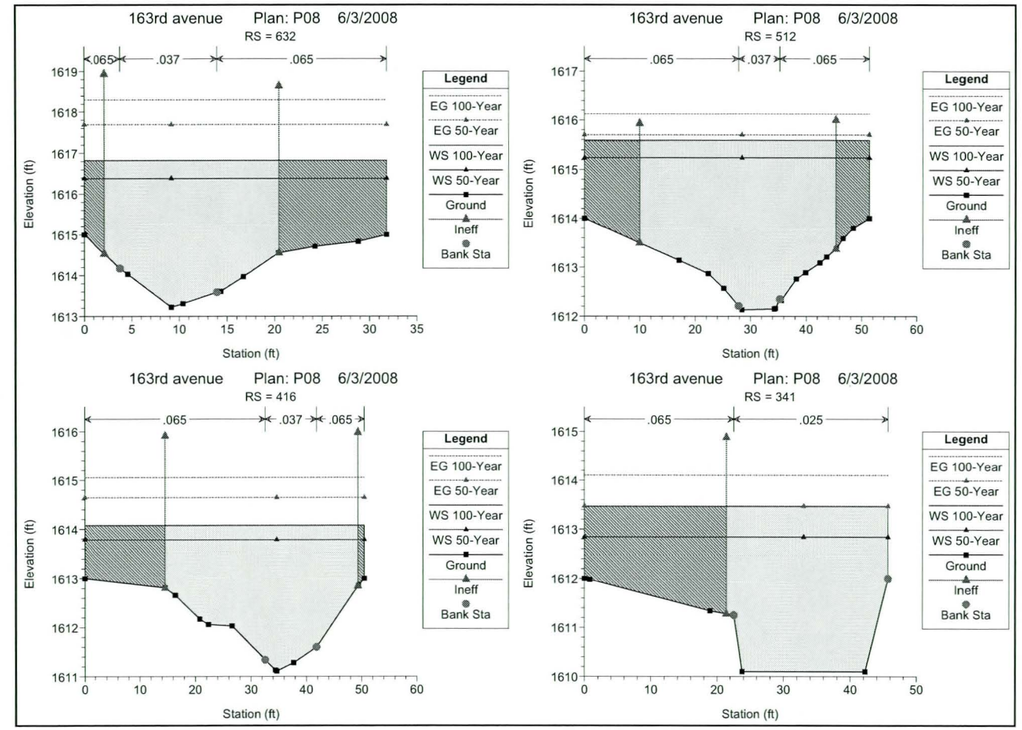

163rd avenue Plan: E08 6/3/2008
RS = 632
.065 .037 .065
163rd avenue Plan: E08 6/3/2008
RS = 512
.065 .037 .065
163rd avenue Plan: E08 6/3/2008
RS = 416
.065 .037 .065
163rd avenue Plan: E08 6/3/2008
RS = 341
.065 .037 .065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

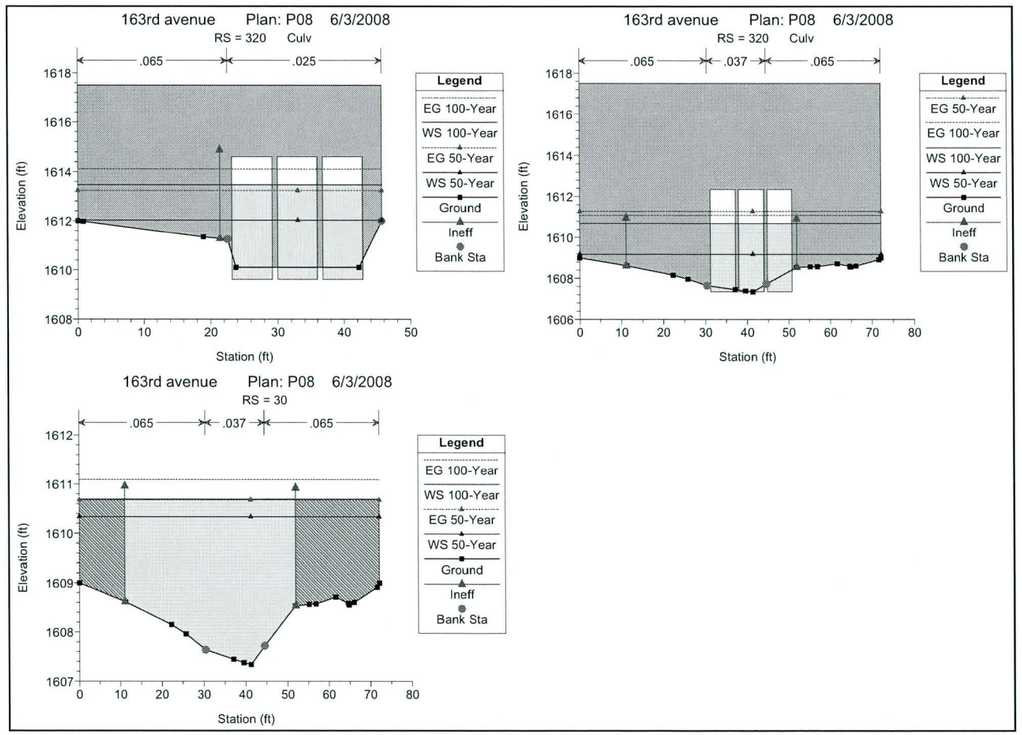


HEC-RAS Plan: Exstwash8 River: Padelford Wash Reach: Split 2

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Split 2	632	100-Year	480.00	1613.22	1616.80	1616.80	1618.24	0.015113	10.74	56.47	31.78	1.05
Split 2	632	50-Year	384.00	1613.22	1616.40	1616.40	1617.64	0.015359	9.92	48.90	31.78	1.04
Split 2	512	100-Year	480.00	1612.13	1615.43	1614.94	1616.04	0.008990	8.38	94.04	51.39	0.82
Split 2	512	50-Year	384.00	1612.13	1615.10	1614.66	1615.62	0.008840	7.74	82.14	51.39	0.79
Split 2	416	100-Year	480.00	1611.11	1614.57	1614.06	1615.20	0.008398	8.08	92.52	50.47	0.79
Split 2	416	50-Year	384.00	1611.11	1614.11	1613.79	1614.72	0.009753	7.87	76.55	50.47	0.83
Split 2	341	100-Year	480.00	1610.10	1614.25	1613.21	1614.66	0.004936	7.15	114.72	45.68	0.63
Split 2	341	50-Year	384.00	1610.10	1613.73	1612.93	1614.11	0.005561	6.92	96.06	45.68	0.65
Split 2	236	100-Year	480.00	1609.48	1613.63	1612.49	1614.16	0.004631	7.01	96.58	49.19	0.61
Split 2	236	50-Year	384.00	1609.48	1613.09	1612.17	1613.57	0.004930	6.59	82.39	49.19	0.61
Split 2	111	100-Year	480.00	1607.90	1611.59	1611.59	1613.08	0.015995	11.46	56.77	36.54	1.09
Split 2	111	50-Year	384.00	1607.90	1611.18	1611.18	1612.46	0.016194	10.59	49.21	36.54	1.07
Split 2	30	100-Year	480.00	1607.34	1610.70	1609.84	1611.10	0.005008	6.17	112.18	72.15	0.61
Split 2	30	50-Year	384.00	1607.34	1610.34	1609.58	1610.68	0.005000	5.69	97.57	72.15	0.59

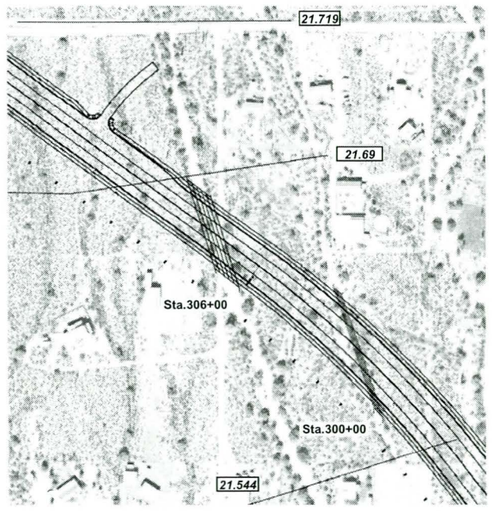

163rd avenue Plan: P08 6/3/2008
Padelford Wash Split 2
Legend
EG 100-Year
WS 100-Year
EG 50-Year
WS 50-Year
Ground
LOB
Elevation (ft)
Main Channel Distance (ft)


163rd avenue Plan: P08 6/3/2008
RS = 632
.065
.037
.065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: P08 6/3/2008
RS = 512
.065
.037
.065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: P08 6/3/2008
RS = 416
.065
.037
.065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: P08 6/3/2008
RS = 341
.065
.025
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)



HEC-RAS Plan: Propwash8 River: Padelford Wash Reach: Split 2

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Split 2	632	100-Year	480.00	1613.22	1616.83	1616.83	1618.30	0.015147	10.81	55.38	31.78	1.05
Split 2	632	50-Year	384.00	1613.22	1616.38	1616.38	1617.69	0.016168	10.14	47.27	31.78	1.06
Split 2	512	100-Year	480.00	1612.13	1615.59	1614.94	1616.13	0.007567	7.93	98.96	51.39	0.75
Split 2	512	50-Year	384.00	1612.13	1615.24	1614.66	1615.70	0.007401	7.30	86.62	51.39	0.73
Split 2	416	100-Year	480.00	1611.11	1614.08	1614.08	1615.06	0.016063	10.01	75.26	50.47	1.06
Split 2	416	50-Year	384.00	1611.11	1613.78	1613.78	1614.64	0.016102	9.30	65.12	50.47	1.04
Split 2	341	100-Year	480.00	1610.10	1613.47	1612.65	1614.10	0.002827	6.42	76.46	45.68	0.63
Split 2	341	50-Year	384.00	1610.10	1612.84	1612.32	1613.47	0.003652	6.41	61.18	45.68	0.71
Split 2	320		Culvert									
Split 2	30	100-Year	480.00	1607.34	1610.69	1609.84	1611.09	0.005007	6.16	112.60	72.15	0.61
Split 2	30	50-Year	384.00	1607.34	1610.33	1609.59	1610.68	0.005000	5.68	97.91	72.15	0.59



Culvert 9
4 - 48" RCP

Culvert 10
5-10'x5' CBC

Legend

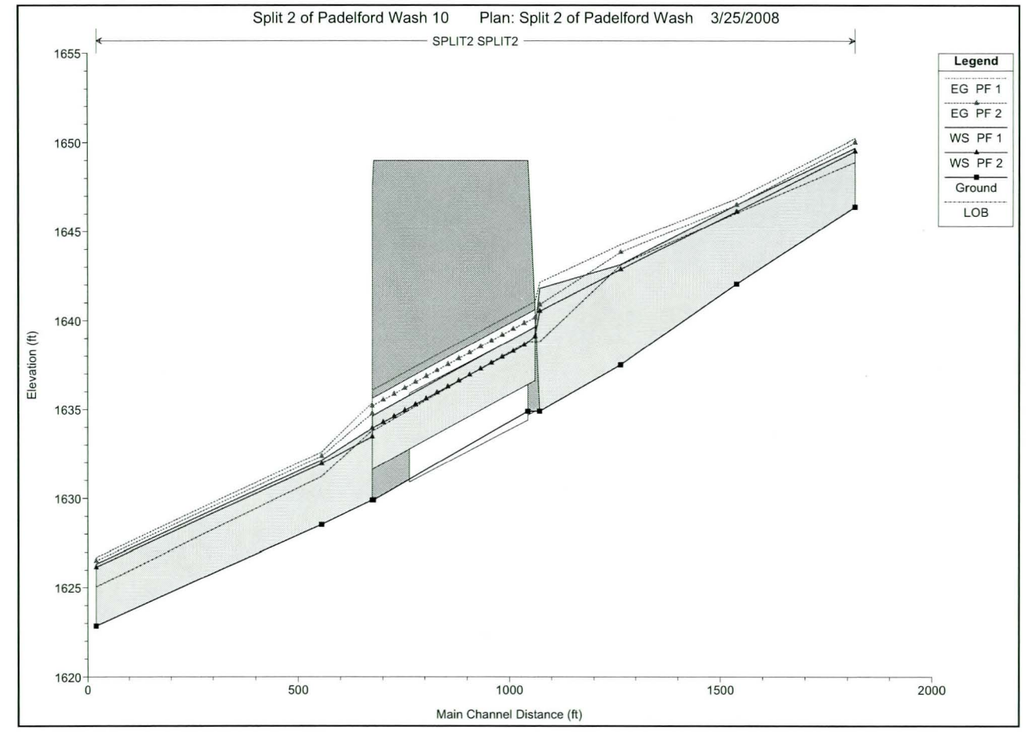
300 Cross Section ID

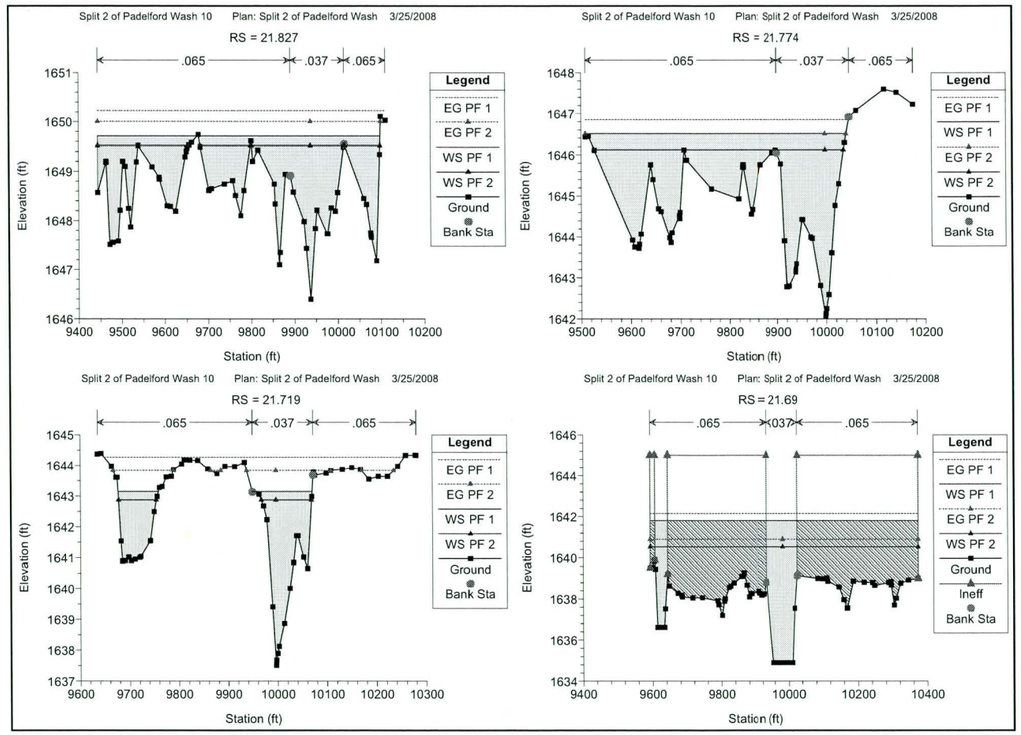
Source: Modified Padelford Wash Split 2 HEC-RAS Model

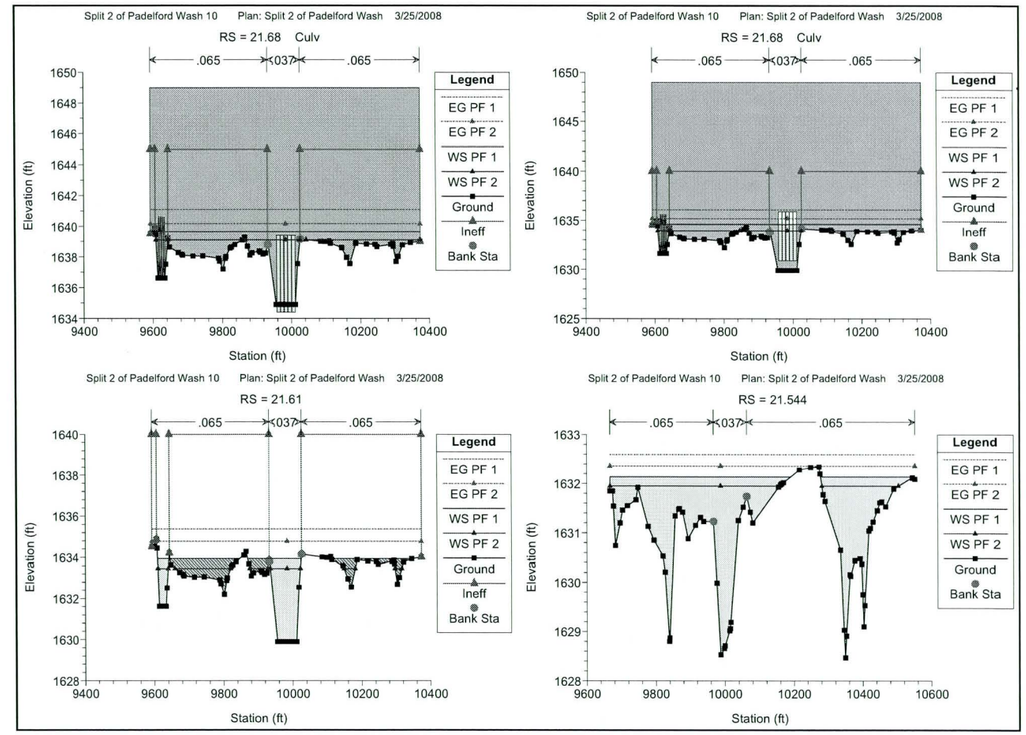
Not to Scale

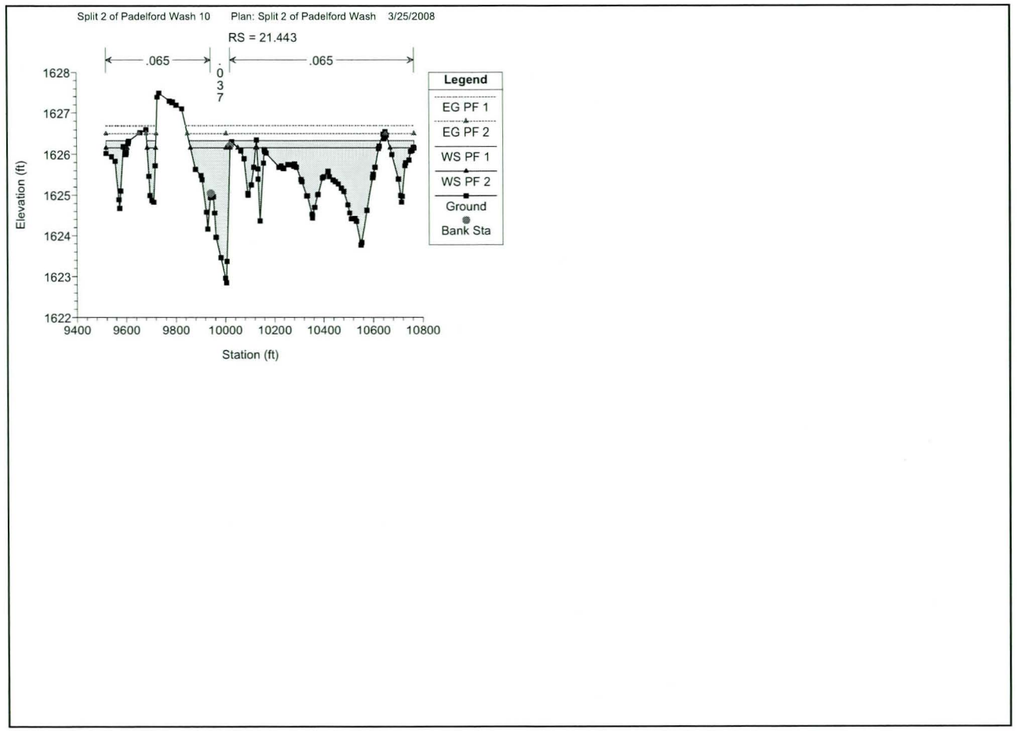
163rd Avenue DCR
Jomax Road to Dove Valley Road

Andes Engineering



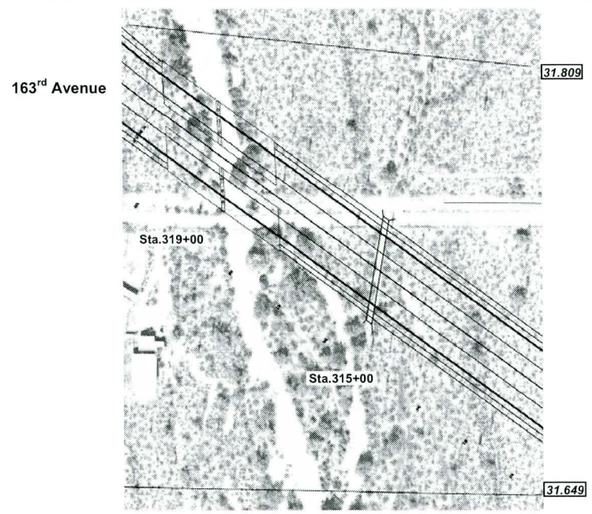

Split 2 of Padelford Wash 10 Plan: Split 2 of Padelford Wash 3/25/2008
RS = 21.827
.065 .037 .065
Elevation (ft)
Station (ft)
Legend
EG PF 1
EG PF 2
WS PF 1
WS PF 2
Ground
Bank Sta
Split 2 of Padelford Wash 10 Plan: Split 2 of Padelford Wash 3/25/2008
RS = 21.774
.065 .037 .065
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
EG PF 2
WS PF 2
Ground
Bank Sta
Split 2 of Padelford Wash 10 Plan: Split 2 of Padelford Wash 3/25/2008
RS = 21.719
.065 .037 .065
Elevation (ft)
Station (ft)
Legend
EG PF 1
EG PF 2
WS PF 1
WS PF 2
Ground
Bank Sta
Split 2 of Padelford Wash 10 Plan: Split 2 of Padelford Wash 3/25/2008
RS = 21.69
.065 .037 .065
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
EG PF 2
WS PF 2
Ground
Ineff
Bank Sta


Split 2 of Padelford Wash 10 Plan: Split 2 of Padelford Wash 3/25/2008
RS = 21.68 Culv
.065 .037 .065
Elevation (ft)
Station (ft)
Legend
EG PF 1
EG PF 2
WS PF 1
WS PF 2
Ground
Ineff
Bank Sta
Split 2 of Padelford Wash 10 Plan: Split 2 of Padelford Wash 3/25/2008
RS = 21.68 Culv
.065 .037 .065
Elevation (ft)
Station (ft)
Legend
EG PF 1
EG PF 2
WS PF 1
WS PF 2
Ground
Ineff
Bank Sta
Split 2 of Padelford Wash 10 Plan: Split 2 of Padelford Wash 3/25/2008
RS = 21.61
.065 .037 .065
Elevation (ft)
Station (ft)
Legend
EG PF 1
EG PF 2
WS PF 1
WS PF 2
Ground
Ineff
Bank Sta
Split 2 of Padelford Wash 10 Plan: Split 2 of Padelford Wash 3/25/2008
RS = 21.544
.065 .037 .065
Elevation (ft)
Station (ft)
Legend
EG PF 1
EG PF 2
WS PF 1
WS PF 2
Ground
Bank Sta



HEC-RAS Plan: SPLIT2WASH91 River: SPLIT2 Reach: SPLIT2

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SPLIT2	21.827	PF 1	3149.00	1646.40	1649.71	1649.71	1650.23	0.018857	7.64	718.24	650.50	1.05
SPLIT2	21.827	PF 2	2519.00	1646.40	1649.52	1649.52	1650.00	0.019816	7.25	597.71	623.35	1.06
SPLIT2	21.774	PF 1	3149.00	1642.06	1646.51		1646.85	0.005724	5.63	891.84	531.74	0.62
SPLIT2	21.774	PF 2	2519.00	1642.06	1646.13	1645.79	1646.50	0.007123	5.77	690.96	508.73	0.68
SPLIT2	21.719	PF 1	3149.00	1637.51	1643.14	1643.14	1644.27	0.017816	9.22	415.57	203.42	1.08
SPLIT2	21.719	PF 2	2519.00	1637.51	1642.88	1642.88	1643.84	0.013928	8.48	365.70	179.48	0.96
SPLIT2	21.69	PF 1	3149.00	1634.90	1641.81	1638.92	1642.15	0.001415	4.95	724.71	780.27	0.36
SPLIT2	21.69	PF 2	2519.00	1634.90	1640.53	1638.46	1640.90	0.002089	5.13	558.08	780.27	0.42
SPLIT2	21.68		Culvert									
SPLIT2	21.61	PF 1	3149.00	1629.90	1633.94	1633.94	1635.38	0.013374	9.96	353.02	625.76	0.99
SPLIT2	21.61	PF 2	2519.00	1629.90	1633.46	1633.46	1634.77	0.013605	9.44	295.87	382.68	0.98
SPLIT2	21.544	PF 1	3149.00	1628.53	1632.14		1632.60	0.012670	7.41	854.46	798.01	0.90
SPLIT2	21.544	PF 2	2519.00	1628.53	1631.95		1632.36	0.012438	6.89	710.20	712.58	0.88
SPLIT2	21.443	PF 1	3149.00	1622.85	1626.33	1626.22	1626.69	0.010004	7.06	1023.49	1015.05	0.81
SPLIT2	21.443	PF 2	2519.00	1622.85	1626.16	1626.10	1626.51	0.010014	6.72	850.39	939.68	0.80



Culvert 11
10'x5' CBC

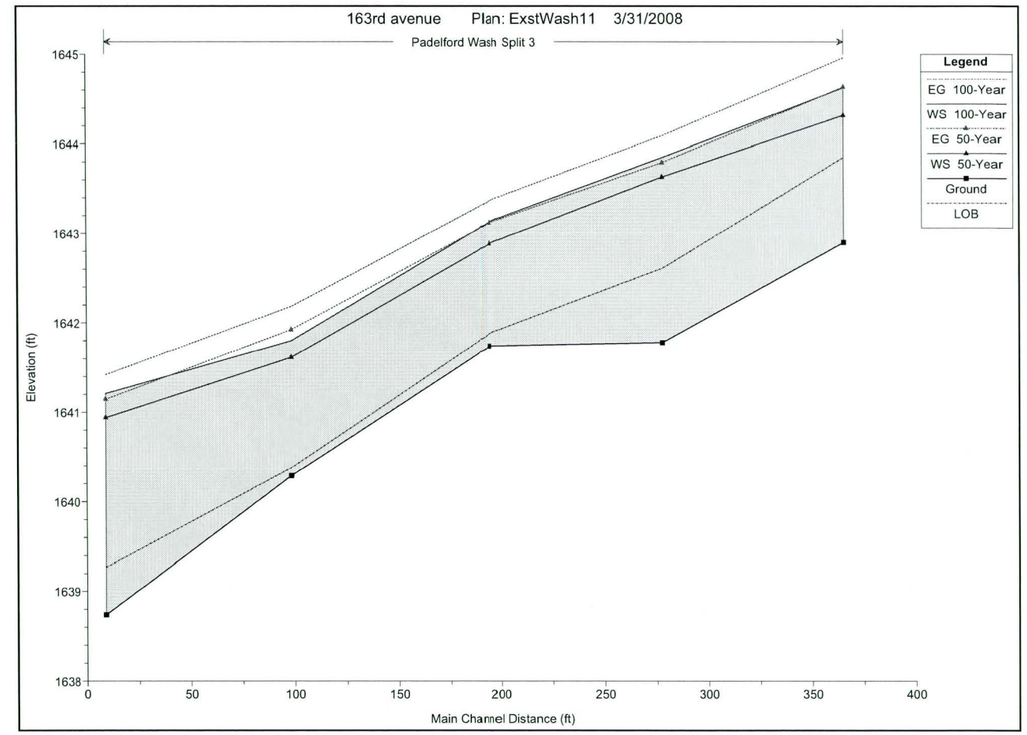
Split 3 Bridge
238' Long

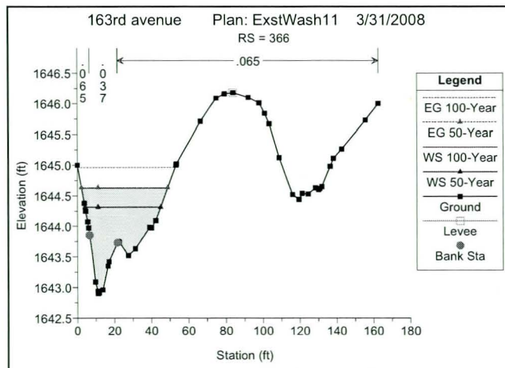
Legend

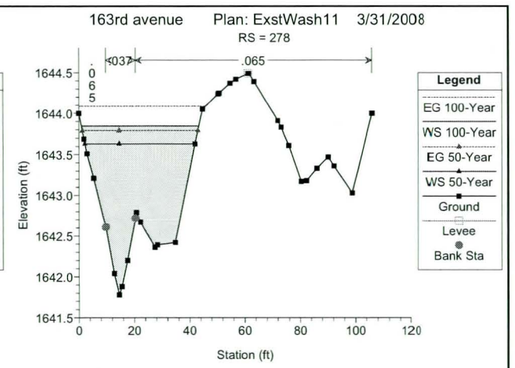
300 Cross Section ID

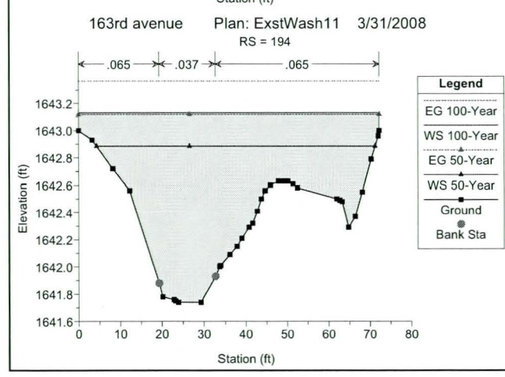
Source: Modified Padelford Wash Split 3 HEC-RAS Model

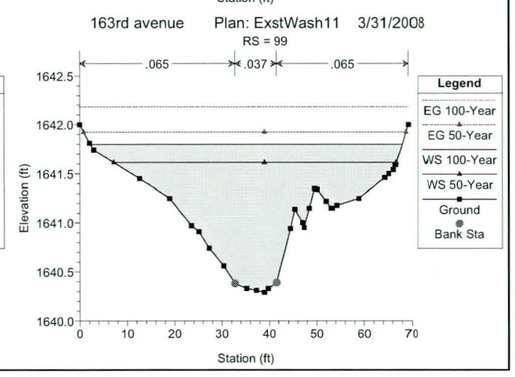
Not to Scale

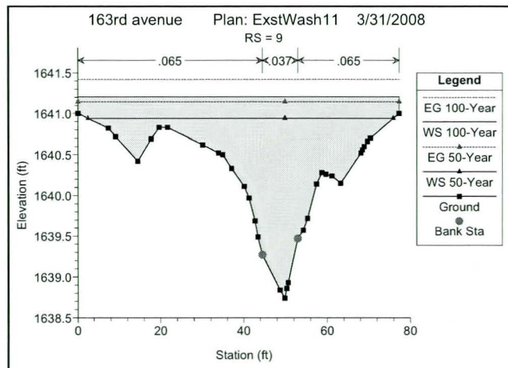



163rd avenue Plan: ExstWash11 3/31/2008
RS = 366
.065
.065
.037
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)


163rd avenue Plan: ExstWash11 3/31/2008
RS = 278
.065
.037
.065
Legend
EG 100-Year
WS 100-Year
EG 50-Year
WS 50-Year
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)


163rd avenue Plan: ExstWash11 3/31/2008
RS = 194
.065
.037
.065
Legend
EG 100-Year
WS 100-Year
EG 50-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


163rd avenue Plan: ExstWash11 3/31/2008
RS = 99
.065
.037
.065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


163rd avenue Plan: ExstWash11 3/31/2008
RS = 9
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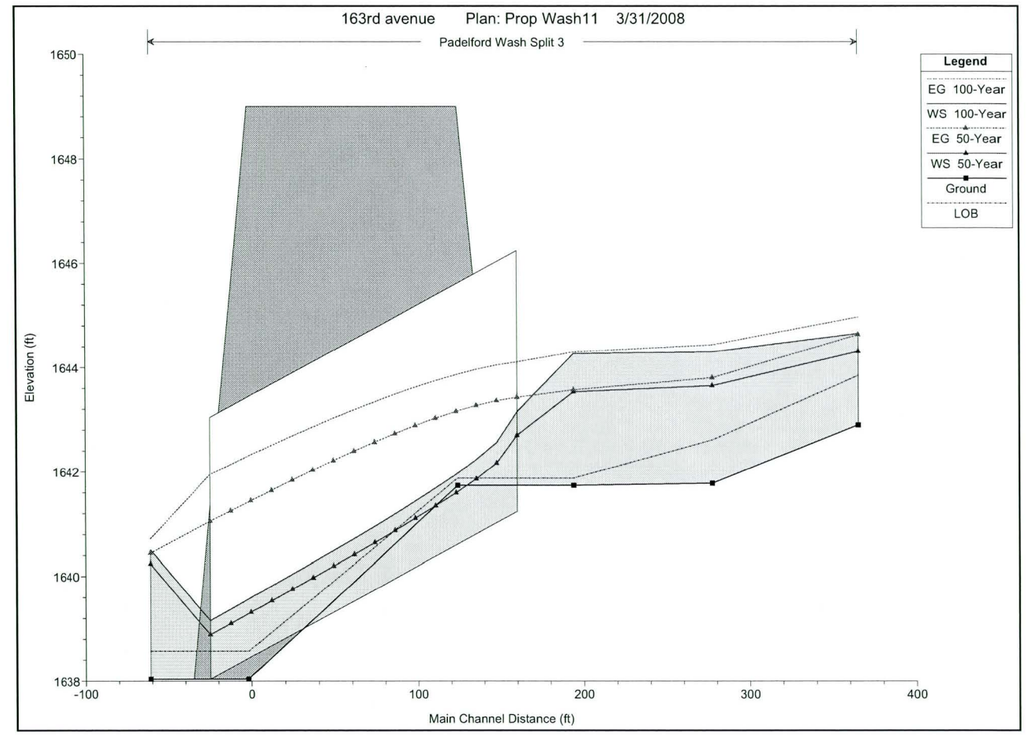
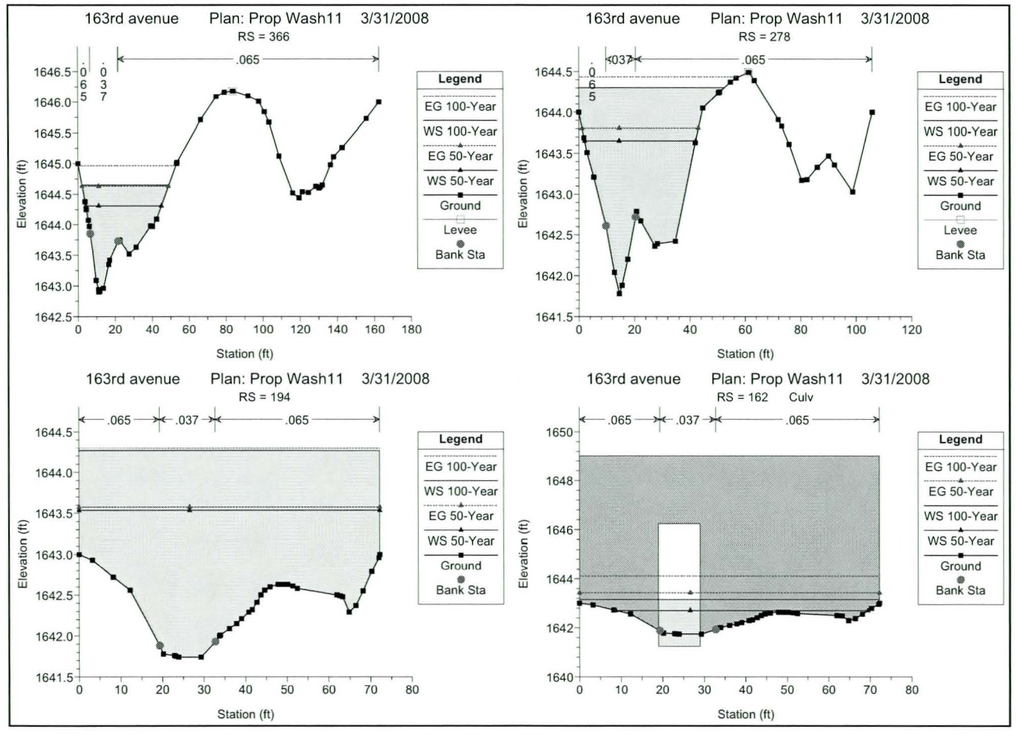
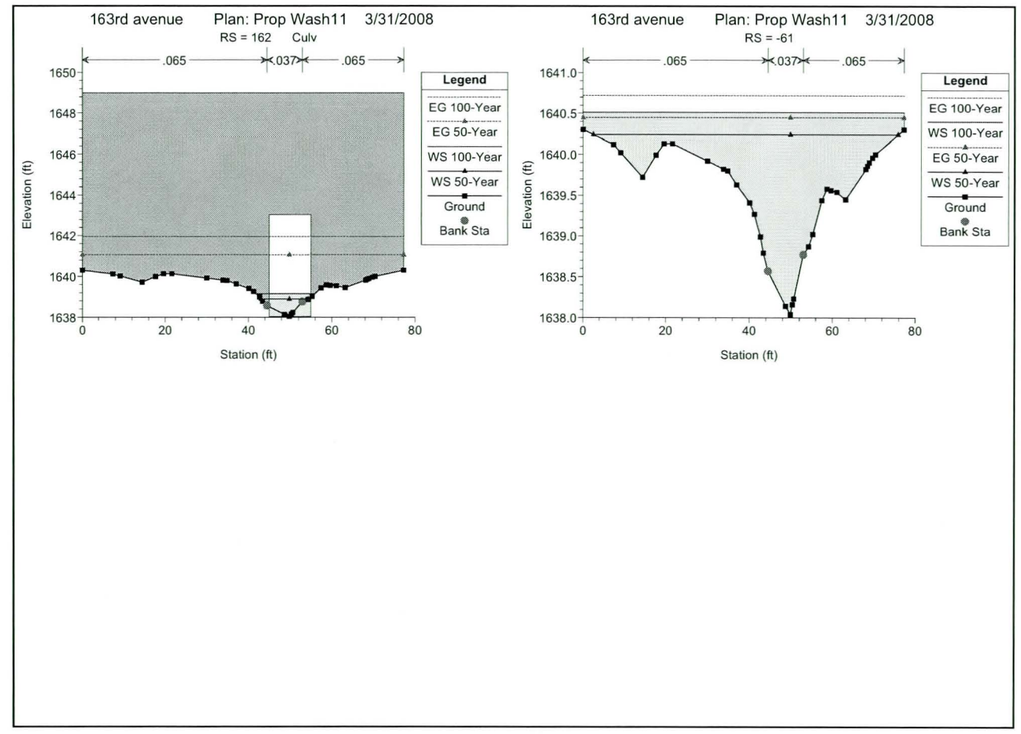
.037
.065
Legend
EG 100-Year
WS 100-Year
EG 50-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

HEC-RAS Plan: exstwash11 River: Padelford Wash Reach: Split 3

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Split 3	366	100-Year	150.00	1642.90	1644.63	1644.52	1644.96	0.012328	5.34	41.47	46.56	0.82
Split 3	366	50-Year	100.00	1642.90	1644.32	1644.29	1644.63	0.015659	5.04	27.92	41.00	0.88
Split 3	278	100-Year	150.00	1641.78	1643.85	1643.50	1644.09	0.007728	4.90	48.90	42.44	0.67
Split 3	278	50-Year	100.00	1641.78	1643.63	1643.25	1643.79	0.005910	3.90	40.06	39.74	0.57
Split 3	194	100-Year	150.00	1641.74	1643.13		1643.37	0.009816	4.87	55.17	72.23	0.74
Split 3	194	50-Year	100.00	1641.74	1642.89		1643.12	0.011417	4.59	37.76	66.98	0.77
Split 3	99	100-Year	150.00	1640.29	1641.80		1642.18	0.015428	6.44	46.49	65.77	0.94
Split 3	99	50-Year	100.00	1640.29	1641.61	1641.61	1641.92	0.013616	5.52	34.81	59.54	0.86
Split 3	9	100-Year	150.00	1638.74	1641.21	1641.06	1641.42	0.005001	4.72	67.31	77.28	0.56
Split 3	9	50-Year	100.00	1638.74	1640.94	1640.65	1641.15	0.005004	4.32	46.56	73.39	0.55

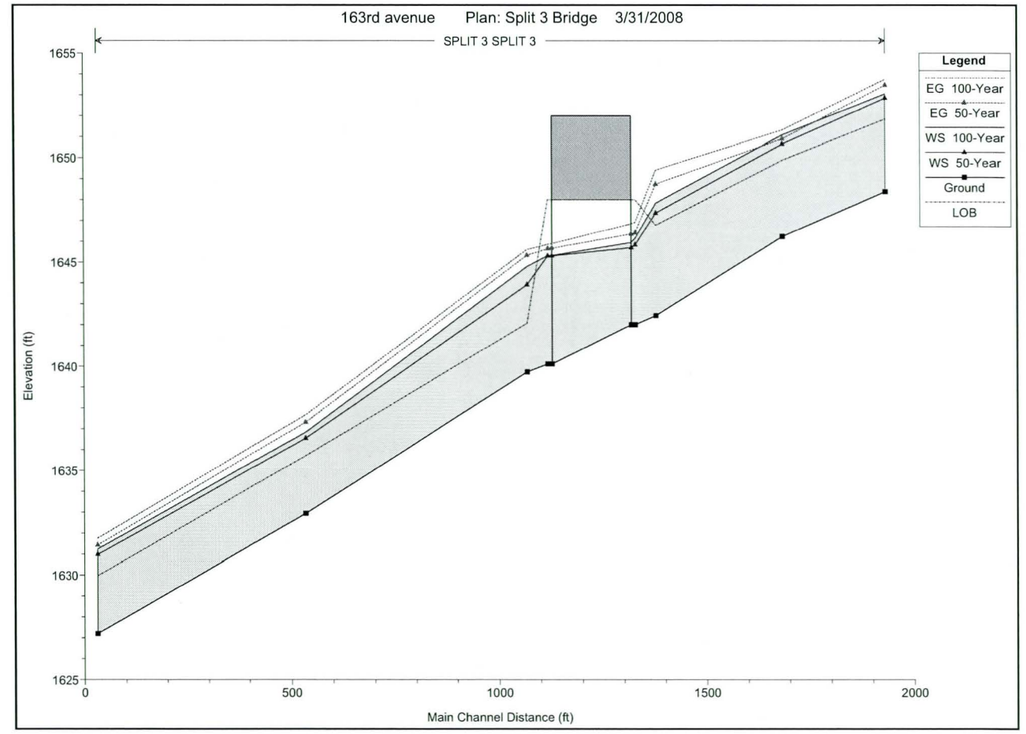


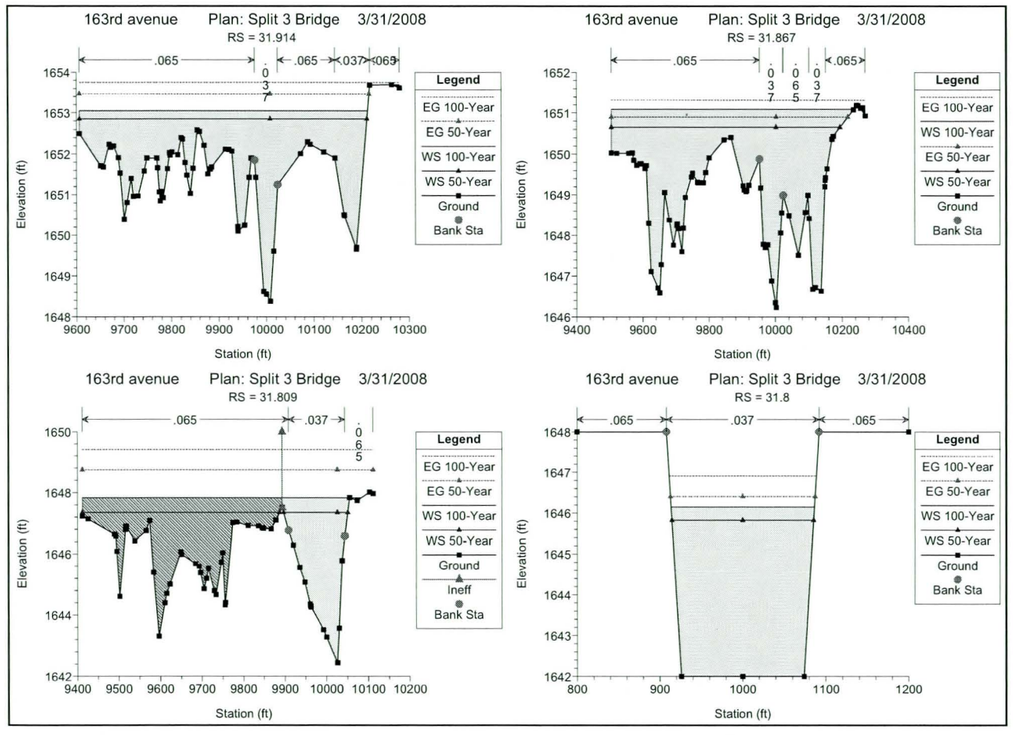

163rd avenue Plan: Prop Wash11 3/31/2008
RS = 366
.065
Elevation (ft)
Station (ft)
Legend
EG 100-Year
WS 100-Year
EG 50-Year
WS 50-Year
Ground
Levee
Bank Sta
163rd avenue Plan: Prop Wash11 3/31/2008
RS = 278
.037
.065
Elevation (ft)
Station (ft)
Legend
EG 100-Year
WS 100-Year
EG 50-Year
WS 50-Year
Ground
Levee
Bank Sta
163rd avenue Plan: Prop Wash11 3/31/2008
RS = 194
.065
.037
.065
Elevation (ft)
Station (ft)
Legend
EG 100-Year
WS 100-Year
EG 50-Year
WS 50-Year
Ground
Bank Sta
163rd avenue Plan: Prop Wash11 3/31/2008
RS = 162 Culv
.065
.037
.065
Elevation (ft)
Station (ft)
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta

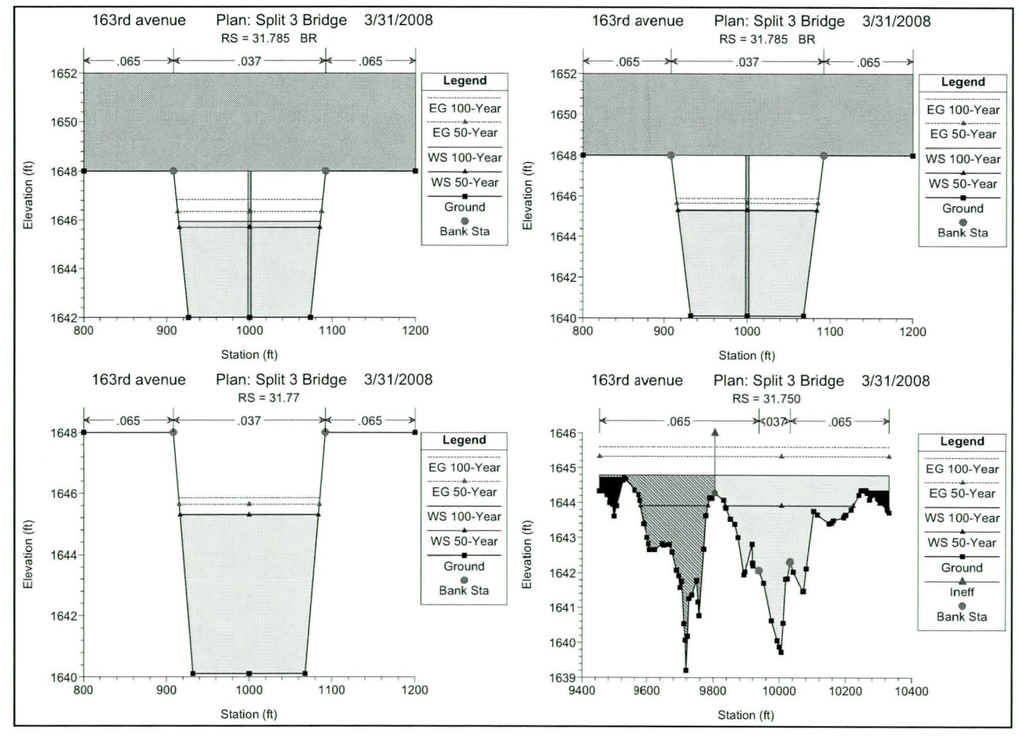

163rd avenue Plan: Prop Wash11 3/31/2008
RS = 162 Culv
.065
.037
.065
Elevation (ft)
Station (ft)
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
163rd avenue Plan: Prop Wash11 3/31/2008
RS = -61
.065
.037
.065
Elevation (ft)
Station (ft)
Legend
EG 100-Year
WS 100-Year
EG 50-Year
WS 50-Year
Ground
Bank Sta

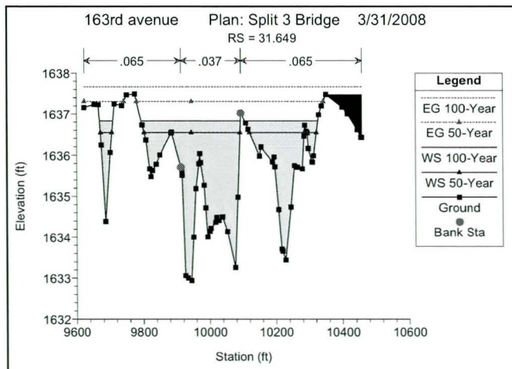
HEC-RAS Plan: propwash11 River: Padelford Wash Reach: Split 3

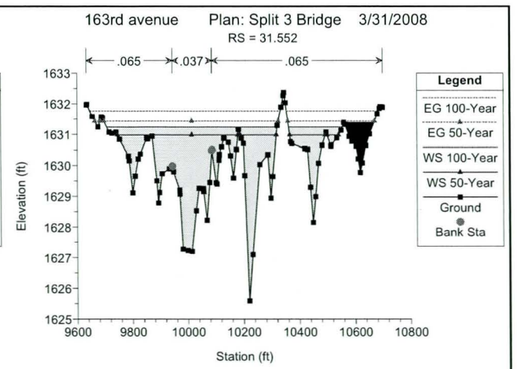
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Split 3	366	100-Year	150.00	1642.90	1644.65	1644.52	1644.97	0.011390	5.20	42.73	47.04	0.79
Split 3	366	50-Year	100.00	1642.90	1644.31	1644.29	1644.63	0.016083	5.08	27.64	40.88	0.89
Split 3	278	100-Year	150.00	1641.78	1644.30	1643.50	1644.43	0.003204	3.71	70.00	52.46	0.45
Split 3	278	50-Year	100.00	1641.78	1643.65	1643.25	1643.81	0.005596	3.83	40.88	40.01	0.56
Split 3	194	100-Year	150.00	1641.74	1644.27	1643.04	1644.30	0.000659	1.89	137.36	72.23	0.21
Split 3	194	50-Year	100.00	1641.74	1643.53	1642.84	1643.57	0.001295	2.10	84.27	72.23	0.28
Split 3	162		Culvert									
Split 3	-61	100-Year	150.00	1638.04	1640.51	1640.36	1640.72	0.005001	4.72	67.31	77.28	0.56
Split 3	-61	50-Year	100.00	1638.04	1640.24	1639.95	1640.45	0.005004	4.32	46.56	73.39	0.55




163rd avenue Plan: Split 3 Bridge 3/31/2008
RS = 31.914
.065 .065 .037 .069
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: Split 3 Bridge 3/31/2008
RS = 31.867
.065 .065
Legend
EG 100-Year
WS 100-Year
EG 50-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: Split 3 Bridge 3/31/2008
RS = 31.809
.065 .037
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: Split 3 Bridge 3/31/2008
RS = 31.8
.065 .037 .065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)


163rd avenue Plan: Split 3 Bridge 3/31/2008
RS = 31.785 BR
.065 .037 .065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: Split 3 Bridge 3/31/2008
RS = 31.785 BR
.065 .037 .065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: Split 3 Bridge 3/31/2008
RS = 31.77
.065 .037 .065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
163rd avenue Plan: Split 3 Bridge 3/31/2008
RS = 31.750
.065 .037 .065
Legend
EG 100-Year
EG 50-Year
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)





HEC-RAS Plan: bridge River: SPLIT 3 Reach: SPLIT 3

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SPLIT 3	31.914	100-Year	4660.00	1648.38	1653.06	1653.06	1653.75	0.011324	9.76	970.65	606.17	0.92
SPLIT 3	31.914	50-Year	3728.00	1648.38	1652.85	1652.85	1653.47	0.010399	8.98	846.78	604.74	0.87
SPLIT 3	31.867	100-Year	4660.00	1646.23	1651.09		1651.32	0.003442	5.41	1512.88	730.46	0.51
SPLIT 3	31.867	50-Year	3728.00	1646.23	1650.65		1650.90	0.004078	5.38	1201.62	688.78	0.54
SPLIT 3	31.809	100-Year	4660.00	1642.44	1647.83	1647.83	1649.41	0.012576	10.11	476.46	669.55	0.97
SPLIT 3	31.809	50-Year	3728.00	1642.44	1647.35	1647.35	1648.74	0.013548	9.47	398.93	629.71	0.98
SPLIT 3	31.8	100-Year	4660.00	1642.00	1646.15	1645.06	1646.91	0.005098	7.00	665.26	172.88	0.63
SPLIT 3	31.8	50-Year	3728.00	1642.00	1645.83	1644.64	1646.41	0.004284	6.11	610.21	170.96	0.57
SPLIT 3	31.785		Bridge									
SPLIT 3	31.77	100-Year	4660.00	1640.11	1645.31		1645.85	0.002773	5.90	789.44	167.63	0.48
SPLIT 3	31.77	50-Year	3728.00	1640.11	1645.29		1645.64	0.001797	4.74	786.23	167.52	0.39
SPLIT 3	31.750	100-Year	4660.00	1639.73	1644.79	1644.79	1645.60	0.008024	8.70	960.64	878.34	0.79
SPLIT 3	31.750	50-Year	3728.00	1639.73	1643.91	1643.76	1645.33	0.017196	10.69	550.11	588.90	1.11
SPLIT 3	31.649	100-Year	4660.00	1632.94	1636.83	1636.83	1637.67	0.012449	8.16	831.86	560.55	0.91
SPLIT 3	31.649	50-Year	3728.00	1632.94	1636.54	1636.54	1637.31	0.012945	7.69	674.53	516.54	0.91
SPLIT 3	31.552	100-Year	4485.00	1627.20	1631.24	1630.86	1631.76	0.008469	7.13	1123.28	805.98	0.77
SPLIT 3	31.552	50-Year	3588.00	1627.20	1630.98	1630.48	1631.43	0.008178	6.55	920.59	732.73	0.74

HEC-RAS Plan: bridge River: SPLIT 3 Reach: SPLIT 3

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
SPLIT 3	31.809	100-Year	1648.85	1647.01	1647.01	0.19	0.38	561.13	645.22	4013.75	1.03	11.58
SPLIT 3	31.809	50-Year	1648.19	1647.01	1647.01	0.17	0.21	561.13	516.17	3211.00	0.83	9.26
SPLIT 3	31.8	100-Year	1647.29	1646.71	1645.06			176.27		4660.00		6.10
SPLIT 3	31.8	50-Year	1646.65	1646.17	1644.64			173.03		3728.00		5.57
SPLIT 3	31.785 BR U	100-Year	1647.24	1646.61	1645.13			171.63		4660.00		6.41
SPLIT 3	31.785 BR U	50-Year	1646.61	1646.08	1644.68			168.50		3728.00		5.84
SPLIT 3	31.785 BR D	100-Year	1644.95	1643.42	1643.42			152.13		4660.00		9.92
SPLIT 3	31.785 BR D	50-Year	1644.30	1642.95	1642.95			149.30		3728.00		9.32
SPLIT 3	31.77	100-Year	1644.86	1643.33	1643.33	5.05	0.21	155.60		4660.00		9.92
SPLIT 3	31.77	50-Year	1644.23	1642.90	1642.90	5.27	0.17	152.96		3728.00		9.26
SPLIT 3	31.649	100-Year	1637.67	1636.83	1636.83	5.14	0.09	560.55	305.15	3651.34	703.51	8.16
SPLIT 3	31.649	50-Year	1637.31	1636.54	1636.54	5.14	0.09	516.54	177.32	3039.70	510.99	7.69

APPENDIX B

RAINFALL DATA

Andes Engineering

163rd Ave., Jomax Rd. to Dove Valley Rd.
Design Concept Report
Rainfall Data

	Point Values (in)					
Duration	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
5 MIN	0.27	0.36	0.44	0.54	0.61	0.69
10 MIN	0.41	0.55	0.66	0.81	0.93	1.05
15 MIN	0.51	0.69	0.82	1.01	1.15	1.30
30 MIN	0.68	0.92	1.11	1.36	1.55	1.75
1 HOUR	0.84	1.14	1.37	1.68	1.92	2.16
2 HOUR	0.97	1.30	1.55	1.89	2.15	**2.42**
3 HOUR	1.01	1.33	1.59	1.93	2.21	2.51
6 HOUR	**1.17**	1.50	1.76	2.13	**2.41**	**2.71**
12 HOUR	1.33	1.69	1.94	2.34	2.63	2.93
24 HOUR	**1.63**	2.09	2.45	2.96	3.36	**3.77**

	Rainfall Intensity (in/hr)					
Duration	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
5 MIN	3.24	4.32	5.28	6.48	7.32	8.28
10 MIN	2.46	3.30	**3.96**	4.86	5.58	6.30
15 MIN	2.04	2.76	3.28	4.04	4.60	5.20
30 MIN	1.36	1.84	2.22	2.72	3.10	3.50
1 HOUR	0.84	1.14	1.37	1.68	1.92	2.16
2 HOUR	0.49	0.65	0.78	0.95	1.08	1.21
3 HOUR	0.34	0.44	0.53	0.64	0.74	0.84
6 HOUR	0.20	0.25	0.29	0.36	0.40	0.45
12 HOUR	0.11	0.14	0.16	0.20	0.22	0.24
24 HOUR	0.07	0.09	0.10	0.12	0.14	0.16

POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

Arizona 33.75 N 112.41 W 1584 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 Feb 1 2008

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	0.21	0.31	0.39	0.52	0.65	0.75	0.79	0.93	1.06	1.28	1.36	1.62	1.84	2.00	2.43	2.84	3.35	3.70
2	0.27	0.41	0.51	0.68	0.84	0.97	1.01	1.17	1.33	1.63	1.73	2.08	2.35	2.56	3.13	3.66	4.32	4.78
5	0.36	0.55	0.69	0.92	1.14	1.30	1.33	1.50	1.69	2.09	2.25	2.73	3.11	3.36	4.11	4.80	5.67	6.27
10	0.44	0.66	0.82	1.11	1.37	1.55	1.59	1.76	1.97	2.45	2.65	3.26	3.71	4.01	4.85	5.67	6.68	7.35
25	0.54	0.81	1.01	1.36	1.68	1.89	1.93	2.13	2.34	2.96	3.22	4.01	4.56	4.91	5.84	6.84	8.02	8.77
50	0.61	0.93	1.15	1.55	1.92	2.15	2.21	2.41	2.63	3.36	3.66	4.62	5.25	5.64	6.60	7.74	9.03	9.82
100	0.69	1.05	1.30	1.75	2.16	2.42	2.51	2.71	2.93	3.77	4.13	5.26	5.98	6.40	7.37	8.65	10.05	10.88
200	0.77	1.17	1.45	1.95	2.41	2.70	2.82	3.02	3.23	4.20	4.61	5.94	6.75	7.21	8.15	9.58	11.07	11.92
500	0.87	1.33	1.65	2.22	2.74	3.08	3.25	3.45	3.65	4.80	5.28	6.90	7.84	8.33	9.21	10.82	12.44	13.29
1000	0.95	1.45	1.80	2.42	3.00	3.37	3.60	3.79	3.97	5.27	5.80	7.68	8.72	9.24	10.01	11.79	13.49	14.32

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: Formatting forces estimates near zero to appear as zero.

*** Upper bound of the 90% confidence interval**
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	0.26	0.40	0.50	0.67	0.83	0.94	0.99	1.12	1.25	1.49	1.60	1.90	2.16	2.33	2.78	3.28	3.84	4.21
2	0.34	0.52	0.65	0.87	1.08	1.21	1.27	1.42	1.58	1.88	2.04	2.42	2.76	2.98	3.58	4.22	4.95	5.44
5	0.46	0.70	0.87	1.18	1.46	1.61	1.66	1.81	1.99	2.41	2.64	3.18	3.64	3.91	4.69	5.54	6.51	7.13
10	0.55	0.84	1.04	1.41	1.74	1.92	1.97	2.12	2.32	2.82	3.12	3.79	4.34	4.65	5.54	6.53	7.66	8.37
25	0.68	1.03	1.28	1.72	2.13	2.33	2.38	2.55	2.75	3.39	3.78	4.65	5.32	5.68	6.65	7.86	9.18	9.97
50	0.77	1.17	1.45	1.96	2.42	2.65	2.72	2.89	3.08	3.85	4.29	5.34	6.11	6.51	7.50	8.88	10.34	11.18
100	0.87	1.32	1.64	2.20	2.73	2.98	3.08	3.24	3.44	4.32	4.82	6.08	6.94	7.37	8.38	9.94	11.51	12.39
200	0.97	1.48	1.83	2.46	3.05	3.30	3.46	3.61	3.80	4.82	5.39	6.85	7.83	8.29	9.26	11.01	12.70	13.60
500	1.10	1.68	2.08	2.80	3.47	3.77	3.99	4.12	4.30	5.51	6.19	7.97	9.10	9.60	10.47	12.46	14.30	15.20
1000	1.21	1.84	2.28	3.07	3.80	4.14	4.43	4.54	4.71	6.07	6.84	8.88	10.14	10.64	11.42	13.59	15.54	16.43

* The **upper** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **greater** than.
** 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: Formatting prevents estimates near zero to appear as zero.

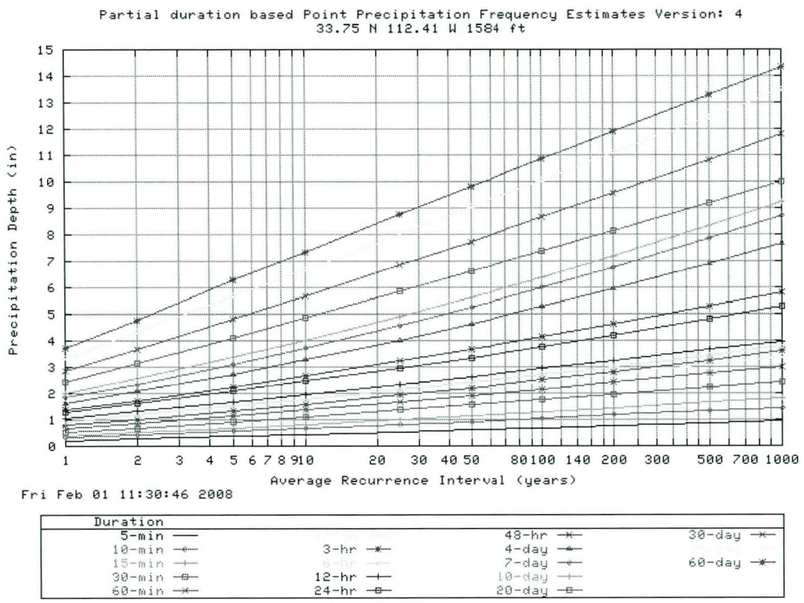
*** Lower bound of the 90% confidence interval**
Precipitation Frequency Estimates (inches)

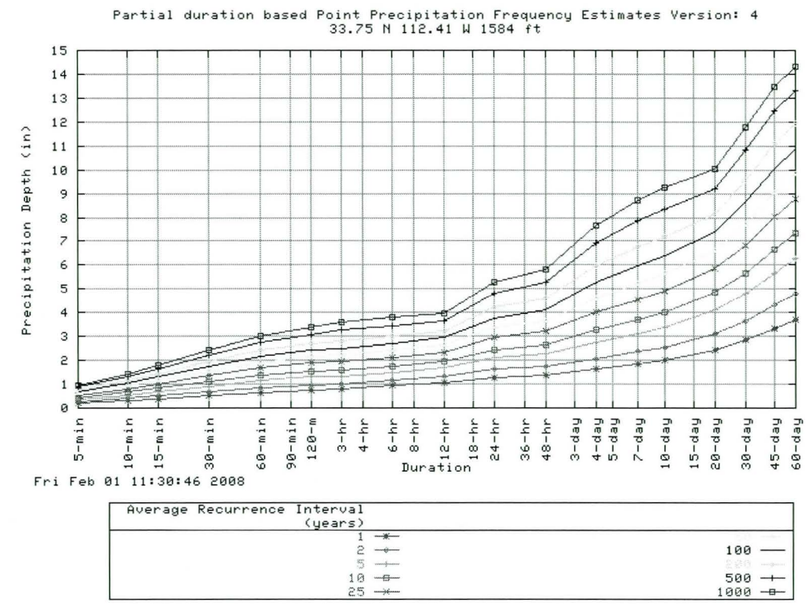
ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.17	0.25	0.31	0.42	0.52	0.62	0.65	0.79	0.91	1.12	1.15	1.41	1.58	1.73	2.12	2.46	2.92	3.24
2	0.21	0.33	0.41	0.55	0.68	0.80	0.83	1.00	1.15	1.41	1.47	1.80	2.03	2.21	2.73	3.17	3.77	4.19
5	0.29	0.44	0.55	0.74	0.91	1.06	1.09	1.27	1.44	1.81	1.90	2.36	2.66	2.90	3.58	4.16	4.93	5.49
10	0.35	0.53	0.65	0.88	1.09	1.25	1.29	1.48	1.67	2.12	2.23	2.80	3.17	3.45	4.21	4.89	5.79	6.42
25	0.42	0.64	0.79	1.06	1.32	1.50	1.55	1.75	1.97	2.53	2.69	3.43	3.88	4.21	5.05	5.88	6.93	7.63
50	0.47	0.72	0.89	1.20	1.48	1.69	1.75	1.96	2.19	2.85	3.04	3.93	4.44	4.80	5.69	6.63	7.77	8.53
100	0.52	0.80	0.99	1.33	1.65	1.88	1.96	2.17	2.40	3.17	3.40	4.45	5.03	5.42	6.33	7.38	8.62	9.40
200	0.57	0.87	1.08	1.46	1.81	2.06	2.16	2.37	2.61	3.49	3.76	4.98	5.63	6.06	6.97	8.14	9.46	10.26

500	0.64	0.97	1.20	1.62	2.00	2.29	2.42	2.64	2.87	3.93	4.23	5.73	6.47	6.94	7.82	9.12	10.56	11.38
1000	0.68	1.04	1.29	1.74	2.15	2.46	2.62	2.83	3.06	4.25	4.59	6.32	7.14	7.62	8.44	9.87	11.38	12.21

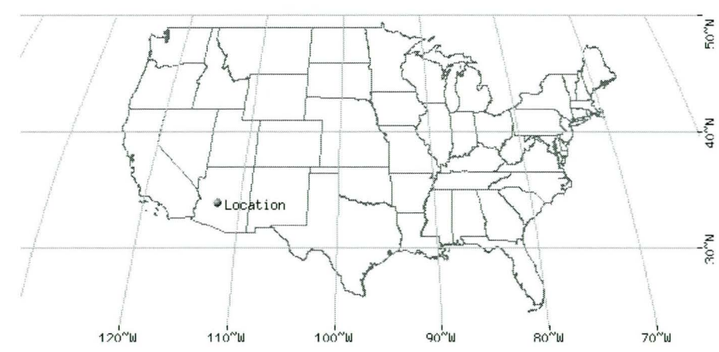
* The **lower** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **less** than.
** These precipitation frequency estimates are based on a partial duration maxima series. **ARI** is the Average Recurrence Interval.

Please refer to the documentation for more information. NOTE: Formatting prevents estimates near zero to appear as zero.





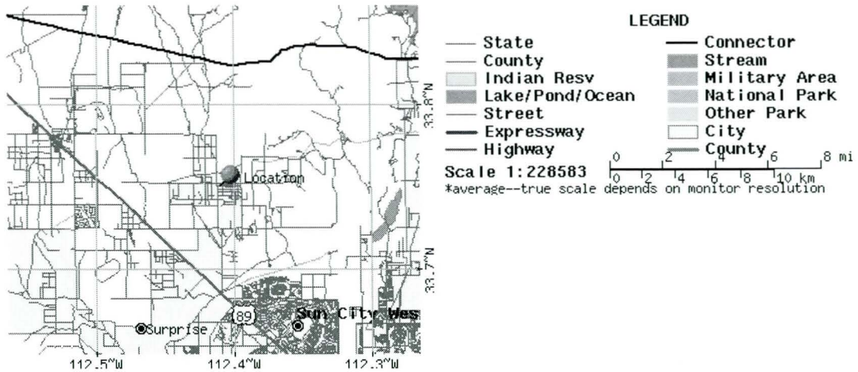
Maps -



These maps were produced using a direct map request from the U.S. Census Bureau Mapping and Cartographic Resources **Tiger Map Server**.

Please read disclaimer for more information.

http://hdsc.nws.noaa.gov/cgi-bin/hdsc/buildout.perl?type=pf&units=us&series=pd&statena... 2/1/2008



Other Maps/Photographs -

View USGS digital orthophoto quadrangle (DOQ) covering this location from TerraServer; **USGS Aerial Photograph** may also be available from this site. A DOQ is a computer-generated image of an aerial photograph in which image displacement caused by terrain relief and camera tilts has been removed. It combines the image characteristics of a photograph with the geometric qualities of a map. Visit the USGS for more information.

Watershed/Stream Flow Information -

Find the Watershed for this location using the U.S. Environmental Protection Agency's site.

Climate Data Sources -

Precipitation frequency results are based on data from a variety of sources, but largely NCDC. The following links provide general information about observing sites in the area, regardless of if their data was used in this study. For detailed information about the stations used in this study, please refer to our documentation.

Using the **National Climatic Data Center's (NCDC)** station search engine, locate other climate stations within:

+/-30 minutes ...OR... +/-1 degree of this location (33.75/-112.41). Digital ASCII data can be obtained directly from **NCDC**.

Find Natural Resources Conservation Service (NRCS) SNOTEL (SNOwpack TELemetry) stations by visiting the **Western Regional Climate Center's state-specific SNOTEL station maps**.

Hydrometeorological Design Studies Center
DOC/NOAA/National Weather Service
1325 East-West Highway
Silver Spring, MD 20910
(301) 713-1669
Questions?: HDSC.Questions@noaa.gov

Disclaimer

APPENDIX C

ON-SITE DATA AND DRAINAGE AREAS

Andes Engineering

Project 0503D
Roadway 163rd Ave NB
Frequency 10-Year

NORTHBOUND

Designed	KCP	Date	2/1/2008
Reviewed	JOG	Date	3/28/2008

163rd Ave., Jomax to Dove Valley DCR
Inlet Hydraulic Computation Sheet
NORTHBOUND LANES

Inlet #	99	110	115	119	124	130	132	140	146	150	154A	155	158
Station	101+21	151+47	164+26	177+35	189+18	197+07	204+38	233+26	257+43	279+08	307+45	312+42	325+58
Grate Elevation													
Offset from CL	71.00	70.50	70.50	71.00	71.00	70.00	70.00	70.00	70.00	42.48	55.78	55.00	67.00
Lt or Rt	Rt	Rt	Rt	Rt	Rt	Rt	Rt	Rt	Rt	Rt	Rt	Rt	Rt
Upstream Inlet		115	119		130	132		146	150	154A	155		
Direction of Flow	v	<<<<	<<<<	<<<<	v	<<<<	<<<<	v	<<<<	<<<<	<<<<	<<<<	>>>>
HYDROLOGY													
Tc (min)	10	10	10	10	10	10	10	10	10	10	10	10	10
i (in/hr)	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96
Contributing Area													
Pavement (Sq.ft.)	186336	34960	49729	33777	46707	35087	63469	123884	68485	110730	18353	21268	24598
Pavement (Acre)	4.2777	0.8026	1.1416	0.7754	1.0723	0.8055	1.4571	2.8440	1.5722	2.5420	0.4213	0.4883	0.5647
Side Slopes (Acre)													
Total Area	4.2777	0.8026	1.1416	0.7754	1.0723	0.8055	1.4571	2.8440	1.5722	2.5420	0.4213	0.4883	0.5647
Runoff Coefficient C													
Pavement	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Roadside	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Composite C	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Flows													
Known (cfs)													
Bypass (cfs)	0	0.28	0.61	0.00	2.35	3.45	0.00	2.48	2.21	0.00	0.79	0.00	0.00
CIA (cfs)	14.40	2.70	3.84	2.61	3.61	2.71	4.90	9.57	5.29	8.56	1.42	1.64	1.90
Total Q (cfs)	14.40	2.98	4.45	2.61	5.96	6.16	4.90	12.05	7.50	8.56	2.21	1.64	1.90
HYDRAULICS													
Roadway Slopes (ft/ft)													
Longitudinal (So)	0.000000	0.018500	0.004000	0.021000	0.000000	0.011000	0.011000	0.000000	0.009000	0.012044	0.006500	0.006500	0.002951
Cross Slope (Sx)	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200
Gutter													
Width (ft)	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42
Depression (in)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Sw (ft/ft)	0.0588	0.0588	0.0588	0.0588	0.0588	0.0588	0.0588	0.0588	0.0588	0.0588	0.0588	0.0588	0.0588
Gutter Capacity (cfs)	-	0.11	0.05	0.11	-	0.08	0.08	-	0.07	0.09	0.06	0.06	0.04
T in Gutter (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-
T Composite Gutter (ft)	12.57	9.35	14.78	8.63	10.08	13.79	12.61	16.32	15.46	15.38	10.24	9.07	11.26
Eo	0.31	0.42	0.27	0.45	0.39	0.28	0.31	0.24	0.25	0.26	0.38	0.43	0.35
Qs (cfs)	0.00	1.74	3.27	1.44	-	4.41	3.38	-	5.60	6.38	1.37	0.94	1.24
Q check (cfs)	0.00	2.98	4.45	2.61	-	6.16	4.90	-	7.50	8.56	2.22	1.64	1.90
Qw (cfs)	0.00	1.24	1.18	1.17	-	1.75	1.52	-	1.90	2.18	0.85	0.70	0.66
Flow Velocity (ft/s)	0.00	4.36	2.70	4.43	-	4.28	4.05	-	4.17	4.80	2.74	2.54	1.95
Controling T (ft)	12.57	9.35	14.78	8.63	10.08	13.79	12.61	16.32	15.46	15.38	10.24	9.07	11.26
Manning's n	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016
Spread (ft)	15.90	9.35	14.78	8.63	13.54	13.79	12.61	13.20	15.46	15.38	10.24	9.07	11.26
Roadway Width (ft)	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00
Depth of Flow (in)	4.48	2.90	4.21	2.73	3.91	3.97	3.69	3.83	4.37	4.35	3.12	2.84	3.36
Flow Velocity (ft/s)	0.00	4.36	2.70	4.43	0.00	4.28	4.05	0.00	4.17	4.80	2.74	2.54	1.95
Allowable Spread	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
INLET													
Type	COG	COG	COG	COG	CO	COG	CO	COG	COG	COG	CO	CO	COG
Standard	533	533	533	533	532	533	532	533	533	533	532	532	533
Location	Sag	Grade	Grade	Grade	Sag	Grade	Grade	Sag	Grade	Grade	Grade	Grade	Grade
Inlet Depression (in)	2	2	2	2	2	2	2	2	2	2	2	2	2
Capture Ratio	0.8	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Length (ft)	20	20	20	9	8	9	8	20	13	20	8	8	10
Effective Length (ft)	16	16	16	7	6	7	6	16	10	16	6	6	8
Flows													
Intercepted (cfs)	14.40	2.71	4.17	2.00	5.96	3.81	1.45	12.05	5.02	6.35	1.03	0.85	1.73
Bypass (cfs)	0.00	0.27	0.28	0.61	0.00	2.35	3.45	0.00	2.48	2.21	1.18	0.79	0.17

Andes Engineering

Project 0503D
Roadway 163rd Ave SB
Frequency 10-Year

SOUTHBOUND

Designed	KCP	Date	2/1/2008
Reviewed	JOG	Date	3/28/2008

163rd Ave., Jomax to Dove Valley DCR
Inlet Hydraulic Computation Sheet
SOUTHBOUND LANES

Inlet #	101	112	116	120	123	126	127	131	134	136A	136B	137	141A	144	149	153	154B	156
Station	101+21	151+47	164+35	177+47	184+07	189+18	190+66	197+07	204+38	217+00	229+45	233+26	243+47	257+43	273+13	285+40	307+57	325+60
Grate Elevation																		
Offset from CL	82.93	82.00	82.00	82.00	82.00	70.00	82.00	70.00	82.00	82.00	70.00	70.00	70.00	70.00	70.00	82.00	55.00	27.00
Lt or Rt	Lt	Lt	Lt	Lt	Lt	Lt	Lt	Lt	Lt	Lt	Lt	Lt	Lt	Lt	Lt	Lt	Lt	Lt
Upstream Inlet		116	120	123		127	131	134	136A			Sag	144	149	153	154B		
Direction of Flow	v	<<<<	<<<<	<<<<	<<<<	v	<<<<	<<<<	<<<<	<<<<	>>>>	v	<<<<	<<<<	<<<<	<<<<	<<<<	>>>>
HYDROLOGY																		
Tc (min)	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
i (in/hr)	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96
Contributing Area																		
Pavement (Sq.ft.)	185779	47262	49214	28641	9361	14898	29529	35469	46973	25355	13236	52821	65034	55138	49247	63413	30598	21067
Pavement (Acre)	4.2649	1.0850	1.1298	0.6575	0.2149	0.3420	0.6779	0.8143	1.0783	0.5821	1.5127	1.2126	1.4930	1.2658	1.1306	1.4558	0.7024	0.4836
Side Slopes (Acre)																		
Total Area	4.2649	1.0850	1.1298	0.6575	0.2149	0.3420	0.6779	0.8143	1.0783	0.5821	1.5127	1.2126	1.4930	1.2658	1.1306	1.4558	0.7024	0.4836
Runoff Coefficient C																		
Pavement	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Roadside	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Composite C	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Flows																		
Known (cfs)																		
Bypass (cfs)	-	0.17	0.16	0.16	-	1.69	0.92	1.33	1.35	-	-	5.78	5.34	3.03	4.58	1.29	-	-
CIA (cfs)	14.36	3.65	3.80	2.21	0.72	1.15	2.28	2.74	3.63	1.96	5.09	4.08	5.03	4.26	3.81	4.90	2.36	1.63
Total Q (cfs)	14.36	3.82	3.96	2.38	0.72	2.84	3.20	4.07	4.98	1.96	5.09	9.86	10.37	7.29	8.39	6.19	2.36	1.63
HYDRAULICS																		
Roadway Slopes (ft/ft)																		
Longitudinal (So)	0.000000	0.018500	0.004000	0.021000	0.003500	0.000000	0.003500	0.011000	0.011000	0.035000	0.012000	0.000000	0.026000	0.009000	0.011000	0.012044	0.006500	0.002951
Cross Slope (Sx)	0.0200	0.0200	0.0210	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200
Gutter																		
Width (ft)	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42
Depression (in)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Sw (ft/ft)	0.0588	0.0588	0.0588	0.0588	0.0588	0.0588	0.0588	0.0588	0.0588	0.0588	0.0588	0.0588	0.0588	0.0588	0.0588	0.0588	0.0588	0.0588
Gutter Capacity (cfs)	-	0.11	0.05	0.11	0.05	-	0.05	0.08	0.08	0.15	0.09	-	0.13	0.07	0.08	0.09	0.06	0.04
T in Gutter (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T Composite Gutter (ft)	10.24	10.32	13.71	8.31	7.34	15.63	13.35	11.73	12.69	6.89	12.59	6.65	14.28	15.29	15.53	13.57	10.49	10.60
Eo	0.38	0.38	0.28	0.46	0.52	0.25	0.29	0.33	0.31	0.55	0.31	0.56	0.27	0.26	0.25	0.29	0.37	0.37
Qs (cfs)	-	2.38	2.84	1.28	0.35	-	2.26	2.71	3.44	0.89	3.50	-	7.52	5.42	6.27	4.40	1.48	1.03
Q check (cfs)	-	3.82	3.96	2.38	0.72	-	3.20	4.07	4.98	1.96	5.09	-	10.37	7.29	8.39	6.19	2.36	1.63
Qw (cfs)	-	1.44	1.12	1.10	0.37	-	0.94	1.36	1.54	1.07	1.59	-	2.85	1.87	2.12	1.79	0.88	0.60
Flow Velocity (ft/s)	-	4.64	2.65	4.33	1.64	-	2.37	3.87	4.07	5.00	4.22	-	6.73	4.14	4.62	4.44	2.78	1.88
Controling T (ft)	10.24	10.32	13.71	8.31	7.34	15.63	13.35	11.73	12.69	6.89	12.59	6.65	14.28	15.29	15.53	13.57	10.49	10.60
Manning's n	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016
Spread (ft)	15.65	10.32	13.71	8.31	7.34	5.03	13.35	11.73	12.69	6.89	12.59	10.50	14.28	15.29	15.53	13.57	10.49	10.60
Roadway Width (ft)	40.00	40.00	40.00	40.00	40.00	28.00	28.00	28.00	40.00	40.00	28.00	28.00	28.00	28.00	28.00	40.00	28.00	28.00
Depth of Flow (in)	4.47	3.14	4.10	2.65	2.42	1.87	3.36	3.47	3.71	2.31	3.88	3.18	4.09	4.33	4.39	3.92	3.16	3.28
Flow Velocity (ft/s)	0.00	4.64	2.65	4.33	1.64	0.00	2.37	3.87	4.07	5.00	4.22	0.00	6.73	4.14	4.62	4.44	2.78	1.88
Allowable Spread	25.00	25.00	23.61	25.00	25.00	16.00	16.00	18.00	25.00	25.00	16.00	16.00	16.00	16.00	16.00	25.00	16.00	16.00
INLET																		
Type	COG	COG	COG	COG	CO	CO	CO	COG	COG	CO	COG	COG	COG	CO	COG	CO	CO	COG
Standard	533	533	533	533	532	532	532	533	533	532	533	533	533	532	533	532	532	533
Location	Sag	Grade	Grade	Grade	Grade	Sag	Grade	Grade	Grade	Grade	Grade	Sag	Grade	Grade	Grade	Grade	Grade	Grade
Inlet Depression (in)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Capture Ratio	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Length (ft)	20.0	20.0	20.0	20.0	8.0	8.0	8.0	13.0	13.0	8.0	13.0	20.0	13.0	8.0	13.0	8.0	8.0	10.0
Effective Length (ft)	16	16	16	16	6	6	6	10	10	6	10	16	10	6	10	6	6	8
Flows																		
Intercepted (cfs)	14.36	3.38	3.79	2.22	0.56	2.84	1.51	3.15	3.65	0.61	3.71	9.86	5.97	1.94	5.36	1.61	1.07	1.51
Bypass (cfs)	0.00	0.52	0.17	0.16	0.16	0.00	1.69	0.92	1.33	1.35	1.38	0.00	4.40	5.34	3.03	4.58	1.29	0.11

Andes Engineering

Project 0503D
Roadway 163rd Ave MEDIAN
Frequency 10-Year

MEDIAN

Designed	KCP	Date	2/1/2008
Reviewed	JOG	Date	3/28/2008

163rd Ave., Jomax to Dove Valley DCR Project
Inlet Hydraulic Computation Sheet Roadway
MEDIAN Frequenc

Inlet #	100	102	103	104	105	106	107	108	109	111	113	114	117	118	121	122	125	128	129
Station	101+21	109+27	111+26	118+77	120+61	128+15	129+82	138+56	142+64	151+47	159+38	161+29	168+83	170+66	180+00	181+90	189+18	192+61	194+02
Grate Elevation																			
Offset from CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lt or Rt																			
Upstream Inlet																			
Direction of Flow	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v
HYDROLOGY																			
Tc (min)	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
i (in/hr)	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96
Contributing Area																			
Pavement (Acre)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Side Slopes (Acre)	1.3352	0.3282	1.1716	0.3062	1.1860	0.3095	1.3639	0.7219	1.3622	1.3599	0.3095	0.7987	0.3095	1.5444	0.3091	0.6933	0.4567	0.2130	1.6130
Total Area	1.335	0.328	1.172	0.306	1.186	0.310	1.364	0.722	1.362	1.360	0.310	0.799	0.310	1.544	0.309	0.693	0.457	0.213	1.613
Runoff Coefficient C																			
Pavement	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Roadside	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Composite C	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Flows																			
Known (cfs)																			
Bypass (cfs)																			
CIA (cfs)	3.70	0.91	3.25	0.85	3.29	0.86	3.78	2.00	3.78	3.77	0.86	2.21	0.86	4.28	0.86	1.92	1.27	0.59	4.47
Total Q (cfs)	3.70	0.91	3.25	0.85	3.29	0.86	3.78	2.00	3.78	3.77	0.86	2.21	0.86	4.28	0.86	1.92	1.27	0.59	4.47
HYDRAULICS																			
Ditch																			
Longitudinal Slope (ft/ft)	0.0084	0.0084	0.0084	0.0034	0.0034	0.0034	0.0098	0.0057	0.0057	0.0056	0.0097	0.0071	0.0055	0.0071	0.0059	0.0053	0.0025	0.0059	0.0034
Z (H:1)	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Manning's n	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Bottom Width (ft)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Depth of Flow (in)	6.69	7.22	4.13	7.33	8.35	6.97	2.43	5.42	5.23	3.87	5.17	5.05	5.08	5.21	4.48	6.05	5.84	4.99	5.34
Velocity (fps)	1.92	2.03	1.39	1.30	1.42	1.26	1.06	1.37	1.34	1.09	1.74	1.46	1.30	1.50	1.23	1.42	0.93	1.33	1.05
Computed Q (cfs)	3.59	4.40	0.90	2.91	4.12	2.54	0.26	1.68	1.53	0.68	1.94	1.55	1.40	1.70	1.03	2.17	1.23	1.38	1.25
Standard	537	537	537	537	537	537	537	537	537	537	537	537	537	537	537	537	537	537	537
Grate																			
Reduction Factor	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Grate Length (in)	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00
Grate Width (in)	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00
# of Long Bars	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Width of Long Bars (in)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Width of Side Bars (in)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
# of Transverse Bars	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Width of Trans. Bars (In)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Perimeter (ft)	9.67	9.67	9.67	9.67	9.67	9.67	9.67	9.67	9.67	9.67	9.67	9.67	9.67	9.67	9.67	9.67	9.67	9.67	9.67
Area (sq.ft)	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68
Clogged Perimeter (ft)	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83
Clogged Area (sq.ft.)	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34
Weir Depth (in)	4.83	1.89	4.43	1.81	4.46	1.82	4.90	3.20	4.89	4.89	1.82	3.43	1.82	5.32	1.82	3.12	2.36	1.42	5.48
Orifice Depth (in)	1.04	0.06	0.80	0.05	0.82	0.06	1.08	0.30	1.08	1.08	0.06	0.37	0.06	1.39	0.06	0.28	0.12	0.03	1.51
Controlling Depth (in)	4.83	1.89	4.43	1.81	4.46	1.82	4.90	3.20	4.89	4.89	1.82	3.43	1.82	5.32	1.82	3.12	2.36	1.42	5.48
Depth at Grate (in)	4.83	1.89	4.43	1.81	4.46	1.82	4.90	3.20	4.89	4.89	1.82	3.43	1.82	5.32	1.82	3.12	2.36	1.42	5.48

Andes Engineering

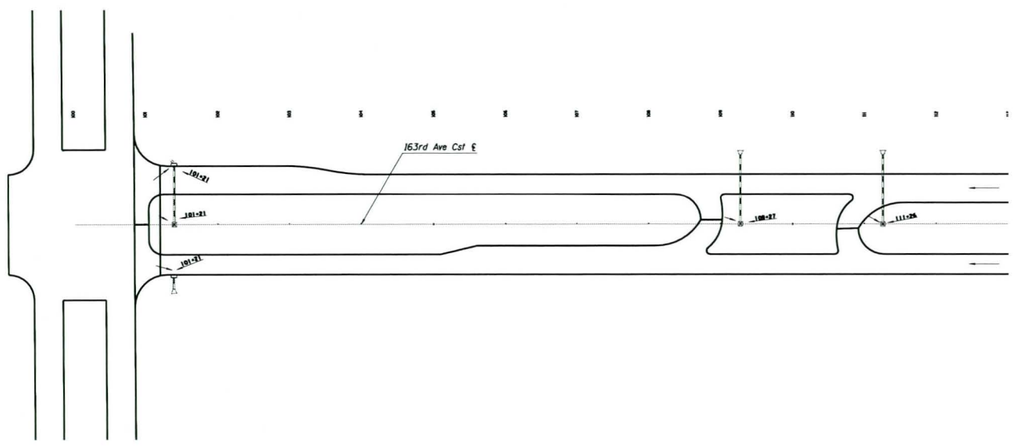
0503D
163rd Ave MEDIAN
10-Year

MEDIAN

163rd Ave., Jomax to Dove Valley DCR
Inlet Hydraulic Computation Sheet
MEDIAN

Inlet #	133	135	136	139	138	141	142	143	145	147	148	151	152	154	157
Station	204+38	211+22	214+33	233+26	234+09	239+64	245+94	247+90	257+43	265+30	267+23	279+08	280+59	288+80	325+60
Grate Elevation															
Offset from CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lt or Rt															
Upstream Inlet															
Direction of Flow	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v
HYDROLOGY															
Tc (min)	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
i (in/hr)	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96
Contributing Area															
Pavement (Acre)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Side Slopes (Acre)	0.3222	0.5371	1.7606	1.5127	0.9940	0.9782	0.3075	1.3793	1.3592	0.3072	1.4673	0.7773	1.3196	5.3865	0.8517
Total Area	0.322	0.537	1.761	1.513	0.994	0.978	0.308	1.379	1.359	0.307	1.467	0.777	1.320	5.387	0.852
Runoff Coefficient C															
Pavement	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Roadside	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Composite C	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Flows															
Known (cfs)															
Bypass (cfs)															
CIA (cfs)	0.89	1.49	4.88	4.19	2.76	2.71	0.85	3.82	3.77	0.85	4.07	2.15	3.66	14.93	2.36
Total Q (cfs)	0.89	1.49	4.88	4.19	2.76	2.71	0.85	3.82	3.77	0.85	4.07	2.15	3.66	14.93	2.36
HYDRAULICS															
Ditch															
Longitudinal Slope (ft/ft)	0.0027	0.0089	0.0047	0.0046	0.0043	0.0098	0.0098	0.0024	0.0034	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010
Z (H:1)	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Manning's n	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Bottom Width (ft)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Depth of Flow (in)	4.41	3.47	4.39	6.70	6.23	5.32	3.03	5.92	7.34	7.96	6.44	5.94	2.80	6.81	4.54
Velocity (fps)	0.83	1.28	1.09	1.42	1.32	1.79	1.38	0.94	1.29	0.75	0.65	0.61	0.37	0.67	0.51
Computed Q (cfs)	0.67	0.64	0.37	2.65	2.18	2.11	0.76	1.37	2.90	1.97	1.12	0.90	0.12	1.30	0.44
Standard	537	537	537	537	537	537	537	537	537	537	537	537	537	537	537
Grate															
Reduction Factor	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Grate Length (in)	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00
Grate Width (in)	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00
# of Long Bars	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Width of Long Bars (in)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Width of Side Bars (in)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
# of Transverse Bars	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Width of Trans. Bars (In)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Perimeter (ft)	9.67	9.67	9.67	9.67	9.67	9.67	9.67	9.67	9.67	9.67	9.67	9.67	9.67	9.67	9.67
Area (sq.ft)	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68
Clogged Perimeter (ft)	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83
Clogged Area (sq.ft.)	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34
Weir Depth (in)	1.87	2.63	5.81	5.25	3.97	3.92	1.81	4.93	4.89	1.81	5.14	3.37	4.79	12.24	3.58
Orifice Depth (in)	0.06	0.17	1.80	1.33	0.57	0.56	0.06	1.11	1.08	0.05	1.25	0.35	1.01	16.88	0.42
Controlling Depth (in)	1.87	2.63	5.81	5.25	3.97	3.92	1.81	4.93	4.89	1.81	5.14	3.37	4.79	16.88	3.58
Depth at Grate (in)	1.87	2.63	5.81	5.25	3.97	3.92	1.81	4.93	4.89	1.81	5.14	3.37	4.79	16.88	3.58

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.				



MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ON-SITE DRAINAGE AREAS
163RD AVENUE DCR
JOMAX ROAD TO DOVE VALLEY ROAD

DESIGNED	KCP	02/11
DRAWN	KCP	02/11
CHECKED	JDG	02/11

Andes Engineering

Sta 100+00 to Sta 113+00

SHEET 1 OF 17

TRACS NO. _____

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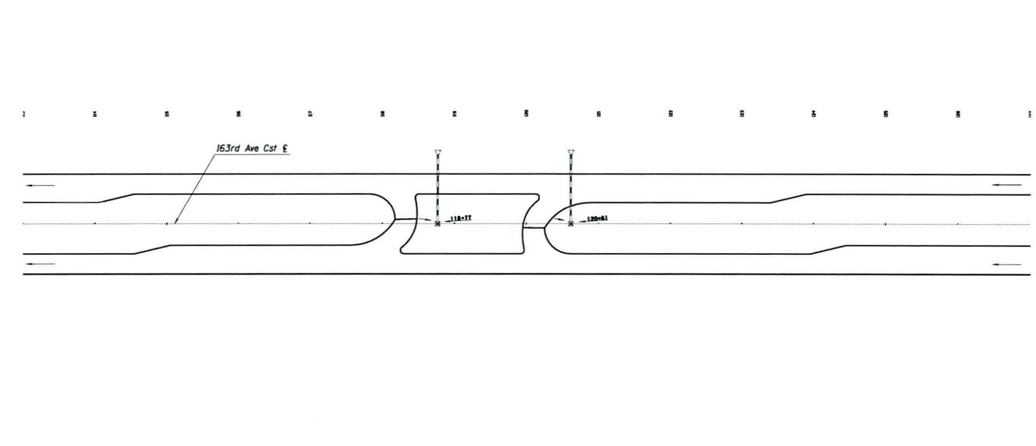
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.				



MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ON-SITE DRAINAGE AREAS
163RD AVENUE DCR
JOMAX ROAD TO DOVE VALLEY ROAD

DESIGNED	KCP	02/11
DRAWN	KCP	02/11
CHECKED	JDG	02/11

Andes Engineering

Sta 113+00 to Sta 127+00

SHEET 2 OF 17

TRACS NO. _____

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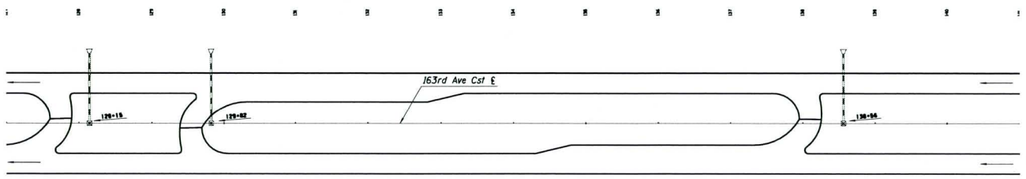
9	AZ.				



MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ON-SITE DRAINAGE AREAS
163RD AVENUE DCR
JOMAX ROAD TO DOVE VALLEY ROAD

DESIGNED	KCP	02/11
DRAWN	KCP	02/11
CHECKED	JDG	02/11

Andes Engineering

Sta 127+00 to Sta 141+00

SHEET 3 OF 17

TRACS NO. _____

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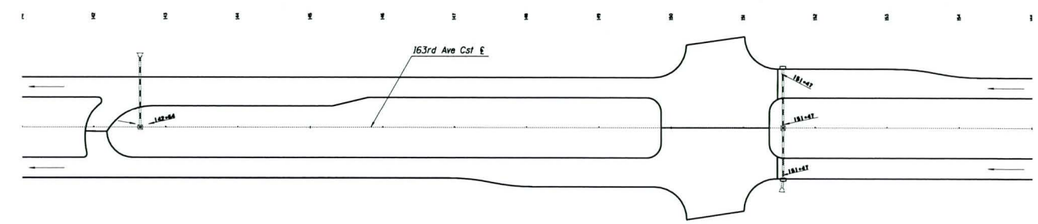
9	AZ.				



MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ON-SITE DRAINAGE AREAS
163RD AVENUE DCR
JOMAX ROAD TO DOVE VALLEY ROAD

DESIGNED	KCP	02/11
DRAWN	KCP	02/11
CHECKED	JDG	02/11

Andes Engineering

Sta 141+00 to Sta 155+00

SHEET 4 OF 17

TRACS NO. _____

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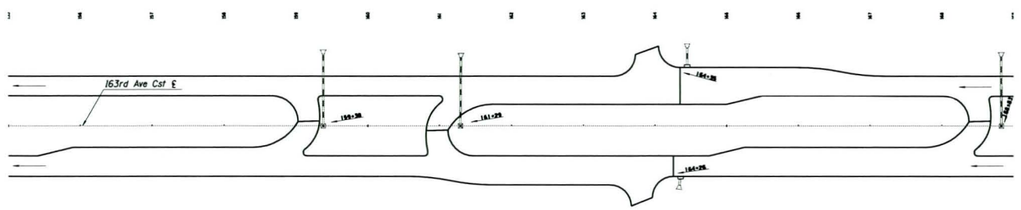
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.				



MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ON-SITE DRAINAGE AREAS
163RD AVENUE DCR
JOMAX ROAD TO DOVE VALLEY ROAD

DESIGNED	KCP	02/11
DRAWN	KCP	02/11
CHECKED	JOG	02/11

Andes Engineering

Sta 155+00 to Sta 169+00

SHEET 5 OF 17

TRACS NO. _____

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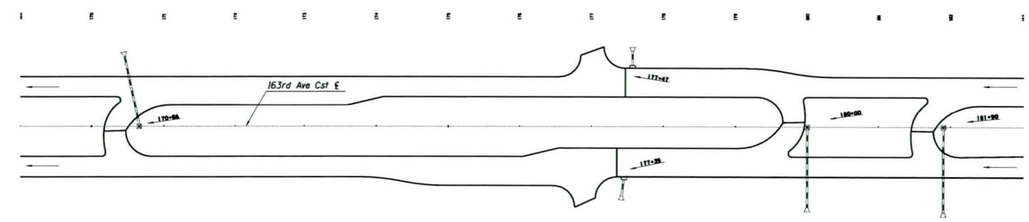
9	AZ.				



MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ON-SITE DRAINAGE AREAS
163RD AVENUE DCR
JOMAX ROAD TO DOVE VALLEY ROAD

DESIGNED	KCP	02/11
DRAWN	KCP	02/11
CHECKED	JOG	02/11

Andes Engineering

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SHEET 6 OF 17

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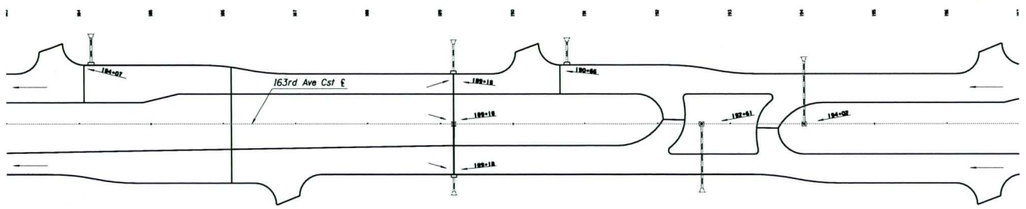

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ON-SITE DRAINAGE AREAS
163RD AVENUE DCR
JOMAX ROAD TO DOVE VALLEY ROAD

DESIGNED	KCP	02/11
DRAWN	KCP	02/11
CHECKED	JDG	02/11

Andes Engineering

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SHEET 7 OF 17

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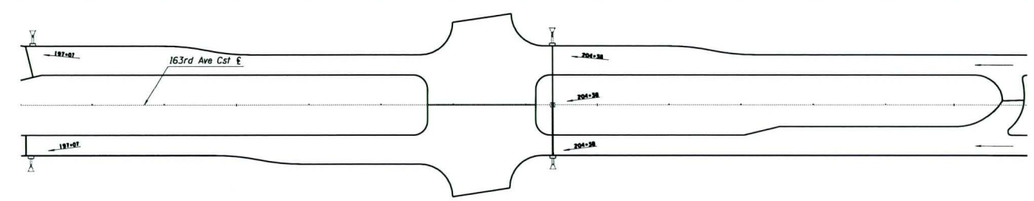

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ON-SITE DRAINAGE AREAS
163RD AVENUE DCR
JOMAX ROAD TO DOVE VALLEY ROAD

DESIGNED	KCP	02/11
DRAWN	KCP	02/11
CHECKED	JDG	02/11

Andes Engineering

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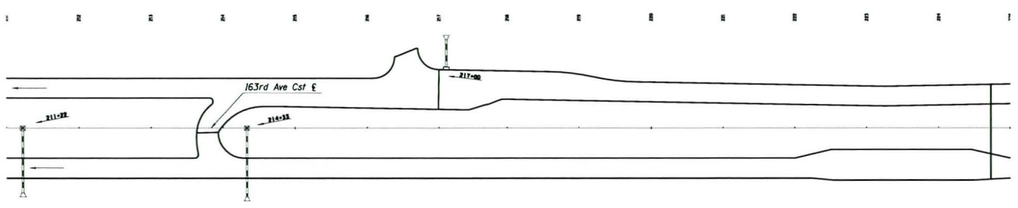

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ON-SITE DRAINAGE AREAS
163RD AVENUE DCR
JOMAX ROAD TO DOVE VALLEY ROAD

DESIGNED	KCP	02/11
DRAWN	KCP	02/11
CHECKED	JDG	02/11

Andes Engineering

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SHEET 9 OF 17

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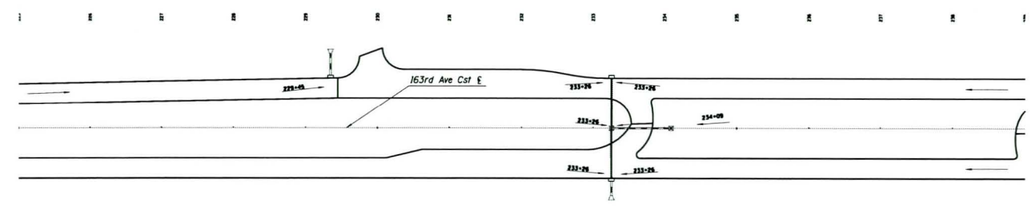

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ON-SITE DRAINAGE AREAS
163RD AVENUE DCR
JOMAX ROAD TO DOVE VALLEY ROAD

DESIGNED	KCP	02/11
DRAWN	KCP	02/11
CHECKED	JDG	02/11

Andes Engineering

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SHEET 10 OF 17

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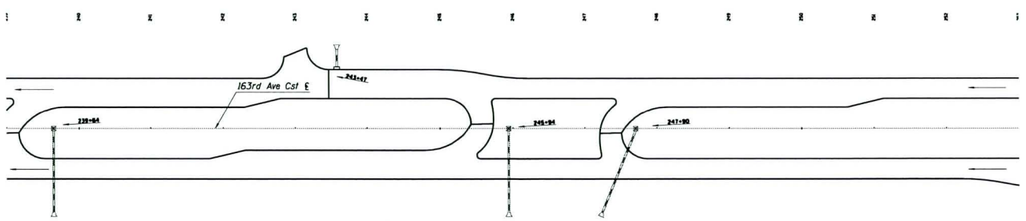

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ON-SITE DRAINAGE AREAS
163RD AVENUE DCR
JOMAX ROAD TO DOVE VALLEY ROAD

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DRAWN	KCP	02/11
CHECKED	JDC	02/11

Andes Engineering

Sta 239+00 to Sta 253+00

SHEET 11 OF 17

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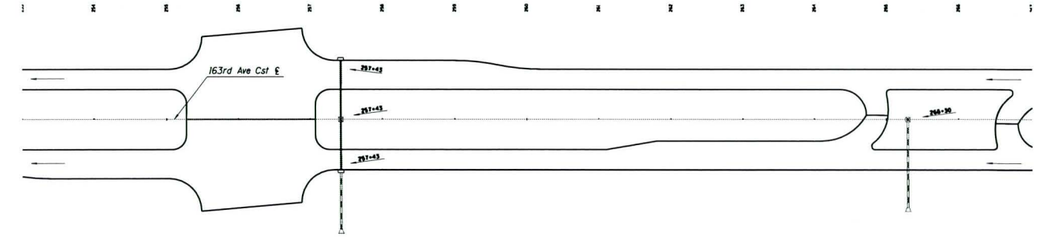

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ON-SITE DRAINAGE AREAS
163RD AVENUE DCR
JOMAX ROAD TO DOVE VALLEY ROAD

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CHECKED	JDC	02/11

Andes Engineering

Sta 253+00 to Sta 267+00

SHEET 12 OF 17

TRACS NO. _____

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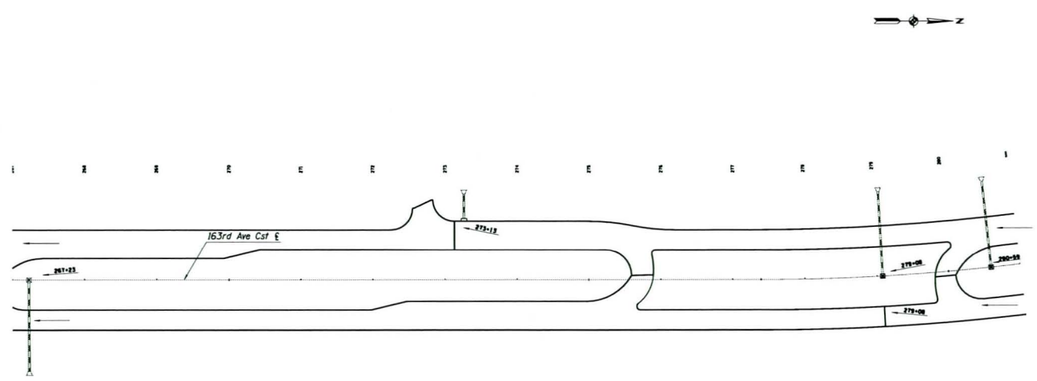

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ON-SITE DRAINAGE AREAS
163RD AVENUE DCR
JOMAX ROAD TO DOVE VALLEY ROAD

DESIGNED	KCP	02/11
DRAWN	KCP	02/11
CHECKED	JDG	02/11

Andes Engineering

Sta 267+00 to Sta 281+00

SHEET 13 OF 17

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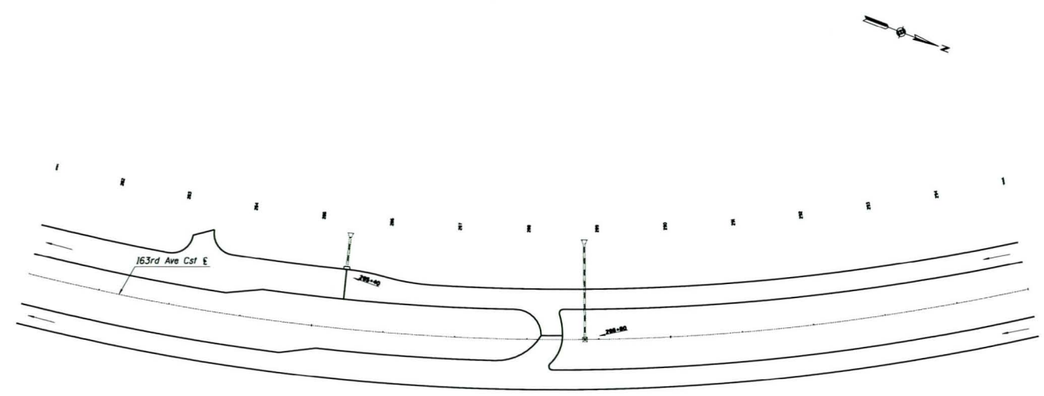

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ON-SITE DRAINAGE AREAS
163RD AVENUE DCR
JOMAX ROAD TO DOVE VALLEY ROAD

DESIGNED	KCP	02/11
DRAWN	KCP	02/11
CHECKED	JDG	02/11

Andes Engineering

Sta 281+00 to Sta 295+00

SHEET 14 OF 17

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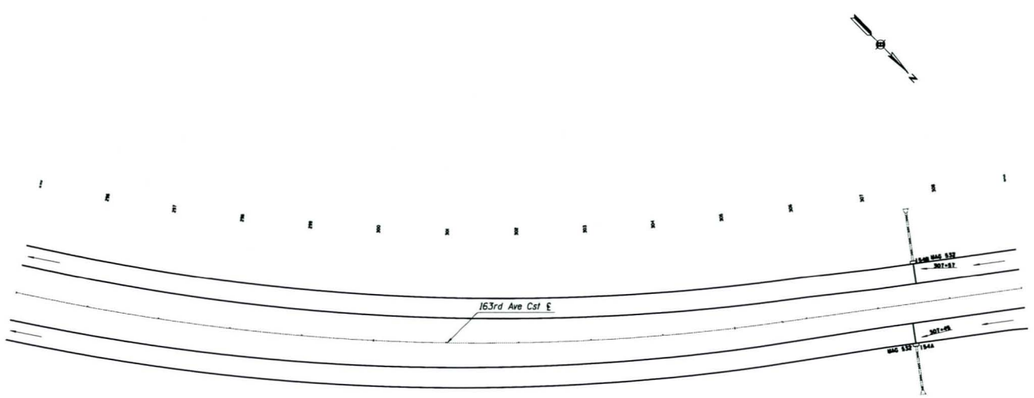

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ON-SITE DRAINAGE AREAS
163RD AVENUE DCR
JOMAX ROAD TO DOVE VALLEY ROAD

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CHECKED	JGC	02/11

Andes Engineering

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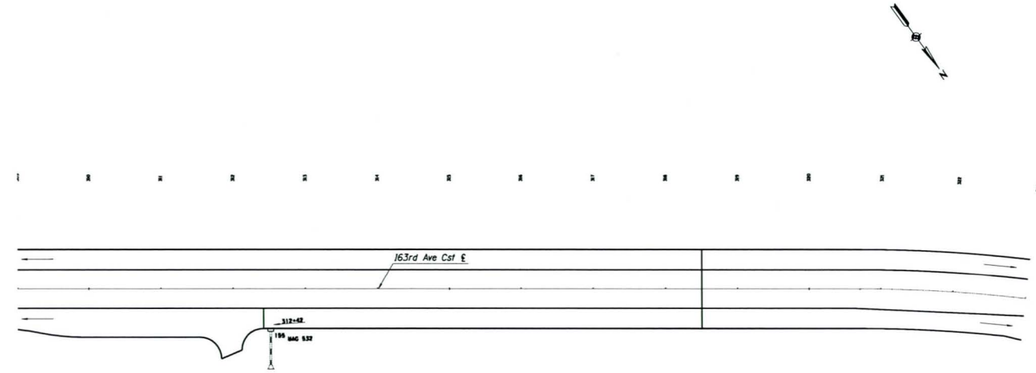

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ON-SITE DRAINAGE AREAS
163RD AVENUE DCR
JOMAX ROAD TO DOVE VALLEY ROAD

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Andes Engineering

Sta 309+00 to Sta 323+00

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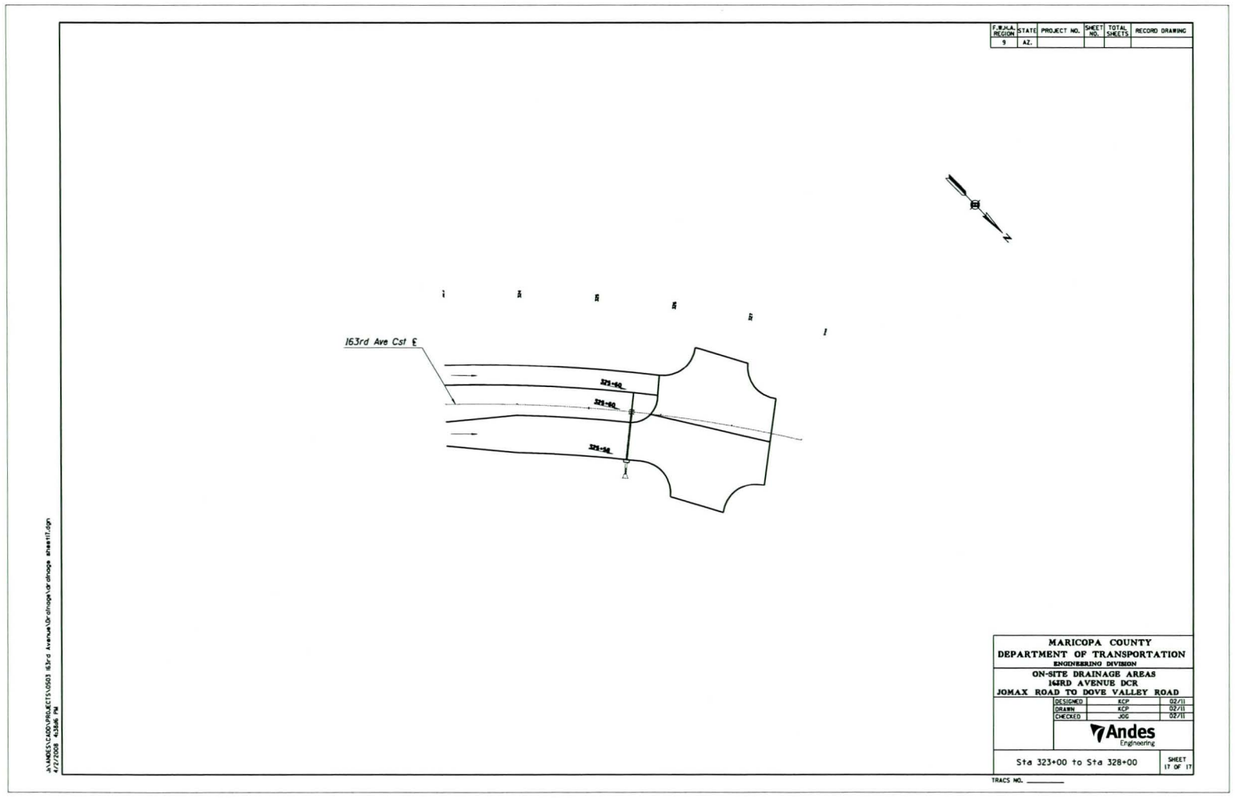


APPENDIX D

NATIONWIDE PERMIT REQUIREMENTS

Excerpt from "Text of 2002 Nationwide Permits"
United States Army Corps Of Engineers
January 15, 2002

14. Linear Transportation Projects. Activities required for the construction, expansion, modification, or improvement of linear transportation crossings (e.g., highways, railways, trails, airport runways, and taxiways) in waters of the US, including wetlands, if the activity meets the following criteria:

a. This NWP is subject to the following acreage limits:

(1) For linear transportation projects in non-tidal waters, provided the discharge does not cause the loss of greater than 1/2-acre of waters of the US; or

(2) For linear transportation projects in tidal waters, provided the discharge does not cause the loss of greater than 1/3-acre of waters of the US.

b. The permittee must notify the District Engineer in accordance with General Condition 13 if any of the following criteria are met:

(1) The discharge causes the loss of greater than 1/10-acre of waters of the US; or

(2) There is a discharge in a special aquatic site, including wetlands;

c. The notification must include a compensatory mitigation proposal to offset permanent losses of waters of the US to ensure that those losses result only in minimal adverse effects to the aquatic environment and a statement describing how temporary losses will be minimized to the maximum extent practicable;

d. For discharges in special aquatic sites, including wetlands, and stream riffle and pool complexes, the notification must include a delineation of the affected special aquatic sites;

e. The width of the fill is limited to the minimum necessary for the crossing;

f. This permit does not authorize stream channelization, and the authorized activities must not cause more than minimal changes to the hydraulic flow characteristics of the stream, increase flooding, or cause more than minimal degradation of water quality of any stream (see General Conditions 9 and 21);

g. This permit cannot be used to authorize non-linear features commonly associated with transportation projects, such as vehicle maintenance or storage buildings, parking lots, train stations, or aircraft hangars; and

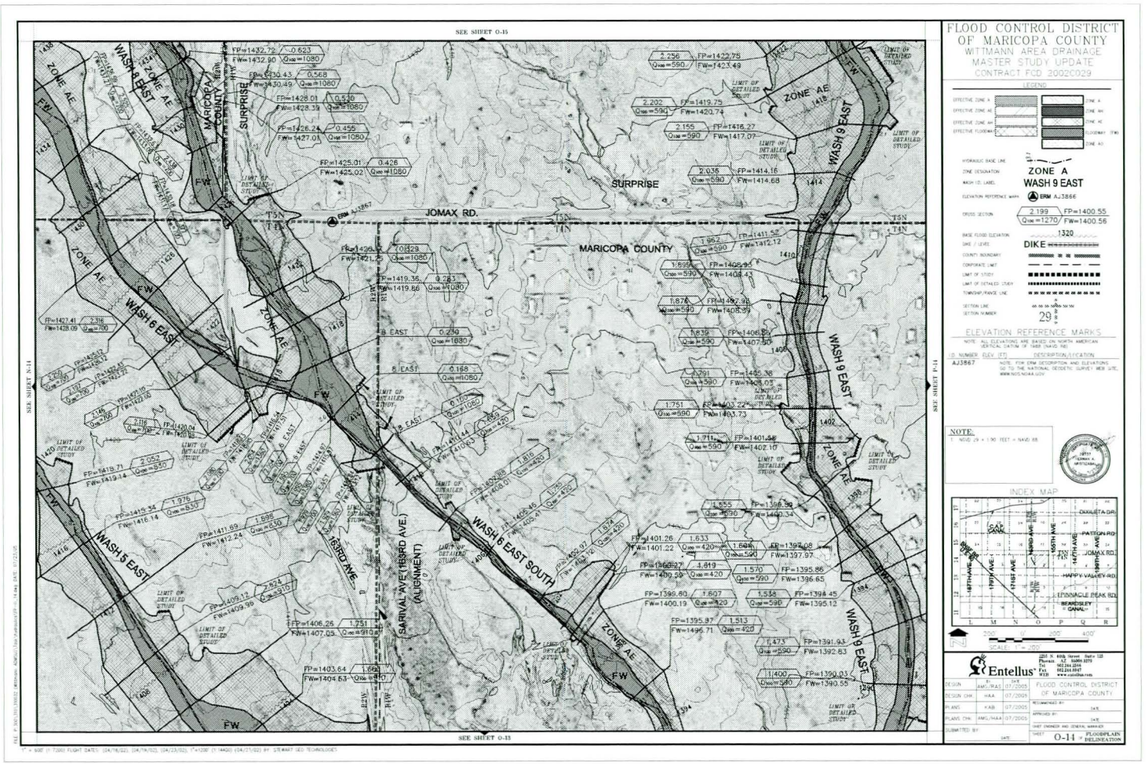
h. The crossing is a single and complete project for crossing waters of the US. Where a road segment (i.e., the shortest segment of a road with independent utility that is part of a larger project) has multiple crossings of streams (several single and complete projects) the Corps will consider whether it should use its discretionary authority to require an Individual Permit. (Sections 10 and 404)

Note: Some discharges for the construction of farm roads, forest roads, or temporary roads for moving mining equipment may be eligible for an exemption from the need for a Section 404 permit (see 33 CFR 323.4).

APPENDIX E

ORIGINAL FLOODPLAIN DATA

from
Wittmann ADMSU and Padelford Wash FDS

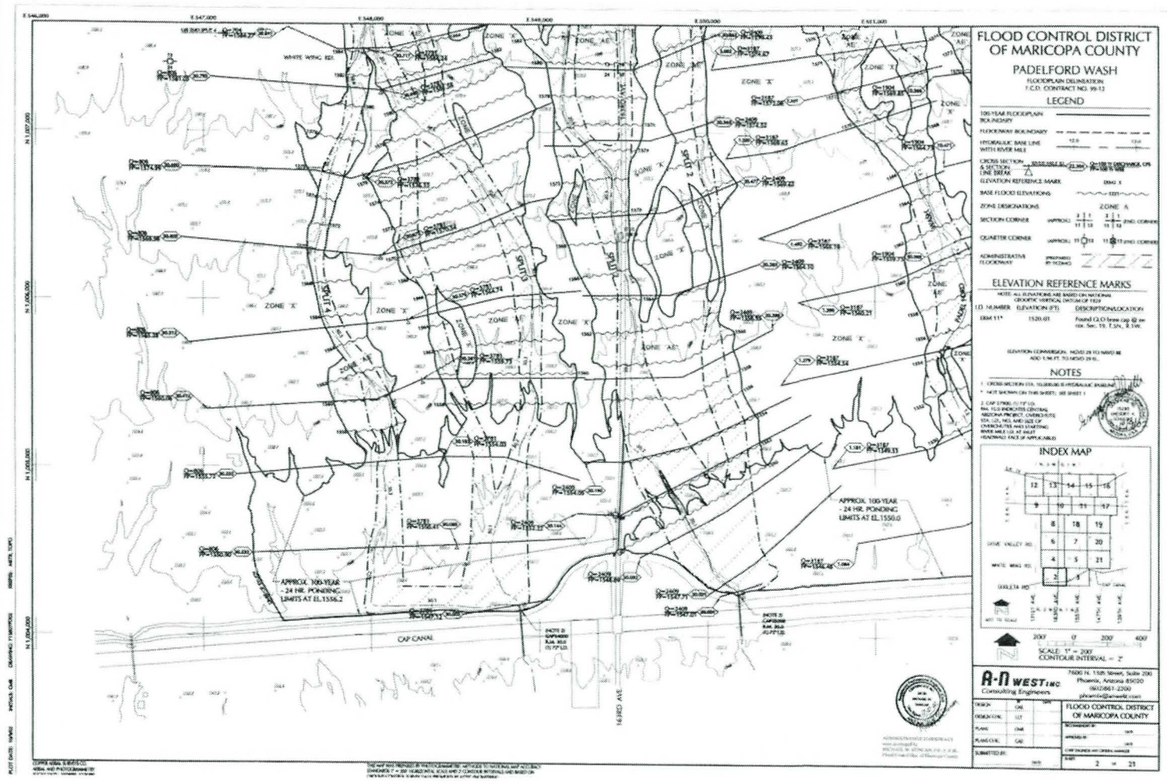

SEE SHEET O-15
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
WITTMANN AREA DRAINAGE
MASTER STUDY UPDATE
CONTRACT FCD 2002C029
LEGEND
ZONE A
WASH 9 EAST
DIKE
ELEVATION REFERENCE MARKS
NOTE:
INDEX MAP
Entellus
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
O-14 - FLOODPLAIN DELINEATION
JOMAX RD.
MARICOPA COUNTY
SURPRISE
WASH 9 EAST
WASH 6 EAST
WASH 5 EAST
WASH 8 EAST SOUTH
SARIVAL AVE (183RD AVE) (ALIGNMENT)
ZONE AE
FW
SEE SHEET O-13

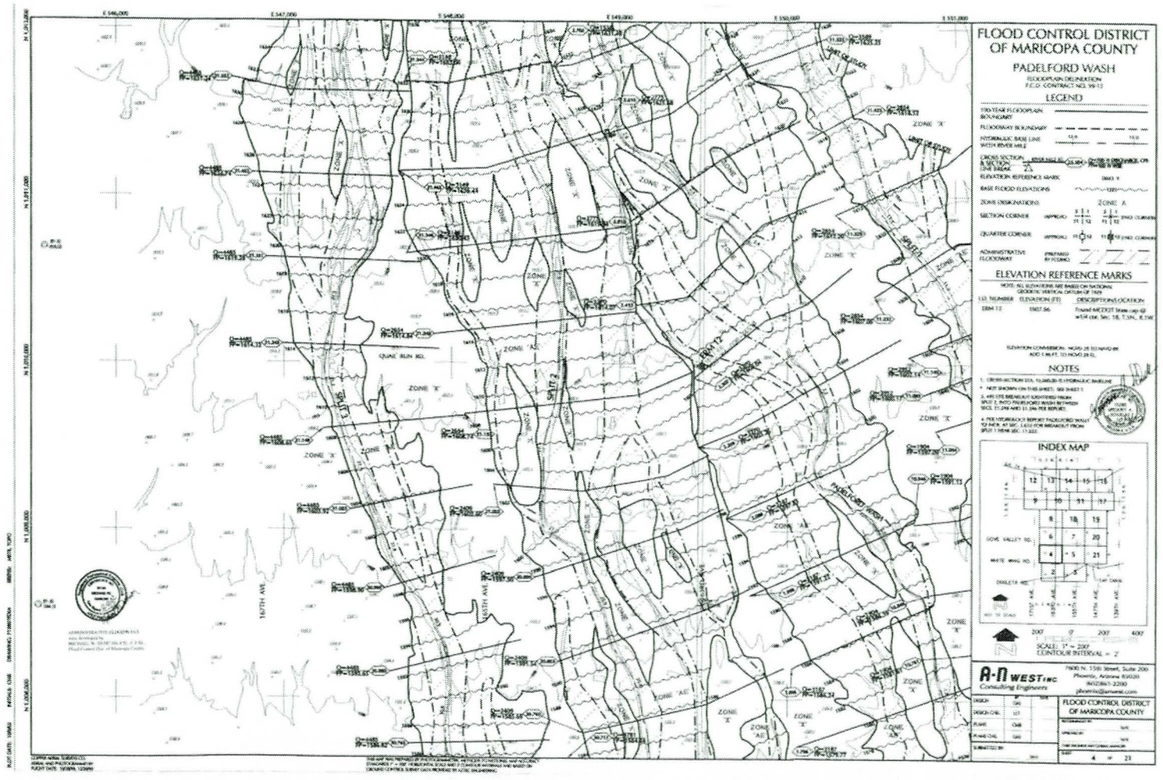
SEE SHEET O-17
ERM DV2059
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
WITTMANN AREA DRAINAGE
MASTER STUDY UPDATE
CONTRACT FCD 2002C029
LEGEND
ZONE A
WASH 9 EAST
DIKE
ELEVATION REFERENCE MARKS
NOTE:
INDEX MAP
Entellus
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
O-16 - FLOODPLAIN DELINEATION
ZONE AE
FW
WASH 9 EAST
WASH 10 EAST
WASH 11 EAST (PADE LORD WASH)
SARIVAL AVE (183RD AVE)
Dale Ln
SEE SHEET O-15

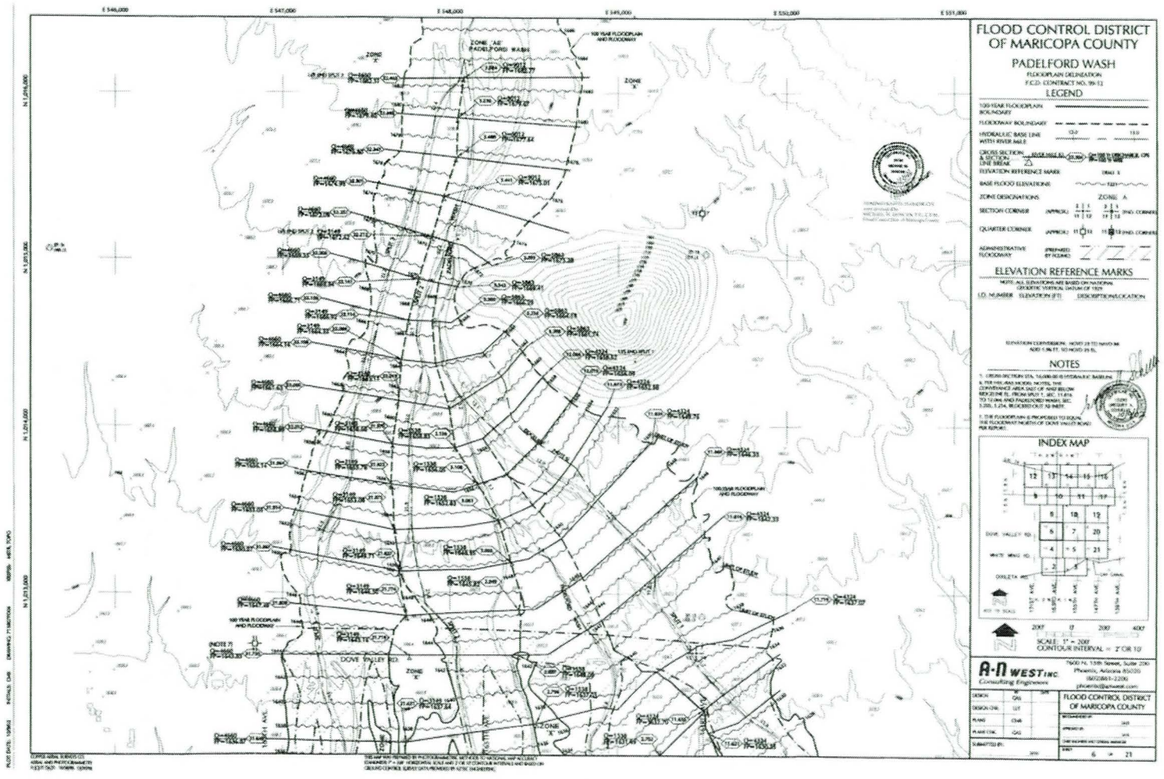
TABLE 2
SUMMARY OF DISCHARGES

Flooding Source and Location	Drainage Area (sq. Mile)	100-Year, 24-hour Peak Discharge (cfs)
Trib. 'A' to Padelford Wash at S.R.74	1.13	1163
Trib. 'B' to Padelford Wash at S.R.74	4.77	4522
Trib. 'A' at Confluence w/Trib. 'B'	6.35	5722
Trib. 'A' Upstream Padelford Wash Confluence	6.84	5775
Trib. 'C' to Padelford Wash at S.R.74	2.68	2135
Trib. 'C', 0.3 Mi. D/S S.R.74	5.28	4637
Trib. 'C', U/S Padelford Wash	5.63	4733
Padelford Wash, U/S End	1.46	1624
Padelford Wash, 0.5 Mi. from U/S End	2.10	2347
Padelford Wash, 0.9 Mi. from U/S End	3.92	3972
Padelford Wash, U/S of Trib. 'C' Confluence	5.09	5263
Padelford Wash, D/S of Trib. 'C' Confluence	10.72	9063
Padelford Wash, D/S of Trib. 'A' Confluence	17.56	13396
Padelford Wash, U/S of Split 3	18.67	13776
Padelford Wash, D/S Split 3	N/A	9012
Padelford Wash, D/S Split 2	N/A	5863
Padelford Wash, D/S Split 1	N/A	1538
Padelford Wash, R.M. 2.610, D/S Weir Flow from Split 1	N/A	2775
Padelford Wash, R.M. 2.412, D/S Weir Flow from Split 2	N/A	3270
Padelford Wash, at C.A.P. Canal	N/A	3187
Split 3 Wash, D/S of Split with Main Padelford Wash	N/A	4660
Split 3 Wash, D/S White Wing Road, U/S Split 4	N/A	4485
Split 3 Wash, D/S Split 4	N/A	3781
Split 2 Wash, D/S of Split with Main Padelford Wash	N/A	3149
Split 2 Wash, D/S Weir Flow to Main Padelford Wash	N/A	2654
Split 2 Wash at C.A.P. Canal	N/A	2409
Split 1 Wash, D/S of Split with Main Padelford Wash	N/A	4324
Split 1 Wash, U/S of Weir out to Main Padelford Wash	N/A	4270
Split 1 Wash, d/S of Weir out to Main Padelford Wash	N/A	2854
Split 1, U/S of Split 5	N/A	2952
Split 1, D/S of Split 5	N/A	1904
Split4, D/S of Split 3 at White Wing Road	N/A	704
Split 5, D/S of Split 1	N/A	1048

Notes: The drainage area is shown as Non-Applicable (N/A) Downstream of the first Split Flow condition.




FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
PADELFORD WASH
FLOODPLAIN DELINEATION
F.C.D. CONTRACT NO. 99-11
LEGEND
ELEVATION REFERENCE MARKS
NOTES
INDEX MAP
SCALE: 1" = 200'
CONTOUR INTERVAL = 2'
A·N WEST INC.
Consulting Engineers
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
4 of 21


FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
PADELFORD WASH
FLOODPLAIN DELINEATION
F.C.D. CONTRACT NO. 99-11
LEGEND
ELEVATION REFERENCE MARKS
NOTES
INDEX MAP
SCALE: 1" = 200'
CONTOUR INTERVAL = 2' OR 10'
A·N WEST INC.
Consulting Engineers
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
6 of 21

Appendix I

Public Involvement Report

Appendix I
Public Involvement Report

MCDOT *RightRoads* Program

The Right System The Right Time The Right Cost

Summary of Public Involvement

April 2008

163rd Avenue

Corridor Improvement Study: Jomax Road to SR 74
Design Concept Report: Jomax Road to Dove Valley Road

Maricopa County Department of Transportation

163rd Avenue
Corridor Improvement Study: Jomax Road to SR 74
Design Concept Report: Jomax Road to Dove Valley Road
TT005

Final Report

Purpose of Public Involvement
This study evaluated planned corridor development and the resulting projected 2026 traffic volumes along the 163rd Avenue corridor to develop the most cost-effective improvement plans that include a recommendation for establishing the future roadway type, alignment, access management strategies, future drainage structures, network connectivity and prioritized construction phasing plans.

Gaining consensus among the agencies and the public is critical to the success of this transportation study as well as the future implementation of its recommendations to provide an efficient roadway for the long term.

Maricopa County Department of Transportation (MCDOT), the City of Surprise, the City of Peoria, the Flood Control District of Maricopa County (FCDMC), the Arizona Department of Transportation (ADOT), Arizona State Land Department, Maricopa Association of Governments (MAG), area property owners and residents, developers, the public and impacted railroad and utility companies are all major stakeholders in this study.

The participation of stakeholder public and multi-agency involvement aids in the development of a consistent roadway and the resolution of conflicting agency requirements; facilitates ultimate regional traffic flow; and preserves the interests and rights of area residents and adjacent development.

STUDY INFORMATION & BACKGROUND

The 163rd Avenue corridor serves northwestern Maricopa County through the cities of Surprise and Peoria. Existing land use south of Dove Valley Road is single family residential on large lots. Between Dove Valley Road and SR 74,

the land is primarily undeveloped. Currently, 163rd Avenue between Jomax Road and Dove Valley Road is a two-lane paved roadway that is intersected by unimproved cross-streets that serve local residential development. North of Dove Valley Road, the roadway is an unimproved dirt road built largely to provide access for waterline construction to development north of SR 74.

In 1997, Maricopa County Department of Transportation (MCDOT) completed a Comprehensive Plan and Transportation System Plan (TSP) for the unincorporated areas of the County. The TSP included recommendations to improve the existing County arterial road network to meet future transportation demands resulting from projected growth and development county-wide. MCDOT's TSP recommendations were considered in the development of the 2004 Maricopa Association of Governments (MAG) Regional Transportation Plan (RTP). 163rd Avenue is classified as a future Principal Arterial by MCDOT, a future Parkway by Surprise and as an Arterial Roadway by Peoria (all six-lane divided roadways).

The MAG RTP further established a need to identify and designate the future 163rd Avenue alignment for the entire corridor connecting Grand Avenue (US 60) and SR 74, traversing all three jurisdictions.

In September 2006, MCDOT, the City of Surprise and the City of Peoria initiated the 163rd Avenue Corridor Improvement Study (CIS) between Jomax Road and SR 74 to address the rapid growth being experienced along this corridor in northwestern Maricopa County. Study findings and recommendations were presented during a public meeting held in July 2007. As the final phase of this study, MCDOT, in coordination with Surprise, conducted a more detailed Design Concept Report (DCR) for the four-mile segment between Jomax Road and Dove Valley Road beyond private development improvements. The DCR has developed 30% design plans for the preferred roadway alignment recommended in the CIS phase specifically to help the City of Surprise guide traffic control, access-related issues and right-of-way requirements for new development. (Roadway construction funded by private development is currently already underway on the southern two-mile segment of 163rd Avenue between Grand Avenue and Jomax Road.)

STUDY PURPOSE & GOAL

The purpose of this study is to develop a consensus-driven vision among partner jurisdictions for 163rd Avenue between Jomax Road and SR 74. The study will establish the facility type, number of lanes, right-of-way needs, and general alignment for Jomax Road that will eventually be required to accommodate projected traffic growth and enhance safety. In cooperation with the City of Peoria and the City of Surprise, the two municipalities within the study area, the study will also develop

access management guidelines (intersection spacing, median breaks and locations) and a plan for the implementation of those guidelines.

In general, this study will provide MCDOT and other jurisdictions with a future "footprint" of 163rd Avenue and a recommended timeframe for the implementation (construction) and phasing of the identified roadway improvements.

Study Need

- Respond to regional growth / local development
- Implementation of regional transportation plans

Study Goals

- Create a "footprint" for 163rd Avenue and develop an implementation plan
- Establish principles, policies and guidelines for corridor improvements
- Develop agreed-upon roadway plans and recommendations

Study Objectives

- Define the role of 163rd Avenue as a critical north/south roadway
- Identify current corridor deficiencies
- Define long-term corridor needs and requirements
- Develop / evaluate alternatives
- Establish future roadway design criteria
- Develop access management guidelines (intersection spacing/median breaks and locations)
- Establish roadway operation and performance criteria
- Complete 30% design plans for 163rd Avenue between Jomax Road and Dove Valley Road (DCR)
- Coordinate with other current ongoing area studies to ensure an integrated roadway network system

Key Issues and Challenges

- Incorporate regional and local travel
- Achieve optimum mobility/access balance for operational efficiency
- Address current and future development
- Incorporate jurisdictional interests
- Address engineering challenges
- Consider roadway environment

Stakeholders

- Maricopa County Department of Transportation
- Flood Control District of Maricopa County
- City of Surprise
- City of Peoria
- Arizona State Land Department

- Arizona Department of Transportation
- Impacted Utilities
- Area Developers
- Affected Business, Property Owners and Residents

Study Milestones

Corridor Improvement Study (CIS)

Field Review	September 2006
Scoping and Data Collection Phase Public Input Meeting	November 2006
Alternatives Analysis Phase Public Input Meeting	February 2007
Planning/Engineering	April 2007
Design Features	May 2007
Findings & Recommendations Phase Public Input Meeting	July 2007

Design Concept Report (DCR)

Planning/Engineering	September 2007
Design Features	October 2007
Draft Report Submittal CIS & DCR	December 2007
DCR Public Input Meeting	December 2007
Final Report Submittal CIS & DCR	April 2008

STUDY APPROACH

The 163rd Avenue CIS was carried out in two phases: a Planning Phase and an Engineering Phase.

The CIS Planning Phase:
The Planning Phase gathers general background information and prepares several reports (traffic analysis, drainage, utilities, environmental) leading to well-founded recommendations for improvements and longer-term needs along 163rd Avenue. During the Planning Phase, meetings are conducted with affected jurisdictions, agencies, stakeholders and the impacted public to form a broad consensus of the overall needs and vision of the corridor.

Based on the needs identified, alternatives are developed and evaluated for technical and environmental feasibility, public acceptability and economic viability.

CIS Engineering Phase:
The Engineering Phase of the study followed the selection of a preferred alternative. Preliminary engineering design plans, right-of-way requirements and estimated construction costs were prepared for near-term and long-term roadway improvements. Roadway construction phasing priorities, along with policies and guidelines to preserve the intended function of the future roadway, were also developed.

With the selection of the preferred roadway alignment, the more detailed DCR phase of the study proceeded to evaluate 163rd Avenue between Jomax Road and Dove Valley Road. The report developed 30% design plans that specify roadway type, alignment and access points. The DCR also defines crossing drainage ways (bridges or culverts) and generated a more detailed cost estimate to allow accurate budgeting for construction.

CIS/DCR RECOMMENDATIONS AND CONCLUSIONS

CIS Draft Findings & Recommendations
163rd Avenue: Jomax Road – SR 74

In both Peoria and Surprise General Plans, 163rd Avenue is designated as a future six-lane divided "Parkway" with provision for right and left turns at major intersections. The Peoria parkway right-of-way width requirement is 150-feet. Peoria uses standard intersections with all turn lanes concentrated at the intersection and managed by traffic signal.

The required Surprise parkway right-of-way width is 200-feet, 50-feet greater than City of Peoria's parkway right-of-way width requirement. The additional

roadway right-of-way width (50') requirement within the City of Surprise jurisdiction is necessary to accommodate the "indirect left turn" traffic control measure currently under evaluation for implementation on portions of the 163rd Avenue corridor within Surprise. Under this access plan, left-turn movement is eliminated at the intersection. Instead, motorists make a U-turn at a point beyond the intersection then return to the intersection from the opposite direction and turn right in the desired direction.

Selection of the "Preferred Alignment"
The 163rd Avenue corridor alignment alternatives cover a broad area bounded by 175th Avenue alignment on the west side of the corridor and 163rd Avenue alignment on the east side of the corridor. The primary basis for the selection of a preferred roadway alignment is to identify an efficient "path" through the area that has the least possible impact on existing development and homes, drainage paths, utilities and environmentally sensitive areas. The preferred alignment must also be economically feasible (affordable to build).

Each of the advanced alignment alternatives sought to balance corridor attributes and impacts (positive or negative). Through additional analysis of the advanced alternatives, the preferred alignment alternative emerged as the option that minimized, mitigated or avoided negative impacts.

The preferred alternative follows the general alignment of 163rd Avenue between Jomax Road and Quail Run, then moves westerly to the 167th Avenue alignment between Quail Run and Dove Valley Road. This preferred alternative minimizes negative impacts to private properties and the need for expensive bridge structures at major drainage crossings.

Within the City of Surprise, between Jomax Road and Dove Valley Road, the roadway should consist of six travel lanes (three lanes each direction) in a 200-foot right-of-way corridor (to accommodate indirect left-turn traffic control measure). Roadway widening will occur east of the existing western right-of-way line to avoid potential acquisition of improved properties. This alignment also avoids environmentally sensitive areas near the CAP canal.

North of Dove Valley Road to SR 74, within the City of Peoria, the future roadway should also consist of six travel lanes (three lanes each direction) in a 150-foot right-of-way corridor. Currently, there is no development in this reach and the primary concern is the most efficient traversing of major drainage courses such as the Padelford Wash. The preferred alignment along 167th Avenue at this point also aligns with the entrance to the Quintero development, a future grade separated traffic interchange at SR 74 under ADOT's plan.

Access Management Guidelines
In general, a variety of techniques will be used to manage roadway access. In Surprise, intersection treatments will incorporate the "indirect left-turn" concept. In Peoria, signalized intersections with traditional left-turn lanes will be implemented. In some cases, a frontage road system may be appropriate to augment local access. Throughout the corridor, left turns may be restricted to maintain roadway efficiency and enhance traffic safety.

Design Concept Report (DCR) Preferred Alternative
163rd Avenue: Jomax Road to Dove Valley Road

The 163rd Avenue DCR evaluated the segment between Jomax Road and Dove Valley Road and developed 30% design plans that specify roadway type, alignment, access points and crossing drainage ways (bridges/culverts). The DCR has also identified new right-of-way needs and generated a more detailed cost estimate to allow accurate budgeting for construction.
Several alternatives within the preferred alignment corridor (established through the CIS process) were developed between Jomax Road and Dove Valley Road. Each alternative consisted of a six-lane divided "parkway" with provision for right and left turns at major intersections. The alternatives differed according to alignment, median width and intersection treatment. Three study alternatives were selected for more detailed investigation:

Alternative 1 - Indirect Left-Turn:
This alternative utilizes the City of Surprise 200-foot, six-lane Parkway typical roadway cross section (Indirect Lefts) with a 60 foot median width. The roadway alignment follows the existing 163rd Avenue roadway for the majority of the project limits. At the northern limit, the alignment is shifted to 167th Avenue.

Alternative 2- Indirect Left-Turn on Dixileta Drive:
This alternative also utilizes the City of Surprise 200-foot, six-lane Parkway typical roadway cross section (Indirect Lefts) with a 60 foot median width. However, a narrower median width is used at Dixileta Drive. To compensate for the narrower median, indirect left crossovers are used on Dixileta Drive to provide for left-turning traffic on 163rd Avenue.

The roadway alignment follows the existing 163rd Avenue roadway except at Dixileta Drive where the alignment shifts approximately 29-feet to the west. At the northern limit the alignment shifts to 167th Avenue. The median width is 10-feet at the intersection and then flares to 60-feet through the remaining project limit.

Alternative 3- Standard Left-Turn:
This alternative utilizes a conventional signalized intersection configuration with a 30-feet median for the project limit. The roadway alignment follows the existing 163rd Avenue roadway for the majority of the project limits. At the northern limit the alignment is shifted to 167th Avenue.

Evaluation of DCR Alternatives

The benefits and disadvantages of each alternative were evaluated among the project partners. Considerations included safety, private property impacts, drainage issues, operational characteristics, roadway corridor consistency, public input and project costs.

All of the alternatives impacted at least two private residences. Alternative 2 complicated the Indirect Left-Turn concept by placing the u-turn crossovers on Dixileta Drive. This alternative also has greater impacts to drainage ways. Alternative 3 did not support the City of Surprise's vision for a "Parkway" classification. It also did not achieve the same higher projected safety benefits as Alternative 1.

The 163rd Avenue DCR recommends Alternative 1 "Indirect Left-Turn" as the preferred option. Alternative 1 is consistent with the vision of the City of Surprise for future parkways, which utilizes the Indirect Left-Turn concept. Alternative 1 consists of a six-lane roadway with three lanes in each direction divided by a 60-feet median. The right-of-way width is 200-feet. Proposed improvements to 163rd Ave between Jomax Road and Dove Valley Road include the installation of drainage culverts to provide an all-weather roadway, multi-use paths for pedestrian, bicycle and equestrian traffic, and access management strategies (median breaks, intersection spacing and locations) to enhance safety and improve traffic flow.

RECOMMENDED FUTURE IMPLEMENTATION & ROADWAY CONSTRUCTION SCHEDULE

(Based on Project Need- Forecasted traffic volumes, area growth and development)

163rd Avenue: Jomax Road to Dove Valley Road

- *Interim Four-Lane Divided Roadway with Indirect Left Turn Intersection Treatment*

Final Design	Year 2017
Construction	Year 2018 to 2020

Construction of segments of this roadway may be advanced by the City of Surprise and/or adjacent developers. It is recommended that the traffic analysis for this area be reevaluated upon approval and adoption of traffic impact studies of adjacent developments.

- *Ultimate Six-Lane Parkway with Indirect Left Turn Intersection Treatment*

Final Design & Construction	"Build Out"

Build-Out Year is beyond 2030 and dependent on local development.

163rd Avenue: Dove Valley Road to SR 74

- Interim Four-Lane Divided Roadway
- Ultimate Six-Lane Parkway with Conventional Intersection Treatment

The City of Peoria has no current plans to advance this segment of 163rd Avenue. The need for additional study and design work will be evaluated on an annual basis as part of the City's Capital Improvement Program.

PROJECT FUNDING

Funding for final design and construction of 163rd Avenue between Jomax Road and Dove Valley Road has not yet been identified. The DCR recommendations will be evaluated for inclusion in the MCDOT Transportation Improvement Program and the City of Surprise Capital Improvement Program. A portion of the funding is expected to come from adjacent developments as part of project requirements.

PUBLIC INVOLVEMENT

Through the course of this study's process, MCDOT *RightRoads* Program conducted a total of four open house public input meetings. Three public meetings were conducted during the corridor study phase to discuss and gather public comment on future corridor improvements and access control measures for 163rd Avenue between Jomax Road and SR 74 followed by a final public meeting to present the recommended conceptual design alternative for the southernmost segment of the study area (163rd Avenue between Jomax Road and Dove Valley Road).

Participants: Renee Probst, MCDOT Planning
Roberta Crowe, MCDOT Planning
Tim Oliver, MCDOT Planning,
Mike Pavlina, MCDOT Planning
Hedy Hall, Lands and Real Estate Division
Steve Hogan, Parsons Brinckerhoff
Jennifer Love, Parsons Brinckerhoff
Joy Melita, Parsons Brinckerhoff

The first "Public Scoping" meeting, held November 2006, provided the public with an opportunity to inform the project team about the study area and local transportation needs. The second meeting, held March 2007, presented corridor alignment alternatives for public review and comment. The third "Findings & Recommendations" (Preferred Alignment) public meeting, held July 2007, presented the CIS findings and a recommended roadway and corridor selection along with generalized access management strategies for public review. The fourth and final public meeting summarized the preferred alternative of the DCR conducted for 163rd Avenue between Jomax Road and Dove Valley Road and presented proposed roadway improvements.

All public meetings were conducted in an "open house" format which provided a free, open and accurate exchange of information between area residents with specific issues and questions and the project team.

Outreach Methods

The following outreach methods were used to inform and notify the general public and impacted residents about the study, public input meeting dates and locations and additional opportunities or means for input:

- Media releases
- Newspaper articles
- Display advertisements in local and regional publications
  - Arizona Republic
  - Daily News Sun
  - Surprise Independent
  - Peoria Independent
  - Peoria Times
  - The Wester
  - Surprise Today
  - Northwest Valley News
- MCDOT website
- Partner agency mediums
- Direct mail flyers to adjacent property owners and previous meeting attendees

Public Comment

Over 240 people attended four public input meetings conducted through the course of this study. Graphics, aerials and display exhibits presented corridor alternatives and study information. Study Fact Sheets and Comment Sheets were distributed to all those in attendance. A computerized simulation showing the "Indirect Left-Turn" intersection concept and operation was presented at the final DCR public meeting. The following information is representative of discussions that the project team had with meeting attendees and written comments received by MCDOT. Please refer to "Exhibit C" as reference for public comments.

Scoping Phase Public Meeting
Meeting Purpose: Gather public comment regarding the study area, existing conditions, current corridor deficiencies, future transportation needs and public review of overall Study Goals and Objectives

5:00 – 7:00 p.m., November 2, 2006
Hampton Inn, 14783 W. Grand Avenue, Surprise, AZ 85374
Attendance: 55

Written public comments

- Don't like routes 3 and 6
- Any info on Patton Rd. please advise
- Since my property includes ¾ of 163rd how are you going to compensate owners that are required to have 2 ½ acres to meet the subdivision requirements?
- Based on alignments on the map, the road cuts into our property dangerously close to home.
- Line #1 seems to be best. Hope it will be highly considered.
- Line #1 is best.
- Overall I appreciate the presentation. Thank you for including me.

Alternatives Analysis Phase Public Meeting
Meeting Purpose: Gather public comment regarding preliminary study findings, traffic analysis and corridor alignment alternatives and future roadway options.

5:00 – 7:00 p.m., March 6, 2007
Hampton Inn, 14783 W. Grand Avenue, Surprise, AZ 85374
Attendance: 85

Written public comments:

- It would impact me severely to have the Alternatives of 3B or 4C developed – it would necessitate selling my property!! VERY BAD FOR ME and all my neighbors feel the same!!!! 163rd Ave. to Alt. 2D out to 167th Avenue extending out to SR74 or any of the alternatives south; (1A or 7C) would be acceptable.
- Between 163rd and Grand and Lake Pleasant Blvd, we prefer Highway 7C. It's less developed and seems most ideal.
- Between Jomax and Dove Valley Rd. I would like to use 171st Ave.
- If north of the CAP should 171st Ave. be chosen would the alignment be moved to the State Trust Land rather than impact private residences and a commercial enterprise.
- Section 1 – I really like 7C. It impacts the least amount of homes. The most offensive in Sec. 1 is 3B, 4C and 2D. After Dove Valley Rd., it doest not seem to matter much as far as homes being affected. It does look like 1A off 7C would be great.
- 1. I prefer Alternative 7c from Jomax to approximately Dove Valley and Alt. 1A from approximately Dove Valley to SR 74. This arrangement would impact few homes and give less impact to the neighborhood overall. Also, with this, 163rd would need a dead end type of collector (much like it functions now) for the area north and south of the CAP canal. 2. If alternative 7C truly has a fatal flaw, then my second choice would be: Alt. 2D – from Jomax to about 1 mile south of SR 74 AND Alt. 4C – from 1 mile south of SR74 to SR74.
- The 3B proposal on 163rd Avenue is the preferred plan. The other plan requires some property loss and relocation of fencing.
- 9 years ago this coming May we moved out here to get away from all the hustle and bustle of city living. We love the peace & quiet that we have. All the 8 families on our little slice of heaven have an acre and ¼, so we don't have the congestion and crowding that we had in the city. As to your suggested routes for 163rd Ave. or alternate routes: 3B & 4C would only add to congestion & noise level for our area. Say no, please. 2D only if deemed necessary. My choice would be 7C which would still give us somewhat a sense of country life.
- Please consider your final choices with us in thought. Most of us in my area are retired seniors and we had planned on being here permanently. Thank you.
- Would like to know why you would need 60 feet median with 6 lanes & sidewalk and bike path. I have been driving around Surprise and in no other location with 6 lanes of traffic do I find a 60 ft. median – 6 lanes is fine – 10 feet median would suffice.
- The six lane parkway on 163rd Ave: I would like to see a route that would affect the least amount of people. Wondered if a route going a little bit east of the original 163rd Ave. was considered, especially north of the CAP canal. I really don't like route #3B out of the plans. This

goes almost through my backyard when it curves off 163rd and White Wing. I am a 48 year old, chronically ill and facing disability very soon. I can not afford to move and buy another house. I will not have a home if I have to move. I could not afford another home. Most people that like out on 163rd wanted to have a little bit of rural in their lives. The inconvenience of a few roadways was their trade-off for that little bit of rural. With your plan it shows that there are plans of housing developments east of 163rd and north of the CAP canal. You show that White Wing or Lone Mountain as a 6-lane road. Why not consider making the 6 lane roads running east and west near the CAP canal, and on or north of Dove Valley. This is not far off, or distance-wise from your plans. Utilizing the land near the CAP canal since I don't think homes will be built next to it. It would be neat to have some rural homes still intact. This will not affect too many homes. There will still be a little bit of rural looking area in the city. The 6 lane east and west if not far off from the plan. The residential areas going in really don't have to sacrifice much, as far as distance to roadways. Really would like to see White Wing/Lone Mountain as a 4 lane road instead of 6 lanes. Making it 6 lanes you would be taking a lot of homes then if made 4 lanes. Also would like to see that route 3B NOT be used on 163rd Ave.

Comments/questions received by Project Team during discussions with meeting attendees:

- Most comments and questions focused on the increasing need for improvements to address growth and development, improve accessibility and public safety. The importance of minimizing or avoiding negative impacts to existing development was also stressed by most meeting attendees along with the desire for information regarding a construction timetable.
- Interest in the floodplains and the voluntary buy-out program.
- Many liked the alternatives along 171st Ave which were identified as having fatal flaws by City of surprise
- Burros. Wild burros are roaming the area according to a few people. How are these animals handled from environmental and construction perspectives?
- 163rd Ave, south of Jomax (outside project limits). The old road is being used where the new road curves away from the existing alignment. A few people mentioned the old road should be blocked off with a physical barrier.
- Maintenance of 163rd Ave and Jomax Rd. The roads have many potholes according to the local residents and need attention.
- Right-of-way. Some residents along 163rd Ave mentioned that they own the property the existing roadway is on. If an alignment is

selected that leaves the existing alignment, how will the row need be handled for the existing road?

- Timeline. When will construction start and we need to move?!?
- General expression of not wanting growth and development.
- How are these potential alignments going to impact my property?
- How will the new power lines and fiber optic cables on the south side of Patton Road be impacted by the future roadway?
- Is there going to be a crossing of Patton Road over US 60?
- Can the city of Surprise rezone my property?
- How will the potential alignment impact my specific parcel?
- How much right-of-way is needed to accommodate the roadway on Patton and Jomax Roads?
- Prefer the 171st Avenue alignment, less impact to existing properties.
- The 4C alternative was also an alternative that many people liked. A gentleman whose property would be impacted by this alignment was very interested in a "full take" but he wouldn't be interested in a minor property acquisition since he felt the new Roadway would be in his front yard. His home is located in the floodplain, so we provided him with information regarding the voluntary buy-out program being offered by FCD.
- Concerns about the Dove Valley Road parkway transition to Lone Mountain. Again impacts a few homes.
- Numerous complaints about the roadway condition of both Jomax Road and 163rd Avenue. The roads have many potholes and loose gravel.
- 163rd Ave, south of Jomax (outside project limits). The old road is being used where the new road curves away from the existing with a barrier.
  Right-of-way. Some residents along 163rd Ave mentioned that they own the property the existing roadway is on. If an alignment is selected that leaves the existing alignment, how will the right of way need be handled for the existing road?
  Schedule: All wanted to know when construction or at least ROW buy out would occur. Explained the process and that this is development driven. No funding is currently identified for design or construction.
- General concern about the City of Surprise "not being up front about all of their roadway plans".
- General concern about the indirect left concept and the additional ROW associated w/such a design.
- Many people where happy that we are at least "planning for the future" especially since the big Chrysler Proving Ground buyout occurred. Many people wanted to see pavement in the ground now though and were disappointed when told that we were only making sure we preserve the right-of-way necessary to accommodate the ultimate facility concept.

Findings and Recommendations Phase Public Meeting
Meeting Purpose: Gather public comment regarding study findings and "Preferred Alternative", recommended access management strategies and improvement phasing timeline.

5:00 – 7:00 p.m., July 17, 2007
Hampton Inn, 14783 W. Grand Avenue, Surprise, AZ 85374
Attendance: 65

Written public comments:

- I still don't see why there is 60' median, not enough cross-overs – none in front of my house. I am totally opposed to this!
- There is no need for a 60' median.
- I am very unhappy with this plan. What will happen with run-off? Why not put it in undeveloped areas just east of here?
- They had pat programmed answers for the most part. I did not feel they were really interested in what the community said or cared. Cities and developers already had them. I am very unhappy with this plan. What will happen with run-off? Why not put it in undeveloped areas just east of here?
- The road does not enter our property but will run right behind us. What happens to our property value and will we be able to be zoned commercial at some stage? Will there be a noise barrier? What about washes and their routing? Will this roadway cause our land to be in a flood zone? Will there be any building restrictions? What kind of time line are we looking at?

Comments/questions received by Project Team during discussions with meeting attendees:

- The 163rd Avenue Meeting was well attended. Many people were satisfied w/the alternative that we were recommending, alignment wise, but most were not happy that this roadway will be a 6-lane higher capacity facility.
- ...disappointed in the indirect left turn intersection configuration mainly because of the additional ROW needed to implement. Some were confused over the operational implications but most understood the approach.
- A main issue was access to the new facility by both those on the corridor and those a street away.
- The most contentious issue was in the area just south of Dove Valley were the shift in the alignment occurs. Many people were concerned about their property values, the noise and visual impact that this new facility might cause. We discussed ways to minimize these impacts and our ROW agent discussed the ROW acquisition process with

those who might be impacted. Many of these residences either wanted to shift the alignment east and tunnel through the mountain terrain or shift it further west along alignment alternative 7.

- When we discussed the significant environmental impacts along with additional wash crossings and the potential lost of capacity (alternative 7), a few were still not satisfied with our recommendation.
- In the area of Dixileta, where a potential impact to three properties exists, residents were upset. The project team needs to discuss possible approaches to mitigate these impacts during the DCR phase.
- In general, many voiced the need for better roadway network in the area but still wanted to maintain a rural environment.
- The section of 163rd south of Jomax needs improvements. The curve just south of the "intersection isn't functioning properly" and the residents were upset that Surprise only had the developer put in a three-lane section.
- Some residents also expressed their displeasure of the City allowing changes in the drainage flow patterns by the new developments.
- Most were very interested in a connection to SR74 and would like to see these improvements in Peoria immediately.
- Based on numerous comments regarding the 200 ft. ROW and the ROW impacts in the vicinity of Dixileta we will re-evaluate the need for this full cross-section in this area.

DCR Preferred Alternative Public Meeting

Meeting Purpose: Gather public comment regarding the DCR conducted for 163rd Avenue between Jomax Road and Dove Valley Road and present the proposed roadway improvements.

5:00 – 7:00 p.m., December 12, 2007
Hampton Inn, 14783 W. Grand Avenue, Surprise, AZ 85374
Attendance: 37

Written Comments:

- The road does not enter our property but will run right behind us. What happens to our property value and will we be able to be zoned commercial at some stage? Will there be a noise barrier? What about washes and their routing? Will this roadway cause our land to be in a flood zone? Will there be any building restrictions? What kind of time line are we looking at?
- Would appreciate someone who could speak to us who has access to information about what is going to happen- This affects our lifestyle- most of us live many miles from our work because we appreciate the solitude and quietness of the neighborhood- This road has a very

negative impact on our lifestyle to say the least- building walls to lessen the noise is not enough.
- The length of time for this project should be more specific. Living with this proposed project casts a big cloud over my life. Who is going to want to buy our property when it's possibly commercial but not positively?
- Staff was evasive with questions asked. (Regarding construction schedule)
- We moved to 163rd to raise our family away from town and crime, know you are bringing it all right to our front door. I'm not happy about this road at all. You are taking our life away.
- Concerned about the ability to enter and exit with a 30 ft 5th wheel travel trailer. And how much of my yard am I going to lose.
- Why are builders assuming that this extension is necessary? At this time houses are not being built. And I don't think the economy will support this
- Would like a more formal meeting and be told the truth by someone who really knows what is going on with all the cards on the table. It is hard to live and run a business with this kind of a black cloud.
- My home is all I have for my retirement now you have taken that away.

Comments/questions received by Project Team during discussions with meeting attendees:

- Encouraged all with whom I talked to fill out a card. Some concern over unable to sell home.
- One comment about indirect lefts "You have to go a half mile out of your way".
- Residents currently have access to 163rd for their horse trailers and 5th-wheels. Please ensure these types of vehicles will be able to access property on new frontage road system.
- Re-examine access to homes near Dove Valley Rd intersection
- Consider access to lots which does not currently have a home
- Some comments about areas outside our limits, specifically the new development at Grand and Jomax.
- Many people were very disappointed that these improvements are not scheduled for construction.
- I received numerous complaints about 163rd Avenue, south of Jomax because of the alignment change and roadway geometry approaching this intersection. Also, there is the perception that it took a fatality for both agencies to act and install a signal at this intersection.
- The homeowners who would be directly impacted by the improvements (south of Dixileta) had offered solutions to row issues. One owner

simply wanted her house relocated to the southeast corner of her property with new access to Dixileta. Another on the west side of 163rd wanted his home rotated 180 degrees so his front of his home would face the new access road, thus eliminating his direct access to 163rd.

- Many homeowners in this area have already establish functional joint access and access road network that either has minimized or totally eliminated direct access onto 163rd.
- Many people were concerned about the impacts that the new proposed facility will have on:
  - Drainage patterns
  - Well water – worried about contamination
  - Noise level
  - Access to property
  - Property Values
  - Environment
- The simulation that presented the "Michigan Left Turn" intersection operation was very successful. However, response to this new unconventional intersection design was mixed. Many were pleased with this approach since it improves facility safety. Others were frustrated that they would have to drive 660 feet beyond the access road to their property. Many were also concerned about making a U-turn with their horse trailer.
- Pedestrian and equestrian crossings were very important to the community.
- Should consider equestrian friendly drainage structures.
- Overall, many agreed w/the alignment chosen and understood the need for a higher level facility in the future but would prefer standard intersections and construction to occur for a four-lane facility sooner than later. They feel the new developments in this area should be constructing these facilities.

FUTURE ACTIVITIES AND CONSIDERATIONS FOR FUTURE CORRIDOR DEVELOPMENT

As the preferred alternative becomes better defined through more in-depth phases of project development, additional elements will be considered that address the needs and impacts of future projects within the context of the current and future settings along the 163rd Avenue corridor.

The following are capsulated key issues identified during this study's Stakeholder Advisory Committee and public involvement process that should

be taken into consideration by individual jurisdictions as the recommendations of this study are carried forward through design and construction:

- Project Funding. There is currently no funding programmed for construction. It can be anticipated that area developers will participate as part of project requirements.
- Access Management Strategies. MCDOT, the Cities of Surprise and Peoria have specific expectations regarding roadway access. These strategies should be implemented to ensure a seamless roadway with efficient traffic flow, safety and good access to local land uses.
- Environmental Impacts and Noise Mitigation. Specific impacts on the local environment will require further evaluation in future project development.
- New Right-of-Way Requirements. Final roadway configuration will determine how much land will need to be acquired.
- Landscaping plans. Final project design will specify the type of landscaping to be used.
- Drainage Structures. Because the future roadway corridor crosses a number of washes and lies partly in a flood zone, it will be critical to ensure the roadway is designed to provide "all weather" crossings during major storm flows. Bridges along the new roadway will be designed during final roadway design.
- Bicycle, Pedestrian and Transit Access. Future projects will be designed to accommodate alternative modes of travel and provide access to trails and neighborhoods in the area.
- Corridor Traffic Management. ITS (Intelligent Transportation System) will control operation of traffic between jurisdictions and differing intersection configurations.
- Jurisdictional Coordination. As with the overall traffic control, implementation of different corridor improvements and access management concepts will need to be coordinated to ensure a safe, seamless and efficient transportation facility.

CONCLUSION

It is recommended that future project development build upon the public involvement program established during this study and continue as a comprehensive program progression.

For more information about the study, contact Renee Probst, MCDOT Planning at 602/506-8622 or Roberta Crowe, MCDOT Public Information Officer at 602/506-8003.

Exhibit A:
Public Meeting Notification & Newspaper Display Advertisement

MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION

We Need Your Input
163rd Avenue
Corridor Improvement Study
Jomax Road to SR 74
Design Concept Report
Jomax Road to Dove Valley Road

Public Open House

Thursday, November 2, 2006
5:00 p.m. to 7:00 p.m.

Hampton Inn
Grand Colonnade

14783 W. Grand Avenue
Surprise, AZ
(north of Bell Road)

Public "Scoping" Meeting

The Maricopa County Department of Transportation's (MCDOT) ***RightRoads* Program** is conducting the first in a series of three public open house meetings to gather community input about potential improvements along 163rd Avenue between Jomax Road and SR 74. The goal of this study is to identify and establish the future roadway type, alignment, number of lanes and right-of-way requirements along the 163rd Avenue corridor to safely accommodate future traffic demand.

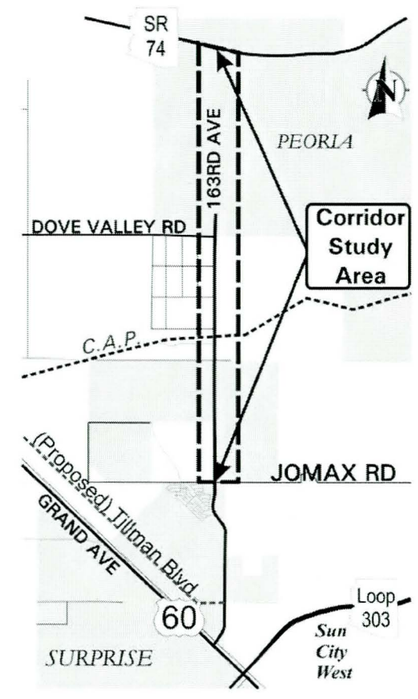
Stop by anytime between 5:00 and 7:00 p.m. to speak with MCDOT project team members.

For more information, contact Renee Probst at (602) 506-8622 or write to Probst at: MCDOT, 2910 W. Durango Street, Phoenix, AZ 85009, or e-mail at: reneeprobst@mail.maricopa.gov or contact Roberta Crowe, Public Information Officer at (602) 506-8003.

Reasonable accommodations may be made available for people with disabilities with a minimum 72-hour notice. For more information on such accommodations, contact Roberta Crowe at **(602) 506-8003**.

Si desea recibir esta información en Español, favor llamar (480) 350-9288.

Con adviso de setenta y dos horas o más, es posible obtener plans reasonables para personas con discapacidades; lo mismo para representantes que hablan Español. Si quiere más información, llamar (480) 350-9288.



District 4 Supervisor, Max Wilson
www.mcdot.maricopa.gov

MCDOT RightRoads PROGRAM
The Right System The Right Time The Right Cost

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MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION

We Need Your Input
163rd Avenue
Corridor Improvement Study
Jomax Road to SR 74
Design Concept Report
Jomax Road to Dove Valley Road

Public Open House

Tuesday, March 6, 2007
5:00 p.m. to 7:00 p.m.

Hampton Inn
Grand Colonnade

14783 W. Grand Avenue
Surprise, AZ
(north of Bell Road)

Alternative Analysis Phase

The Maricopa County Department of Transportation's (MCDOT) ***RightRoads* Program** is conducting the second in a series of three public open house meetings to gather community input about potential improvements along 163rd Avenue between Jomax Road and SR 74. The goal of this study is to identify and establish the future roadway type, alignment, number of lanes and right-of-way requirements along the 163rd Avenue corridor to safely accommodate future traffic demand.

Stop by anytime between 5:00 and 7:00 p.m. to speak with MCDOT project team members.

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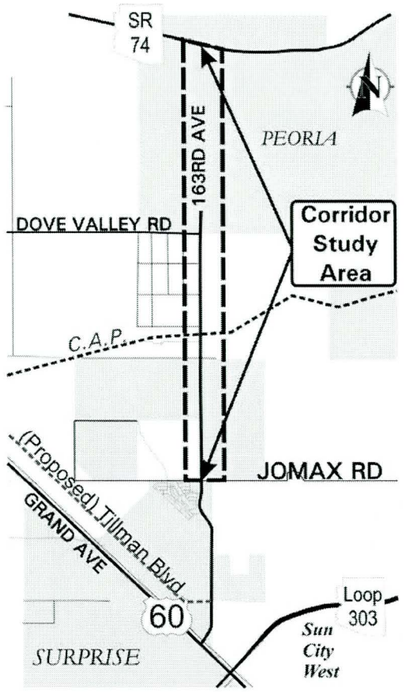

District 4 Supervisor, Max Wilson
www.mcdot.maricopa.gov

MCDOT RightRoads PROGRAM
The Right System The Right Time The Right Cost

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MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION

We Need Your Input
163rd Avenue
Corridor Improvement Study
Jomax Road to SR 74
Design Concept Report
Jomax Road to Dove Valley Road

Public Open House

Tuesday, July 17, 2007
5:00 p.m. to 7:00 p.m.

Hampton Inn
Grand Colonnade

14783 W. Grand Avenue
Surprise, AZ
(north of Bell Road)

Findings and Recommendations

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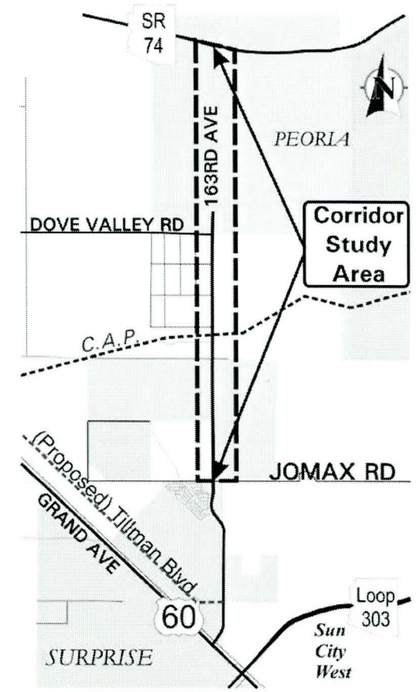

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MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION

We Need Your Input
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Jomax Road to Dove Valley Road
Design Concept Phase

Public Open House

Wednesday, December 12, 2007
5:00 p.m. to 7:00 p.m.

Hampton Inn
Grand Colonnade

14783 W. Grand Avenue
Surprise, AZ
(north of Bell Road)

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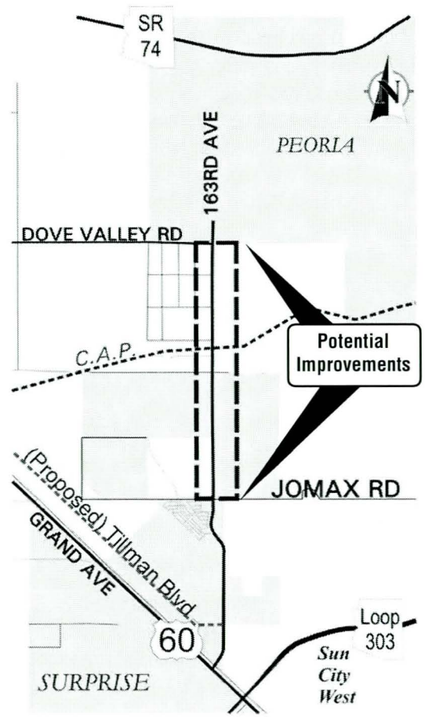

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MARICOPA COUNTY MCDOT TRANSPORTATION
Right Road Right Time Right Cost

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MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION

We Need Your Input
163rd Avenue
Corridor Improvement Study
Jomax Road to SR 74
Design Concept Report
Jomax Road to Dove Valley Road

Public Open House

Thursday, November 2, 2006
5:00 p.m. to 7:00 p.m.

Hampton Inn Grand Colonnade

14783 W. Grand Avenue
Surprise, AZ
(north of Bell Road)

Public "Scoping" Meeting

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MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION

We Need Your Input
163rd Avenue
Corridor Improvement Study
Jomax Road to SR 74
Design Concept Report
Jomax Road to Dove Valley Road

Public Open House

Tuesday, March 6, 2007
5:00 p.m. to 7:00 p.m.

Hampton Inn Grand Colonnade

14783 W. Grand Avenue
Surprise, AZ
(north of Bell Road)

Alternative Analysis Phase

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MCDOT RightRoads PROGRAM
The Right System The Right Time The Right Cost

MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION

We Need Your Input
163rd Avenue
Jomax Road to Dove Valley Road
Design Concept Phase

Public Open House

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5:00 p.m. to 7:00 p.m.

Hampton Inn Grand Colonnade

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MARICOPA COUNTY MCDOT TRANSPORTATION
Right Road Right Time Right Cost

Exhibit B:
Media Hits

Officials begin formulating plans for 163rd Ave.

Jonathan J. Higuera
The Arizona Republic
Nov. 11, 2006 12:00 AM
It won't be long before 5,000 new homes dot the corridor along 163rd Avenue between Jomax Road and Arizona 74.

All those residents likely will spend a lot of time on 163rd Avenue getting to and from Grand Avenue, the main thoroughfare to the south.

But the condition of the road will have to improve if it is to become more than just a bottleneck, transportation officials agree.

Last week the Maricopa County Department of Transportation held a public open house on its plans to improve the road, which is paved from Jomax to Dove Valley Road, but is just a dirt road from there to Arizona 74.

Residents turned out to ask that it be built sooner rather than later, but were disappointed to learn that no funding is available for construction.

The open house was intended to gather input from the public on possible alignments of the road, which faces a number of engineering challenges ranging from washes to mountainous terrain to crossing the Central Arizona Project canal.

"We can't just say, 'Snap a line and build it here,' " said Randy Overmyer, a senior transportation planner for Surprise, which contains about four miles of the road.

Surprise has a vested interest in seeing an improved 163rd Avenue because housing developments are cropping up around the area. The city kicked in $300,000 to Maricopa County to get more engineering and design work done on the southernmost four miles of 163rd Avenue.

But the plans for improving the road are in the very early stages, said Renee Probst, a county transportation project manager. The county is gathering data, including current and projected traffic volumes, road crossings and right-of-way issues.

"Past studies have projected a high volume on this road, enough to dictate six lanes," she said.

An important step will be deciding on an exact alignment, she and others say.

"We need it before we can get down to the brass tacks," said Overmyer. "And every alignment has its pluses and minuses."

Corridor Improvement Study schedule

February - Second public input meeting.

June - Draft report.

August - Final report.

October - Draft of Design Concept Report and final public input meeting.

January 2008 - Final Design Concept Report submitted.

Source: Maricopa County Department of Transportation

County gathers input on 163rd Avenue plans

Jonathan J. Higuera
The Arizona Republic
Nov. 16, 2006 12:00 AM
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The road from Jomax to Arizona 74 traverses the cities of Surprise and Peoria and also takes in unincorporated parts of the county.

A version of this story may have appeared in your community Republic.

Published: Mar 26, 2007 - 10:18:44 pm EDT

Residents talk 163rd alignment; Improvements a must for public

By Matt Loeschman, Independent Newspapers

The second public input meeting regarding the 163rd Avenue alignment drew nearly 100 Surprise residents concerned with future transportation options in the northern portion of the city.

Maricopa County Department of Transportation held the meeting earlier this month, the second public input gathering regarding the future transportation corridor.

"I would say we had about 85 people show up," reported MCDOT spokeswoman Roberta Crowe. "The interest has been pretty consistent. We presented seven different alternative alignments for this corridor and four of them were carried forward."

According to MCDOT documentation, the group's regional transportation plan identifies the need to establish an alignment for 163rd Avenue between Grand Avenue (U.S. 60) and State Route 74. The southern two-mile segment is under construction, but MCDOT is working with Surprise and Peoria transportation officials on two studies — a corridor improvement study between Jomax Road and SR 74 and a design concept report for the portion of 163rd Avenue between Jomax and Dove Valley roads.

"We're working with several entities on this project," Ms. Crowe added. "We want to get ahead of the game so this roadway will be able to handle the amount of traffic we expect to see in the future."

According to MCDOT estimates, 163rd Avenue could carry as many as 50,000 vehicles per day by 2030.

"The new roadway will eventually provide a seamless transportation route that will affect the cities of Surprise and Peoria," Ms. Crowe noted. "It will offer regional connectivity and consistent roadway features."

Recommendations include roadway type, number of lanes, right-of-way requirements and traffic control measures along with access features and drainage improvements to safely accommodate future travel need.

"We are addressing growth and development up to 25 years in the future," Ms. Crowe said.

The 163rd Avenue corridor serves northern Maricopa County through Surprise and Peoria. Land use south of Dove Valley Road is single-family residential on large lots while land is undeveloped between Dove Valley Road and SR 74.

Presently, the 163rd Avenue corridor between Jomax and Dove Valley roads is a two-lane paved road intersected by "unimproved" cross streets, according to MCDOT documentation. North of Dove Valley Road, a dirt road provides access for vehicles performing water line construction on developments north of SR 74.

Big changes are in store, according to Surprise City Engineer Dr. Robert Maki.

"Some of this is in our city limits now and all of it is in our planning area," Dr. Maki explained. "We are looking at these alignments to see what might work best. It's a collaborative effort."

Those in attendance saw several large maps and asked questions of transportation officials.

Surprise resident Jennifer Hansen also attended the forum.

"This appears to help the people that live in the northern area. We are pretty much locked into either Bell Road or Grand Avenue and the traffic can be really horrible," she explained.

Resident Roger Werley said he is pleased to see entities working together on the study.

"It is good to see the entities getting together to address the transportation issues before the fact instead of after," he said. "We all know what kind of problems we have in Surprise. This corridor is going to be a key in the future."

A "findings and recommendations" public meeting is set for October 2007 with the final design concept report submittal tentatively scheduled for January 2008.

Post your opinions in the Public Issues Forums at newszap.com. News Editor Matt Loeschman can be reached at 972-6101 or mloeschman@newszap.com.

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Final public hearing Tuesday on plans for 163rd Ave.

Brent Whiting
The Arizona Republic
Jul. 13, 2007 02:14 PM

Transportation planners will meet in Surprise on Tuesday to gather public input on long-range plans involving 163rd Ave., projected as a major north-south road in the Northwest Valley.

It's the last of three public meetings to review plans for the thoroughfare along a nearly 7-mile stretch from Jomax Road north to Arizona 74.

The first informal open house was held Nov. 2. The second was March 6.

Construction design plans for the southern portion of the 163rd Avenue corridor are expected to be offered this fall, said Roberta Crowe, a spokeswoman for the Maricopa County Department of Transportation.

Officials are deciding, among others things, a possible future alignment, roadway type, number of lanes and right-of-way requirements to accommodate traffic demands, Crowe said.

Officials say past studies project enough traffic to justify six lanes.

Currently, 163rd Avenue is paved for the four miles from Jomax north to Dove Valley

Road to progress

Patrick Roland/Daily News-Sun
July 20, 2007 - 9:28PM
Victoria Franklin lives on a single lane dirt road in the middle of wide open desert space that may become a six-lane freeway as growth pushes west in Surprise.

The 55-year-old moved to the land four years ago because she wanted peace and quiet as she contemplated her eventual retirement.

"They're destroying our neighborhood," said Franklin, at a meeting Tuesday where Maricopa County Department of Transportation officials showed plans for what may be the new 163rd Avenue.

"This was going to be my retirement. If I lose this, I am out of Maricopa County. I can't start over at 55," she said.

"I'm a single woman. I want to be settled not starting over."

MCDOT unveiled the preferred alignment for what will become a six-lane highway at the meeting Tuesday. The path follows 163rd Avenue between Jomax Road and Quail Run, and then moves west to the 167th Avenue alignment between Quail Run and Dove Valley Road. Officials picked the alignment because it minimizes negative impacts to properties and the need for expensive bridge structures at major drainage crossings.

The roadway is half in Surprise and half in Peoria. The Surprise right of way, from Jomax to Dove Valley roads, will be 200 feet in width to accommodate "indirect left turns," which allow motorists to bypass left-turn lanes at intersections. The Peoria section runs from Dove Valley Road to State Route 74 and will be 150 feet wide.

MCDOT spokeswoman Roberta Crowe said, the the county does not have a time frame for when construction will begin, nor is there any money devoted to the plan. MCDOT will come back to the community in October with a construction priority and phasing recommendation.

"As development occurs, this study can be implemented," Crowe said. "In the meantime, the roadway corridor is preserved and protected from development and encroachment."

But most of the residents who attended the presentation Tuesday want nothing to do with

a larger 163rd Avenue.

"When I lived in Oregon, I lived on a major thoroughfare and the noise is just ridiculous," said Barbara Brown, who retired to Arizona two years ago. "When we bought out here, we did not want to be near a big road. That was one of the reasons we moved out so far. We love it the way it is out here."

Thomas Barnhill is more concerned about getting answers quickly so he can move on with his life.

"I'm in limbo as to what exactly I am going to do and I want straight answers," the retired Marine said. "If they want to buy me out, fine, but I need to go on with my life and have the peace and quiet I was seeking when I moved out here."

Others are concerned about what will happen to their livestock.

"We bought out here for horses, for our retirement," said Margaret Ruffato. "This will affect noise, the right of way. We'll have lights at night. They aren't looking at us simple folks who moved out here long ago and are happy."

Surprise Councilwoman Martha Bails sympathized with resident concerns but said growth is inevitable, and city and county leaders should have done a better job of planning for these changes 20 years ago.

"None of this was documented and it wasn't disclosed," Bails said. "We don't want to destroy people's property, but as the city grows, we have to provide roads. We have to be able to get people in and out."

Photos by Pete Pallagi/Daily News-Sun

Phil Burgess of Surprise is concerned that a proposed six-lane freeway to be built along the alignment of 163rd will not only cut through his land, but will also put his disabled child at risk.

Meeting announced on long-range plans for 163rd Avenue

Brent Whiting
The Arizona Republic
Nov. 30, 2007 10:40 AM

Transportation planners will gather in Surprise to review long-range plans for 163rd Avenue along the four-mile stretch between Jomax and Dove Valley roads, officials said Friday.

There is no definite timetable, but the thoroughfare is projected as a major north-south road in the Northwest Valley, said Roger Ball, a spokesman for the Maricopa County Department of Transportation.

A southerly portion of 163rd Avenue, the three-mile stretch between U.S. 60 and Jomax Road, has been the focus of major construction and study.

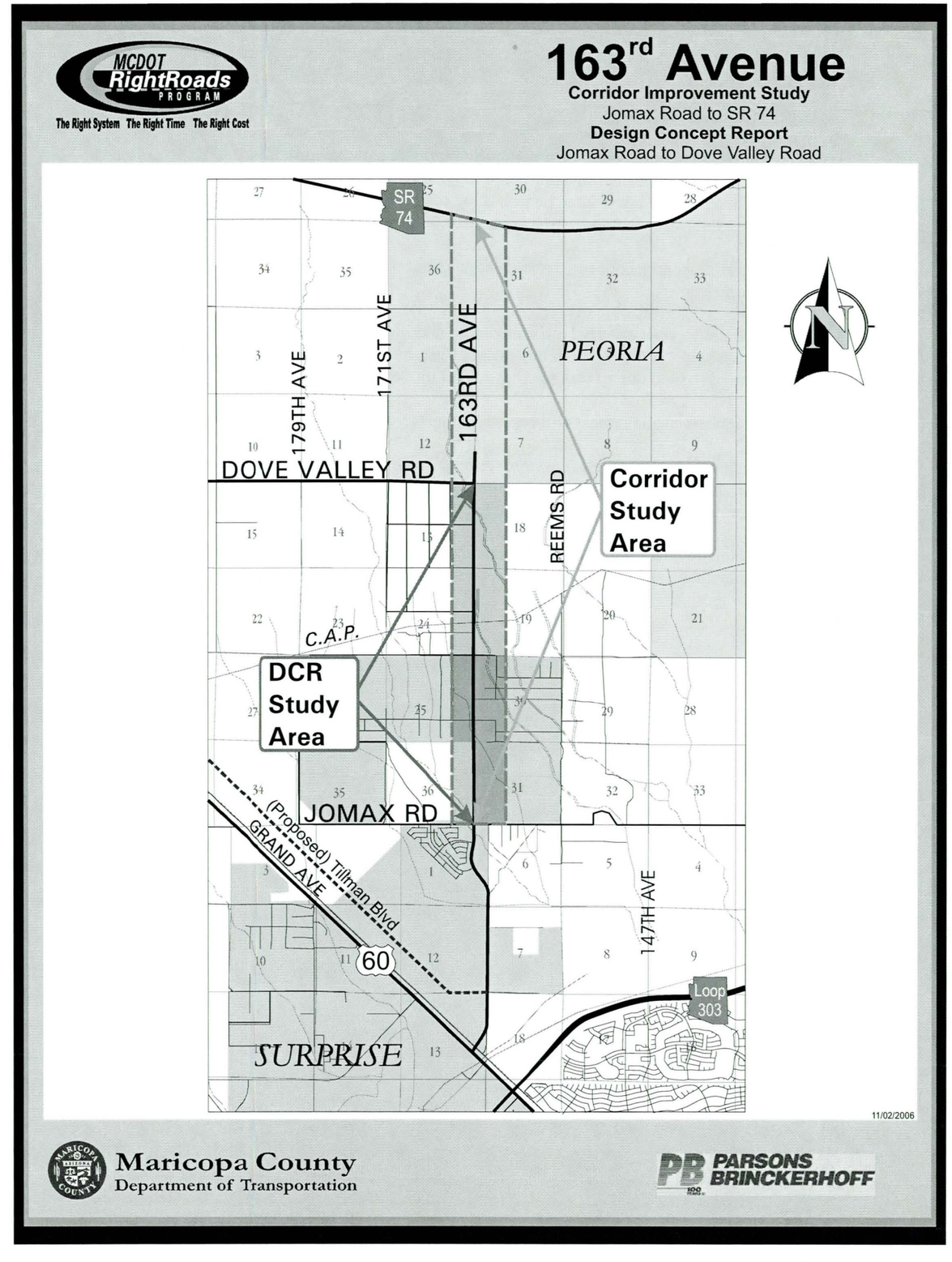
An informal meeting on the northerly portion is set for 5 to 7 p.m. Dec. 12. The open house will be at the Hampton Inn, 14783 W. Grand Ave., north of Bell Road near Dysart Road.

Currently, 163rd Avenue is paved for the four miles from Jomax north to Dove Valley Road, but the remainder is a dirt road north to Arizona 74.

Planners want to gather public input on plans for potential improvements from Jomax to Dove Valley, including additional lanes, intersections, drainage and other improvements, according to McDOT officials.

Exhibit C:

1. **Public Meeting #1 "Scoping Phase"**
   Handouts, Displays/Graphics
2. **Public Meeting #2 "Alternatives Analysis Phase"**
   Handouts, Displays/Graphics
3. **Public Meeting #3 "Findings & Recommendations Phase"**
   Handouts, Displays/Graphics
4. **Public Meeting # 4 "Preferred Alternative" Design Concept Report**
   Handouts, Displays/Graphics



MCDOT RightRoads PROGRAM

The Right System The Right Time The Right Cost

163rd Avenue

Corridor Improvement Study

Jomax Road to SR 74

Design Concept Report

Jomax Road to Dove Valley Road

Study Need

- Respond to regional growth / local development
- Implementation of regional transportation plans

Study Goals

- Create a "vision" or footprint for 163rd Avenue and develop a plan for achieving the vision
- Establish principles, policies and guidelines for corridor improvements
- Develop agreed-upon roadway plans and recommendations

11/02/2006

Maricopa County
Department of Transportation

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163rd Avenue

Corridor Improvement Study
Jomax Road to SR 74
Design Concept Report
Jomax Road to Dove Valley Road

Scoping Phase

MCDOT RightRoads PROGRAM
The Right System The Right Time The Right Cost

Maricopa County Department of Transportation **November 2, 2006**

Background

In 1997, Maricopa County Department of Transportation (MCDOT) completed a Comprehensive Plan and Transportation System Plan (TSP) for the unincorporated areas of the County. The TSP included recommendations to improve the existing arterial road network to meet transportation demands resulting from projected growth in the County. Recommendations contained in the TSP were considered in the development of the 2004 Maricopa Association of Governments (MAG) Regional Transportation Plan (RTP).

Addressing rapid growth in this area, the RTP identified the need to establish an alignment for 163rd Avenue between Grand Avenue (US 60) and SR 74. The southern two-mile segment is already under construction by development. MCDOT, in cooperation with the City of Surprise, is conducting a Corridor Improvement Study (CIS) between Jomax Road and SR 74 and Design Concept Report (DCR), a more in-depth evaluation, for the portion of 163rd Avenue between Jomax Road and Dove Valley Road to address the influence of imminent development.

The new roadway will provide a seamless transportation route, regional connectivity, consistent roadway features and standards through the cities of Surprise and Peoria and ensure adequate right-of-way preservation along the entire corridor.

Study Purpose

The purpose of this study is to develop a consensus-driven plan for 163rd Avenue among partner jurisdictions between Jomax Road and SR 74. The study goal is to establish the ultimate future roadway alignment, identify existing corridor deficiencies and future requirements, establish consistent roadway design and performance criteria, and generate preliminary design plans to meet future travel demands.

The study recommendations will include roadway type, number of lanes, roadway cross-section and ultimate right-of-way requirements and traffic control measures along with access features and drainage improvements to safely accommodate future travel need. This study will provide the County, the City of Surprise and other impacted jurisdictions with a future "footprint" of 163rd Avenue along with a recommended timeframe for the phasing of roadway construction. Policies and guidelines for access management strategies developed during this study will ensure the future implementation of this roadway as a regionally significant transportation corridor.

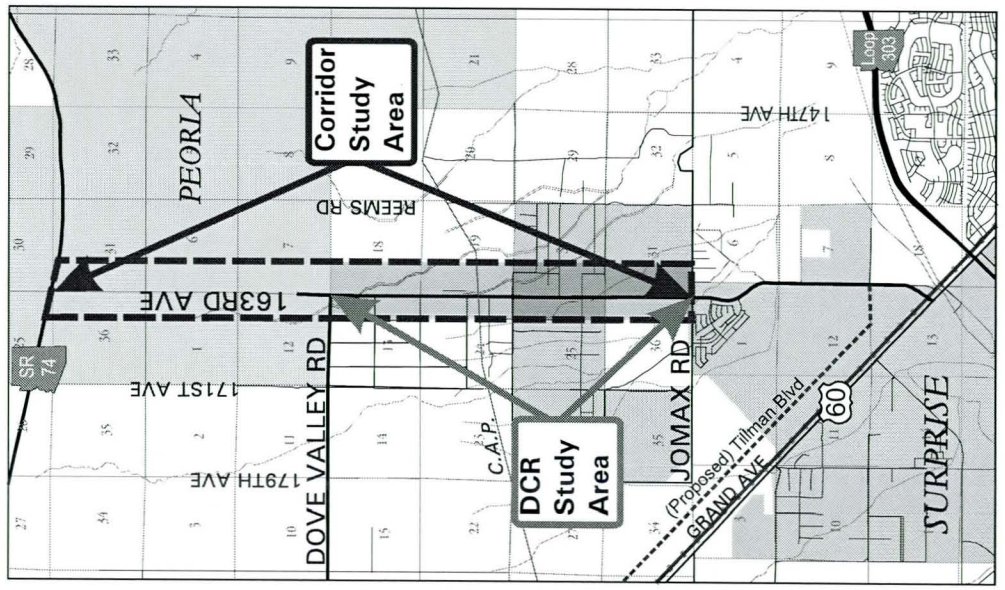
Within the corridor's southerly four miles between Jomax Road and Dove Valley Road, the preferred corridor will develop 30% design plans to aid the City of Surprise in managing access for future area development.

Corridor Description

The 163rd Avenue corridor serves northern Maricopa County through the cities of Surprise and Peoria. Existing land use south of Dove Valley Road is single-family residential homes on large lots. Between Dove Valley Road and SR 74, the land is undeveloped.

Currently, 163rd Avenue between Jomax and Dove Valley is a two-lane paved roadway intersected by unimproved cross-streets that serve the local residential community. North of Dove Valley, the roadway is an unimproved dirt road built largely to provide access for waterline construction serving development north of SR 74.

MCDOT, City of Peoria and City of Surprise all classify 163rd Avenue as a six-lane divided roadway.



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For more information, contact Renee Probst at (602) 506-8622 or write to her at:
MCDOT, 2901 W. Durango Street, Phoenix, AZ 85009, or e-mail at: ReneeProbst@mail.maricopa.gov.

Study Approach

The Corridor Improvement Study (CIS) will be carried out in two phases, a planning phase and an engineering phase. The DCR for the segment between Jomax Road and Dove Valley Road will be completed following the selection of a preferred roadway alignment.

Planning Phase

The Planning Phase will gather general background information and prepare several reports (future traffic analysis, area drainage features and plans, existing utilities and future siting and environmental reports) leading to well-founded recommendations for improvements that address longer-term need along the corridor.

During the Planning Phase, public "Scoping" meetings will be conducted with affected jurisdictions, agencies, stakeholders and the impacted public to gather information to form a broad consensus of the overall study objectives, needs and vision of the corridor.

Based on the corridor needs identified, conceptual alternatives will be developed and evaluated for technical and environmental feasibility, public acceptance and economic viability. The alternatives will be presented at a second "Alternatives Analysis" public meeting to gather additional input.

Engineering Phase

The Engineering Phase of the study follows the selection of a preferred roadway alignment alternative. Preliminary engineering design plans, right-of-way requirements and estimated construction costs will be prepared for near-term and long-term roadway design features. Priorities for roadway construction phasing, along with policies and guidelines to preserve the intended function of the roadway, will be developed.

The preliminary plans and cost estimates will be presented during a final "Findings and Recommendations" public meeting to gather input on the preferred (recommended) design alternative for 163rd Avenue.

Design Concept Report

Once the preferred alignment is known, the DCR will evaluate the southerly four miles between Jomax Road and Dove Valley Road. This report will produce 30% design plans that will specify the roadway type, size and location within the corridor and define the need for bridged crossings or culverts and access points. The DCR will also generate a more detailed cost estimate to allow accurate budgeting for project construction.

Project Stakeholders

- Maricopa County Department of Transportation
- Flood Control District of Maricopa County
- City of Surprise
- City of Peoria
- Arizona State Land Department
- Arizona Department of Transportation
- Impacted Utilities
- Area Developers
- Affected Business, Property Owners and Residents

Study Need

- Respond to regional growth / local development
- Implementation of regional transportation plans

Study Goals

- Create a "vision" or footprint for 163rd Avenue and develop a plan for achieving the vision
- Establish principles, policies and guidelines for corridor improvements
- Develop agreed-upon roadway plans and recommendations

Study Objectives

- Define the role of 163rd Avenue as a critical north/south roadway
- Identify current corridor deficiencies
- Define long-term corridor needs and requirements
- Develop / evaluate alternatives
- Establish design criteria for future roadway
- Develop access management guidelines (intersection spacing/median break locations)
- Establish roadway operation and performance criteria
- Complete 30% design plans for 163rd Avenue between Jomax Road and Dove Valley Road
- Coordinate with other current ongoing area studies to ensure an integrated roadway corridor system

Study Issues and Challenges

- Incorporate regional and local travel
- Achieve mobility/access balance
- Address current and future development
- Incorporate jurisdictional interests
- Address engineering challenges
- Consider roadway environment

Study Milestone Schedule

Field Review	September 2006
Scoping Public Input Meeting	**November 2, 2006**
Alternatives Analysis Public Input Meeting	**February 2007**
Planning/Engineering CIS	March 2007
Design Features CIS	May 2007
Draft Report Submittal CIS	June 2007
Final Report Submittal CIS	August 2007
Planning/Engineering DCR	September 2007
Design Features DCR	October 2007
Draft Report Submittal DCR	October 2007
Findings and Recommendations Public Input Meeting	**October 2007**
Final Report Submittal DCR	January 2008

Public Involvement

Gaining consensus among the agencies and the public is critical to the success of the study and implementation of its recommendations to provide an efficient roadway for the long term. Three public input meetings are held during the course of the study process. This first "Public Scoping" meeting provides the public with an opportunity to inform project team members about the study area and their transportation needs. It also provides project team members an opportunity to discuss and elicit feedback from the public regarding study purpose/need/goals.

The second "Alternatives Analyses" public meeting, currently scheduled for February 2007, will present preliminary findings and roadway alternatives or options for public review. The final public information meeting (currently slated for October 2007) will present study findings and a recommended roadway and corridor selection along with access management strategies. Your input during each phase of study development is very important.

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163rd Avenue

Corridor Improvement Study
Jomax Road to SR 74
Design Concept Report
Jomax Road to Dove Valley Road

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163rd Avenue
Corridor Improvement Study
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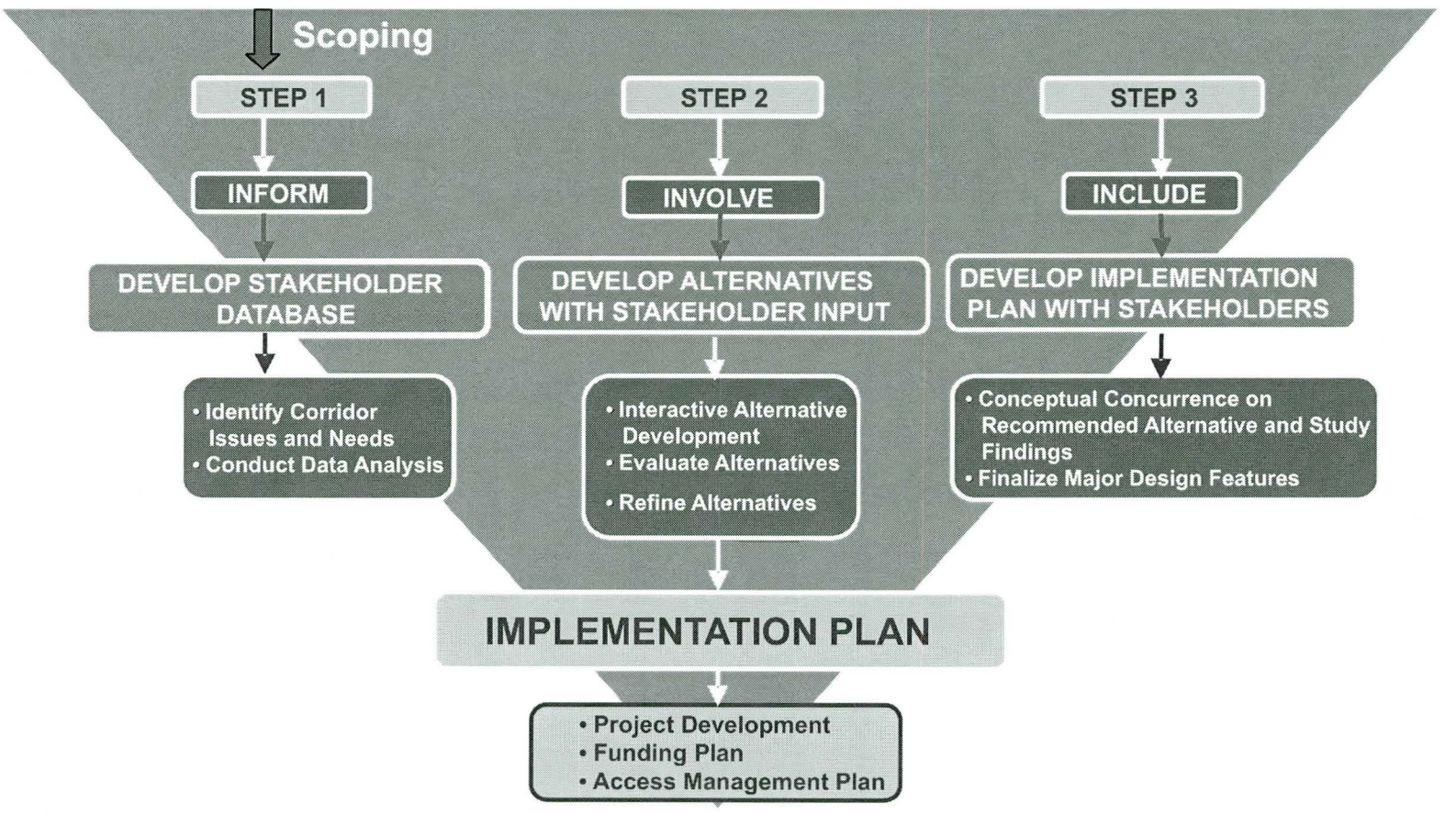
Interactive Study Process



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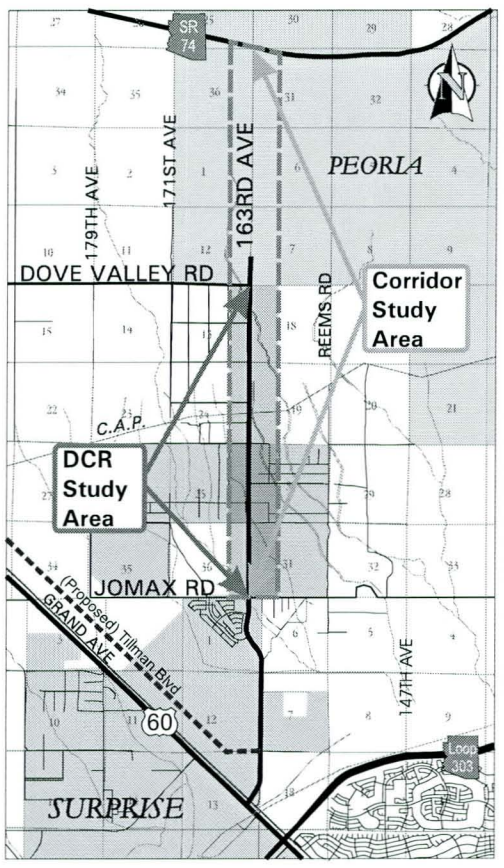

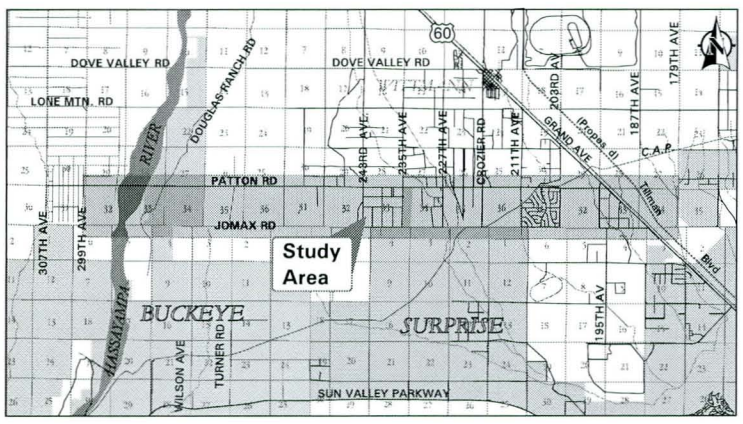

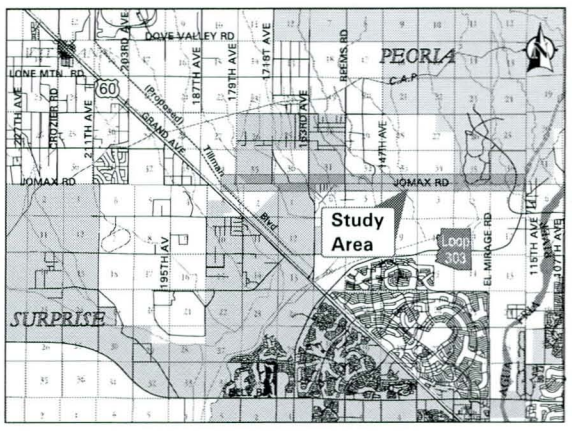

Patton/Jomax

Corridor Improvement Study
299th Avenue to 179th Avenue

Jomax East

Corridor Improvement Study
Tillman Boulevard to SR Loop 303

Maricopa County
Department of Transportation

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Project Stakeholders

- Maricopa County Department of Transportation
- Flood Control District of Maricopa County
- City of Surprise
- City of Peoria
- Arizona State Land Department
- Arizona Department of Transportation
- Impacted Utilities
- Area Developers
- Affected Business, Property Owners and Resident

Public Involvement

Gaining consensus among the agencies and the public is critical to the success of the study and implementation of its recommendations to provide an efficient roadway for the long term. Three public input meetings are held during the course of the study process. The first "Public Scoping" meeting, held November last year, provided the public with an opportunity to inform the project team about the study area and local transportation needs.

This second "Alternatives Analyses" public meeting will present preliminary findings and roadway alternatives or options for public review. The final public information meeting (currently slated for October 2007) will present study findings and a recommended roadway and corridor selection along with access management strategies. Your input during each phase of study development is very important.

Study Milestone Schedule

Field Review	September 2006
Scoping Public Input Meeting	**November 2, 2006**
Alternatives Analysis Public Input Meeting	**March 6, 2007**
Planning/Engineering CIS	April 2007
Design Features CIS	May 2007
Draft Report Submittal CIS	July 2007
Final Report Submittal CIS	September 2007
Planning/Engineering DCR	September 2007
Design Features DCR	October 2007
Draft Report Submittal DCR	November 2007
Findings and Recommendations Public Input Meeting	**October 2007**
Final Report Submittal DCR	January 2008

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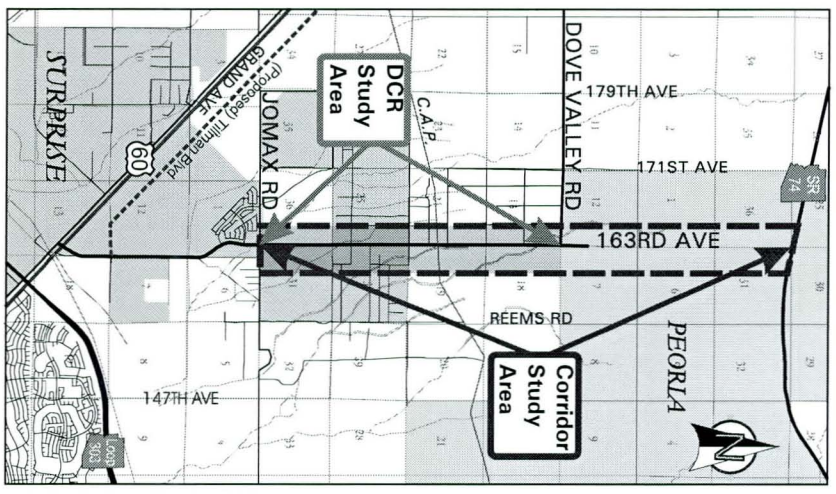

163rd Avenue

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Alternatives Analysis Phase

Maricopa County Department of Transportation **March 6, 2007**

BACKGROUND

In 1997, Maricopa County Department of Transportation (MCDOT) completed a Comprehensive Plan and Transportation System Plan (TSP) for the unincorporated areas of the County. The TSP included recommendations to improve the existing arterial road network to meet future transportation demands resulting from projected growth and development countywide. MCDOT's TSP recommendations were considered in the development of the 2004 Maricopa Association of Governments (MAG) Regional Transportation Plan (RTP).

In direct response to the rapid growth being experienced in northwestern Maricopa County, the RTP identified the need to designate the future roadway alignment for 163rd Avenue between Grand Avenue (US 60) and SR 74.

163rd Avenue is classified as a future Principal Arterial by MCDOT, a future Parkway by Surprise and as an arterial by Peoria (all six-lane divided roadways).

Roadway construction, funded by private development, is already underway on the southern two-mile segment of 163rd Avenue between Grand Avenue and Jomax Road. MCDOT is conducting this current Corridor Improvement Study (CIS) in cooperation with the City of Surprise, for the portion of 163rd Avenue between Jomax Road and SR 74 (beyond the private development improvements) and a more detailed Design Concept Report (DCR) is being conducted on the segment of 163rd Avenue between Jomax Road and Dove Valley Road to address imminent development.

CORRIDOR DESCRIPTION

The 163rd Avenue corridor serves northwestern Maricopa County through the cities of Surprise and Peoria. Existing land use south of Dove Valley Road is single family residential on large lots. Between Dove Valley Road and SR 74, the land is undeveloped.

Currently, 163rd Avenue between Jomax Road and Dove Valley Road is a two-lane paved roadway that is intersected by unimproved cross-streets that serve the local residential development. North of Dove Valley Road, the roadway is an unimproved dirt road that was built largely to provide access for construction of a waterline to a development north of SR 74.

STUDY PURPOSE

An agreed-upon plan for this future roadway corridor will ensure regional connectivity, consistent roadway features and standards through the cities of Surprise and Peoria, and ensure adequate right-of-way preservation along the entire corridor.

The purpose of this study is to develop a consensus-driven vision among partner jurisdictions for 163rd Avenue between Jomax Road and SR 74. The study goal is to establish the ultimate roadway alignment, identify existing corridor deficiencies and future requirements and to determine consistent roadway design and performance criteria to meet the established future needs.

Recommended corridor improvements will include future roadway type, number of lanes, roadway cross-section and ultimate right-of-way requirements, traffic control measures, an access management plan, and drainage improvements to safely accommodate future travel demands. This study will provide the County and other responsible jurisdictions with a future "footprint" of 163rd Avenue along with a recommended time for the implementation and phasing of roadway improvements.

The DCR for the four-mile segment between Jomax Road and Dove Valley Road will identify the preferred corridor and develop 30% design plans to help the City of Surprise in managing current development access issues

Study Need

- Respond to regional growth / local development
- Implementation of regional transportation plans

Study Goals

- Create a "vision" or footprint for 163rd Avenue and develop a plan for achieving the vision
- Establish principles, policies and guidelines for corridor improvements
- Develop agreed-upon roadway plans and recommendations

For more information, contact Renee Probst at (602) 506-8622 or write to her at:
MCDOT, 2901 W. Durango Street, Phoenix, AZ 85009, or e-mail at: ReneeProbst@mail.maricopa.gov.

Study Objectives

- Define the role of 163rd Avenue as a critical north/south roadway
- Identify current corridor deficiencies
- Define long-term corridor needs and requirements
- Develop / evaluate alternatives
- Establish design criteria for future roadway
- Develop access management guidelines (intersection spacing/median break locations)
- Establish roadway operation and performance criteria
- Complete 30% design plans for 163rd Avenue between Jomax Road and Dove Valley Road
- Coordinate with other current ongoing area studies to ensure an integrated roadway corridor system

Study Issues and Challenges

- Incorporate regional and local travel
- Achieve mobility/access balance
- Address current and future development
- Incorporate jurisdictional interests
- Address engineering challenges
- Consider roadway environment

STUDY APPROACH

The 163rd Avenue Corridor Improvement Study is being carried out in two phases: a Planning Phase and an Engineering Phase. The Design Concept Report will be completed once the CIS selects the preferred roadway alignment.

CIS Planning Phase: The Planning Phase gathers general background information and prepares several reports (traffic analysis, drainage, utilities, environmental) leading to well-founded recommendations for improvements and longer-term needs along 163rd Avenue. During the Planning Phase, meetings are conducted with affected jurisdictions, agencies, stakeholders and the impacted public to form a broad consensus of the overall needs and vision of the corridor.

Based on the needs identified, alternatives will be developed and evaluated for technical and environmental feasibility, public acceptability and economic viability.

CIS Engineering Phase: The Engineering Phase of the study will begin following the selection of a preferred alternative. Preliminary engineering design plans, right-of-way requirements and estimated construction costs will be prepared for near-term and long-term roadway improvements. Roadway construction phasing priorities, along with policies and guidelines to preserve the intended function of the future roadway, will be developed.

The DCR portion of the study evaluating the segment between Jomax Road and Dove Valley Road will develop 30% design plans that specify roadway type, alignment, access points and define the need for bridged crossings/culverts. The DCR will also generate a more detailed cost estimate to allow accurate budgeting for construction.

Current Activities and Key Technical Findings

Since the first public "Scoping" meeting (November 2006) and following completion of required technical analyses, the 163rd Avenue Corridor Study has defined and begun evaluation of future roadway alternatives.

Drainage Report

A drainage report was prepared to study the impact of roadway alignments on known flood areas. The report also addressed potential drainage structures/features where the alternative roadway alignments crossed a known flood location.

Environmental Overview

The potential environmental impact of the roadway alignment alternatives was studied. The analysis looked at plants and animals, hazardous materials, cultural resources such as ancient burial grounds, existing land uses, and other environmental features in the area. The report found that no endangered species were evidenced within the project area and the likelihood of the existence of sensitive species in the project area was found to be very low.

Utilities Overview

Identifying the best place to locate a future roadway requires a good understanding of the present and planned utilities in the area. Few major utilities are present at this time and impacts associated with roadway development can be readily accommodated. The Central Arizona Project (CAP)canal is the most significant utility and will be addressed according to CAP requirements.

Traffic Overview

Traffic volumes in the area today are nominal. There is little traffic in the developed areas and a large portion of the corridor traverses vacant land. Year 2030 traffic volumes, based on anticipated development and growth, are projected to be high and will require a roadway that can safely accommodate 50,000 or more vehicles a day. Intersections at major cross-streets should also be designed to carry high traffic volumes.

Consideration of "In-Direct Left Turn" at Major Intersections

In both Peoria and Surprise General Plans, 163rd Avenue is designated as a future six-lane divided "parkway" with provision for right and left turns at major intersections. The Peoria parkway right-of-way width requirement is 150 feet. Peoria uses standard intersections with all turn lanes concentrated at the intersection and managed by traffic signal.

The Surprise parkway right-of-way width is 200 feet. The additional roadway right-of-way width (50') is necessary to accommodate the "in-direct left turn". This traffic control measure is under evaluation for implementation on portions of the 163rd Avenue corridor.

Under this traffic control measure, left-turn movement is eliminated at the intersection. Motorists travel through the intersection and make a U-turn at a point beyond the intersection and return to the intersection from the opposite direction to make a right turn toward the desired direction.

Advanced Roadway Alignment Alternatives

The 163rd Avenue corridor alignment alternatives cover a broad area extending generally along the 175th Avenue alignment on the west side of the corridor to the 163rd Avenue alignment on the east side of the corridor and several potential alignments in-between. The primary basis for the selection of a preferred roadway alignment is to identify a efficient "path" through the area that also has the least possible impact on existing development and homes, drainage paths, utilities and environmentally-sensitive areas and is also economically feasible (affordable to build).

Each of the advanced alignment alternatives balance corridor attributes and impacts in different ways and to varying degrees. In effect, they "trade off" impact in one area for the impact in another. The final recommended alignment will be the alternative that best minimizes, mitigates or avoids negative impacts and is economically viable. The recommended alignment alternative may reflect a combination of different advanced alternative roadway segments.

- **Alternative 7C** - Travels westward to the 171st Avenue alignment just north of Jomax Road and continues northward to SR 74.
- **Alternative 1A** - Follows the 163rd Avenue alignment to Patton Road, travels west to 171st Avenue alignment north of Dove Valley Road and returns to 167th Avenue alignment at SR 74.
- **Alternative 2D** - Travels along the 163rd Avenue alignment and shifts west to the 167th Avenue alignment at Montgomery Road and continues northward to SR 74.
- **Alignment 4C** (Similar to Alternative 2D) Travels along the 163rd Avenue alignment and shifts west to the 167th Avenue alignment at White Wing/Lone Mountain Road and continues northward to SR 74.
- **Alignment 3B** Travels northward beginning just east of the 163rd Avenue alignment and shifts to 167th Avenue alignment at Quail Run, continuing northward, and midway between Dove Valley Road and SR 74 shifts to the 175th Avenue alignment and continues northward on 175th Avenue alignment to SR 74.

Alternatives 5D and 6E, located east of the163rd Avenue alignment, were eliminated due to significant topographic and drainage conflicts.

Evaluation of Roadway Alignment Alternatives

Advanced alternatives are evaluated based upon the following criteria:

Roadway

- Roadway cross-section (number of lanes/right-of-way requirements)
- New drainage structure requirements
- Earthwork (Cut/Fill Requirements

Traffic and Access Management

- Traffic Circulation Element
- Access Management

Environmental Impacts

- Negative impact on biological resources
- Evidence of hazardous materials
- Impact to 4f properties
- Presence of recorded cultural sites

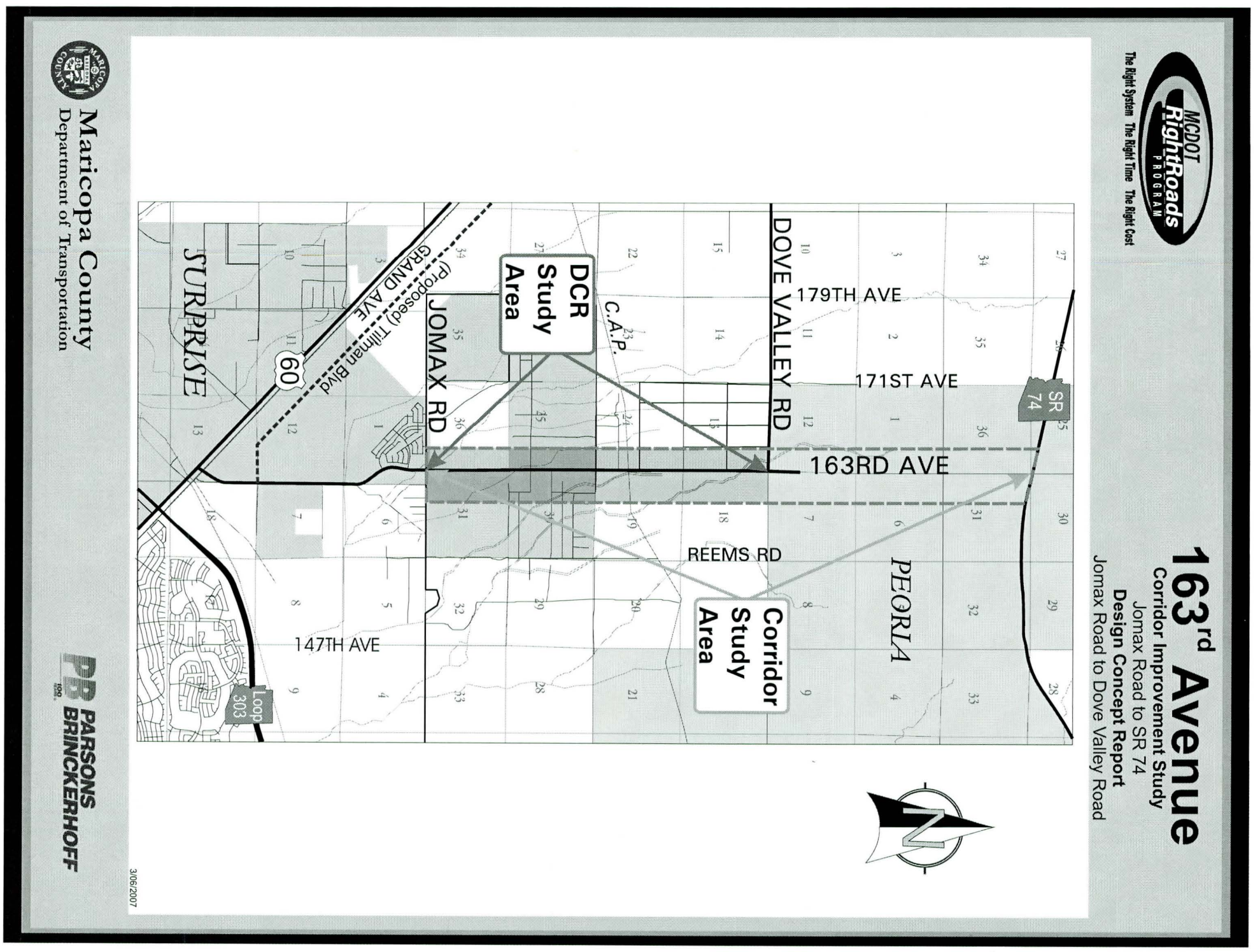
Utility and Right-of-Way Considerations

- Utility relocation or accommodation
- New public ROW requirements

Socio-Economic Factors

- Impact to State Land
- Impact to improved properties
- Impact to proposed development
- Existing & Future Land Use/Zoning Compatibility

Public Acceptability



Study Need

- Respond to regional growth / local development
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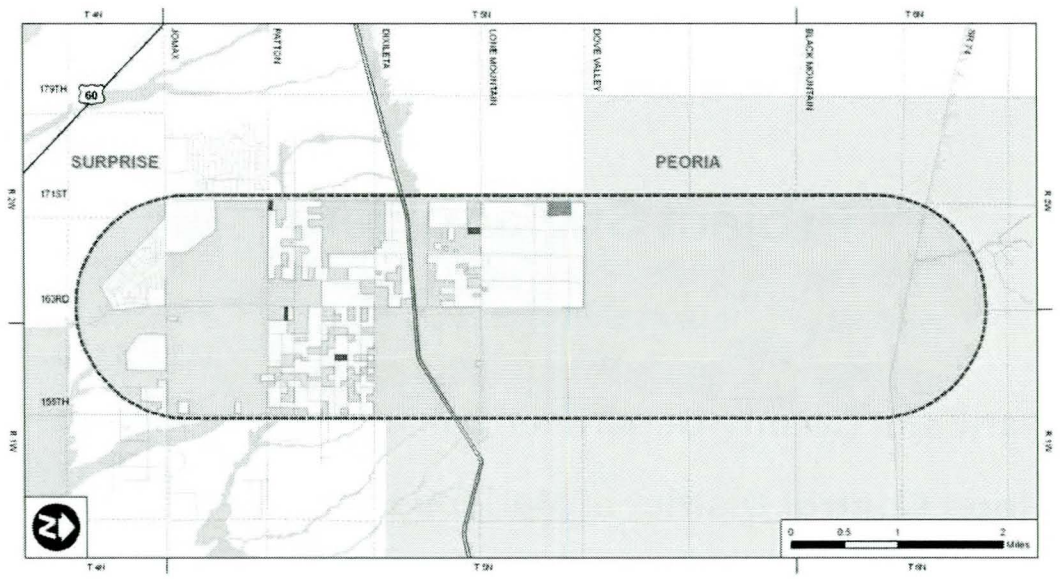
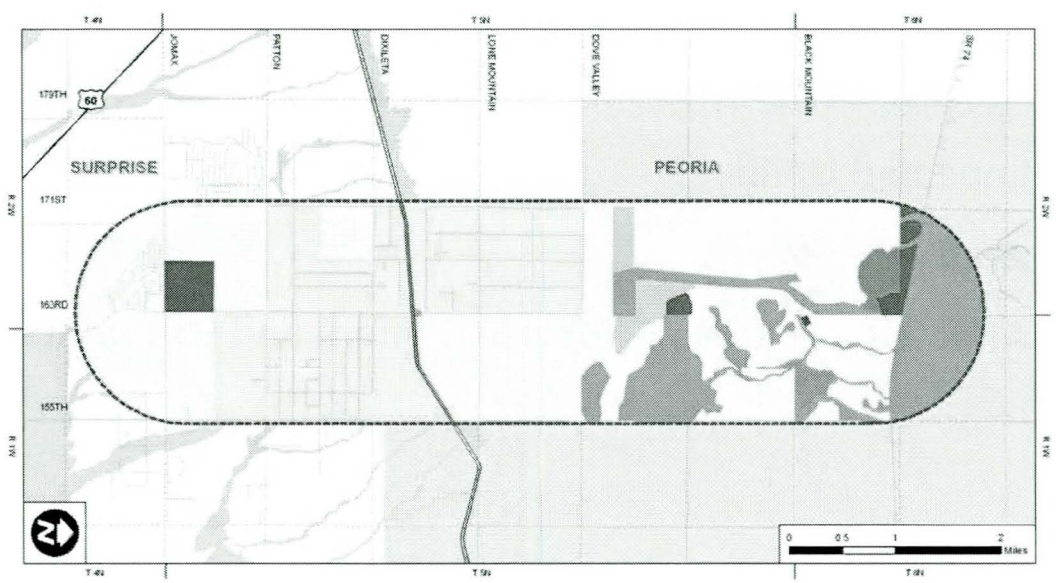


Existing Land Use

Sources: MAG and PB

Legend

- Residential
- Commercial
- Agriculture
- Public/Quasi-Public
- Vacant
- Water
- Central Arizona Project (CAP) Canal
- Railroad
- Roadways
- Corridor Study Area
- Peoria Planning Area
- Surprise Planning Area
- Flood Plains



Future Land Use

Sources: City of Peoria and City of Surprise

Legend

Peoria Land Use
- Residential/Estate
- Residential/Low
- Residential/Medium
- Residential/Medium High
- Mixed Use
- Business Park/Industrial
- Community Commercial
- Park/Open Space
- Public/Quasi-Public

Surprise Land Use
- Rural Residential
- Low Density Residential
- Suburban Residential
- Commercial
- Open Space

- Central Arizona Project (CAP) Canal
- Railroad
- Roadways
- Corridor Study Area
- Peoria Planning Area
- Surprise Planning Area
- Flood Plains

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Segment 1: Jomax Road to CAP Canal Roadway Alignment Alternatives

Criterion	1A West Alignment	2D CAR Alignment	3B East Alignment	4C 163rd Ave Alignment	7C 171st Ave Alignment
Engineering Features					
Typical Section	● 6-Lane Parkway	● 6-Lane Parkway	● 6-Lane Parkway	● 6-Lane Parkway	● 6-Lane Parkway
New Drainage Structures Requirements	◑ 4 Minor Crossings 1 Major Crossing	◑ 4 Minor Crossings 1 Major Crossing	◑ 4 Minor Crossings 1 Major Crossing	◑ 4 Minor Crossings 1 Major Crossing	● 6 Minor Crossings 1 Major Crossing
Earthwork Requirements	○ Minimal Cut and Fill Level Terrain	○ Minimal Cut and Fill Level Terrain	○ Minimal Cut and Fill Level Terrain	○ Minimal Cut and Fill Level Terrain	○ Minimal Cut and Fill Level Terrain
Approach to Dale Rd & Daileta Rd Intersections	● 163rd is NW-SE Consider skew	○ 163rd is North-South	○ 163rd is North-South	○ 163rd is North-South	○ 163rd is North-South
Traffic /Transportation Planning					
City of Surprise Traffic Circulation Element	⊗ Significant diversion from 163rd Ave	○ On or near 163rd Ave	○ On or near 163rd Ave	○ On or near 163rd Ave	⊗ Significant diversion from 163rd Ave
Access Mgmt Strategies Required	◑ Local access needs	◑ Local access needs	◑ Local access needs	◑ Local access needs	◑ Local access needs
Environmental Impacts					
Negative Impact on Biological Resources	◑ No federally listed species identified Desert tortoise may be present	◑ No federally listed species identified Desert tortoise may be present	◑ No federally listed species identified Desert tortoise may be present	◑ No federally listed species identified Desert tortoise may be present	◑ No federally listed species identified Desert tortoise may be present
Evidence of Hazardous Materials	○ No hazardous materials identified	○ No hazardous materials identified	○ No hazardous materials identified	○ No hazardous materials identified	○ No hazardous materials identified
Impact to 4f Properties	◑ CAP Trail is 4(f) property	◑ CAP Trail is 4(f) property	◑ CAP Trail is 4(f) property	◑ CAP Trail is 4(f) property	◑ CAP Trail is 4(f) property
Presence of Recorded Cultural Sites	◑ Numerous sites in area Class III survey needed to determine impacts	◑ Numerous sites in area Class III survey needed to determine impacts	◑ Numerous sites in area Class III survey needed to determine impacts	◑ Numerous sites in area Class III survey needed to determine impacts	◑ Numerous sites in area Class III survey needed to determine impacts
Utility Considerations					
Utility Relocation or Accommodation	◑ New CAP Crossing Overhead Power, Underground Tele.	◑ New CAP Crossing Overhead Power, Underground Tele.	◑ New CAP Crossing Overhead Power, Underground Tele.	◑ New CAP Crossing Overhead Power, Underground Tele.	● New CAP Crossing Most Overhead Power Relocation
Right-of-Way (ROW) Requirements					
New Public ROW Requirements	● 200 ft ROW (Surprise)	● 200 ft ROW (Surprise)	● 200 ft ROW (Surprise)	● 200 ft ROW (Surprise)	● 200 ft ROW (Surprise)
Socio-Economic					
Impact to State Land	● South of Dale Rd	○ Minimal	○ Minimal	○ Minimal	○ None
Impact to Improved Properties	◑ 3 Residential Impacts	○ Zero Residential Impacts	◑ 1 Residential Impact	○ Zero Residential Impacts	◑ 2 Residential Impacts
Impact to Proposed Development	● Sierra Norte [Preliminary Plat]	○ No adjacent developments	○ No adjacent developments	○ No adjacent developments	◑ Tierra Rico [final Plat]
Existing & Future Land Use/Zoning Compatibility	⊗ Not Compatible with General Plans	○ Compatible with General Plans	○ Compatible with General Plans	○ Compatible with General Plans	⊗ Not Compatible with General Plans
Public Opinion					
Public Acceptance					

LEGEND: ○ No/Minimal Impact/Issue ◑ Modest Impact/Issue ● Significant Impact/Issue ⊗ Fatal Flaw

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Maricopa County Department of Transportation

MCDOT RightRoads PROGRAM

The Right System The Right Time The Right Cost

163rd Avenue

Corridor Improvement Study

Jomax Road to SR 74

Design Concept Report

Jomax Road to Dove Valley Road

Segment 2: CAP Canal to Dove Valley Road North
Roadway Alignment Alternatives

Criterion	1A West Alignment	2D CAR Alignment	3B East Alignment	4C 163rd Ave Alignment	7C 171st Ave Alignment
Engineering Features					
Typical Section	● 6-Lane Parkway	● 6-Lane Parkway	● 6-Lane Parkway	● 6-Lane Parkway	● 6-Lane Parkway
New Drainage Structures Requirements	◑ 4 Minor Crossings	● 1 Minor Crossings 1 Bridge	● 2 Minor Crossings 1 Bridge	● 4 Minor Crossings 1 Bridge	◑ 4 Minor Crossings
Earthwork Requirements	○ Minimal Cut and Fill Level Terrain	○ Minimal Cut and Fill Level Terrain	○ Minimal Cut and Fill Level Terrain	○ Minimal Cut and Fill Level Terrain	○ Minimal Cut and Fill Level Terrain
Approach to Dove Valley Rd Intersection	○ 163rd is North-South	○ 163rd is North-South	○ 163rd is North-South	● 163rd is NW-SE Consider skew	○ 163rd is North-South
Intersection Compatibility with Future Lone Mountain Road	○ 163rd is North-South	○ 163rd is North-South	● 163rd is NW-SE Consider skew	○ 163rd is North-South	○ 163rd is North-South
Traffic /Transportation Planning					
City of Peoria General Plan	⊗ Significant diversion	○ Compatible with 163rd Ave alignment	○ Compatible with 163rd Ave alignment	○ Compatible with 163rd Ave alignment	⊗ Significant diversion
City of Surprise Traffic Circulation Element	⊗ Diversion needed	○ Compatible with 163rd Ave alignment	○ Compatible with 163rd Ave alignment	○ Compatible with 163rd Ave alignment	⊗ Diversion needed
Access Mgmt Strategies Required	◑ Local access needs	● Significant access	◑ Local access needs	◑ Local access needs	◑ Local access needs
Environmental Impacts					
Negative Impact on Biological Resources	◑ No federally listed species identified Desert tortoise may be present	◑ No federally listed species identified Desert tortoise may be present	◑ No federally listed species identified Desert tortoise may be present	◑ No federally listed species identified Desert tortoise may be present	◑ No federally listed species identified Desert tortoise may be present
Evidence of Hazardous Materials	○ No hazardous materials identified	○ No hazardous materials identified	○ No hazardous materials identified	○ No hazardous materials identified	○ No hazardous materials identified
Impact to 4f Properties	○ No 4(f) properties identified	○ No 4(f) properties identified	○ No 4(f) properties identified	○ No 4(f) properties identified	○ No 4(f) properties identified
Presence of Recorded Cultural Sites	◑ Numerous sites in area Class III survey needed to determine impacts.	◑ Numerous sites in area Class III survey needed to determine impacts	◑ Numerous sites in area Class III survey needed to determine impacts	◑ Numerous sites in area Class III survey needed to determine impacts	◑ Numerous sites in area Class III survey needed to determine impacts
Utility Considerations					
Utility Relocation or Accommodation	◑ Overhead Power	◑ Overhead Power, Water	◑ Overhead Power, Water	◑ Overhead Power, Water	◑ Overhead Power
Right-of-Way (ROW) Requirements					
New Public ROW Requirements	● 200 ft ROW (Surprise) 150 ft ROW (Peoria)	● 200 ft ROW (Surprise) 150 ft ROW (Peoria)	● 200 ft ROW (Surprise) 150 ft ROW (Peoria)	● 200 ft ROW (Surprise) 150 ft ROW (Peoria)	● 200 ft ROW (Surprise) 150 ft ROW (Peoria)
Socio-Economic					
Impact to State Land	○ Minimal	○ None	◑ S/O Marisol Ranch	○ Minimal	○ None
Impact to Improved Properties	◑ 1 Residential Impact	● 17 Residential Impacts	◑ 6 Residential Impacts	○ Zero Residential Impacts	◑ 1 Residential Impacts
Impact to Proposed Development	◑ Does not abut Marisol Ranch	◑ Does not abut Marisol Ranch	◑ Does not abut Marisol Ranch	○ Direct access to Marisol Ranch	◑ Does not abut Marisol Ranch
Land Use/Zoning Compatibility	⊗ Not Compatible with General Plans	○ Compatible with General Plans	○ Compatible with General Plans	○ Compatible with General Plans	⊗ Not Compatible with General Plans
Public Opinion					
Public Acceptance					

LEGEND: ○ No/Minimal Impact/Issue ◑ Modest Impact/Issue ● Significant Impact/Issue ⊗ Fatal Flaw

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Maricopa County Department of Transportation

PARSONS BRINCKERHOFF

MCDOT RightRoads PROGRAM

The Right System The Right Time The Right Cost

163rd Avenue

Corridor Improvement Study

Jomax Road to SR 74

Design Concept Report

Jomax Road to Dove Valley Road

Segment 3: Dove Valley Road North to SR 74
Roadway Alignment Alternatives

Criterion	1A West Alignment	2D CAR Alignment	3B East Alignment	4C 163rd Ave Alignment	7C 171st Ave Alignment
Engineering Features					
Typical Section	● 6-Lane Parkway	● 6-Lane Parkway	● 6-Lane Parkway	● 6-Lane Parkway	● 6-Lane Parkway
New Drainage Structures Requirements	● 5 Minor Crossings 2 Major Crossings	● 2 Minor Crossings 2 Major Crossings	○ 0 Crossings	● 3 Minor Crossings 2 Major Crossings	● 2 Minor Crossings 2 Major Crossings
Earthwork Requirements	○ Minimal Cut and Fill Level Terrain	● Significant Excavation Cuts into hill	○ Minimal Cut and Fill Level Terrain	○ Minimal Cut and Fill Level Terrain	○ Minimal Cut and Fill Level Terrain
Quintero Rd Access	○ No Impact	○ No Impact	● Realign or add TI on SR 74	No Impact	● Realign or add TI on SR 74
Traffic /Transportation Planning					
Meets Existing SR 74 Connection Plans	○ Yes	○ Yes	● No; Poor SR 74 TI spacing	○ Yes	◑ No; Requires adjustment
City of Peoria General Plan	○ OK	○ OK	⊗ Poor SR 74 spacing	○ OK	⊗ Requires adjustment
Access Mgmt Strategies Required	○ No access	○ No access	○ No access	○ No access	○ No access
Environmental Impacts					
Negative Impact on Biological Resources	◑ No federally listed species identified Desert tortoise may be present	○ No federally listed species identified Desert tortoise may be present	◑ No federally listed species identified Desert tortoise may be present	◑ No federally listed species identified Desert tortoise may be present	◑ No federally listed species identified Desert tortoise may be present
Evidence of Hazardous Materials	○ No hazardous materials identified	○ No hazardous materials identified Household waste dumping on 167th Ave	○ No hazardous materials identified Household waste dumping on 167th Ave	○ No hazardous materials identified Household waste dumping on 167th Ave	○ No hazardous materials identified
Impact to 4f Properties	○ No 4(f) properties identified	○ No 4(f) properties identified	○ No 4(f) properties identified	○ No 4(f) properties identified	○ No 4(f) properties identified
Presence of Recorded Cultural Sites	◑ Numerous sites in area Class III survey needed to determine impacts	◑ Numerous sites in area Class III survey needed to determine impacts	◑ Numerous sites in area Class III survey needed to determine impacts.	◑ Numerous sites in area Class III survey needed to determine impacts	◑ Numerous sites in area Class III survey needed to determine impacts
Utility Considerations					
Utility Relocation or Accommodation	◑ Future water & wastewater coordination	◑ Existing water; Future water & wastewater coordination	◑ Existing water; Future water & wastewater coordination	◑ Existing water; Future water & wastewater coordination	◑ Future water & wastewater coordination
Right-of-Way (ROW) Requirements					
New Public ROW Requirements	● 150 ft ROW (Peoria)	● 150 ft ROW (Peoria)	● 150 ft ROW (Peoria)	● 150 ft ROW (Peoria)	● 150 ft ROW (Peoria)
Socio-Economic					
Impact to State Land	○ Minimal	○ None	◑ S/O Marisol Ranch	○ Minimal	○ None
Impact to Improved Properties	○ Zero Residential Impacts	○ Zero Residential Impacts	○ Zero Residential Impacts	○ Zero Residential Impacts	○ Zero Residential Impacts
Impact to Proposed Development	◑ ¼ mile west of developments	○ Direct access to developments	● ½ mile+ west of developments	◑ ¼ mile west of developments	● ½ mile west of developments
Land Use/Zoning Compatibility	○ Compatible with General Plans	○ Compatible with General Plans	⊗ Not Compatible with General Plans	○ Compatible with General Plans	⊗ Not Compatible with General Plans
Public Opinion					
Public Acceptance					

LEGEND: ○ No/Minimal Impact/Issue ◑ Modest Impact/Issue ● Significant Impact/Issue ⊗ Fatal Flaw

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The Right System The Right Time The Right Cost

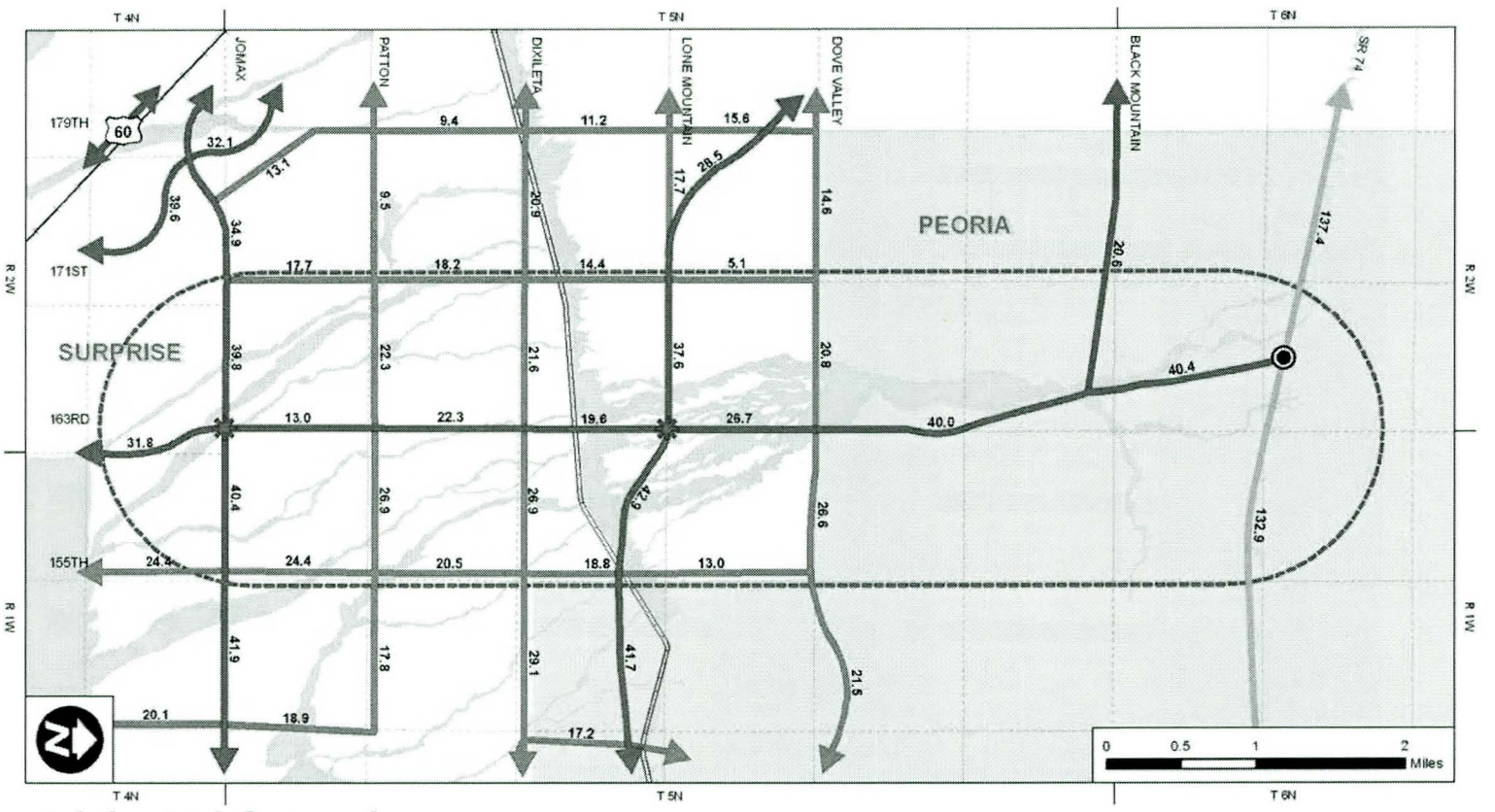
163rd Avenue

Corridor Improvement Study

Jomax Road to SR 74

Design Concept Report

Jomax Road to Dove Valley Road



Northwest Adopted General Plans Roadway Network Projected Traffic Volumes

Note: Volumes are shown in thousands.

Sources: MCDOT, MAG, and the CK Group Inc.

Legend

- 6 Lane Freeway
- 6 Lane Expressway
- 6 Lane Parkway
- 6 Lane Major Arterial
- 4 Lane Minor Arterial
- Central Arizona Project (CAP) Canal
- Railroad
- Corridor Study Area
- Major Design Feature
- Traffic Interchange
- Flood Plains
- Peoria Planning Area
- Surprise Planning Area

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163rd Avenue

Corridor Improvement Study

Jomax Road to SR 74

Design Concept Report

Jomax Road to Dove Valley Road

163rd Avenue

Corridor Improvement Study

Jomax Road to SR 74

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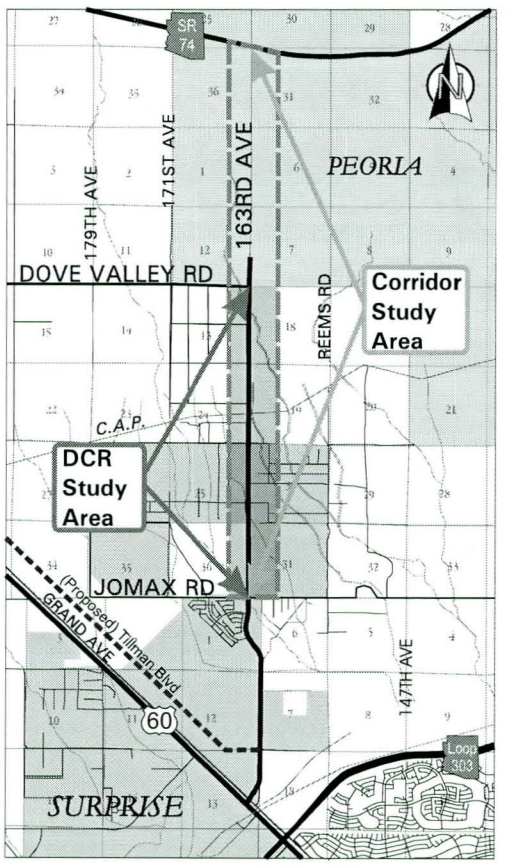
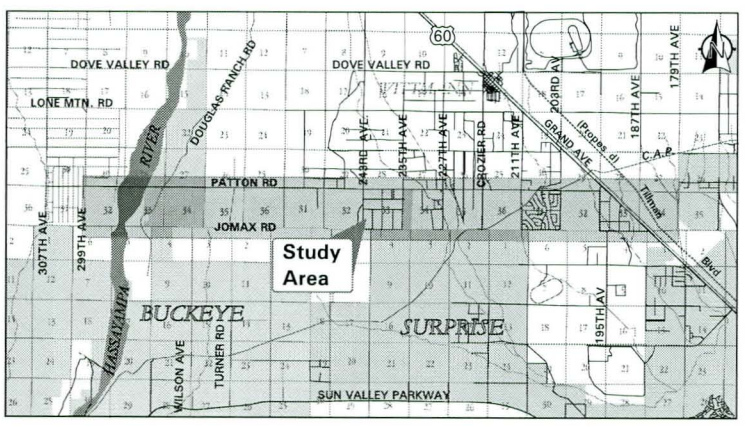
Jomax Road to Dove Valley Road

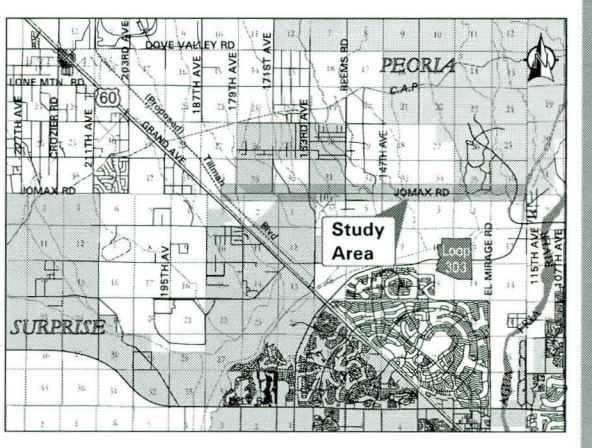




Patton/Jomax

Corridor Improvement Study

299th Avenue to 179th Avenue



Jomax East

Corridor Improvement Study

Tillman Boulevard to SR Loop 303

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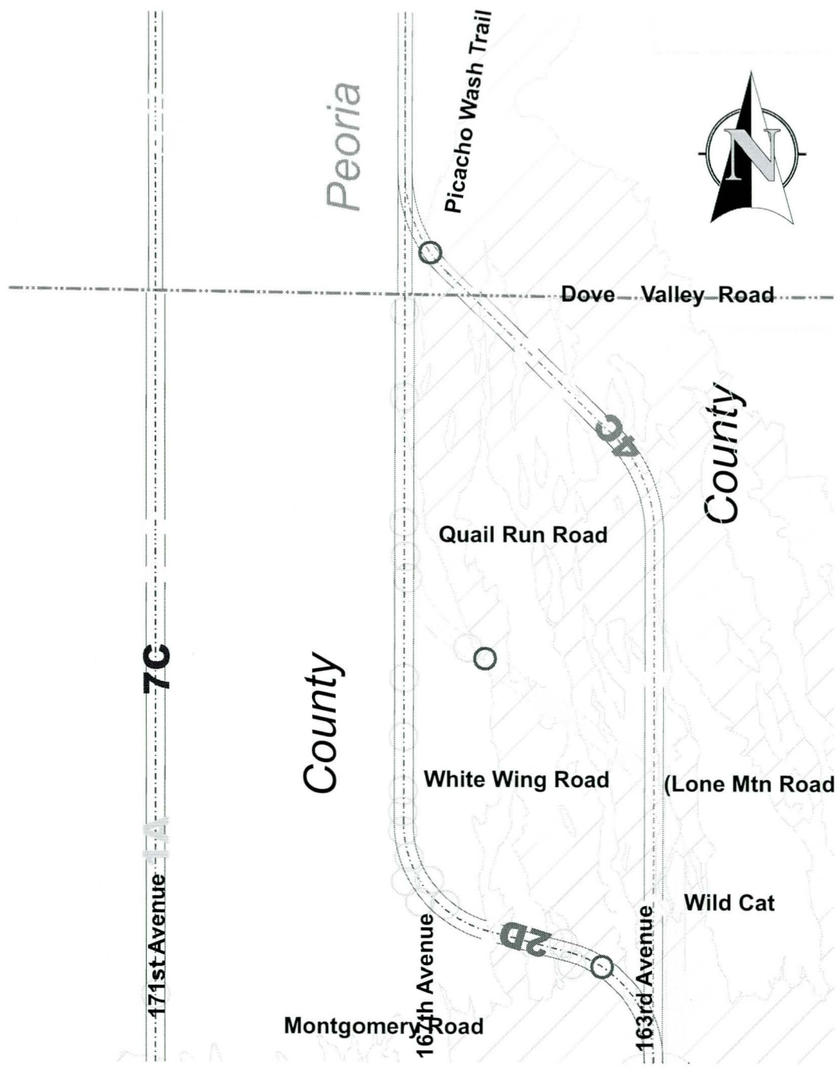
SEGMENT ALTERNATIVES

163rd Avenue Corridor Improvement Study Jomax Road to SR74



Legend

- Right-of-Way
- Floodplain
- Developments
- Minor Drainage Ways
- Major Drainage Ways
- Potential Impact

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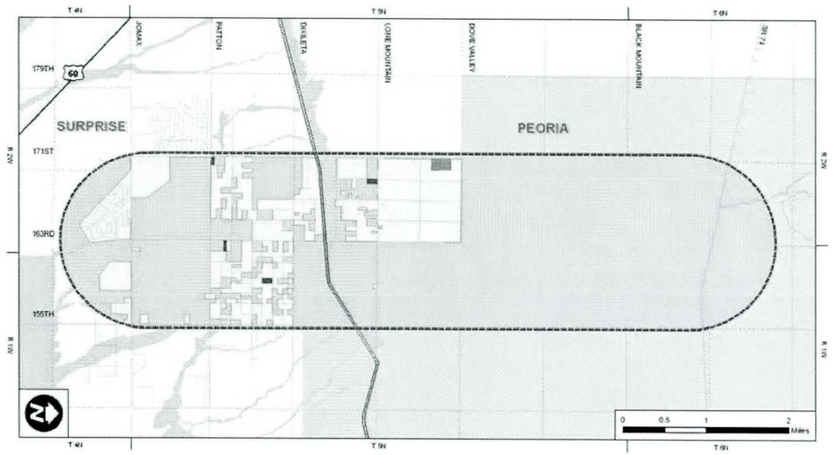
The Right System The Right Time The Right Cost

163rd Avenue

Corridor Improvement Study
Jomax Road to SR 74
Design Concept Report
Jomax Road to Dove Valley Road

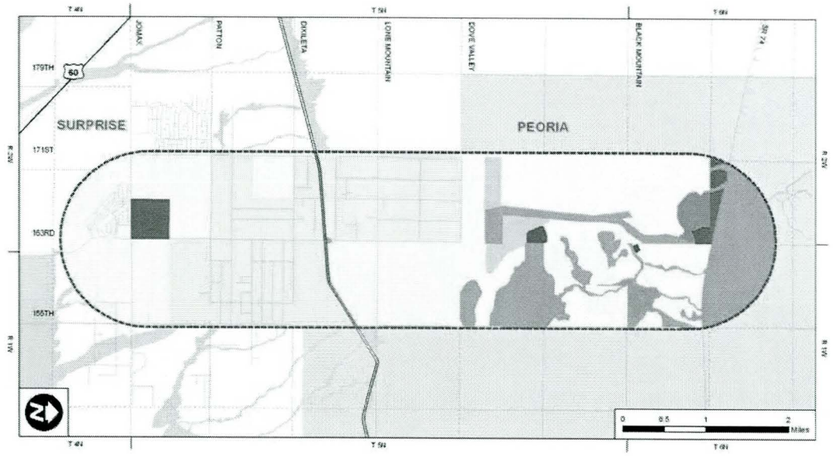


Existing Land Use

Sources: MAG and PB

Legend

- Residential
- Commercial
- Agriculture
- Public/Quasi-Public
- Vacant
- Water
- Central Arizona Project (CAP) Canal
- Railroad
- Roadways
- Corridor Study Area
- Peoria Planning Area
- Surprise Planning Area
- Flood Plains



Future Land Use

Sources: City of Peoria and City of Surprise

Legend

Peoria Land Use
- Residential/Estate
- Residential/Low
- Residential/Medium
- Residential/Medium High
- Mixed Use
- Business Park/Industrial
- Community Commercial
- Park/Open Space
- Public/Quasi-Public

Surprise Land Use
- Rural Residential
- Low Density Residential
- Suburban Residential
- Commercial
- Open Space

- Central Arizona Project (CAP) Canal
- Railroad
- Roadways
- Corridor Study Area
- Peoria Planning Area
- Surprise Planning Area
- Flood Plains

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163rd Avenue

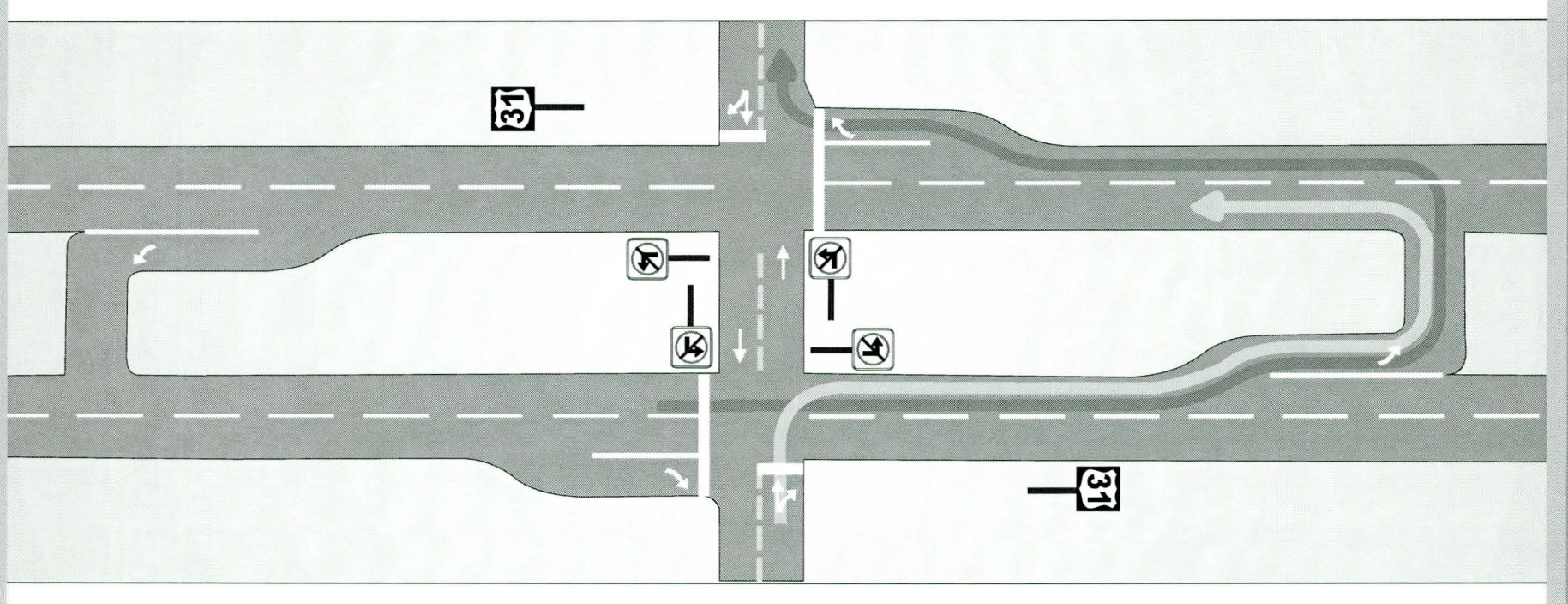
Corridor Improvement Study

Jomax Road to SR 74

Design Concept Report

Jomax Road to Dove Valley Road

In-Direct left Turn



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Department of Transportation

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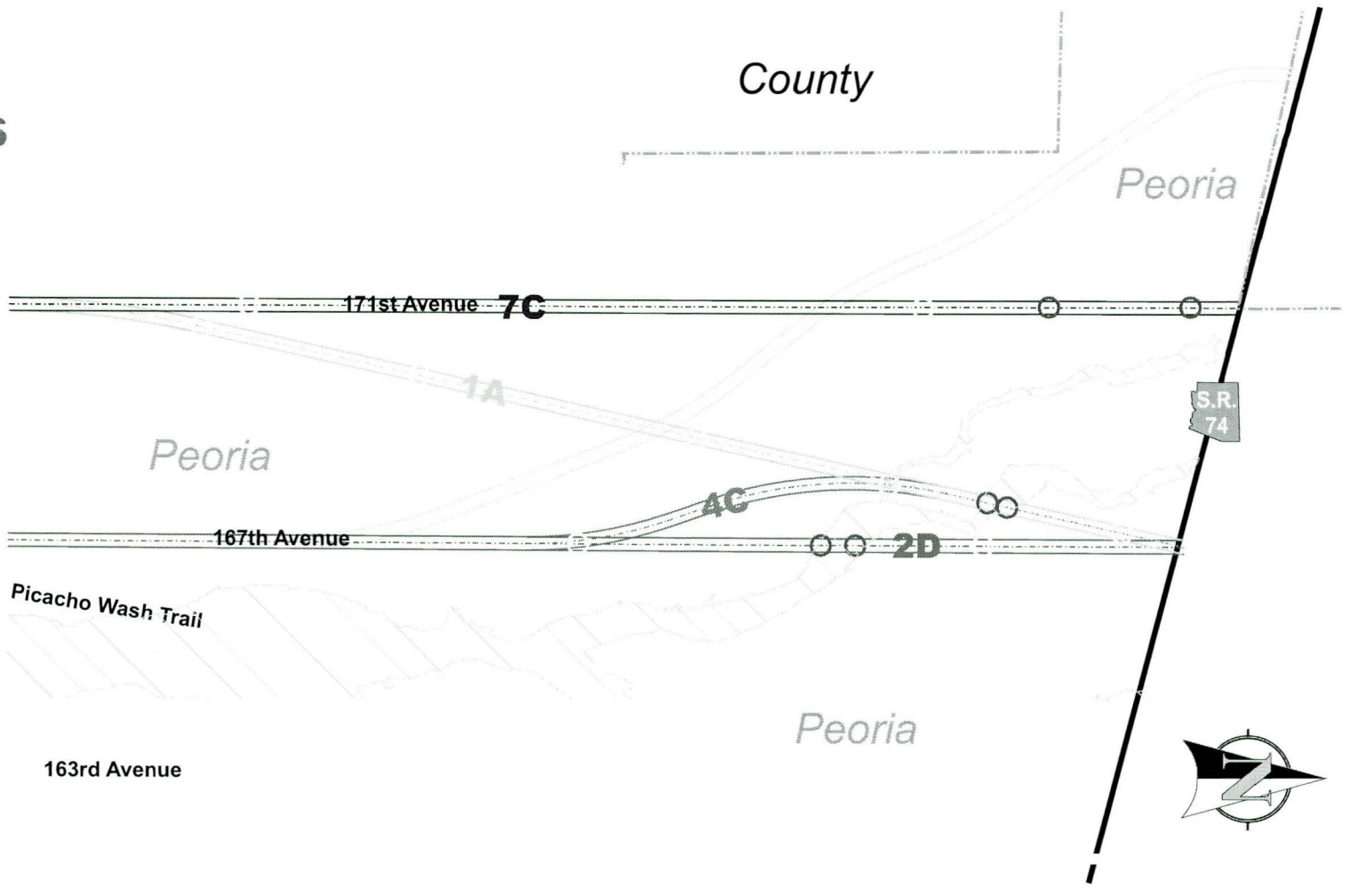
SEGMENT ALTERNATIVES

163rd Avenue Corridor Improvement Study Jomax Road to SR74



Legend

- Right-of-Way
- Floodplain
- Developments
- Minor Drainage Ways
- Major Drainage Ways
- Potential Impact

MCDOT RightRoads PROGRAM
The Right System The Right Time The Right Cost

163rd Avenue

Corridor Improvement Study
Jomax Road to SR 74
Design Concept Report
Jomax Road to Dove Valley Road

Study Objectives

- Define the role of 163rd Avenue as a critical north/south roadway
- Identify current corridor deficiencies
- Define long-term corridor needs and requirements
- Develop / evaluate alternatives
- Establish design criteria for future roadway
- Develop access management guidelines (intersection spacing/median break locations)
- Establish roadway operation and performance criteria
- Complete 30% design plans for 163rd Avenue between Jomax Road and Dove Valley Road
- Coordinate with other current ongoing area studies to ensure an integrated roadway corridor system

Study Challenges

- Incorporate regional and local travel
- Achieve mobility/access balance
- Address current and future development
- Incorporate jurisdictional interests
- Address engineering challenges
- Consider roadway environment

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163rd Avenue
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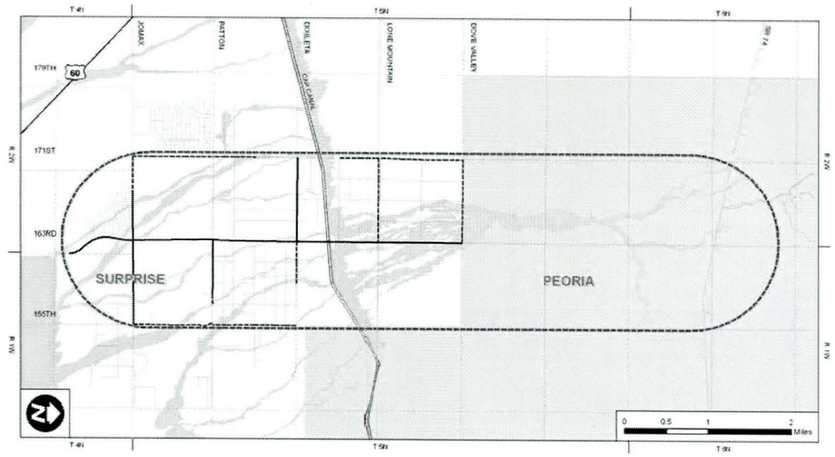
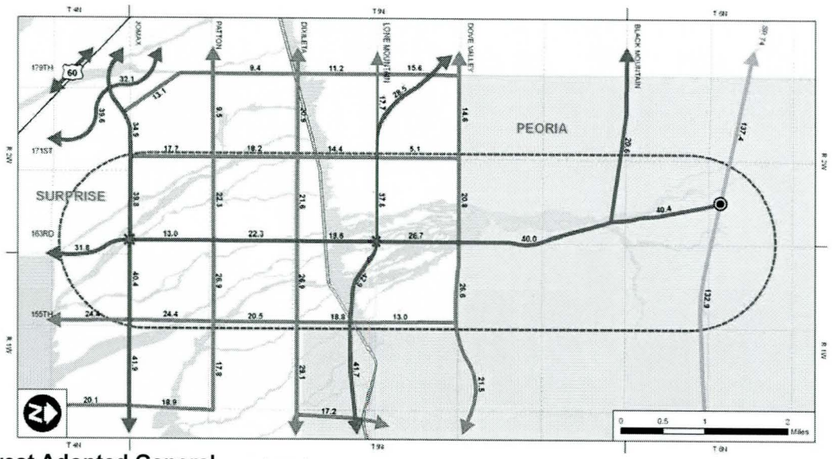


Existing Roadway Network

Legend
- Paved Roadway
- Unpaved Roadway
- Unpaved Residential
- Central Arizona Project (CAP) Canal
- Railroad
- Corridor Study Area
- Flood Plains
- Peoria Planning Area
- Surprise Planning Area



Northwest Adopted General Plans Roadway Network Projected Traffic Volumes

Note: Volumes are shown in thousands.
Sources: MCDOT, MAG, and the CK Group Inc.

Legend
- 6 Lane Freeway
- 6 Lane Expressway
- 6 Lane Parkway
- 6 Lane Major Arterial
- 4 Lane Minor Arterial
- Central Arizona Project (CAP) Canal
- Railroad
- Corridor Study Area
- Major Design Feature
- Traffic Interchange
- Flood Plains
- Peoria Planning Area
- Surprise Planning Area

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163rd Avenue

Corridor Improvement Study
Jomax Road to SR 74
Design Concept Report
Jomax Road to Dove Valley Road

Study Milestone Schedule

Field Review	September 2006
Scoping Public Input Meeting	**November 2, 2006**
Alternatives Analysis Public Input Meeting	**March 6, 2007**
Planning/Engineering CIS	March 2007
Design Features CIS	May 2007
Draft Report Submittal CIS	June 2007
Final Report Submittal CIS	August 2007
Planning/Engineering DCR	September 2007
Design Features DCR	October 2007
Draft Report Submittal DCR	October 2007
Findings and Recommendations Public Input Meeting	**October 2007**
Final Report Submittal DCR	January 2008

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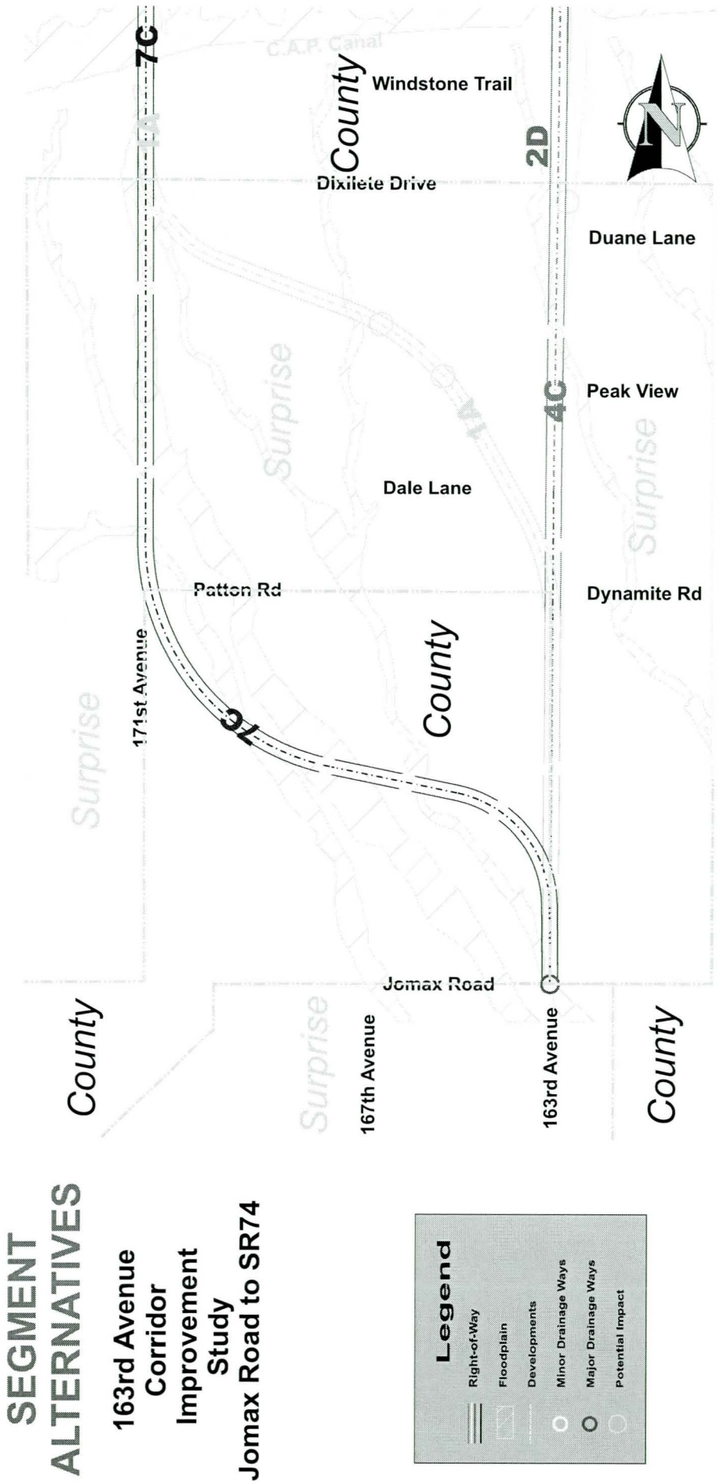

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163rd Avenue

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Jomax Road to SR 74

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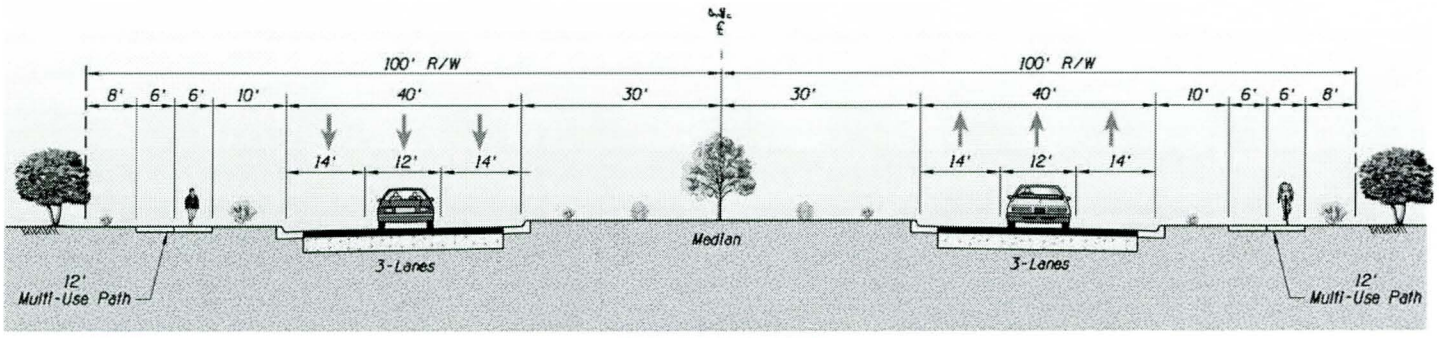
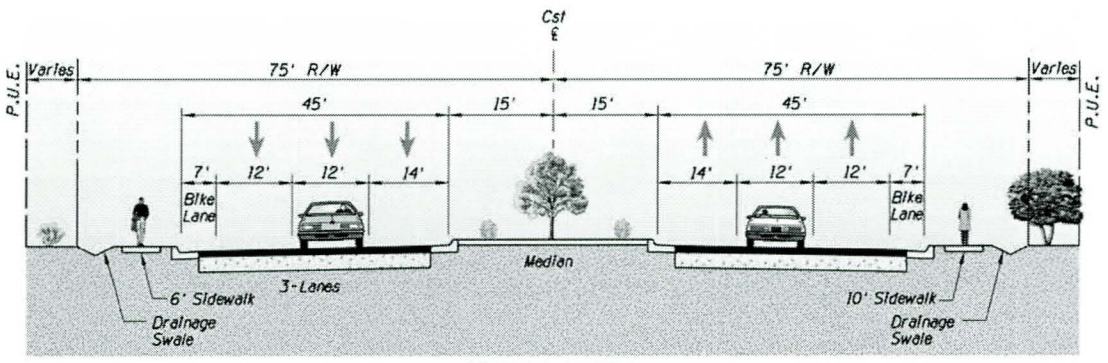


CITY OF SURPRISE
PARKWAY

Jomax Road to Dove Valley Road



CITY OF PEORIA
PARKWAY

Dove Valley Road to SR 74

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163rd Avenue

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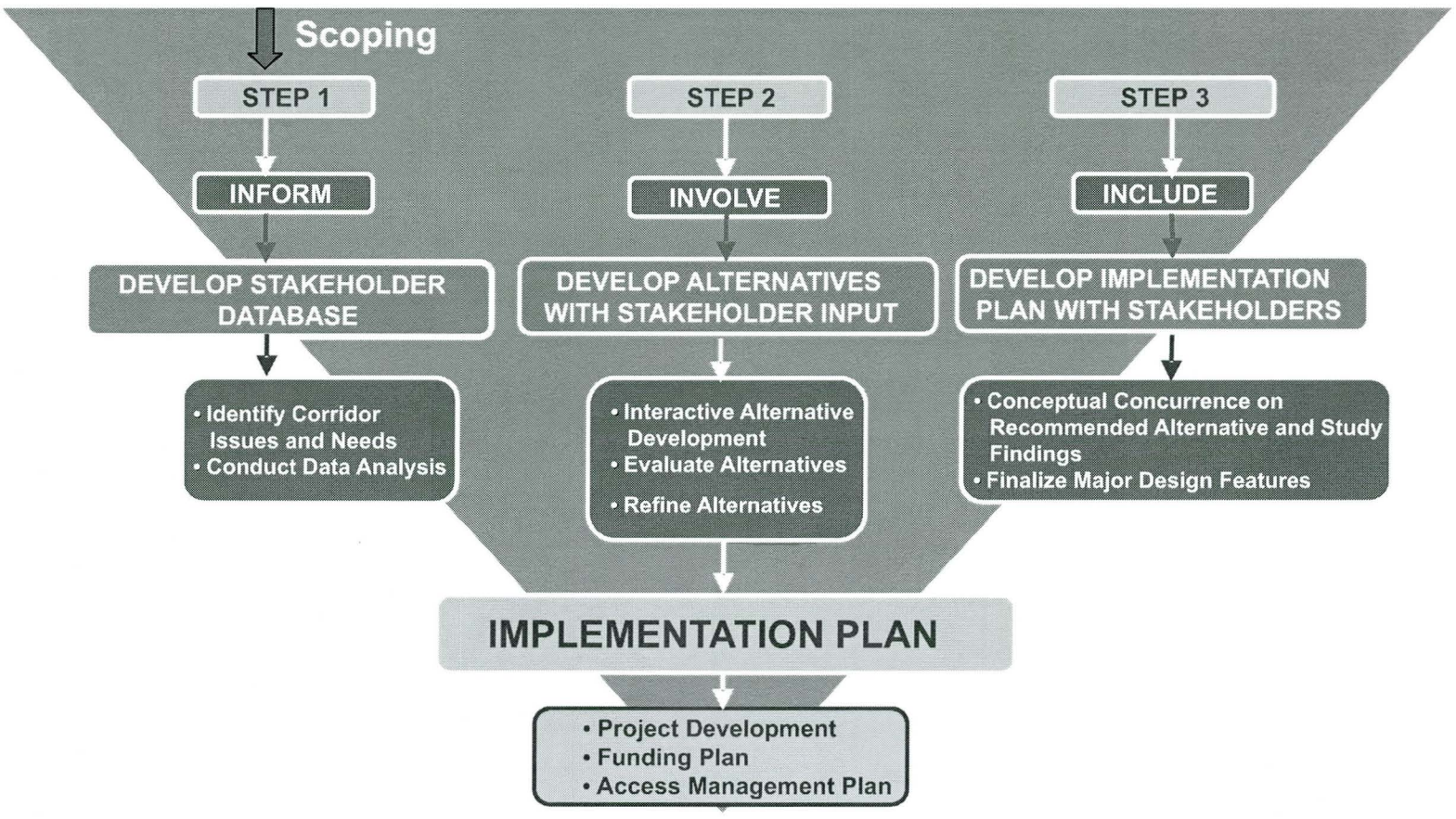
Jomax Road to Dove Valley Road

Interactive Study Process



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Department of Transportation

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MCDOT RightRoads PROGRAM

The Right System The Right Time The Right Cost

163rd Avenue

Corridor Improvement Study

Jomax Road to SR 74

Design Concept Report

Jomax Road to Dove Valley Road

Segment 1: Jomax Road to CAP Canal
Roadway Alignment Alternatives

Criterion	1A West Alignment	2D CAR Alignment	3B East Alignment	4C 163rd Ave Alignment (RECOMMENDED)	7C 171st Ave Alignment
Engineering Features					
Typical Section	● 6-Lane Parkway	● 6-Lane Parkway	● 6-Lane Parkway	● 6-Lane Parkway	● 6-Lane Parkway
New Drainage Structures Requirements	◑ 4 Minor Crossings 1 Major Crossing	◑ 4 Minor Crossings 1 Major Crossing	◑ 4 Minor Crossings .1 Major Crossing	◑ 4 Minor Crossings 1 Major Crossing	● 6 Minor Crossings 1 Major Crossing
Earthwork Requirements	○ Minimal Cut and Fill Level Terrain	○ Minimal Cut and Fill Level Terrain	○ Minimal Cut and Fill Level Terrain	○ Minimal Cut and Fill Level Terrain	○ Minimal Cut and Fill Level Terrain
Approach to Dale Rd & Dixileta Rd Intersections	● 163rd is NW-SE Consider skew	○ 163rd is North-South	○ 163rd is North-South	○ 163rd is North-South	○ 163rd is North-South
Traffic /Transportation Planning					
City of Surprise Traffic Circulation Element	⊗ Significant diversion from 163rd Ave	○ On or near 163rd Ave	○ On or near 163rd Ave	○ On or near 163rd Ave	⊗ Significant diversion from 163rd Ave
Access Mgmt Strategies Required	◑ Local access needs	◑ Local access needs	◑ Local access needs	◑ Local access needs	◑ Local access needs
Environmental Impacts					
Negative Impact on Biological Resources	◑ No federally listed species identified Desert tortoise may be present	◑ No federally listed species identified. Desert tortoise may be present	◑ No federally listed species identified Desert tortoise may be present	◑ No federally listed species identified Desert tortoise may be present	◑ No federally listed species identified Desert tortoise may be present
Evidence of Hazardous Materials	○ No hazardous materials identified	○ No hazardous materials identified	○ No hazardous materials identified	○ No hazardous materials identified	○ No hazardous materials identified
Impact to 4f Properties	◑ CAP Trail is 4(f) property	◑ CAP Trail is 4(f) property	◑ CAP Trail is 4(f) property	◑ CAP Trail is 4(f) property	◑ CAP Trail is 4(f) property
Presence of Recorded Cultural Sites	◑ Numerous sites in area Class III survey needed to determine impacts	◑ Numerous sites in area Class III survey needed to determine impacts	◑ Numerous sites in area Class III survey needed to determine impacts	◑ Numerous sites in area Class III survey needed to determine impacts	◑ Numerous sites in area Class III survey needed to determine impacts
Utility Considerations					
Utility Relocation or Accommodation	◑ New CAP Crossing Overhead Power, Underground Tele.	◑ New CAP Crossing Overhead Power, Underground Tele	◑ New CAP Crossing Overhead Power, Underground Tele.	◑ New CAP Crossing Overhead Power, Underground Tele.	● New CAP Crossing Most Overhead Power Relocation
Right-of-Way (ROW) Requirements					
New Public ROW Requirements	● 200 ft ROW (Surprise)	● 200 ft ROW (Surprise)	● 200 ft ROW (Surprise)	● 200 ft ROW (Surprise)	● 200 ft ROW (Surprise)
Socio-Economic					
Impact to State Land	● South of Dale Rd	○ Minimal	◑ North of Dixileta Rd	○ Minimal	○ None
Impact to Improved Properties	◑ 3 Residential Impacts	○ Zero Residential Impacts	◑ 1 Residential Impact	○ Zero Residential Impacts	◑ 2 Residential Impacts
Impact to Proposed Development	● Sierra Norte (Preliminary Plat)	○ No adjacent developments	○ No adjacent developments	○ No adjacent developments	◑ Tierra Rico (Final Plat)
Existing & Future Land Use/Zoning Compatibility	⊗ Not Compatible with General Plans	○ Compatible with General Plans	○ Compatible with General Plans	○ Compatible with General Plans	⊗ Not Compatible with General Plans
Public Opinion					
Public Acceptance	○	○	○	○	○

LEGEND: ○ No/Minimal Impact/Issue ◑ Modest Impact/Issue ● Significant Impact/Issue ⊗ Fatal Flaw

7/17/2007

Maricopa County Department of Transportation

MCDOT RightRoads PROGRAM

The Right System The Right Time The Right Cost

163rd Avenue

Corridor Improvement Study

Jomax Road to SR 74

Design Concept Report

Jomax Road to Dove Valley Road

Segment 2: CAP Canal to Dove Valley Road North
Roadway Alignment Alternatives

Criterion	1A West Alignment	2D CAR Alignment	3B East Alignment	4C 163rd Ave Alignment (RECOMMENDED)	7C 171st Ave Alignment
Engineering Features					
Typical Section	● 6-Lane Parkway	● 6-Lane Parkway	● 6-Lane Parkway	● 6-Lane Parkway	● 6-Lane Parkway
New Drainage Structures Requirements	◑ 4 Minor Crossings	● 1 Minor Crossings 1 Bridge	● 2 Minor Crossings 1 Bridge	● 4 Minor Crossings 1 Bridge	◑ 4 Minor Crossings
Earthwork Requirements	○ Minimal Cut and Fill Level Terrain	○ Minimal Cut and Fill Level Terrain	○ Minimal Cut and Fill Level Terrain	○ Minimal Cut and Fill Level Terrain	○ Minimal Cut and Fill Level Terrain
Approach to Dove Valley Rd Intersection	○ 163rd is North-South	○ 163rd is North-South	○ 163rd is North-South	● 163rd is NW-SE Consider skew	○ 163rd is North-South
Intersection Compatibility with Future Lone Mountain Road	○ 163rd is North-South	○ 163rd is North-South	● 163rd is NW-SE Consider skew	○ 163rd is North-South	○ 163rd is North-South
Traffic /Transportation Planning					
City of Peoria General Plan	⊗ Significant diversion	○ Compatible with 163rd Ave alignment	○ Compatible with 163rd Ave alignment	○ Compatible with 163rd Ave alignment	⊗ Significant diversion
City of Surprise Traffic Circulation Element	⊗ Diversion needed	○ Compatible with 163rd Ave alignment	○ Compatible with 163rd Ave alignment	○ Compatible with 163rd Ave alignment	⊗ Diversion needed
Access Mgmt Strategies Required	◑ Local access needs	● Significant access	◑ Local access needs	◑ Local access needs	◑ Local access needs
Environmental Impacts					
Negative Impact on Biological Resources	◑ No federally listed species identified Desert tortoise may be present	◑ No federally listed species identified Desert tortoise may be present	◑ No federally listed species identified Desert tortoise may be present	◑ No federally listed species identified Desert tortoise may be present	◑ No federally listed species identified Desert tortoise may be present
Evidence of Hazardous Materials	○ No hazardous materials identified	○ No hazardous materials identified	○ No hazardous materials identified	○ No hazardous materials identified	○ No hazardous materials identified
Impact to 4f Properties	○ No 4(f) properties identified	○ No 4(f) properties identified	○ No 4(f) properties identified	○ No 4(f) properties identified	○ No 4(f) properties identified
Presence of Recorded Cultural Sites	◑ Numerous sites in area Class III survey needed to determine impacts.	◑ Numerous sites in area Class III survey needed to determine impacts	◑ Numerous sites in area Class III survey needed to determine impacts	◑ Numerous sites in area Class III survey needed to determine impacts	◑ Numerous sites in area Class III survey needed to determine impacts
Utility Considerations					
Utility Relocation or Accommodation	◑ Overhead Power	◑ Overhead Power, Water	◑ Overhead Power, Water	◑ Overhead Power, Water	◑ Overhead Power
Right-of-Way (ROW) Requirements					
New Public ROW Requirements	● 200 ft ROW (Surprise) 150 ft ROW (Peoria)	● 200 ft ROW (Surprise) 150 ft ROW (Peoria)	● 200 ft ROW (Surprise) 150 ft ROW (Peoria)	● 200 ft ROW (Surprise) 150 ft ROW (Peoria)	● 200 ft ROW (Surprise) 150 ft ROW (Peoria)
Socio-Economic					
Impact to State Land	○ Minimal	○ None	◑ S/O Marisol Ranch	○ Minimal	○ None
Impact to Improved Properties	◑ 1 Residential Impact	● 17 Residential Impacts	◑ 6 Residential Impacts	○ Zero Residential Impacts	◑ 1 Residential Impacts
Impact to Proposed Development	◑ Does not abut Marisol Ranch	◑ Does not abut Marisol Ranch	◑ Does not abut Marisol Ranch	○ Direct access to Marisol Ranch	◑ Does not abut Marisol Ranch
Land Use/Zoning Compatibility	⊗ Not Compatible with General Plans	○ Compatible with General Plans	○ Compatible with General Plans	○ Compatible with General Plans	⊗ Not Compatible with General Plans
Public Opinion					
Public Acceptance	○	●	◑	○	○

LEGEND: ○ No/Minimal Impact/Issue ◑ Modest Impact/Issue ● Significant Impact/Issue ⊗ Fatal Flaw

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Jomax Road to SR 74

Design Concept Report

Jomax Road to Dove Valley Road

Segment 3: Dove Valley Road North to SR 74
Roadway Alignment Alternatives

Criterion	1A West Alignment	2D CAR Alignment	3B East Alignment	RECOMMENDED 4C 163rd Ave Alignment	7C 171st Ave Alignment
Engineering Features					
Typical Section	● 6-Lane Parkway	● 6-Lane Parkway	● 6-Lane Parkway	● 6-Lane Parkway	● 6-Lane Parkway
New Drainage Structures Requirements	● 5 Minor Crossings 2 Major Crossings	● 2 Minor Crossings 2 Major Crossings	○ 0 Crossings	● 3 Minor Crossings 2 Major Crossings	● 2 Minor Crossings 2 Major Crossings
Earthwork Requirements	○ Minimal Cut and Fill Level Terrain	● Significant Excavation Cuts into hill	○ Minimal Cut and Fill Level Terrain	○ Minimal Cut and Fill Level Terrain	○ Minimal Cut and Fill Level Terrain
Quintero Rd Access	○ No Impact	○ No Impact	● Realign or add TI on SR 74	No Impact	● Realign or add TI on SR 74
Traffic /Transportation Planning					
Meets Existing SR 74 Connection Plans	○ Yes	○ Yes	● No; Poor SR 74 TI spacing	○ Yes	◑ No; Requires adjustment
City of Peoria General Plan	○ OK	○ OK	⊗ Poor SR 74 spacing	○ OK	⊗ Requires adjustment
Access Mgmt Strategies Required	○ No access	○ No access	○ No access	○ No access	○ No access
Environmental Impacts					
Negative Impact on Biological Resources	◑ No federally listed species identified Desert tortoise may be present	○ No federally listed species identified Desert tortoise may be present	◑ No federally listed species identified Desert tortoise may be present	◑ No federally listed species identified Desert tortoise may be present	◑ No federally listed species identified Desert tortoise may be present
Evidence of Hazardous Materials	○ No hazardous materials identified	○ No hazardous materials identified Household waste dumping on 167th Ave	○ No hazardous materials identified Household waste dumping on 167th Ave	○ No hazardous materials identified Household waste dumping on 167th Ave	○ No hazardous materials identified
Impact to 4f Properties	○ No 4(f) properties identified	○ No 4(f) properties identified	○ No 4(f) properties identified	○ No 4(f) properties identified	○ No 4(f) properties identified
Presence of Recorded Cultural Sites	◑ Numerous sites in area Class III survey needed to determine impacts	◑ Numerous sites in area Class III survey needed to determine impacts	◑ Numerous sites in area Class III survey needed to determine impacts.	◑ Numerous sites in area Class III survey needed to determine impacts	◑ Numerous sites in area Class III survey needed to determine impacts
Utility Considerations					
Utility Relocation or Accommodation	◑ Future water & wastewater coordination	◑ Existing water; Future water & wastewater coordination	◑ Existing water; Future water & wastewater coordination	◑ Existing water; Future water & wastewater coordination	◑ Future water & wastewater coordination
Right-of- Way (ROW) Requirements					
New Public ROW Requirements	● 150 ft ROW (Peoria)	● 150 ft ROW (Peoria)	● 150 ft ROW (Peoria)	● 150 ft ROW (Peoria)	● 150 ft ROW (Peoria)
Socio-Economic					
Impact to State Land	○ Minimal	○ None	◑ S/O Marisol Ranch	○ Minimal	○ None
Impact to Improved Properties	○ Zero Residential Impacts	○ Zero Residential Impacts	○ Zero Residential Impacts	○ Zero Residential Impacts	○ Zero Residential Impacts
Impact to Proposed Development	◑ ¼ mile west of developments	○ Direct access to developments	● ½ mile+ west of developments	◑ ¼ mile west of developments	● ½ mile west of developments
Land Use/Zoning Compatibility	○ Compatible with General Plans	○ Compatible with General Plans	⊗ Not Compatible with General Plans	○ Compatible with General Plans	⊗ Not Compatible with General Plans
Public Opinion					
Public Acceptance	○	○	○	○	○

LEGEND: ○ No/Minimal Impact/Issue ◑ Modest Impact/Issue ● Significant Impact/Issue ⊗ Fatal Flaw

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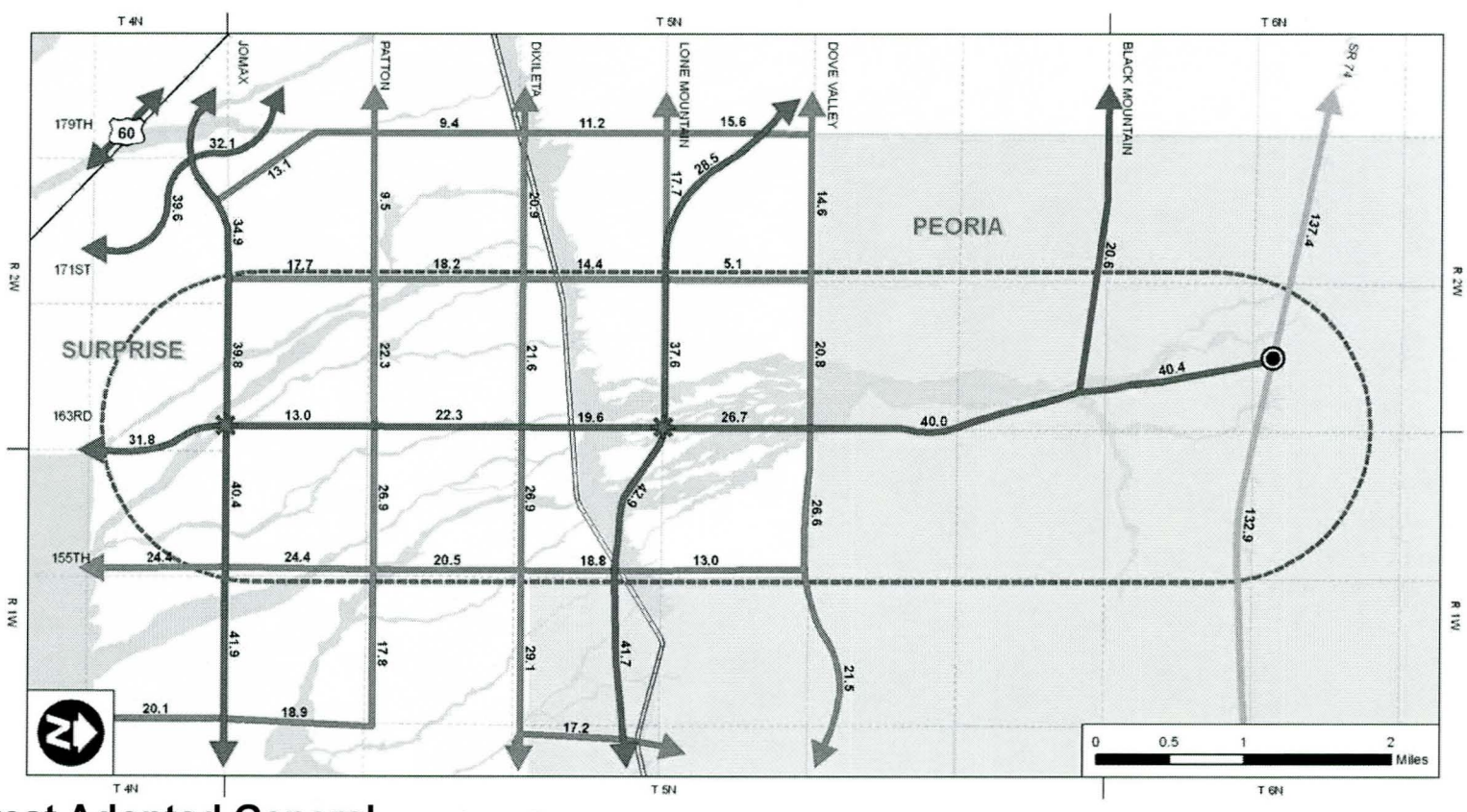

Northwest Adopted General Plans Roadway Network Projected Traffic Volumes

Note: Volumes are shown in thousands.

Sources: MCDOT, MAG, and the CK Group Inc.

Legend

- 6 Lane Freeway
- 6 Lane Expressway
- 6 Lane Parkway
- 6 Lane Major Arterial
- 4 Lane Minor Arterial
- Central Arizona Project (CAP) Canal
- Railroad
- Corridor Study Area
- Major Design Feature
- Traffic Interchange
- Flood Plains
- Peoria Planning Area
- Surprise Planning Area

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Corridor Improvement Study

Jomax Road to SR 74

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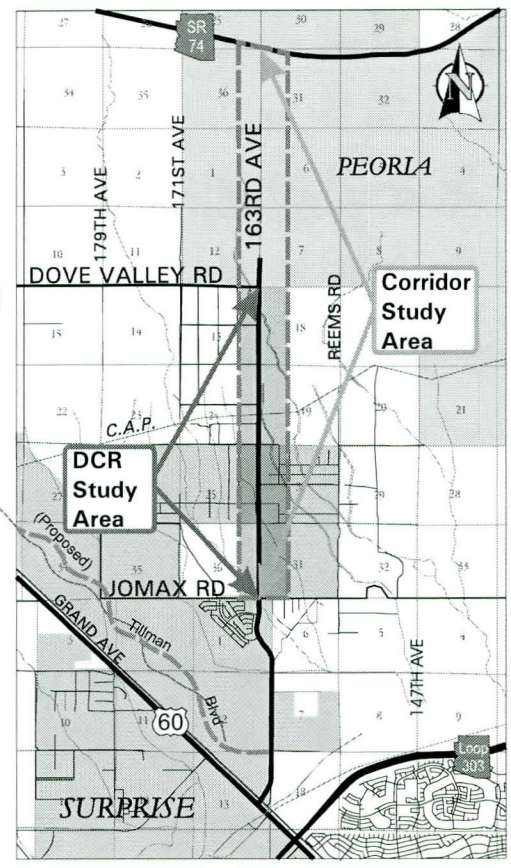
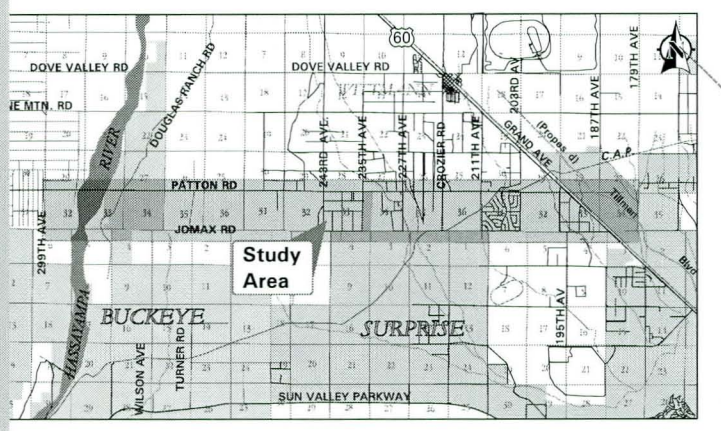
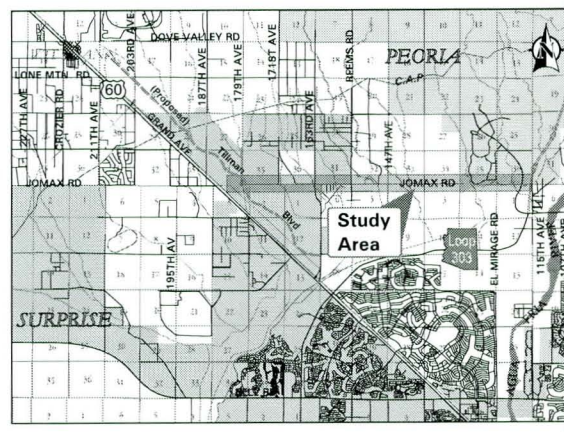
Jomax Road to Dove Valley Road

(50% Complete)







Patton/Jomax

Corridor Improvement Study

299th Avenue to 179th Avenue

(90% Complete)

Jomax East

Corridor Improvement Study

Tillman Boulevard to SR Loop 303

(65% Complete)

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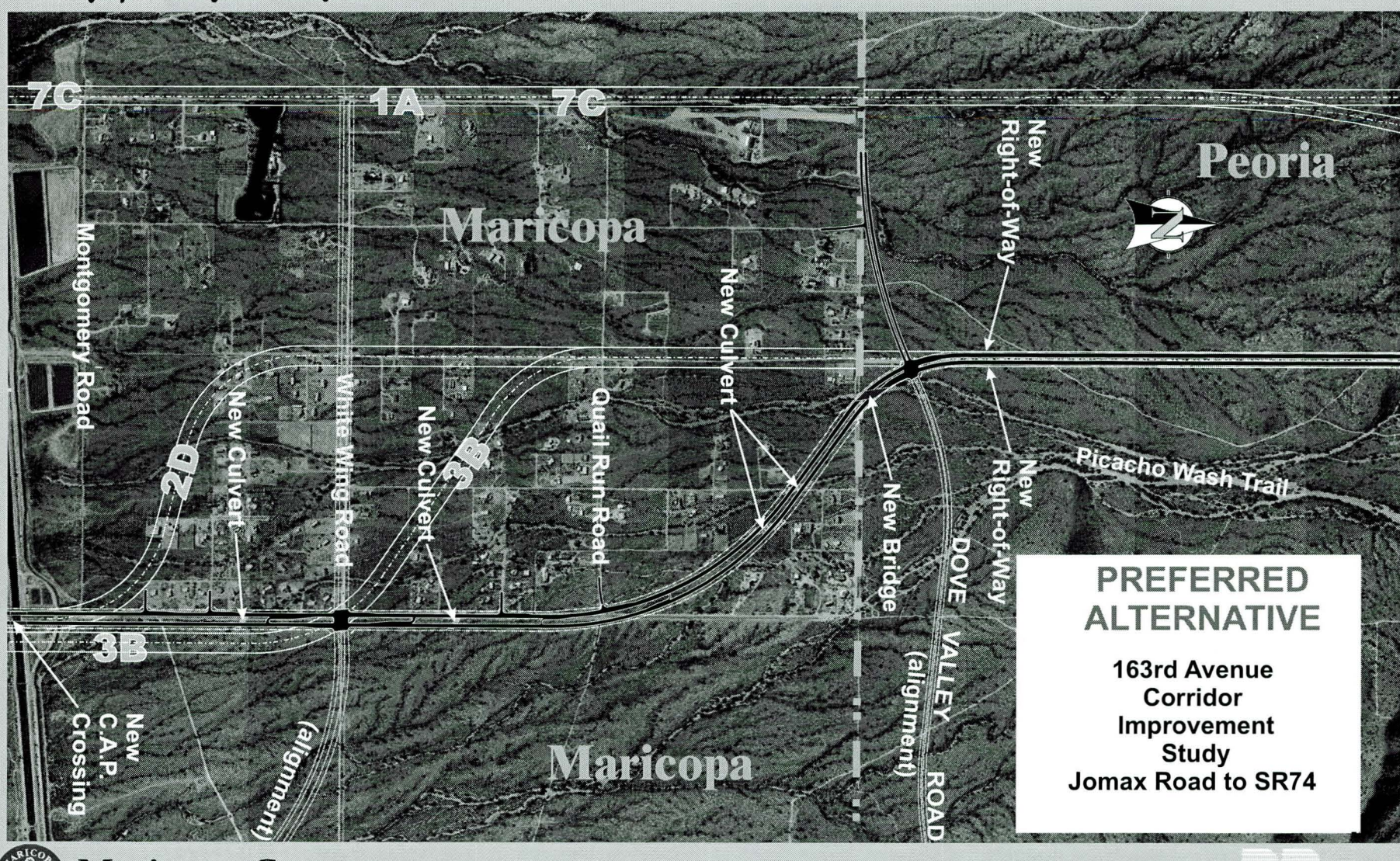

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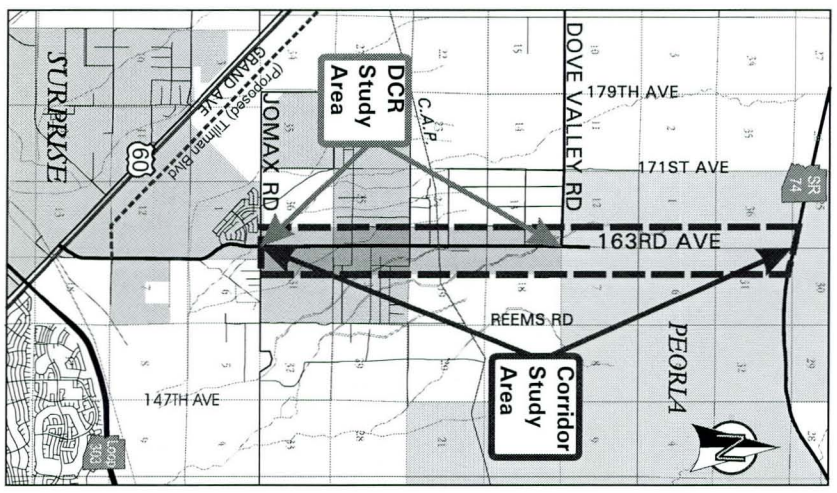
Future Activities and Considerations for Future Corridor Development

The DCR will develop 30% design plans for the segment between Jomax Road and Dove Valley Road. This work is now underway and focusing on the preferred alignment with completion slated for the end of 2007.

As the preferred alternative becomes better defined through more in-depth phases of project development, additional elements will be addressed that more fully account for the needs and impacts of future projects within the context of the current and future settings along the 163rd Avenue corridor.

The following are key issues identified during this study's public involvement process that should be taken into consideration by individual jurisdictions as the recommendations of this study are carried forward into design and implementation:

- **Project Funding.** There is currently no funding programmed for construction. It can be anticipated that area developers will participate as part of project requirements.
- **Access Management Strategies**. MCDOT, the cities of Surprise and Peoria have specific expectations regarding roadway access. Specific strategies should be implemented to ensure a seamless roadway with efficient traffic flow, safety and good access to local land uses.
- **Environmental Impacts and Noise Mitigation**. Specific impacts on the local environment will require further evaluation in future project development.
- **New Right-of-Way Requirements**. Final roadway configuration will determine how much land will need to be acquired.
- **Landscaping plans**. Final project design will specify the type of landscaping to be used.
- **Drainage Structures**. Because the future roadway corridor crosses a number of washes and lies partly in a flood zone, it will be critical to ensure the roadway is designed to provide "all weather" crossings during major storm flows. Bridges along the new roadway will be designed during final roadway design.
- **Bicycle, Pedestrian and Transit Access**. Future projects will be designed to accommodate alternative modes of travel and provide access to trails and neighborhoods in the area.
- **Corridor Traffic Management.** ITS (Intelligent Transportation System) will control operation of traffic between jurisdictions and differing intersection configurations.
- **Jurisdictional Coordination.** As with the overall traffic control, implementation of different corridor improvements and access management concepts will need to be coordinated to ensure a safe, seamless and efficient transportation facility.



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"Findings/Recommendations" Public Meeting

Maricopa County Department of Transportation — July 17, 2007

BACKGROUND

In 1997, Maricopa County Department of Transportation (MCDOT) completed a Comprehensive Plan and Transportation System Plan (TSP) for the unincorporated areas of the County. The TSP included recommendations to improve the existing County arterial road network to meet future transportation demands resulting from projected growth and development county-wide. MCDOT's TSP recommendations were considered in the development of the 2004 Maricopa Association of Governments (MAG) Regional Transportation Plan (RTP).

In direct response to the rapid growth being experienced in northwestern Maricopa County, the RTP identified the need to designate the future roadway alignment for 163rd Avenue between Grand Avenue (US 60) and SR 74.

MCDOT is conducting this current Corridor Improvement Study (CIS) for the portion of 163rd Avenue between Jomax Road and SR 74 (beyond the private development improvements). As part of this study, a more detailed Design Concept Report (DCR) is being conducted on the segment of 163rd Avenue between Jomax Road and Dove Valley Road to address imminent development.

The study segment of 163rd Avenue being evaluated includes three different jurisdictional planning areas and is classified as a future Principal Arterial by MCDOT, a future Parkway by Surprise and as an Arterial by Peoria (all six-lane divided roadways). Roadway construction funded by private development is currently underway on the southern two-mile segment of 163rd Avenue between Grand Avenue and Jomax Road.

CORRIDOR DESCRIPTION

The 163rd Avenue corridor serves northwestern Maricopa County through the cities of Surprise and Peoria. Existing land use south of Dove Valley Road is single family residential on large lots. Between Dove Valley Road and SR 74, the land is primarily undeveloped.

Currently, 163rd Avenue between Jomax Road and Dove Valley Road is a two-lane paved roadway that is intersected by unimproved cross-streets that serve local residential development. North of Dove Valley Road, the roadway is an unimproved dirt road built largely to provide access for waterline construction to development north of SR 74.

STUDY PURPOSE

An agreed-upon plan for this future roadway corridor will ensure regional connectivity, consistent roadway features and standards through the cities of Surprise and Peoria, and ensure adequate right-of-way preservation along the entire corridor.

The purpose of this study is to develop a consensus-driven vision among partner jurisdictions for 163rd Avenue between Jomax Road and SR 74. The study goal is to establish the ultimate roadway alignment, identify existing corridor deficiencies and future requirements and to determine the parameters for consistent roadway design and performance criteria that meet established future needs.

The recommended corridor improvements include future roadway type, number of lanes, roadway cross-section and ultimate right-of-way requirements, traffic control measures with an access management plan, and drainage improvements to safely accommodate future travel demands.

This study will provide the County and other responsible jurisdictions with a future "footprint" of 163rd Avenue along with a recommended timeframe for the implementation and phasing of roadway improvements.

The DCR for the four-mile segment between Jomax Road and Dove Valley Road will identify the preferred roadway alignment and develop 30% design plans to help the City of Surprise in managing current development access issues. The draft DCR will also be presented to the public for input during a public meeting currently scheduled for October 2007.

For more information, contact Renee Probst at (602) 506-8622 or write to her at:
MCDOT, 2901 W. Durango Street, Phoenix, AZ 85009, or e-mail at: ReneeProbst@mail.maricopa.gov.

Study Need
- Respond to regional growth / local development
- Implementation of regional transportation plans

Study Goals
- Create a "footprint" for 163rd Avenue and develop an implementation plan
- Establish principles, policies and guidelines for corridor improvements
- Develop agreed-upon roadway plans and recommendations

Study Objectives
- Define the role of 163rd Avenue as a critical north/south roadway
- Identify current corridor deficiencies
- Define long-term corridor needs and requirements
- Develop / evaluate alternatives
- Establish future roadway design criteria
- Develop access management guidelines (intersection spacing/median break locations)
- Establish roadway operation and performance criteria
- Complete 30% design plans for 163rd Avenue between Jomax Road and Dove Valley Road (DCR)
- Coordinate with other current ongoing area studies to ensure an integrated roadway network system

Study Issues and Challenges
- Incorporate regional and local travel
- Achieve optimum mobility/access balance for operational efficiency
- Address current and future development
- Incorporate jurisdictional interests
- Address engineering challenges
- Consider roadway environment

STUDY APPROACH

The 163rd Avenue CIS is being carried out in two phases: a Planning Phase and an Engineering Phase.

The CIS Planning Phase:
The Planning Phase gathers general background information and prepares several reports (traffic analysis, drainage, utilities, environmental) leading to well-founded recommendations for improvements and longer-term needs along 163rd Avenue. During the Planning Phase, meetings are conducted with affected jurisdictions, agencies, stakeholders and the impacted public to form a broad consensus of the overall needs and vision of the corridor.
Based on the needs identified, alternatives are developed and evaluated for technical and environmental feasibility, public acceptability and economic viability.

CIS Engineering Phase:
The Engineering Phase of the study followed the selection of a preferred alternative. Preliminary engineering design plans, right-of-way requirements and estimated construction costs are prepared for near-term and long-term roadway improvements. Roadway construction phasing priorities, along with policies and guidelines to preserve the intended function of the future roadway, are developed.

With the selection of the preferred roadway alignment, the more detailed DCR phase of the study will proceed to evaluate 163rd Avenue between Jomax Road and Dove Valley Road. The report will develop 30% design plans that specify roadway type, alignment and access points. The DCR will also define crossing drainage ways (bridges or culverts) and generate a more detailed cost estimate to allow accurate budgeting for construction.

Project Stakeholders
- Maricopa County Department of Transportation
- Flood Control District of Maricopa County
- City of Surprise
- City of Peoria
- Arizona State Land Department
- Arizona Department of Transportation
- Impacted Utilities
- Area Developers
- Affected Business, Property Owners and Residents

Study Milestone Schedule

Field Review	September 2006
Scoping Public Input Meeting	November 2, 2006
Alternatives Analysis	
Public Input Meeting	**March 6, 2007**
Planning/Engineering CIS	April 2007
Design Features CIS	May 2007
Findings & Recommendations (Preferred Alignment)	
Public Input Meeting	**July 2007**
Draft Report Submittal CIS	July 2007
Final Report Submittal CIS	September 2007
Planning/Engineering DCR	September 2007
Design Features DCR	October 2007
DCR Public Input Meeting	**October 2007**
Draft Report Submittal DCR	November 2007
Final Report Submittal DCR	January 2008

Public Involvement

Gaining consensus amongst the agencies and the public is critical to the success of the study and future implementation of its recommendations to provide a safe and efficient roadway for the long term. Four public input meetings are held during the course of the study process. The first "Public Scoping" meeting, held in November last year, provided the public with an opportunity to inform the project team about the study area and local transportation needs. The "Alternatives Analysis" public input meeting held in March this year presented the corridor alternatives advanced for further evaluation for public review and comment. The third "Findings & Recommendations - Preferred Alignment" public input meeting (July 17, 2007) presents the study findings and a recommended roadway and corridor selection along with generalized access management strategies for public review. A fourth and final public input meeting will be conducted to gather input on the draft DCR for the segment of 163rd Avenue between Jomax Road and Dove Valley Road in October 2007. Your input during each phase of study development is very important.

CIS Draft Findings & Recommendations:

Current Activities and Key Technical Findings
Since the "Alternatives Analysis" public input meeting (March 2007) which presented possible corridor alternatives (options), the 163rd Avenue CIS team has completed the necessary technical analyses, evaluated the findings, and based upon the previously identified objectives, has selected a preferred roadway alignment. This alignment is now being carried forward as the basis of more detailed design efforts in the DCR phase (Jomax Road to Dove Valley Road).

In both Peoria and Surprise General Plans, 163rd Avenue is designated as a future six-lane divided "Parkway" with provision for right and left turns at major intersections. The Peoria parkway right-of-way width requirement is 150-feet. Peoria uses standard intersections with all turn lanes concentrated at the intersection and managed by traffic signal.

The required Surprise parkway right-of-way width is 200-feet, 50-feet greater than City of Peoria's parkway right-of-way width requirement. The additional roadway right-of-way width (50') requirement within the City of Surprise jurisdiction is necessary to accommodate the "indirect left turn" traffic control measure currently under evaluation for implementation on portions of the 163rd Avenue corridor within Surprise. Under this access plan, left-turn movement is eliminated at the intersection. Instead, motorists make a U-turn at a point beyond the intersection then return to the intersection from the opposite direction and turn right in the desired direction.

Selection of the "Preferred Alignment"
The 163rd Avenue corridor alignment alternatives cover a broad area bounded by 175th Avenue alignment on the west side of the corridor and 163rd Avenue alignment on the east side of the corridor. The primary basis for the selection of a preferred roadway alignment is to identify an efficient "path" through the area that has the least possible impact on existing development and homes, drainage paths, utilities and environmentally sensitive areas. The preferred alignment must also be economically feasible (affordable to build).

Each of the advanced alignment alternatives sought to balance corridor attributes and impacts (positive or negative). Through additional analysis of the advanced alternatives, the preferred alignment alternative emerged as the option that minimized, mitigated or avoided negative impacts.

The preferred alternative follows the general alignment of 163rd Avenue between Jomax Road and Quail Run, then moves westerly to the 167th Avenue alignment between Quail Run and Dove Valley Road. This preferred alternative minimizes negative impacts to private properties and the need for expensive bridge structures at major drainage crossings.

Within the City of Surprise, between Jomax Road and Dove Valley Road, the roadway should consist of six travel lanes (three lanes each direction) in a 200-foot right-of-way corridor (to accommodate "indirect left-turn traffic control measure). Roadway widening will occur east of the existing western right-of-way line to avoid potential acquisition of improved properties. This alignment also avoids environmentally sensitive areas near the CAP canal.

North of Dove Valley Road to SR 74, within the City of Peoria, the future roadway should also consist of six travel lanes (three lanes each direction) in a 150-foot right-of-way corridor. As of yet there is no development in this reach and the primary concern is the most efficient traversing of major drainage courses such as the Padelford Wash. The preferred alignment along 167th Avenue at this point also aligns with the entrance to the Quintero development, a future grade separated traffic interchange at SR 74 under ADOT's plan.

Access Management Guidelines
Access Management strategy for 163rd Avenue will be further refined in the DCR currently underway as part of this study for the 163rd Avenue segment between Jomax Road and Dove Valley Road. In general, it will use a variety of techniques to manage roadway access. In Surprise, intersection treatments will incorporate the "indirect left-turn" concept. In Peoria, signalized intersections with traditional left-turn lanes will be implemented. In some cases, a frontage road system may be appropriate to augment local access. Throughout the corridor, left turns may be restricted to maintain roadway efficiency and enhance traffic safety.

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Future Activities and Considerations for Future Corridor Development

The following are key issues identified during this study's public involvement process that should be taken into consideration by individual jurisdictions as the recommendations of this study are carried forward into design and implementation:

- **Project Funding.** There is currently no funding programmed for construction. It can be anticipated that area developers will participate as part of project requirements.
- **Access Management Strategies**. MCDOT, the cities of Surprise and Peoria have specific expectations regarding roadway access. Specific strategies should be implemented to ensure a seamless roadway with efficient traffic flow, safety and good access to local land uses.
- **Environmental Impacts and Noise Mitigation**. Specific impacts on the local environment will require further evaluation in future project development.
- **New Right-of-Way Requirements**. Final roadway configuration will determine how much land will need to be acquired.
- **Landscaping plans**. Final project design will specify the type of landscaping to be used.
- **Drainage Structures**. Because the future roadway corridor crosses a number of washes and lies partly in a flood zone, it will be critical to ensure the roadway is designed to provide "all weather" crossings during major storm flows. Bridges along the new roadway will be designed during final roadway design.
- **Bicycle, Pedestrian and Transit Access**. Future projects will be designed to accommodate alternative modes of travel and provide access to trails and neighborhoods in the area.
- **Corridor Traffic Management.** ITS (Intelligent Transportation System) will control operation of traffic between jurisdictions and differing intersection configurations.
- **Jurisdictional Coordination.** As with the overall traffic control, implementation of different corridor improvements and access management concepts will need to be coordinated to ensure a safe, seamless and efficient transportation facility.

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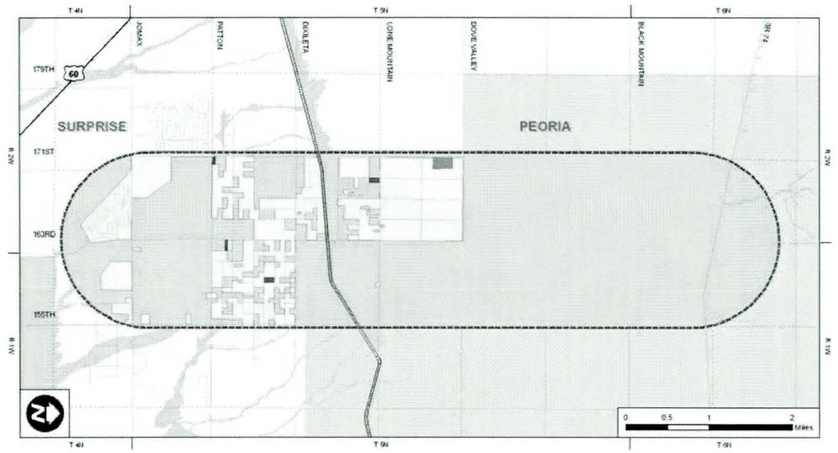
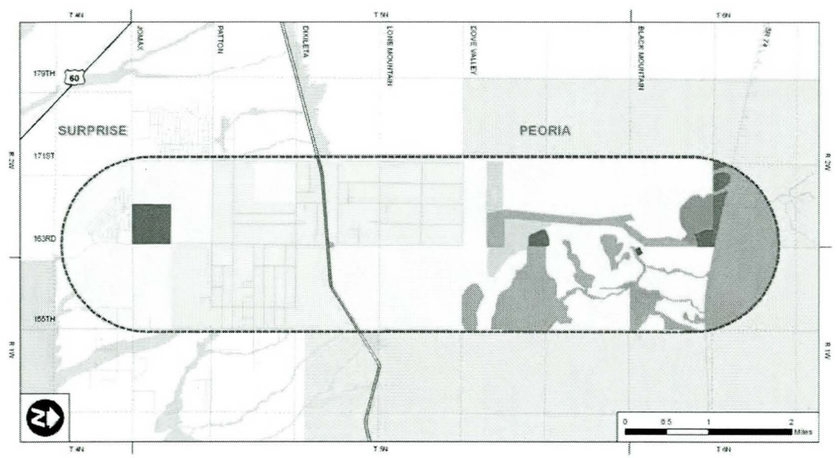


Existing Land Use

Sources: MAG and PB

Legend
Residential
Commercial
Agriculture
Public/Quasi-Public
Vacant
Water
Central Arizona Project (CAP) Canal
Railroad
Roadways
Corridor Study Area
Peoria Planning Area
Surprise Planning Area
Flood Plains



Future Land Use

Sources: City of Peoria and City of Surprise

Legend
Peoria Land Use
Residential/Estate
Residential/Low
Residential/Medium
Residential/Medium High
Mixed Use
Business Park/Industrial
Community Commercial
Park/Open Space
Public/Quasi-Public
Surprise Land Use
Rural Residential
Low Density Residential
Suburban Residential
Commercial
Open Space
Central Arizona Project (CAP) Canal
Railroad
Roadways
Corridor Study Area
Peoria Planning Area
Surprise Planning Area
Flood Plains

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MCDOT RightRoads PROGRAM

The Right System The Right Time The Right Cost

163rd Avenue

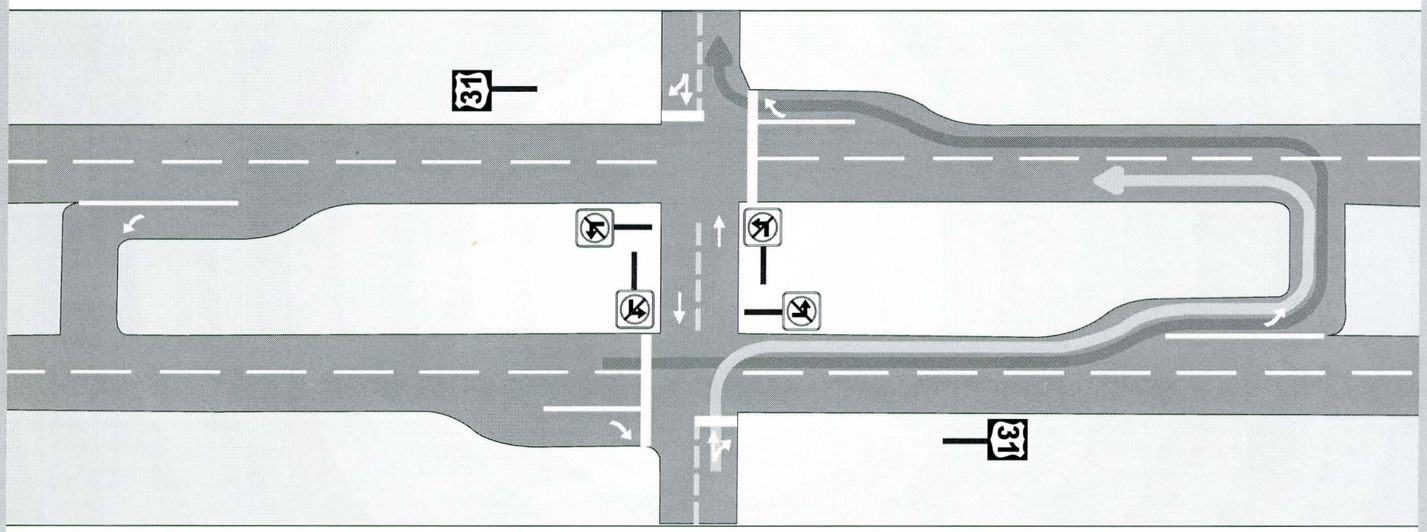
Corridor Improvement Study

Jomax Road to SR 74

Design Concept Report

Jomax Road to Dove Valley Road

In-Direct left Turn



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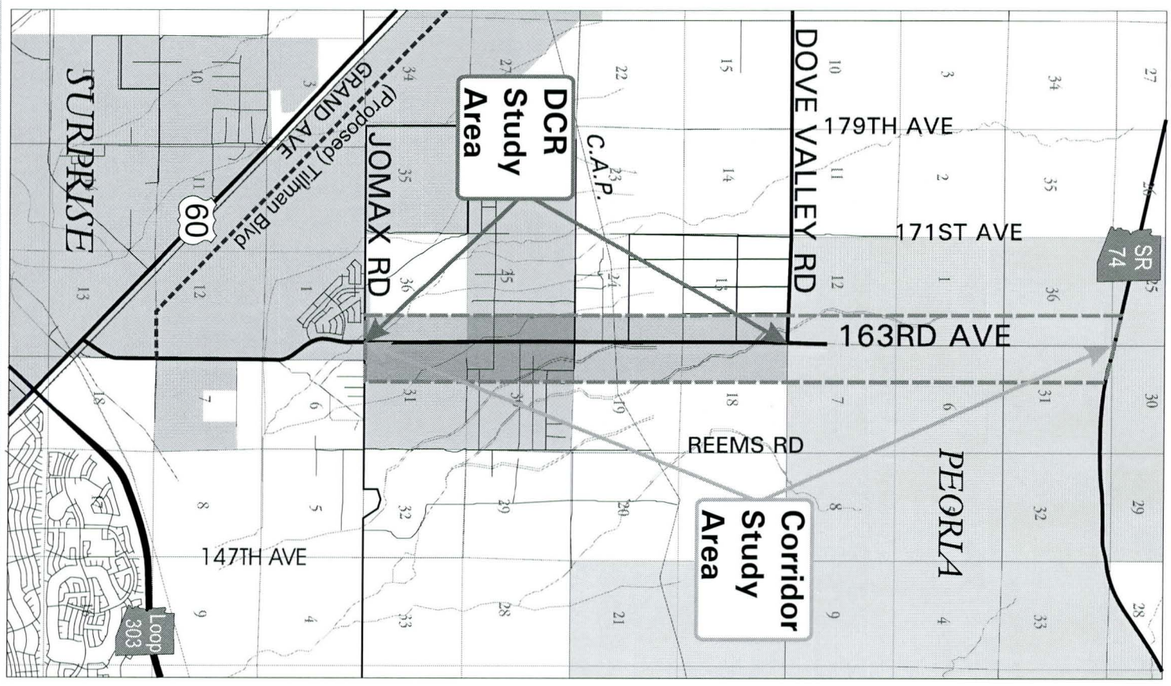

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MCDOT RightRoads PROGRAM

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163rd Avenue

Corridor Improvement Study
Jomax Road to SR 74
Design Concept Report
Jomax Road to Dove Valley Road

Study Need

- Respond to regional growth / local development
- Implementation of regional transportation plans

Study Goals

- Create a "vision" or footprint for 163rd Avenue and develop a plan for achieving the vision
- Establish principles, policies and guidelines for corridor improvements
- Develop agreed-upon roadway plans and recommendations

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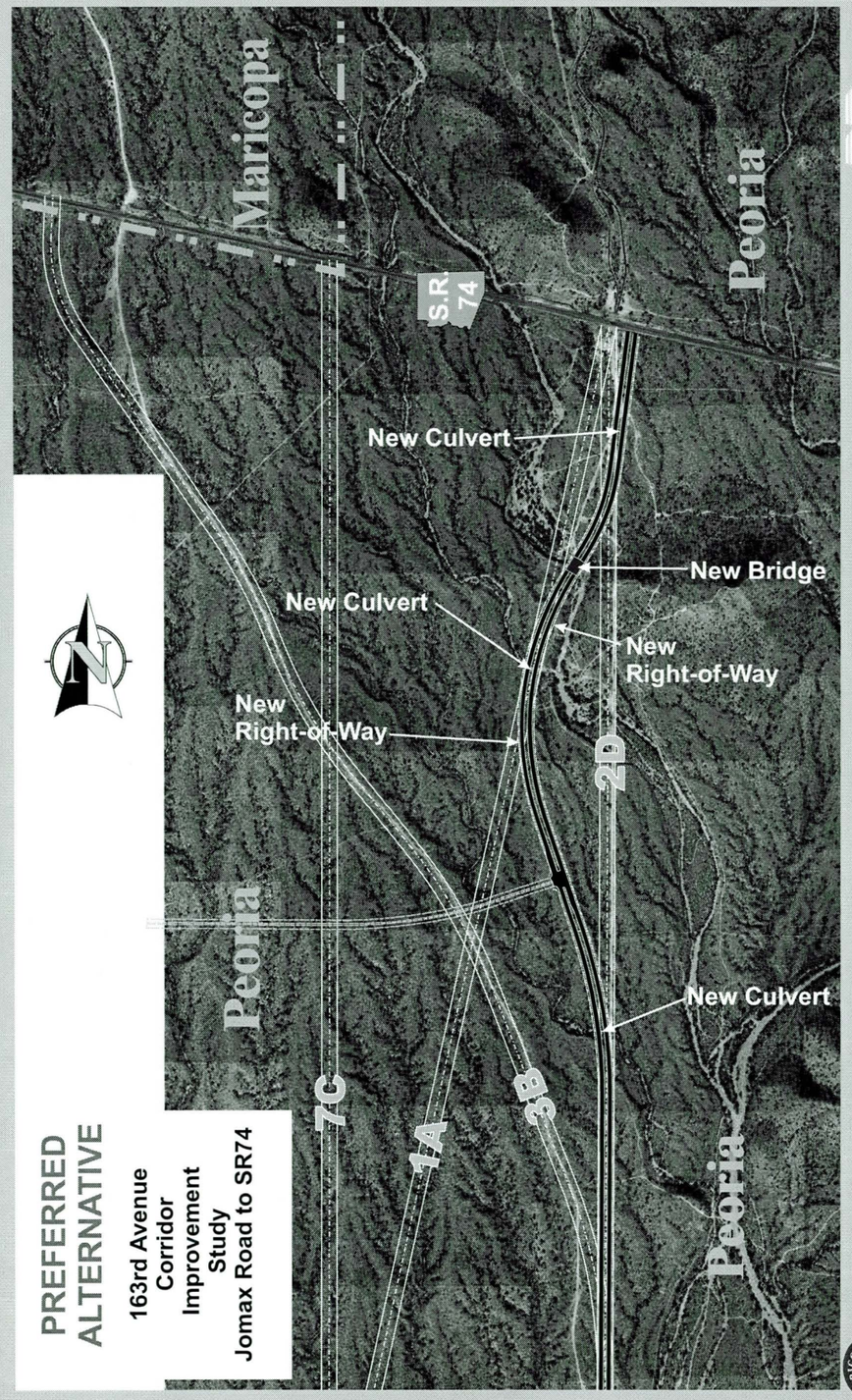
163rd Avenue
Corridor Improvement Study
Jomax Road to SR 74
Design Concept Report
Jomax Road to Dove Valley Road



PREFERRED ALTERNATIVE

163rd Avenue Corridor Improvement Study Jomax Road to SR74

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The Right System The Right Time The Right Cost

163rd Avenue

Corridor Improvement Study
Jomax Road to SR 74
Design Concept Report
Jomax Road to Dove Valley Road

Study Objectives

- Define the role of 163rd Avenue as a critical north/south roadway
- Identify current corridor deficiencies
- Define long-term corridor needs and requirements
- Develop / evaluate alternatives
- Establish design criteria for future roadway
- Develop access management guidelines (intersection spacing/median break locations)
- Establish roadway operation and performance criteria
- Complete 30% design plans for 163rd Avenue between Jomax Road and Dove Valley Road
- Coordinate with other current ongoing area studies to ensure an integrated roadway corridor system

Study Challenges

- Incorporate regional and local travel
- Achieve mobility/access balance
- Address current and future development
- Incorporate jurisdictional interests
- Address engineering challenges
- Consider roadway environment

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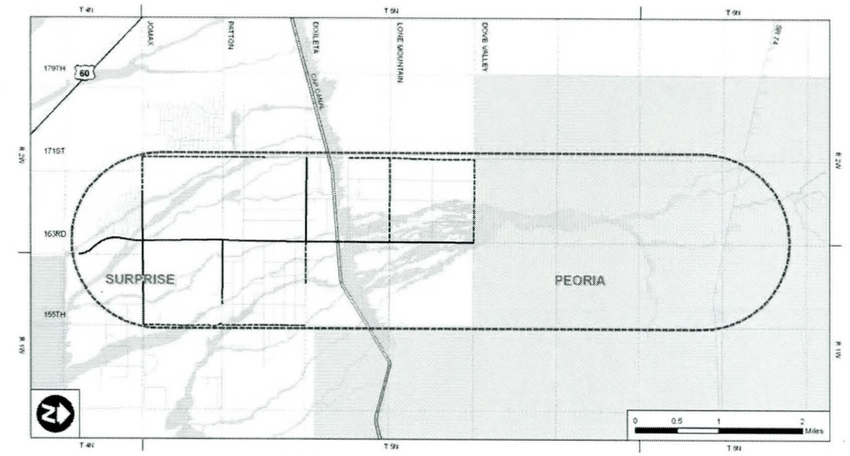
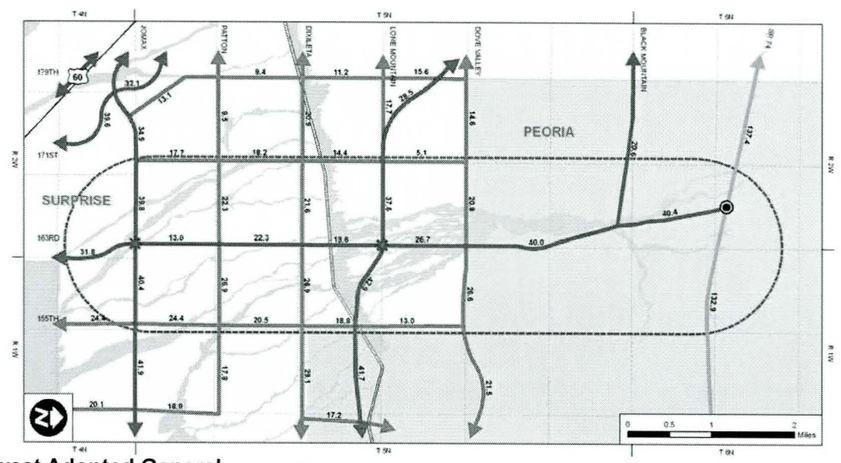
163rd Avenue

Corridor Improvement Study
Jomax Road to SR 74
Design Concept Report
Jomax Road to Dove Valley Road



Existing Roadway Network



Northwest Adopted General Plans Roadway Network Projected Traffic Volumes

Note: Volumes are shown in thousands.
Sources: MCDOT, MAG, and the CX Group Inc.

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MCDOT RightRoads PROGRAM
The Right System The Right Time The Right Cost

163rd Avenue

Corridor Improvement Study
Jomax Road to SR 74
Design Concept Report
Jomax Road to Dove Valley Road

Study Milestone Schedule

Field Review	September 2006
Scoping Public Input Meeting	**November 2, 2006**
Alternatives Analysis Public Input Meeting	**March 6, 2007**
Planning/Engineering CIS	March 2007
Design Features CIS	May 2007
Draft Report Submittal CIS	June 2007
Findings and Recommendation Public Meeting	**July 17, 2007**
Final Report Submittal CIS	August 2007
Planning/Engineering DCR	September 2007
Design Features DCR	October 2007
Draft Report Submittal DCR	October 2007
Design Concept Report (DCR) Public Input Meeting	**October 2007**
Final Report Submittal DCR	January 2008

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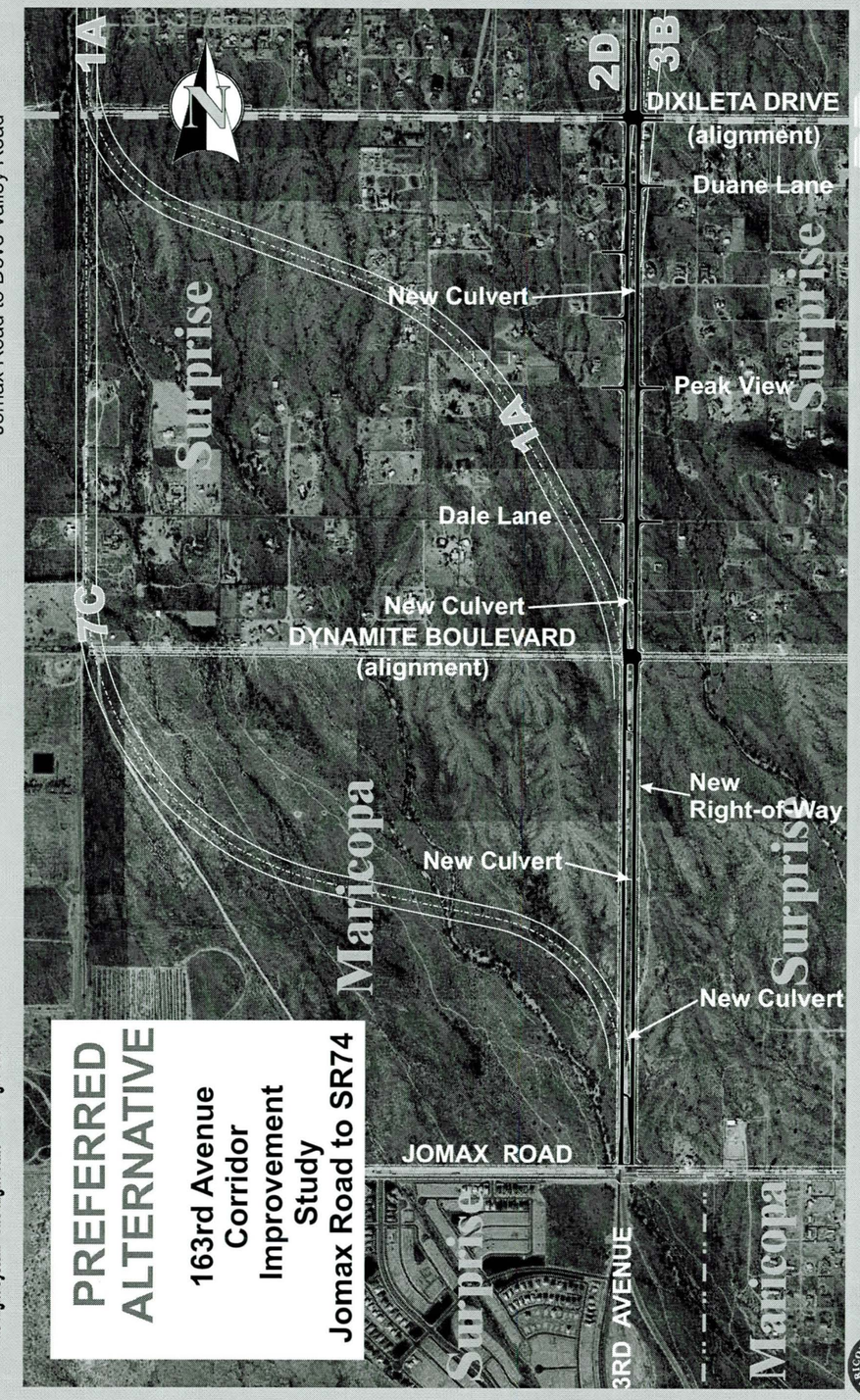

MCDOT RightRoads PROGRAM
The Right System The Right Time The Right Cost

163rd Avenue

Corridor Improvement Study
Jomax Road to SR 74
Design Concept Report
Jomax Road to Dove Valley Road

Project Stakeholders

- Maricopa County Department of Transportation
- Flood Control District of Maricopa County
- City of Surprise
- City of Peoria
- Arizona State Land Department
- Arizona Department of Transportation
- Impacted Utilities
- Area Developers
- Affected Business, Property Owners and Residents

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163rd Avenue

Corridor Improvement Study
Jomax Road to SR 74
Design Concept Report
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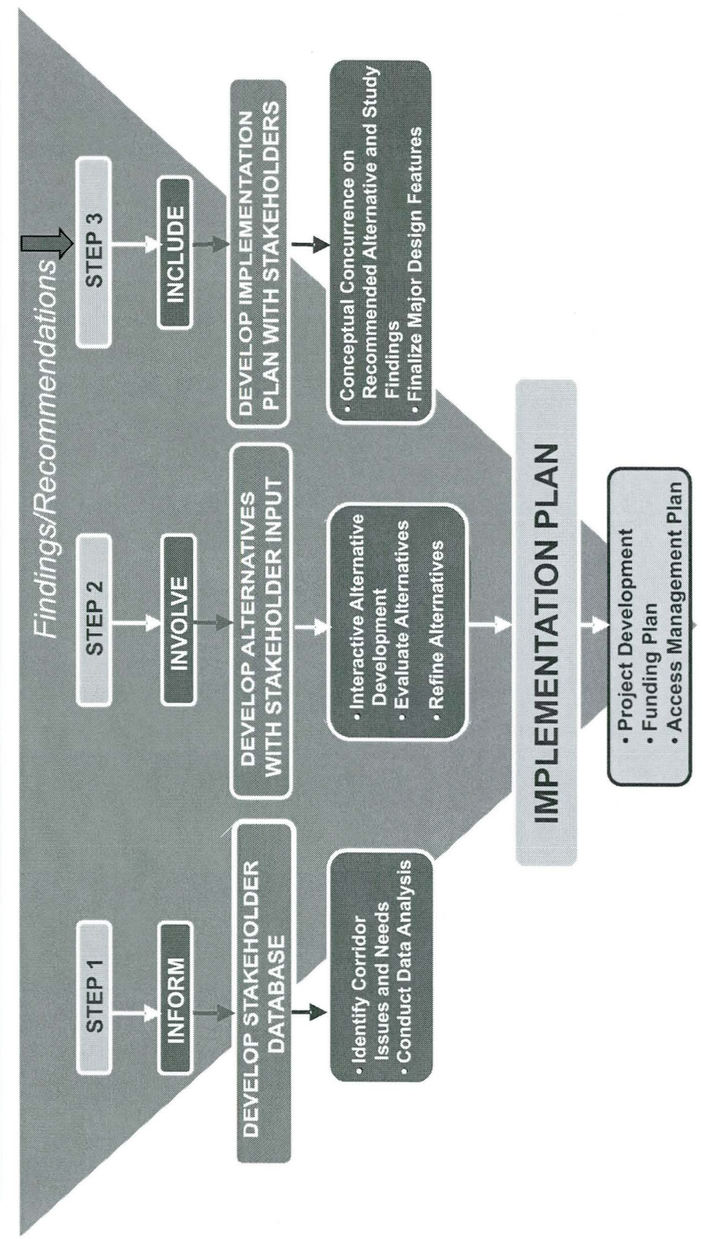
Interactive Study Process



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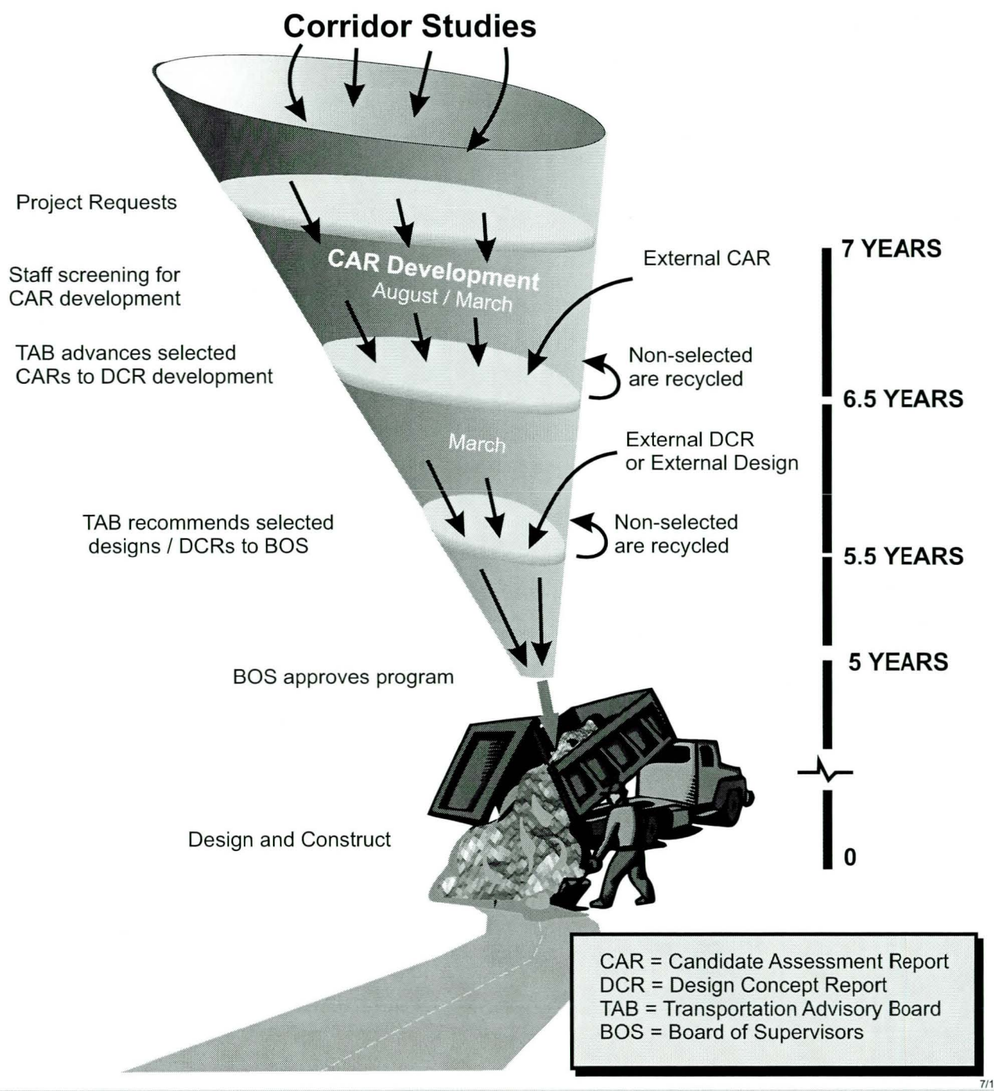
The Right System The Right Time The Right Cost

163rd Avenue

Corridor Improvement Study
Jomax Road to SR 74
Design Concept Report
Jomax Road to Dove Valley Road

Transportation Improvement Program (TIP)



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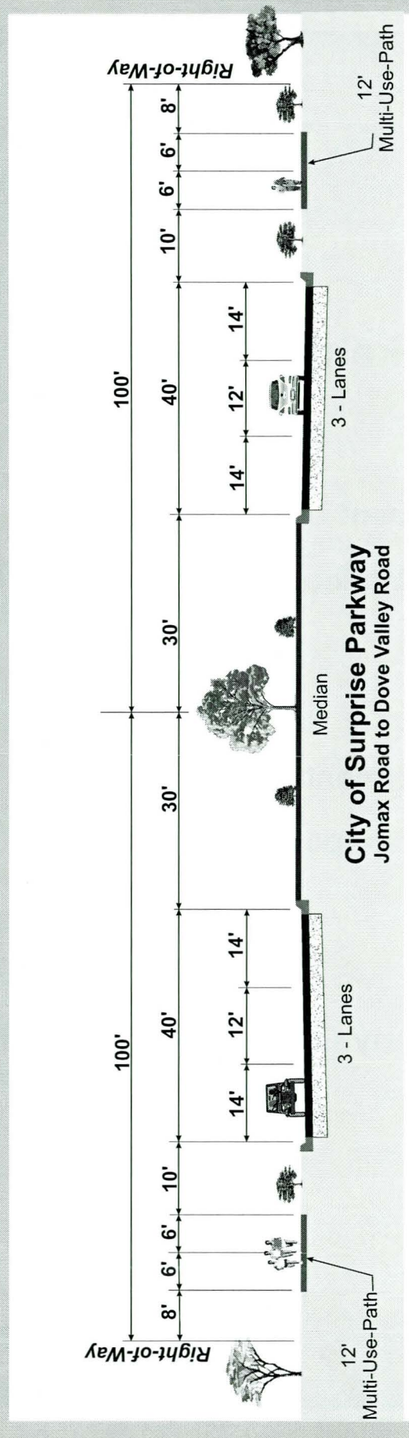

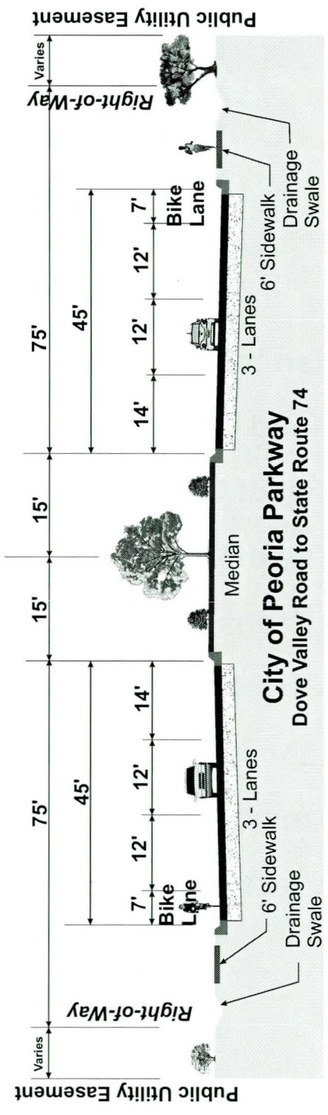

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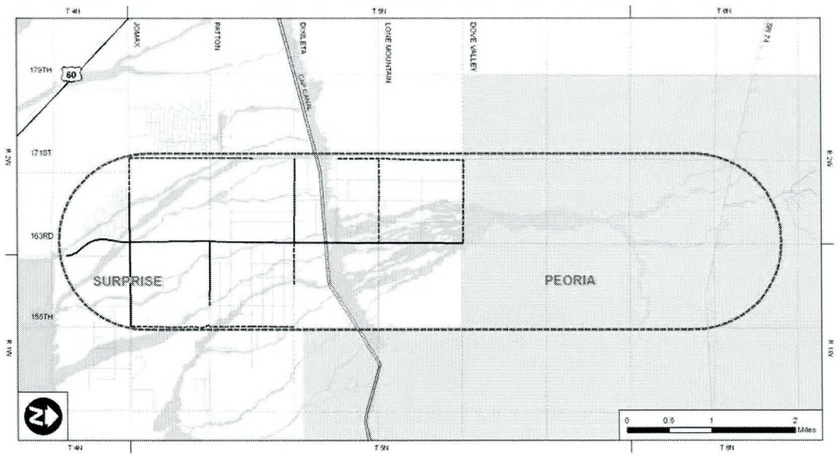
MARICOPA COUNTY MCDOT TRANSPORTATION
Right Road Right Time Right Cost

163rd Avenue

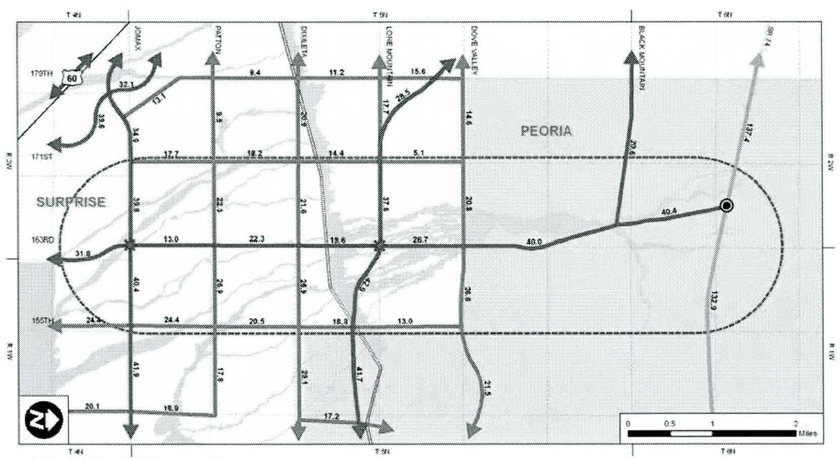
Jomax Road to Dove Valley Road

Design Concept Report



Existing Roadway Network

Legend
- Paved Roadway
- Unpaved Roadway
- Unpaved Residential
- Central Arizona Project (CAP) Canal
- Railroad
- Corridor Study Area
- Flood Plains
- Peoria Planning Area
- Surprise Planning Area



Northwest Adopted General Plans Roadway Network Projected Traffic Volumes

Note: Volumes are shown in thousands.
Sources: MCDOT, MAG, and the CK Group Inc.

Legend
- 6 Lane Freeway
- 6 Lane Expressway
- 6 Lane Parkway
- 6 Lane Major Arterial
- 4 Lane Minor Arterial
- Central Arizona Project (CAP) Canal
- Railroad
- Corridor Study Area
- Major Design Feature
- Traffic Interchange
- Flood Plains
- Peoria Planning Area
- Surprise Planning Area

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MARICOPA COUNTY MCDOT TRANSPORTATION
Right Road Right Time Right Cost

163rd Avenue
Jomax Road to Dove Valley Road
Design Concept Report

Milestone Schedule

Corridor Improvement Study (CIS)

Field Review	September 2006
Scoping and Data Collection Phase Public Input Meeting	**November 2006**
Alternatives Analysis Phase Public Input Meeting	February 2007
Planning/Engineering	April 2007
Design Features	May 2007
Findings & Recommendations Phase Public Input Meeting	**July 2007**
Design Concept Report (DCR)	
Planning/Engineering	September 2007
Design Features	October 2007
Draft Report Submittal CIS & DCR	December 2007
DCR Public Input Meeting	**December 2007**
Final Report Submittal CIS & DCR	January 2008

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Maricopa County
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MARICOPA COUNTY MCDOT TRANSPORTATION

Right Road Right Time Right Cost

163rd Avenue

Jomax Road to Dove Valley Road

Design Concept Report

Project Stakeholders

- Maricopa County Department of Transportation
- Flood Control District of Maricopa County
- City of Surprise
- City of Peoria
- Arizona State Land Department
- Arizona Department of Transportation
- Central Arizona Project
- Impacted Utilities
- Area Developers
- Affected Business, Property Owners and Residents

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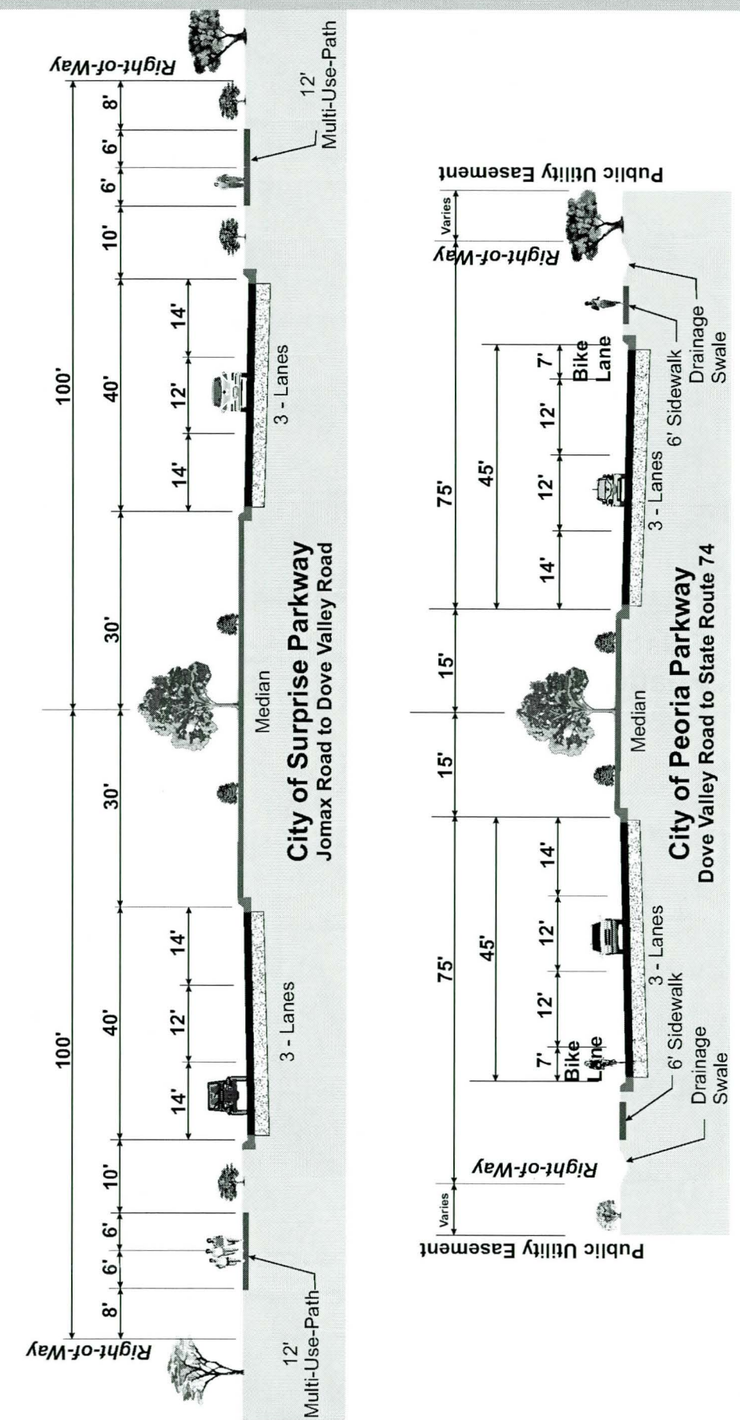
163rd Avenue
Jomax Road to Dove Valley Road
Design Concept Report



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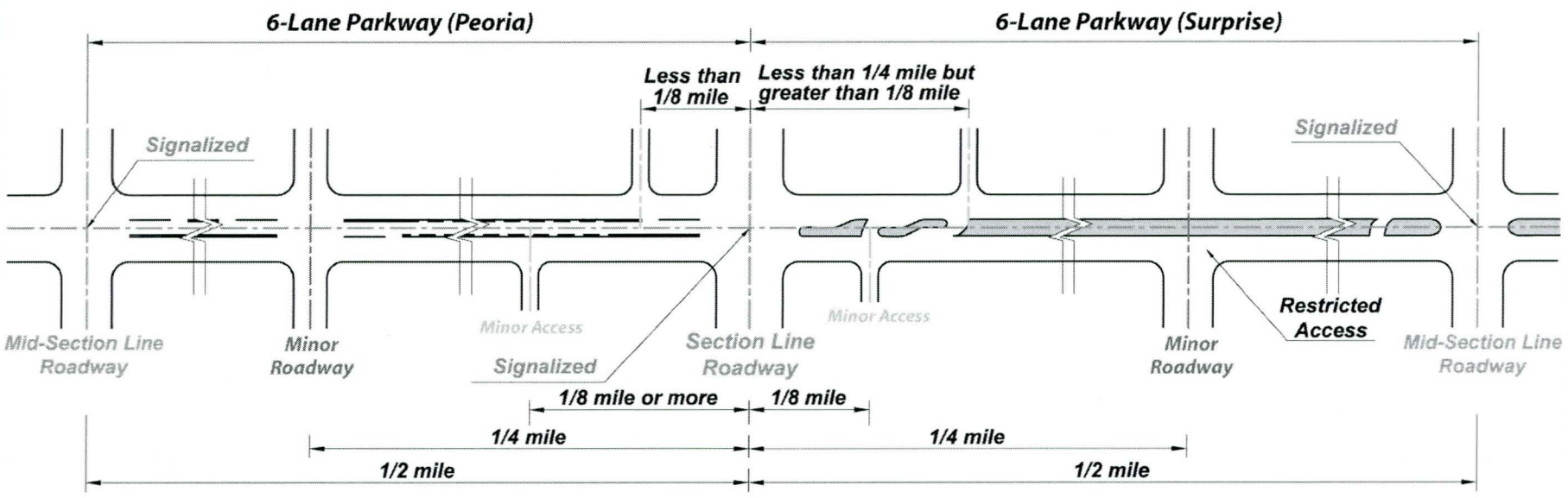
Future Access Management



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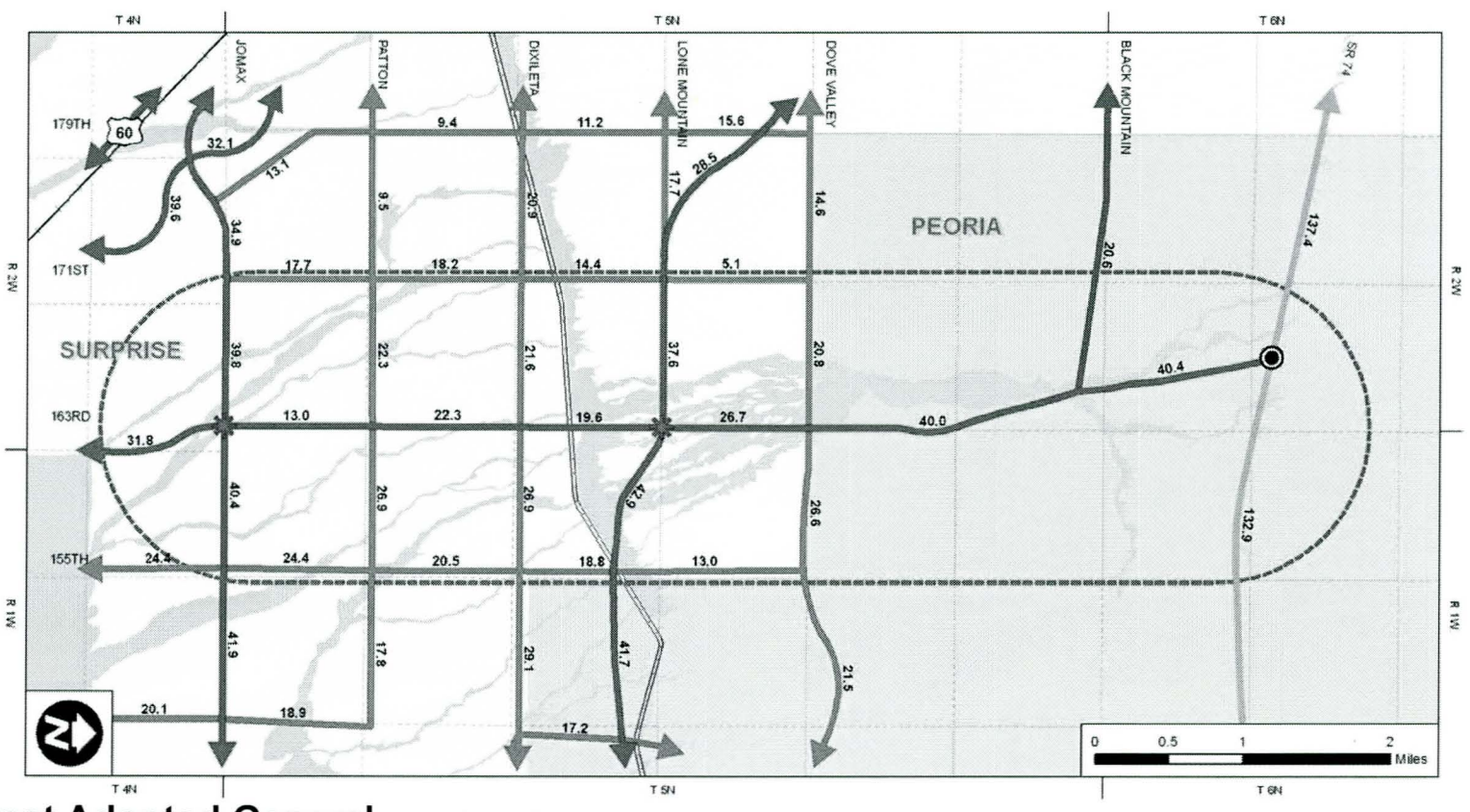
Right Road Right Time Right Cost

163rd Avenue
Jomax Road to Dove Valley Road
Design Concept Report



Northwest Adopted General Plans Roadway Network Projected Traffic Volumes

Note: Volumes are shown in thousands.
Sources: MCDOT, MAG, and the CK Group Inc.

Legend

- 6 Lane Freeway
- 6 Lane Expressway
- 6 Lane Parkway
- 6 Lane Major Arterial
- 4 Lane Minor Arterial
- Central Arizona Project (CAP) Canal
- Railroad
- Corridor Study Area
- Major Design Feature
- Traffic Interchange
- Flood Plains
- Peoria Planning Area
- Surprise Planning Area

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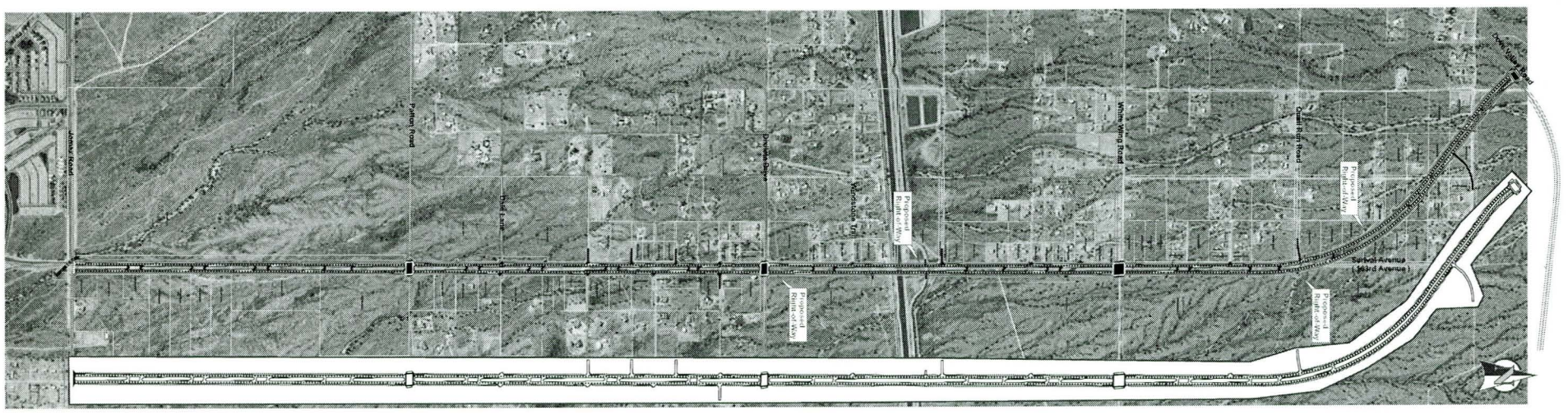


163rd Avenue

Jomax Road to Dove Valley Road

Design Concept Report Phase (DCR)

"Preferred Alternative" Public Meeting

MARICOPA COUNTY MCDOT TRANSPORTATION

Right Road Right Time Right Cost

Maricopa County Department of Transportation **December 12, 2007**

Corridor Description

This segment of 163rd Avenue corridor serves northwestern Maricopa County through the City of Surprise. Currently, 163rd Avenue between Jomax Road and Dove Valley Road is a two-lane paved roadway that is intersected by unimproved cross-streets that serve the local residential development. Existing land use south of Dove Valley Road is single family residential on large lots. Further north, between Dove Valley Road and SR 74, the land is primarily undeveloped and the existing roadway is an unimproved dirt road that was built largely to provide access for construction of a waterline to a development north of SR 74.

Roadway construction, funded by private development, is already underway on the two-mile segment of 163rd Avenue between Grand Avenue and Jomax Road.

Background

This roadway is classified as a future Principal Arterial by MCDOT, a future Parkway by Surprise and as an Arterial Roadway by Peoria (all six-lane divided roadways). The Maricopa Association of Governments (MAG) Regional Transportation Plan (RTP) further established a need to identify and designate the future 163rd Avenue alignment for the entire corridor connecting Grand Avenue (US 60) and SR 74 traversing all three jurisdictions.

In September 2006, MCDOT, the City of Surprise and the City of Peoria initiated the 163rd Avenue Corridor Improvement Study (Jomax Road to SR 74) to address the rapid growth being experienced along this corridor in northwestern Maricopa County. This study's findings and recommendations were presented during a public meeting held earlier this summer.

As the final phase of this study, MCDOT, in coordination with Surprise, is conducting this more detailed Design Concept Report (DCR) for the four-mile segment between Jomax Road and Dove Valley Road (beyond the private development improvements).

The DCR has developed 30% design plans for the preferred roadway alignment recommended in the CIS phase specifically to help the City of Surprise guide traffic control, access-related issues and right-of-way requirements for new development.

Study Need

- Respond to regional growth / local development
- Implementation of regional transportation plans

Study Objectives

- Address current corridor deficiencies
- Address future traffic demand and safety
- Develop / evaluate alternatives
- Implement access management guidelines (intersection spacing/median breaks, locations)
- Develop 30% design plans for 163rd Avenue between Jomax Road and Dove Valley Road

Study Issues and Challenges

- Incorporate regional and local travel
- Achieve mobility/access balance
- Address current and future development
- Incorporate jurisdictional interests
- Address engineering challenges
- Consider roadway environment

For more information, contact Renee Probst at (602) 506-8622 or write to her at:
MCDOT, 2901 W. Durango Street, Phoenix, AZ 85009, or e-mail at: ReneeProbst@mail.maricopa.gov.

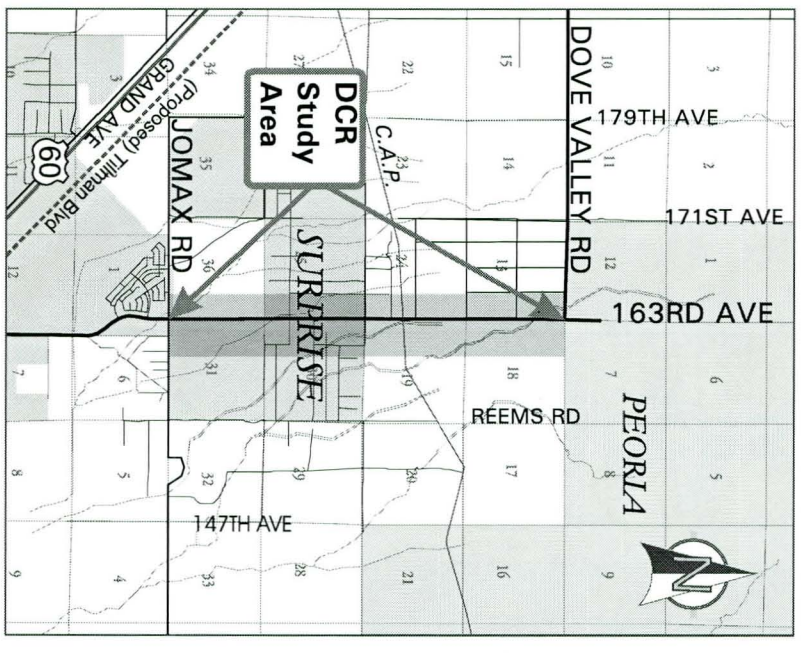
Project Funding

Funding for final design and construction of 163rd Avenue between Jomax Road and Dove Valley Road has not yet been identified. The DCR recommendations will be evaluated for inclusion in the MCDOT Transportation Improvement Program and the City of Surprise Capital Improvement Program. A portion of the funding is expected to come from adjacent developments as part of project requirements.

Public Involvement

Gaining consensus among the agencies and the public is critical to the success of the study and implementation of its recommendations to provide an efficient roadway for the long term. This is the final in a series of four public input meetings held during the course of this study process. The first "Public Scoping" meeting, held November 2006, provided the public with an opportunity to inform the project team about the study area and local transportation needs. The second meeting, held March 2007, presented corridor alignment alternatives for public review and comment. The third "Findings & Recommendations" (Preferred Alignment) public meeting, held July 2007, presented the CIS findings and a recommended roadway and corridor selection along with generalized access management strategies for public review.

This final meeting summarizes the findings of the DCR and presents the proposed corridor improvements. Your input during each phase of study development is very important.



www.mcdot.maricopa.gov

Project Stakeholders

- Maricopa County Department of Transportation
- Flood Control District of Maricopa County
- City of Surprise
- City of Peoria
- Arizona State Land Department
- Arizona Department of Transportation
- Central Arizona Project
- Impacted Utilities
- Area Developers
- Affected Business, Property Owners and Residents

Design Concept Report (DCR) Phase

The 163rd Avenue DCR has evaluated the segment between Jomax Road and Dove Valley Road and developed 30% design plans that specify roadway type, alignment, access points and crossing drainage ways (bridges/culverts). The DCR has also identified new right-of-way needs and generated a more detailed cost estimate to allow accurate budgeting for construction.

Current Activities and Key Technical Findings

Since the "Findings and Recommendations" public meeting held in July 2007, which presented the preferred alignment corridor, the 163rd Avenue CIS study team has completed the required technical analyses and is concluding documentation. As part of the DCR, several alternatives within the preferred alignment corridor (established through the CIS process) were developed between Jomax Road and Dove Valley Road. Each alternative consists of a six-lane divided "parkway" with provision for right and left turns at major intersections. The alternatives differed according to alignment, median width and intersection treatment. Of the studied alternatives, three were selected for more detailed investigation as described below.

Alternative 1 - Indirect Left-Turns:
This alternative utilizes the City of Surprise 200-foot, six-lane Parkway typical roadway cross section (Indirect Lefts) with a 60 foot median width. The roadway alignment follows the existing 163rd Avenue roadway for the majority of the project limits. At the northern limit the alignment is shifted to 167th Avenue.

Alternative 2 Indirect Left Turns on Dixileta Drive:
This alternative also utilizes the City of Surprise 200-foot, six-lane Parkway typical roadway cross section (Indirect Lefts) with a 60 foot median width. However, a narrower median width is used at Dixileta Drive. To compensate for the narrower median, indirect left crossovers are used on Dixileta Drive to provide for left-turning traffic on 163rd Avenue.

The roadway alignment follows the existing 163rd Avenue roadway except at Dixileta Drive where the alignment shifts approximately 29-feet to the west. At the northern limit the alignment shifts to 167th Avenue. The median width is 10-feet at the intersection and then flares to 60-feet through the remaining project limit.

Alternative 3 Standard Left Turns:
This alternative utilizes a conventional signalized intersection configuration with a 30-feet median for the project limit. The roadway alignment follows the existing 163rd Avenue roadway for the majority of the project limits. At the northern limit the alignment is shifted to 167th Avenue.

Evaluation of Alternatives

The benefits and disadvantages of each alternative were evaluated among the project partners. Considerations included safety, private property impacts, drainage issues, operational characteristics, roadway corridor consistency, public input and project costs.

All of the alternatives impacted at least two private residences. Alternative 2 complicated the Indirect Left-Turn concept by placing the u-turn crossovers on Dixileta Drive. This alternative also has greater impacts to drainage ways. Alternative 3 did not support the City of Surprise's vision for a "Parkway" classification. It also did not achieve the same higher projected safety benefits as Alternative 1.

DCR Recommendations and Conclusions

The 163rd Avenue DCR recommends Alternative 1 "Indirect Left-Turns" as the preferred option. Alternative 1 is consistent with the vision of the City of Surprise for future parkways, which utilizes the Indirect Left-Turns concept. Alternative 1 consists of a six-lane roadway with three lanes in each direction divided by a 60 foot median. The right-of-way width is 200 feet. Proposed improvements to 163rd Ave include the installation of drainage culverts to provide an all-weather roadway, multi-use paths for pedestrian, bicycle and equestrian traffic, and access management strategies (Median breaks, intersection spacing and locations) to enhance safety and improve traffic flow.

Milestone Schedule

Corridor Improvement Study (CIS)	
Field Review	September 2006
Scoping and Data Collection Phase	
Public Input Meeting	**November 2006**
Alternatives Analysis Phase	
Public Input Meeting	**February 2007**
Planning/Engineering	April 2007
Design Features	May 2007
Findings & Recommendations Phase	
Public Input Meeting	**July 2007**
Design Concept Report (DCR)	
Planning/Engineering	September 2007
Design Features	October 2007
Draft Report Submittal CIS & DCR	December 2007
DCR Public Input Meeting	**December 2007**
Final Report Submittal CIS & DCR	January 2008

Recommended Future Implementation & Roadway Construction Schedule Based on Project Need

(Forecasted traffic volumes, area growth and development)

- **163rd Avenue:**
  Jomax Road to Dove Valley Road

Interim Four-Lane Divided Roadway with Indirect Left Turn Intersection Treatment

Final Design	Year 2017
Construction	Year 2018 to 2020

Construction of segments of this roadway may be advanced by the City of Surprise and/or adjacent developers. It is recommended that the traffic analysis for this area be reevaluated Upon approval and adoption of traffic impact studies of adjacent developments,.

Ultimate Six-Lane Parkway with Indirect Left Turn Intersection Treatment

Final Design & Construction "Build Out"

Build-Out Year is beyond 2030 and dependent on local development.

- **163rd Avenue: Dove Valley Road to SR 74**

Interim *Four-Lane Divided Roadway*
Ultimate Six-Lane Parkway
Conventional Intersection Treatment

The City of Peoria has no current plans to advance this segment of 163rd Avenue. The need for additional study and design work will be evaluated on an annual basis as part of the City's Capital Improvement Program.

MARICOPA COUNTY MCDOT TRANSPORTATION
Right Road Right Time Right Cost

163rd Avenue

Jomax Road to Dove Valley Road

Design Concept Report

Project Funding

Funding for final design and construction of 163rd Avenue between Jomax Road and Dove Valley Road has not yet been identified. The DCR recommendations will be evaluated for inclusion in the MCDOT Transportation Improvement Program and the City of Surprise Capital Improvement Program for 163rd Avenue between Jomax Road and Dove Valley Road. A portion of the funding is expected to come from adjacent developments as part of project requirements.

Recommended Future Implementation & Roadway Construction Schedule Based on Project Need

(Forecasted traffic volumes, area growth and development)

- **163rd Avenue:**
  Jomax Road to Dove Valley Road

Interim Four-Lane Divided Roadway

Final Design	Year 2017
Construction	Year 2018 to 2020

Construction of segments of this roadway may be advanced by the City of Surprise and/or adjacent developers. It is recommended that the traffic analysis for this area be reevaluated Upon approval and adoption of traffic impact studies of adjacent developments,.

Ultimate Six-Lane Parkway

Final Design & Construction "Build Out"

Build-Out Year is beyond 2030 and dependent on local development.

- **163rd Avenue:**
  Dove Valley Road to SR 74

Interim *Four-Lane Divided Roadway*
Ultimate Six-Lane Parkway

The City of Peoria has no current plans to advance this segment of 163rd Avenue. The need for additional study and design work will be evaluated on an annual basis as part of the City's Capital Improvement Program.

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Department of Transportation

Future Activities and Considerations for Future Corridor Development

The following are key issues identified during this study's public involvement process that should be taken into consideration by individual jurisdictions as the recommendations of this study are carried forward into design and implementation:

- **Project Funding.** There is currently no funding programmed for construction. It can be anticipated that area developers will participate as part of project requirements.
- **Access Management Strategies**. MCDOT, the cities of Surprise and Peoria have specific expectations regarding roadway access. Specific strategies should be implemented to ensure a seamless roadway with efficient traffic flow, safety and good access to local land uses.
- **Environmental Impacts and Noise Mitigation**. Specific impacts on the local environment will require further evaluation in future project development.
- **New Right-of-Way Requirements**. Final roadway configuration will determine how much land will need to be acquired.
- **Landscaping plans**. Final project design will specify the type of landscaping to be used.
- **Drainage Structures**. Because the future roadway corridor crosses a number of washes and lies partly in a flood zone, it will be critical to ensure the roadway is designed to provide "all weather" crossings during major storm flows. Bridges along the new roadway will be designed during final roadway design.
- **Bicycle, Pedestrian and Transit Access**. Future projects will be designed to accommodate alternative modes of travel and provide access to trails and neighborhoods in the area.
- **Corridor Traffic Management.** ITS (Intelligent Transportation System) will control operation of traffic between jurisdictions and differing intersection configurations.
- **Jurisdictional Coordination.** As with the overall traffic control, implementation of different corridor improvements and access management concepts will need to be coordinated to ensure a safe, seamless and efficient transportation facility.

MARICOPA COUNTY MCDOT TRANSPORTATION
Right Road Right Time Right Cost

INDIRECT LEFT TURNS

Indirect Left Turns replace the left turn at an intersection by a u-turn crossover beyond the intersection and then a right turn onto the cross-street. The indirect left turn must occur on a divided roadway. A significant median, at least 60 feet wide, is necessary to accommodate the u-turn movement. This width is adequate for buses and trucks.

The Indirect Left Turn concept is best used on an entire corridor or area to avoid motorist confusion. A benefit to using this type of Median U-turn Intersection Treatment is a higher volume of traffic is able to be moved through the intersection. Research indicates an increase of 20-50%, depending on location. Also, the Indirect Left Turn is a common accident mitigation measure at intersections suffering from a high number of left-turn accidents, since it removes the left-turn movement from the intersection.

The Federal Highway Administration recently published a Technical Briefing paper entitled "Synthesis of the Median U-turn Intersection Treatments", Safety and Operational Benefits. (Publication No FHWA-HR7-07-03)

Among the conclusions in this national report are:

- The safety performance of Median U-turn Intersection Treatment is better than conventional intersections because they have fewer vehicle-vehicle conflict points. Typical total crash reductions range from 20 percent to 50 percent.
- Head-on and angle crashes that have high probabilities of injury are significantly reduced for the Median U-turn Intersection Treatment compared to conventional intersections.
- Reducing signal phases at the intersection (via elimination of left-turn arrows/lanes) provides increased capacity for the Median U-turn Intersection Treatment in comparison to conventional intersections. The capacity increases are typically in the range of 20 percent to 50 percent.

In another recently completed MCDOT study entitled "Enhanced Parkway Study" the following conclusions were noted when a conventional roadway system was compared to one with median indirect lefts using computer simulation:

- The total number of traffic "delay" hours is reduced by one-third, or 33.3 %.
- The total of motorist stops is reduced by more than 20 %
- The total travel or trip time experienced by a motorist is reduced by 10%

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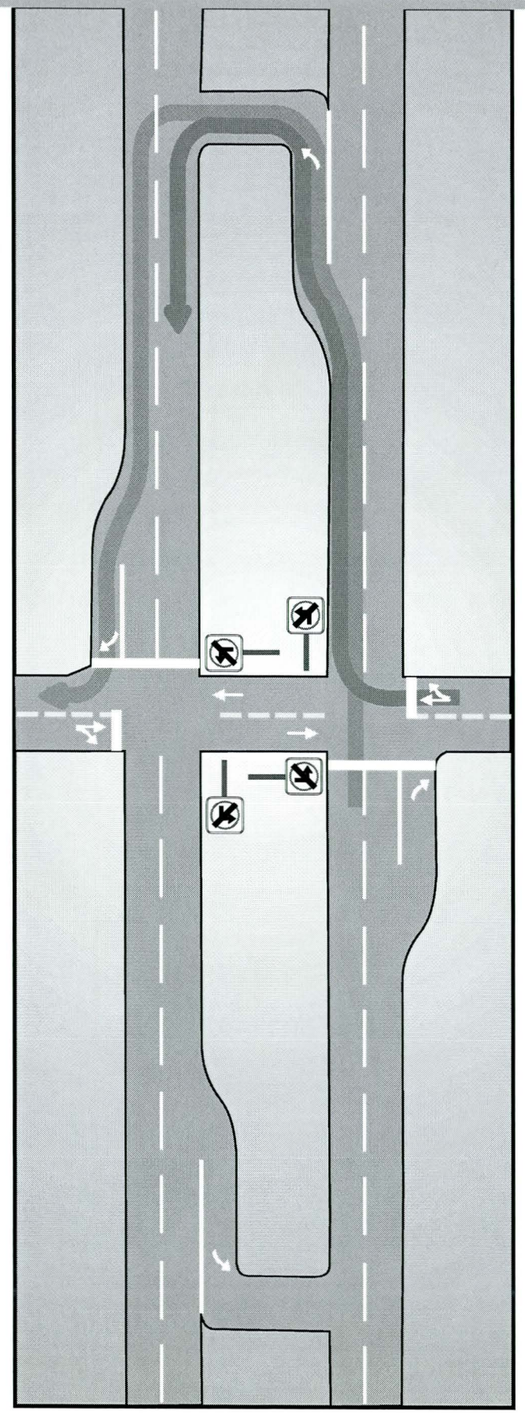
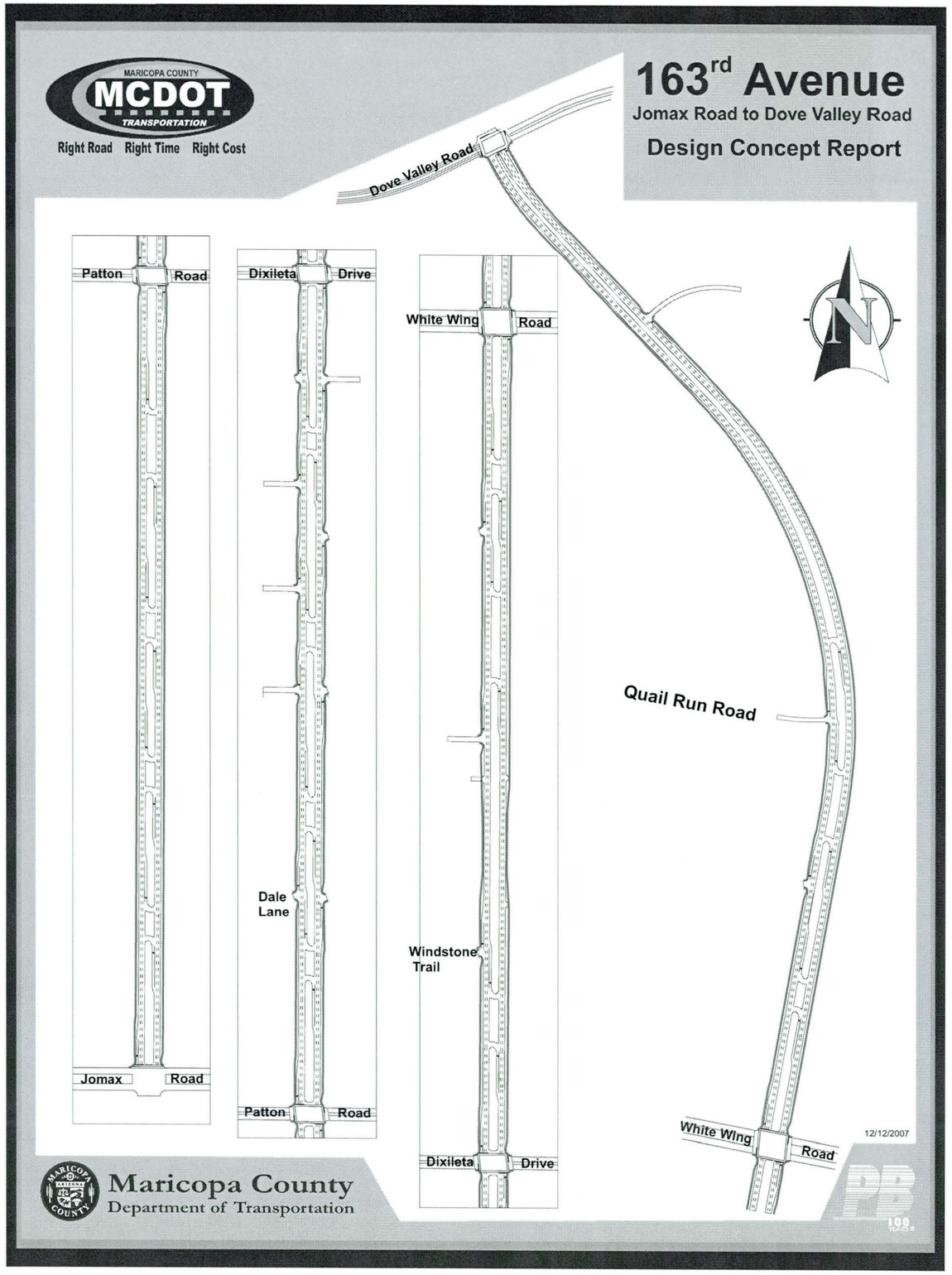
Indirect Left Turn





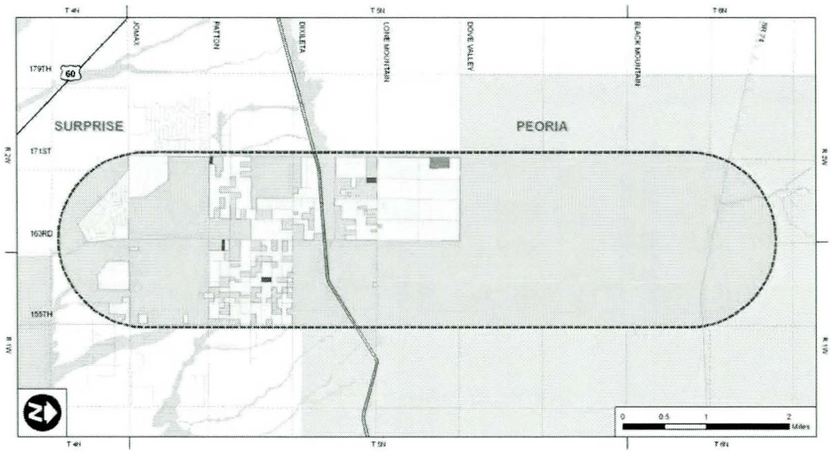
MARICOPA COUNTY MCDOT TRANSPORTATION

Right Road Right Time Right Cost

163rd Avenue

Jomax Road to Dove Valley Road

Design Concept Report

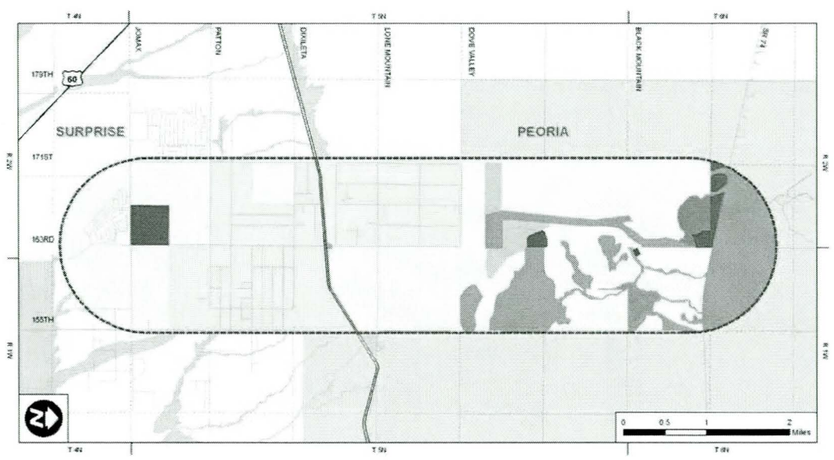


Existing Land Use

Sources: MAG and PB

Legend

- Residential
- Commercial
- Agriculture
- Public/Quasi-Public
- Vacant
- Water
- Central Arizona Project (CAP) Canal
- Railroad
- Roadways
- Corridor Study Area
- Peoria Planning Area
- Surprise Planning Area
- Flood Plains



Future Land Use

Sources: City of Peoria and City of Surprise

Legend

Peoria Land Use

- Residential/Estate
- Residential/Low
- Residential/Medium
- Residential/Medium High
- Mixed Use
- Business Park/Industrial
- Community Commercial
- Park/Open Space
- Public/Quasi-Public

Surprise Land Use

- Rural Residential
- Low Density Residential
- Suburban Residential
- Commercial
- Open Space
- Central Arizona Project (CAP) Canal
- Railroad
- Roadways
- Corridor Study Area
- Peoria Planning Area
- Surprise Planning Area
- Flood Plains

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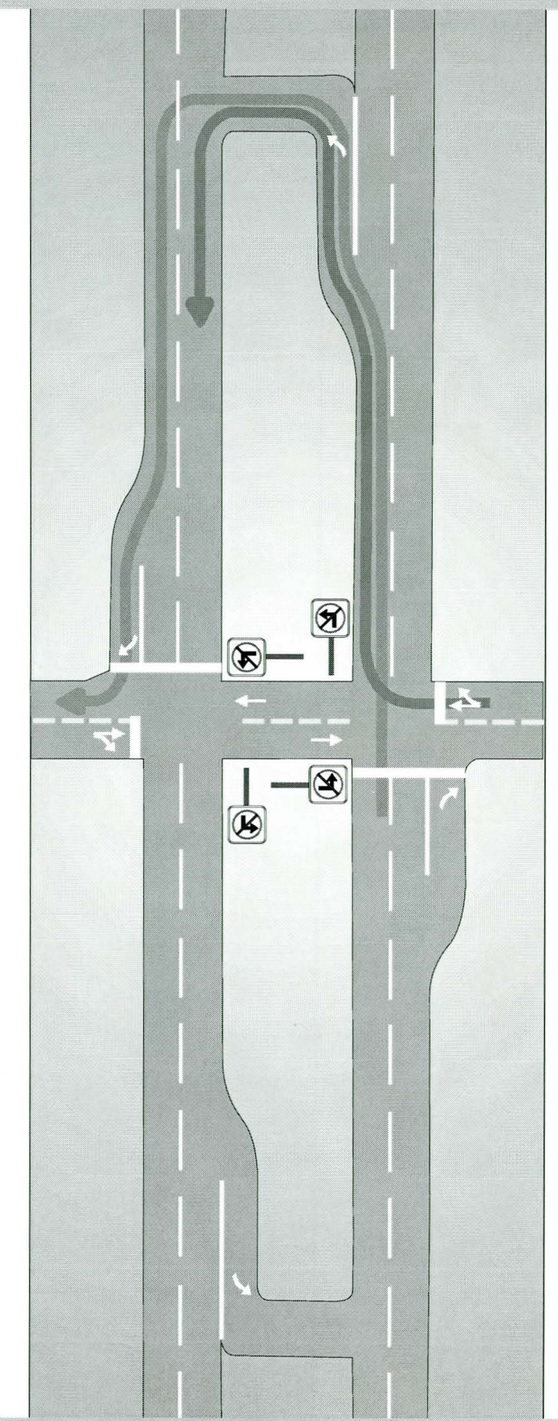
163rd Avenue
Jomax Road to Dove Valley Road
Design Concept Report

Indirect Left Turn



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MARICOPA COUNTY MCDOT TRANSPORTATION
Right Road Right Time Right Cost
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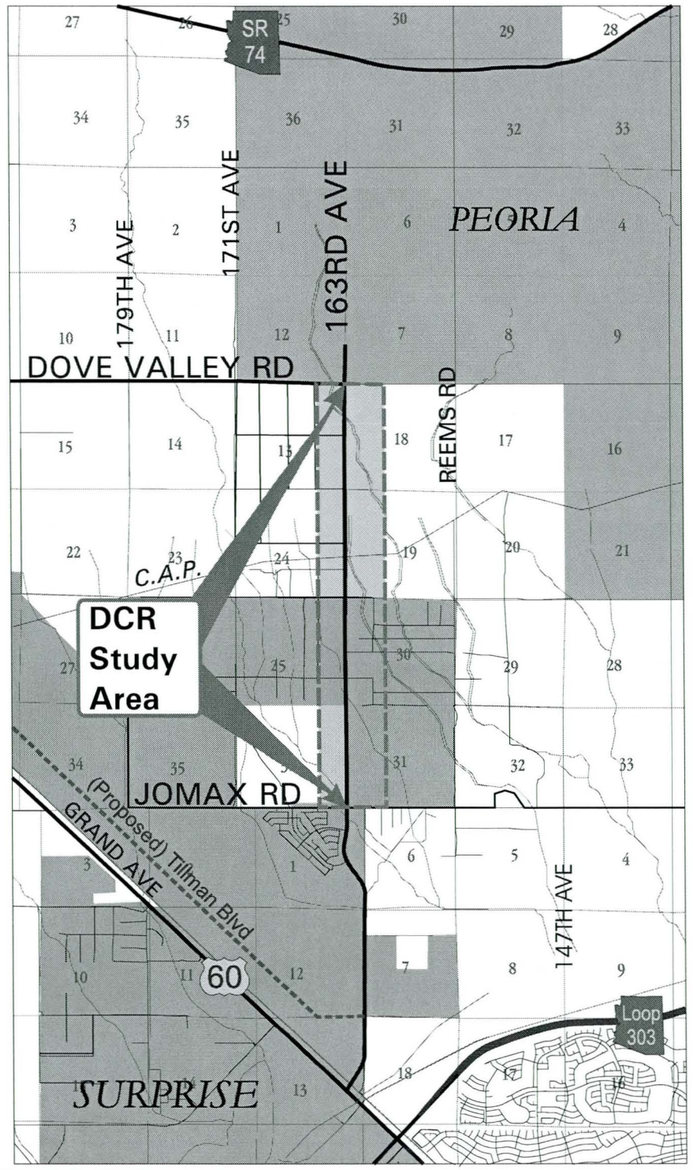
MARICOPA COUNTY MCDOT TRANSPORTATION

Right Road Right Time Right Cost

163rd Avenue

Jomax Road to Dove Valley Road

Design Concept Report



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MARICOPA COUNTY MCDOT TRANSPORTATION

Right Road Right Time Right Cost

163rd Avenue

Jomax Road to Dove Valley Road

Design Concept Report

Study Need

- Respond to regional growth / local development
- Implementation of regional transportation plans

Study Goals

- Create a "vision" or footprint for 163rd Avenue and develop a plan for achieving the vision
- Establish principles, policies and guidelines for corridor improvements
- Develop agreed-upon roadway plans and recommendations

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MARICOPA COUNTY MCDOT TRANSPORTATION

Right Road Right Time Right Cost

163rd Avenue

Jomax Road to Dove Valley Road

Design Concept Report

Study Objectives

- Define the role of 163rd Avenue as a critical north/south roadway
- Identify current corridor deficiencies
- Define long-term corridor needs and requirements
- Develop / evaluate alternatives
- Establish design criteria for future roadway
- Develop access management guidelines (intersection spacing/median break locations)
- Establish roadway operation and performance criteria
- Complete 30% design plans for 163rd Avenue between Jomax Road and Dove Valley Road
- Coordinate with other current ongoing area studies to ensure an integrated roadway corridor system

Study Challenges

- Incorporate regional and local travel
- Achieve mobility/access balance
- Address current and future development
- Incorporate jurisdictional interests
- Address engineering challenges
- Consider roadway environment

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PB 100 YEARS