DURANGO ADMP
REGIONAL RETENTION EVALUATION
FCD 99-41

Prepared for:

Flood Control District of Maricopa County

Prepared by:

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Since 1962

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August, 2002

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Durango ADMP
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The purpose of this Regional Retention Evaluation is to investigate the potential economic benefit of implementing a regional on-site retention approach within the Durango ADMP study area in lieu of the current requirement for developers to incorporate on-site retention within their project limits. This approach is only intended for areas where the current on-site retention requirement is shown to be ineffective in preventing increases in peak runoff rates resulting from land development practices.

The approach used in the evaluation is to estimate the economic benefit to a developer if the on-site retention requirement is waived. A portion of that economic benefit is then used to pay for the construction of a regional retention basin and collection system. The remaining portion of the economic benefit would then be retained by the developer, or shared with the County, as an incentive to participate in the regional retention basin project. An approximately four square mile area within the Durango ADMP study area is used as a case study for the economic analysis.

Hydrology

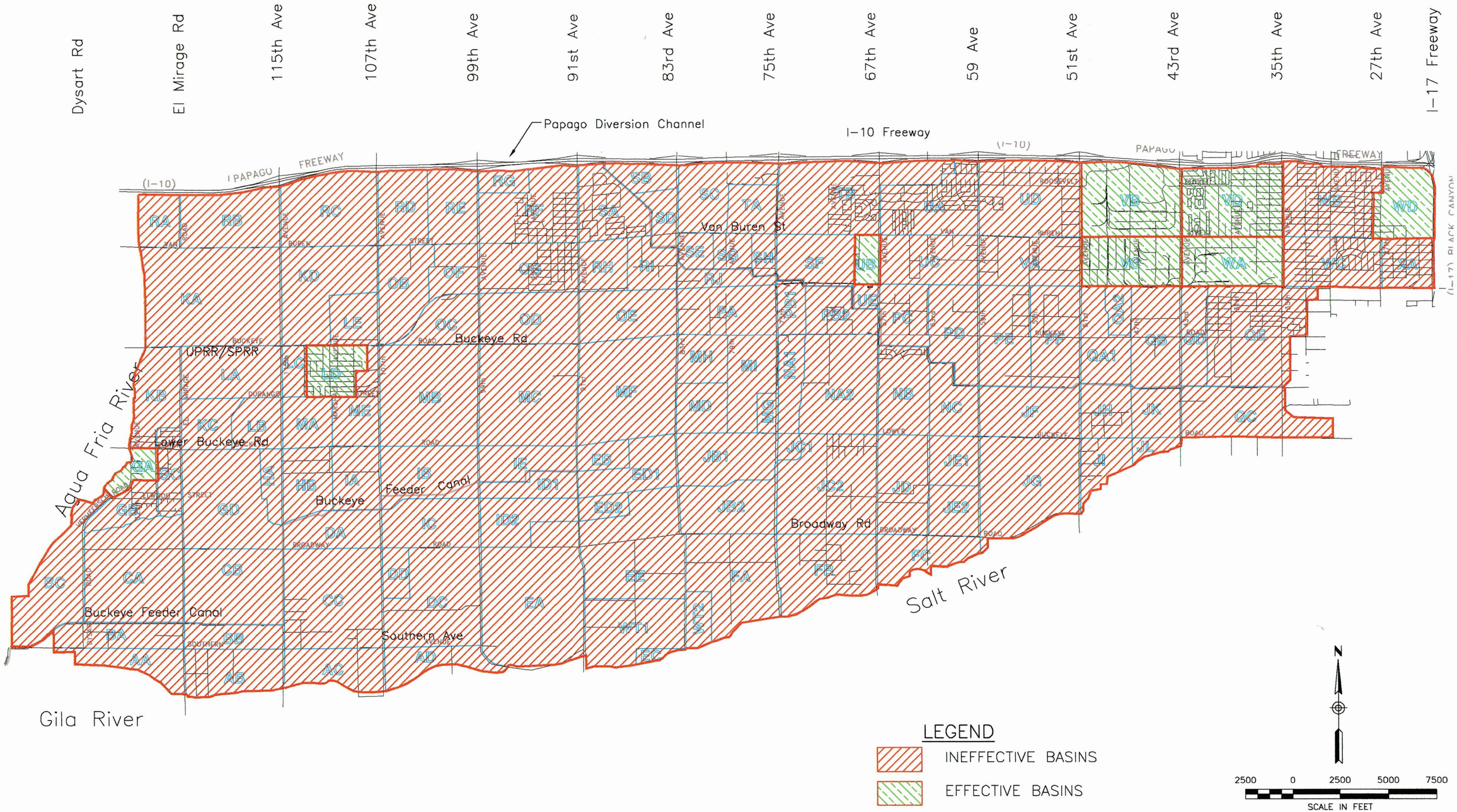
The Durango ADMP HEC-1 hydrology models are used to determine where 100-yr, 2-hr on-site retention is ineffective within the study area. For purposes of this analysis, ineffective on-site retention is defined as when the developed conditions peak discharge, with on-site retention, is higher than the peak discharge in the same sub-basin under existing conditions.

Several Hydrology Models are used for this evaluation:

- Existing conditions, 100-year, 6- and 24-hour storm.
- Fully developed conditions, 100-year, 6- and 24-hour storm, with NO new on-site retention.
- Fully developed conditions, 100-year, 6- and 24-hour storm, WITH new on-site retention incorporated.

The "existing conditions" and "developed conditions with on-site retention" models are already developed from the Durango ADMP. While the "developed conditions with no new on-site retention" is developed for the purpose of this study. All six scenarios are with the ADMP recommended features in place. The results from these models are summarized in a comparison table which shows the peak discharge generated within each sub-basin for all six modeling scenarios. The HEC-1 modeling comparison table is found in **Appendix A**. Sub-basins with ineffective on-site retention are depicted on the drainage sub-area map on **Figure 1**.

Figure 1 indicates that on-site retention is ineffective for nearly the entire Durango ADMP study area. In some areas, this may be due to the change from agricultural land uses, characterized by high retention volumes and infiltration rates, to residential and industrial uses characterized by large impervious areas such as roads, rooftops, and parking lots. These characteristics combined with the additional rainfall in excess of the 2-hour storm generated by the 6-hour and 24-hour storms results in the required on-site retention volume being inadequate to offset the increase in runoff resulting from development.



PROJECT TITLE:
DURANGO AREA DRAINAGE MASTER PLAN
PROJECT NO. FCD 99-41

CONSULTANT:
DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

EXHIBIT TITLE:
EFFECTIVE vs. INEFFECTIVE AREA
08/13/02

FIGURE-1

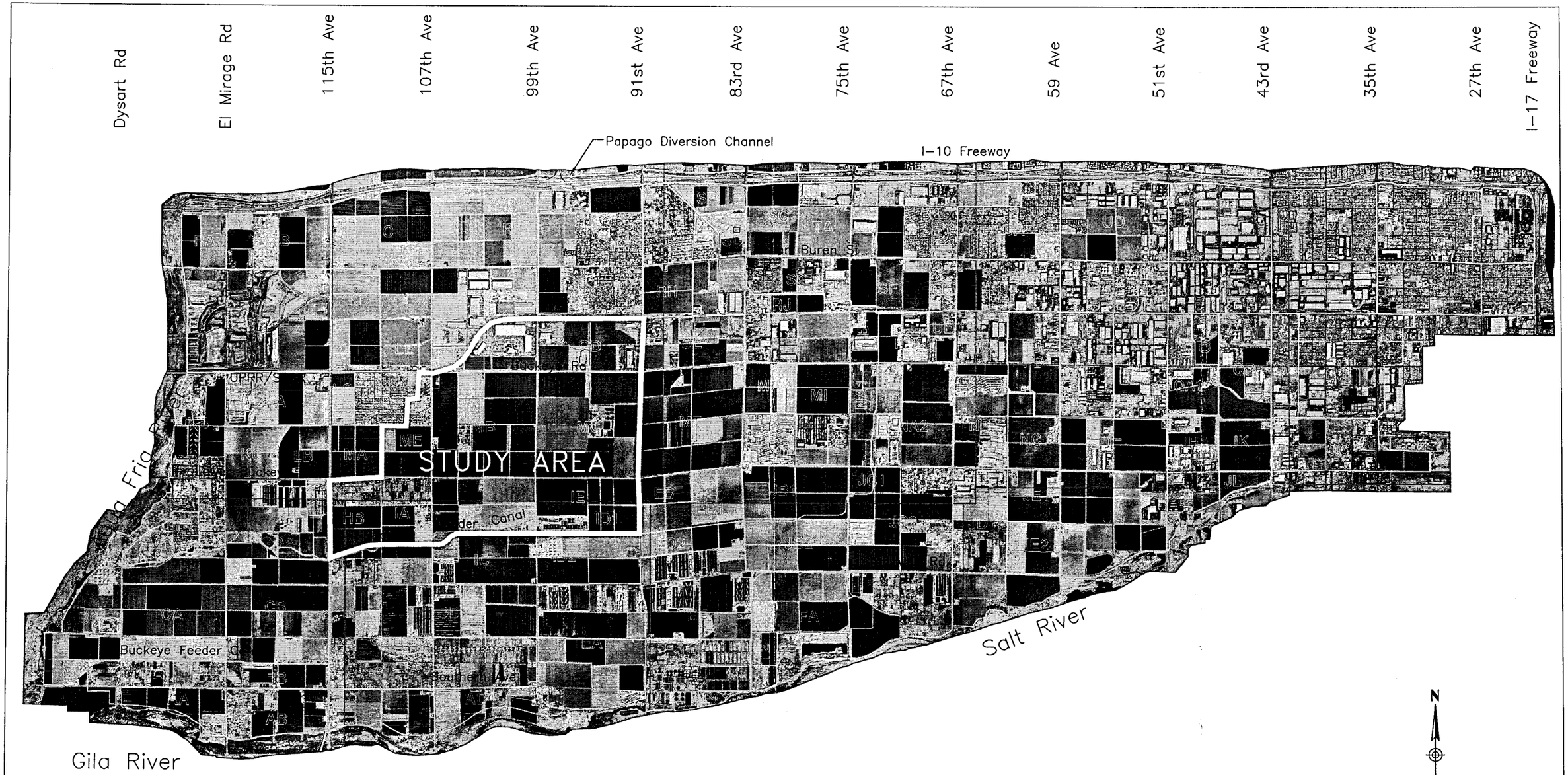


FIGURE-2

PROJECT TITLE:
DURANGO AREA DRAINAGE MASTER PLAN
PROJECT NO. FCD 99-41

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

EXHIBIT TITLE:
STUDY AREA
08/13/02

On-site Retention Concept

With the ineffective sub-basins identified, a representative four (4) square mile study area is chosen for the Regional Retention Evaluation. The evaluation is based on City of Phoenix development requirements. A meeting with the City of Phoenix Development Services Department was conducted to verify development, open-space and "first flush" requirements. The selected representative study area contains mostly undeveloped agricultural land, soon to be developed and is shown on **Figure 2**.

The value to developers within the representative area from waiving the on-site retention requirement is determined by estimating the economic benefit of the reclaimed land normally set aside for on-site retention plus the savings to the developer from not providing a storm drain system to drain the basins. The value of reclaimed land is estimated based on the sale of additional residential units placed on the reclaimed land due to the on-site retention requirement being waived. The reclaimed land area is the area normally required for on-site retention, minus the area that must still be set aside to meet the City of Phoenix 5% open space requirement.

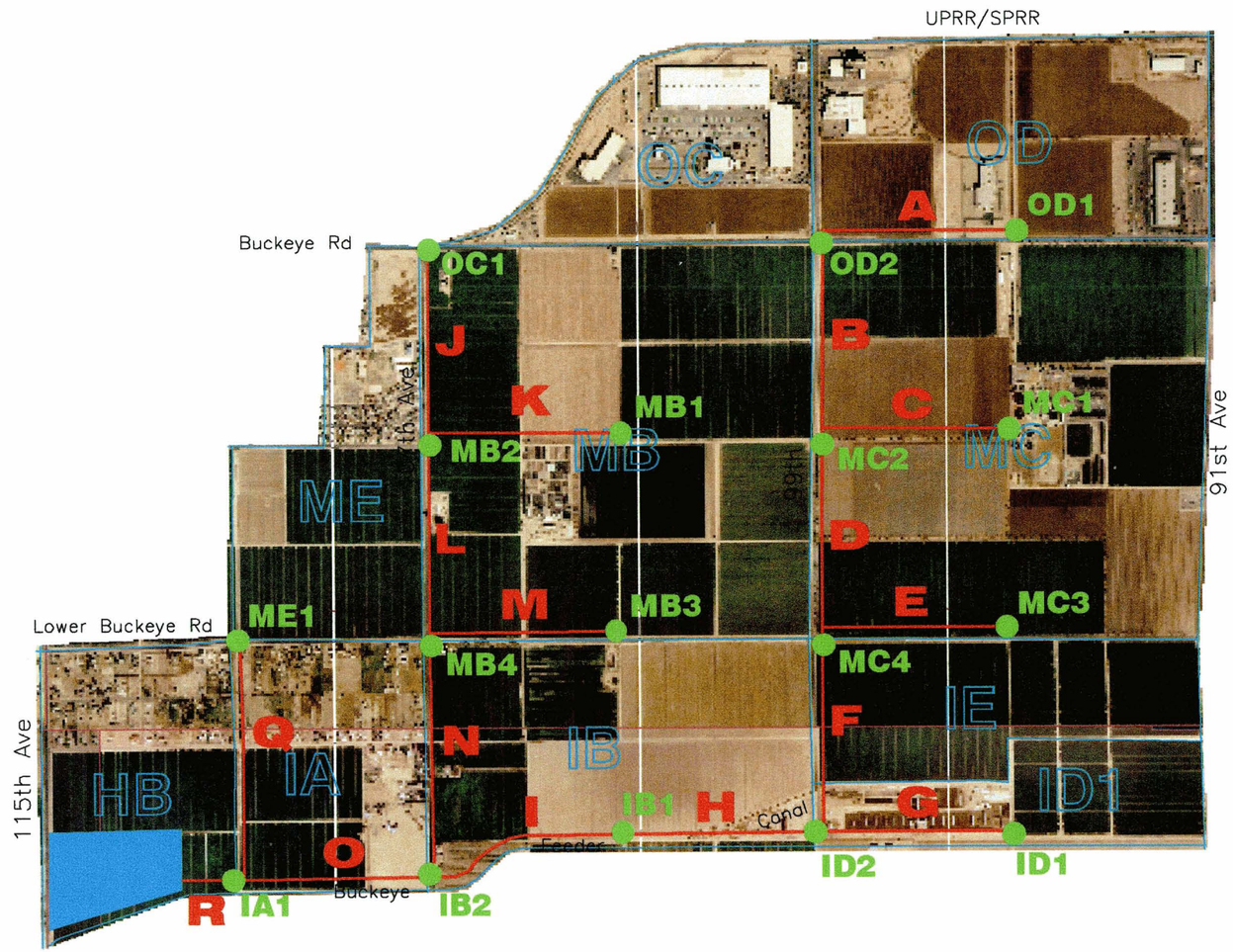
The land area that would be required for on-site retention is estimated based on the Maricopa County method of determining retention volumes, V=CDA/12 where D=2.8 in/hr (3.1 in/hr in Tolleson). This volume is then divided by an average basin depth of 2 feet, which takes into account volume lost in basin grading from features such as side-slopes. Since the developments will still be required to have 5% open space, the open space area is subtracted from the retention basin land area. This results in a net developable land area, which could be used to build additional homes. An average residential lot size of 6000 square feet (7.3 dwelling units per acre) and a net benefit to the developer of $75,000 per additional dwelling unit are assumed for calculations.

If the developers were required to provide on-site retention basins, they would also be required to drain them within 36 hours. A storm drain system for the 4 square mile study area is developed to drain the basins. The storm drain system is estimated to cost $3.8 million. If the on-site retention requirement is waived, this system will not be required thus adding an additional benefit to the developer. The developer would still be required to retain the "first flush" volume, which could be accomplished with shallow basins within the open space areas.

Approximately 165 acres is required for on-site retention within the 4 square mile representative area. Of the 165 acres, 132 acres is still required to meet the open space requirement, leaving 35 acres net developable land for additional dwelling units. At 7.3 units per acre, 257 additional units could be built at a developer benefit of $19,275,000. Adding the developer savings of $3,825,000 from not providing the storm drain system to drain the basins results in an economic benefit to the developer of $23,100,000.

Regional Retention Concept

A location within the representative study area is identified as a regional retention basin site. This location is chosen based on the ability of a collection system to collect and deliver runoff from all developments within the study area. The required land area for the regional retention basin is based on the volume required to capture the entire runoff with no developer on-site retention. A system of channels and culverts is established as a collection system based on a ¼-mile grid. This grid size is chosen due to typical development patterns. The collection system concept is shown on **Figure 3**. The collection system is made up of open channels along roadway alignments with culverts at road crossings.



LEGEND

- CULVERT
- CHANNEL
- BASIN

N

1000 0 1000 2000 3000

SCALE IN FEET

PROJECT TITLE:
DURANGO AREA DRAINAGE MASTER PLAN
PROJECT NO. FCD 99-41

CONSULTANT:
DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

EXHIBIT TITLE:
COLLECTION SYSTEM
08/13/02

FIGURE-3

An estimate of the cost to implement the regional retention basin concept including land acquisition, design, construction, landscape, and the collection system to deliver the runoff to the basin is presented in the cost summary in **Table 1**. Design calculations and cost estimates are presented in **Appendix B**.

Table 1 – Cost Summary

Facility Type	Cost
Channel	$24,884,501
Culvert	$3,669,575
Basin	$22,536,314
Total	**$51,090,390**

Benefits of Regional Approach

The cost to construct the regional basin and collection system is almost 28 million dollars more than the value to the developer from waiving the on-site retention requirement. The regional retention basin could be constructed with the developer savings, however, the cost of the additional collection system required to convey the runoff to the regional basin makes the concept uneconomical.

Appendix A
HEC-1 Modeling Comparison Table

	Existing Conditions		Future Conditions Without Retention			Future Conditions With Retention		Effective vs.	
	6-hr	24-hr	6-hr	24-hr		6-hr	24-hr	Existing Condition 8	Future Condition 51
SUBWD	601	436	562	407	SUBWD	562	407		
					FLOWWD	562	407	EFFECTIVE	FALSE
RTWDXA	557	404	524	378	RTWDXA	523	378		
SUBXA	580	425	601	440	SUBXA	601	440		
					FLOWXA	601	440	FALSE	FALSE
CPXA1	749	527	680	496	CPXA1	584	451		
DIZZ1	0	0	0	0	DIZZ1	0	0		
DIXAO	749	527	680	496	DIXAO	584	451		
RTXAWC	713	509	639	444	RTXAWC	567	422		
SUBWB	1154	880	1154	880	SUBWB	1155	880		
					FLOWWB	1155	880	FALSE	FALSE
RTWBWC	1092	823	1092	823	RTWBWC	1093	824		
SUBWC	922	674	947	692	SUBWC	959	700		
					FLOWWC	959	700	FALSE	FALSE
CPWC	1944	1527	1953	1553	CPWC	1832	1497		
DIQE	0	0	0	0	DIQE	0	0		
DIWCWA	1944	1527	1953	1553	DIWCWA	1832	1497		
RTWCWA	951	710	954	716	RTWCWA	875	691		
SUBWA	1196	872	1191	867	SUBWA	1191	867		
					FLOWWA	1191	867	EFFECTIVE	FALSE
CPWA1	944	883	950	881	CPWA1	869	872		
SUBVD	1195	917	1147	880	SUBVD	1147	880		
					FLOWVD	1147	880	EFFECTIVE	FALSE
RTVDWA	941	695	908	675	RTVDWA	906	675		
CPWA2	1159	1076	1122	1041	CPWA2	1113	1033		
DIQD	707	627	671	594	DIQD	663	586		
DIWAVC	452	448	450	447	DIWAVC	450	446		
RTWAVC	375	359	380	364	RTWAVC	371	359		
SUBVC	1177	857	1168	850	SUBVC	1168	850		
					FLOWVC	1168	850	EFFECTIVE	FALSE
CPVC1	776	872	776	869	CPVC1	769	844		
SUBVB	1651	1299	1627	1271	SUBVB	1633	1276		
					FLOWVB	1633	1276	EFFECTIVE	FALSE
RTVBVC	1152	850	1156	847	RTVBVC	1131	853		
~CPVC2	1368	1292	1386	1302	~CPVC2	1345	1284		
MCVC47	1363	1261	1382	1275	MCVC47	1332	1257		
SUBQA2	189	142	298	220	SUBQA2	299	221		
					FLWQA2	299	221	FALSE	FALSE
CPQA2	1493	1387	1504	1414	CPQA2	1451	1396		
BSN47	993	940	1000	944	BSN47	979	932		
MC47QB	992	938	999	941	MC47QB	978	930		
SUBQB	852	629	1278	934	SUBQB	1278	934		
					FLOWQB	1278	934	FALSE	FALSE
~CPQB	1502	1464	1460	1496	~CPQB	1381	1439		
SUBQD	600	439	656	480	SUBQD	656	480		
					FLOWQD	656	480	FALSE	FALSE
DRQD	707	627	671	594	DRQD	663	586		
RTDIQD	511	353	496	342	RTDIQD	486	334		
@CPQD	604	439	663	480	@CPQD	666	480		
RSQD	525	390	507	432	RSQD	497	428		
DIQC	394	318	383	342	DIQC	377	340		
DIQDQC	132	73	124	90	DIQDQC	120	89		
RTQDQB	90	53	84	50	RTQDQB	79	48		
@CPQB	1542	1472	1496	1500	@CPQB	1415	1444		
MCQBJK	1526	1436	1468	1414	MCQBJK	1386	1362		
SUBJK	417	317	804	588	SUBJK	804	588		
					FLOWJK	715	487	FALSE	EFFECTIVE
~CPJK	1759	1657	1692	1533	~CPJK	1582	1466		
MCJKJL	1725	1602	1643	1469	MCJKJL	1489	1367		

	Existing Conditions		Future Conditions Without Retention			Future Conditions With Retention		Effective vs.	
	6-hr	24-hr	6-hr	24-hr		6-hr	24-hr	Existing Condition 8	Future Condition 51
SUBJL	171	128	286	210	SUBJL	286	210		
					FLOWJL	249	195	FALSE	[illegible]
~CPJL1	1763	1628	1676	1489	~CPJL1	1511	1384		
SUBQE	1646	1319	1734	1394	SUBQE	1734	1394		
					FLOWQE	1734	1394	FALSE	FALSE
DRQE	0	0	0	0	DRQE	0	0		
RTDIQE	0	0	0	0	RTDIQE	0	0		
CPQE	1646	1319	1734	1394	CPQE	1734	1394		
RSQE	1565	1192	1645	1247	RSQE	1622	1243		
RTQEQC	1468	1100	1525	1156	RTQEQC	1477	1152		
SUBQC	1150	871	1358	1023	SUBQC	1358	1023		
					FLOWQC	1358	1023	FALSE	FALSE
DRDIQC	394	318	383	342	DRDIQC	377	340		
RTDIQC	358	271	346	261	RTDIQC	339	255		
CPQC	2200	1758	2201	1720	CPQC	2052	1659		
DISR1	1760	1407	1761	1376	DISR1	1641	1327		
DIQCR	440	352	440	344	DIQCR	410	332		
RTQCJL	345	274	351	277	RTQCJL	303	253		
CPJL2	1982	1852	1787	1609	CPJL2	1605	1480		
SUBQA1	579	433	918	672	SUBQA1	918	672		
					FLWQA1	918	672	FALSE	FALSE
RSQA	547	413	825	604	RSQA	752	567		
DIPF	230	176	341	252	DIPF	312	238		
DIQAPF	317	236	484	351	DIQAPF	441	330		
RTQAJH	274	198	393	273	RTQAJH	281	203		
SUBJH	723	531	888	649	SUBJH	888	649		
					FLOWJH	888	649	FALSE	FALSE
CPJH	686	530	839	655	CPJH	833	644		
RTJHJI	472	349	529	385	RTJHJI	395	314		
SUBJI	572	424	810	592	SUBJI	810	592		
					FLOWJI	810	592	FALSE	FALSE
CPJI	511	430	698	609	CPJI	687	585		
CPJISR	2339	2207	2163	1933	CPJISR	1855	1747		
SUBPF	1289	940	1482	1082	SUBPF	1482	1082		
					FLOWPF	1482	1082	FALSE	FALSE
RETPF	19	10	29	12	RETPF	309	35		
RETPF	1289	940	1482	1082	RETPF	1482	1082		
DRPF	230	176	341	252	DRPF	312	238		
RTDIPF	207	153	300	209	RTDIPF	216	161		
CPPF	1293	945	1496	1104	CPPF	1482	1082		
RSPF	498	332	803	622	RSPF	430	292		
DIPE	0	0	0	0	DIPE	0	0		
DIPFPE	498	332	803	622	DIPFPE	430	292		
RTPFJF	409	278	641	507	RTPFJF	351	240		
SUBUD	1087	851	1697	1341	SUBUD	1704	1346		
					FLOWUD	1704	1346	FALSE	FALSE
DIUA	263	206	409	324	DIUA	411	325		
DIUDUA	824	645	1288	1017	DIUDUA	1293	1021		
RTUDVA	637	483	895	660	RTUDVA	697	549		
SUBVA	1195	869	1195	869	SUBVA	1195	869		
					FLOWVA	1195	869	FALSE	FALSE
CPVA1	1024	898	1437	1130	CPVA1	1011	898		
DIUC	701	685	752	730	DIUC	703	685		
DIVAPE	323	213	684	400	DIVAPE	312	213		
RTVAPE	109	47	427	182	RTVAPE	175	83		
SUBPE	829	600	1410	1028	SUBPE	1412	1030		
					FLOWPE	1412	1030	FALSE	FALSE
DRPE	0	0	0	0	DRPE	0	0		
RTDIPE	0	0	0	0	RTDIPE	0	0		

	Existing Conditions		Future Conditions Without Retention			Future Conditions With Retention		Effective vs.	
	6-hr	24-hr	6-hr	24-hr		6-hr	24-hr	Existing Condition 8	Future Condition 51
CPPE	829	600	1410	1028	CPPE	1412	1030		
RSPE	577	475	945	940	RSPE	643	616		
DIPD	0	0	1	1	DIPD	0	0		
DIPEPD	577	475	944	939	DIPEPD	643	616		
RTPEJF	373	275	585	526	RTPEJF	344	272		
SUBJF	754	558	1601	1167	SUBJF	1602	1169		
					FLOWJF	1602	1169	FALSE	FALSE
CPJF	815	658	1174	1167	CPJF	921	1150		
RTJFJG	646	511	980	848	RTJFJG	555	468		
SUBJG	806	645	1458	1157	SUBJG	1468	1165		
CPJG	837	694	1390	1271	CPJG	1163	1156		
					FLOWJG	1145	1103	FALSE	EFFECTIVE
CPJGSR	2925	2853	3195	2908	CPJGSR	2401	2327		
DRUC	701	685	752	730	DRUC	703	685		
RTVAUC	596	492	688	620	RTVAUC	638	550		
MCUCUC	594	490	683	615	MCUCUC	631	542		
SUBUC	915	672	1014	740	SUBUC	1019	744		
					FLOWUC	1019	744	FALSE	FALSE
@CPUC	752	694	821	771	@CPUC	821	757		
SUBUA	882	663	944	703	SUBUA	944	703		
					FLOWUA	944	678	FALSE	EFFECTIVE
DRUA	263	206	409	324	DRUA	411	325		
RTDIUA	114	83	148	106	RTDIUA	88	73		
@CPUA	882	663	944	704	@CPUA	944	672		
DITB	155	132	166	141	DITB	165	134		
DIUAUC	620	527	662	563	DIUAUC	661	538		
RTUAUC	485	385	515	411	RTUAUC	321	224		
~CPUC2	974	761	1109	946	~CPUC2	930	776		
DIUB	974	761	1109	946	DIUB	930	776		
DIUCPC	0	0	0	0	DIUCPC	0	0		
RTUCPC	0	0	0	0	RTUCPC	0	0		
SUBPC	704	518	743	545	SUBPC	743	545		
					FLOWPC	475	533	FALSE	EFFECTIVE
CPPC	448	506	475	533					
RSPC	33	6	67	20	RSPC	67	20		
RTPCNB	18	6	35	15	RTPCNB	35	15		
SUBNB	551	402	760	550	SUBNB	764	554		
					FLOWNB	764	554	FALSE	FALSE
CPNB1	415	397	542	543	CPNB1	546	547		
DINA	268	256	349	350	DINA	351	352		
DINBNA	147	141	193	194	DINBNA	194	195		
RTNBJD	80	67	101	81	RTNBJD	77	64		
SUBPD	535	403	1097	802	SUBPD	1100	804		
DRPD	0	0	1	1	DRPD	0	0		
CPPD2	535	403	1099	803	CPPD2	1100	804		
RSPD	25	3	308	106	RSPD	315	110		
RTPDNC	23	3	198	92	RTPDNC	204	95		
SUBNC	265	194	755	549	SUBNC	755	549		
					FLOWNC	746	538	FALSE	EFFECTIVE
CPNC	247	191	687	544	CPNC	672	534		
RTNCJE	206	152	516	380	RTNCJE	276	204		
SUBJE1	305	223	572	412	SUBJE1	579	418		
					FLWJE1	571	348	FALSE	EFFECTIVE
CPJE1	263	218	551	431	CPJE1	423	342		
RTJEJD	243	197	530	394	RTJEJD	289	217		
SUBJD	669	491	784	571	SUBJD	784	571		
					FLOWJD	784	571	FALSE	FALSE
CPJD	652	669	905	940	CPJD	1430	1325		
DIJC2	237	243	328	341	DIJC2	517	479		

	Existing Conditions		Future Conditions Without Retention			Future Conditions With Retention		Effective vs.	
	6-hr	24-hr	6-hr	24-hr		6-hr	24-hr	Existing Condition 8	Future Condition 51
DIJDJC	415	426	577	600	DIJDJC	913	846		
RTJDFC	326	301	525	442	RTJDFC	736	607		
SUBJE2	468	349	625	458	SUBJE2	625	458		
					FLWJE2	625	458	FALSE	FALSE
RETJE	180	132	158	32	RETJE	477	359		
RETJE2	468	349	625	458	RETJE2	625	458		
RTJEFC	405	288	527	384	RTJEFC	404	265		
SUBFC	350	265	692	505	SUBFC	692	505		
					FLOWFC	659	419	FALSE	EFFECTIVE
CPFC	789	751	1040	1001	CPFC	1310	1102		
CPFCSR	3438	3441	3922	3759	CPFCSR	1143	1088		
SUBJC2	457	358	825	635	SUBJC2	825	635		
					FLWJC2	825	635	FALSE	FALSE
RETJC2	133	81	72	12	RETJC2	434	433		
RETJC2	457	358	825	635	RETJC2	824	634		
DRJC2	237	243	328	341	DRJC2	517	479		
RTDIJC	132	114	244	203	RTDIJC	300	231		
@CPJC2	529	430	825	669	@CPJC2	903	731		
DIJB2	243	198	367	308	DIJB2	415	336		
DIJCJB	286	232	431	361	DIJCJB	488	395		
RTJCFB	255	207	392	316	RTJCFB	351	270		
SUBFB	675	515	1130	866	SUBFB	1120	858		
					FLOWFB	1120	858	FALSE	FALSE
CPFB	521	504	767	863	CPFB	757	842		
CPFBSR	3636	3741	4218	4300	CPFBSR	1520	1588		
SUBJB2	195	144	461	334	SUBJB2	461	334		
					FLWJB2	449	309	FALSE	EFFECTIVE
DRJB2	243	198	367	308	DRJB2	415	336		
RTDIJB	203	163	312	251	RTDIJB	257	198		
@CPJB2	260	210	462	334	@CPJB2	711	309		
DIEE	93	76	131	120	DIEE	122	109		
DIJBEE	166	134	233	214	DIJBEE	217	193		
RTJBFA	134	111	195	162	RTJBFA	131	103		
SUBFA	483	365	885	669	SUBFA	890	674		
					FLOWFA	890	674	FALSE	FALSE
CPFA	378	357	668	656	CPFA	674	659		
CPSRFA	3792	4034	4574	4869	CPSRFA	1978	2182		
DRUCUB	974	761	1109	946	DRUCUB	930	776		
MCUCUB	975	751	1108	942	MCUCUB	931	774		
SUBUB	262	194	247	182	SUBUB	247	182		
					FLOWUB	247	182	EFFECTIVE	FALSE
~@CPUB	989	886	1127	993	~@CPUB	951	917		
DIUE	0	0	0	0	DIUE	0	0		
DIUBSF	989	886	1127	993	DIUBSF	951	917		
D-B71	579	476	717	583	D-B71	541	507		
71PASS	410	410	410	410	71PASS	410	410		
BSN71	410	410	410	410	BSN71	410	410		
DBSN71	0	0	0	0	DBSN71	0	0		
CLEAR	3792	4034	4574	4869	CLEAR	1988	2182		
SUBTB	1037	811	1147	888	SUBTB	1155	895		
					FLOWTB	1155	895	FALSE	FALSE
DRTB	155	132	166	141	DRTB	165	134		
RTDITB	128	102	137	108	RTDITB	86	63		
CPTB	1050	821	1159	900	CPTB	1155	895		
DITA	254	199	280	218	DITA	279	217		
DITBTA	796	622	879	682	DITBTA	876	678		
RTTBSF	671	511	740	561	RTTBSF	717	544		
SUBSF	349	272	908	662	SUBSF	911	665		
					FLOWSF	831	484	FALSE	EFFECTIVE

	Existing Conditions		Future Conditions Without Retention			Future Conditions With Retention		Effective vs.	
	6-hr	24-hr	6-hr	24-hr		6-hr	24-hr	Existing Condition 8	Future Condition 51
CPSF	939	744	867	740	CPSF	816	651		
DIRJ1	282	223	260	222	DIRJ1	245	195		
DISFRJ	657	521	607	518	DISFRJ	571	456		
RTSFSH	645	511	585	475	RTSFSH	562	435		
SUBSH	298	220	315	232	SUBSH	316	233		
					FLOWSH	316	233	FALSE	FALSE
CPSH	646	520	620	504	CPSH	573	447		
RSSH	579	438	571	445	RSSH	459	350		
DIRJ2	466	344	459	349	DIRJ2	362	269		
DISHRJ	113	94	112	95	DISHRJ	97	81		
RTSHSG	104	87	109	94	RTSHSG	89	76		
SUBTA	222	168	614	450	SUBTA	616	451		
					FLOWTA	495	316	FALSE	EFFECTIVE
DRTA	254	199	280	218	DRTA	279	217		
RTDITA	238	184	262	202	RTDITA	259	199		
@CPTA	396	306	614	455	@CPTA	493	313		
RTTASG	389	297	484	414	RTTASG	289	229		
SUBSG	247	183	353	260	SUBSG	354	261		
					FLOWSG	354	261	FALSE	FALSE
CPSG	403	324	599	614	CPSG	360	269		
RSSG	402	323	599	618	RSSG	348	246		
DIRJ4	302	238	460	476	DIRJ4	258	176		
DISGRJ	101	85	139	143	DISGRJ	90	70		
RTSGSE	99	84	128	129	RTSGSE	84	69		
SUBSC	294	212	907	650	SUBSC	912	653		
					FLOWSC	811	577	FALSE	EFFECTIVE
DISD	159	115	490	351	DISD	438	312		
DISCSD	135	98	417	299	DISCSD	373	265		
RTSCSE	113	80	327	226	RTSCSE	169	107		
SUBSE	407	294	424	308	SUBSE	426	309		
					FLOWSE	426	309	FALSE	FALSE
CPSE	208	288	440	391	CPSE	213	299		
RSSE	186	169	421	367	RSSE	179	147		
DIRJ5	186	169	421	367	DIRJ5	179	147		
DISERJ	0	0	0	0	DISERJ	0	0		
RTSERI	0	0	0	0	RTSERI	0	0		
SUBRJ	207	152	386	283	SUBRJ	387	283		
					FLOWRJ	387	283	FALSE	FALSE
CPRJ1	282	223	260	222	CPRJ1	245	195		
RTSFRJ	260	206	242	185	RTSFRJ	231	179		
CPRJ2	466	344	459	349	CPRJ2	362	269		
RTSHRJ	451	333	456	346	RTSHRJ	349	257		
@CPRJ3	668	524	683	527	@CPRJ3	541	413		
RTRJ3	636	497	671	521	RTRJ3	507	389		
CPRJ4A	302	238	460	476	CPRJ4A	258	176		
CPRJ4B	795	622	883	692	CPRJ4B	643	497		
RTSGRJ	788	612	876	689	RTSGRJ	634	492		
CPRJ5	186	169	421	367	CPRJ5	179	147		
RTSERJ	181	165	405	356	RTSERJ	169	138		
@CPRJ6	870	722	995	825	@CPRJ6	686	581		
RSRJ	760	615	928	779	RSRJ	587	494		
DIPA2	99	46	164	105	DIPA2	39	10		
DIRJPA	662	570	764	673	DIRJPA	547	485		
RTRJRI	655	564	759	670	RTRJRI	542	483		
RTRIRI	652	563	757	668	RTRIRI	539	481		
SUBRI	420	310	736	539	SUBRI	737	540		
					FLOWRI	715	530	FALSE	[illegible]
SUBSB	226	174	525	385	SUBSB	525	385		
					FLOWSB	426	275	FALSE	[illegible]

	Existing Conditions		Future Conditions Without Retention			Future Conditions With Retention		Effective vs.	
	6-hr	24-hr	6-hr	24-hr		6-hr	24-hr	Existing Condition 8	Future Condition 51
RSSB	184	131	414	297	RSSB	135	70		
SUBSD	253	190	480	352	SUBSD	482	353		
					FLOWSD	297	213	FALSE	EFFECTIVE
DRSD	159	115	490	351	DRSD	438	312		
@CPSD	431	310	1193	939	@CPSD	681	505		
RSSD	433	310	1123	913	RSSD	653	502		
RTSDRI	418	305	1065	841	RTSDRI	514	348		
~@CPRI	663	582	1006	967	~@CPRI	842	526		
MCRIRH	657	578	991	951	MCRIRH	534	514		
SUBUE	143	107	194	143	SUBUE	194	143		
					FLOWUE	194	143	FALSE	FALSE
DRUE	0	0	0	0	DRUE	0	0		
CPUE	143	107	194	143	CPUE	194	143		
RSUE	1	1	1	1	RSUE	0	0		
RTUEPB	1	1	1	1	RTUEPB	0	0		
DRB71	410	410	410	410	DRB71	410	410		
MC71PB	410	410	410	410	MC71PB	410	410		
SUBPB2	422	313	711	520	SUBPB2	714	522		
					FLWPB2	714	522	FALSE	FALSE
~CPPB2	827	713	1064	838	~CPPB2	890	806		
MCPB73	820	710	1038	827	MCPB73	863	798		
D-B73	370	260	588	377	D-B73	413	348		
73PASS	450	450	450	450	73PASS	450	450		
MC73NA	450	450	450	450	MC73NA	450	450		
SUBNA2	386	303	952	721	SUBNA2	952	721		
					FLWNA2	898	683	FALSE	EFFECTIVE
DRNA	268	256	349	350	DRNA	351	352		
RTDINA	161	131	205	164	RTDINA	152	124		
~@CPNA	957	849	1300	1175	~@CPNA	1259	1124		
MCNAJC	953	846	1290	1159	MCNAJC	1169	1033		
SUBPB1	212	158	367	270	SUBPB1	368	271		
					FLWPB1	368	271	FALSE	FALSE
DIPA1	40	30	68	51	DIPA1	68	51		
DIPBPA	172	127	299	219	DIPBPA	300	220		
RTPBNA	69	52	88	64	RTPBNA	60	50		
SUBNA1	145	112	395	288	SUBNA1	397	290		
					FLWNA1	341	220	FALSE	EFFECTIVE
CPNA1	148	115	396	291	CPNA1	341	219		
RTNAJC	146	113	369	269	RTNAJC	248	155		
SUBJC1	52	39	116	85	SUBJC1	116	85		
					FLWJC1	94	62	FALSE	EFFECTIVE
~CPJC1	1075	949	1572	1418	~CPJC1	1343	1167		
MCJCJB	1066	943	1538	1370	MCJCJB	1215	1054		
SUBPA	588	431	1099	799	SUBPA	1102	801		
					FLOWPA	1102	801	FALSE	FALSE
DRPA	40	30	68	51	DRPA	68	51		
RTDIPA	11	9	13	10	RTDIPA	9	8		
DRPA2	99	46	164	105	DRPA2	39	10		
RTRJPA	56	19	123	74	RTRJPA	15	5		
CPPA	589	431	1099	800	CPPA	1102	801		
DIOE	106	78	198	144	DIOE	198	144		
DIPAOE	483	354	902	656	DIPAOE	904	657		
RTPAMH	348	247	541	372	RTPAMH	324	227		
SUBMH	325	248	569	418	SUBMH	569	418		
					FLOWMH	558	379	FALSE	EFFECTIVE
CPMH	408	297	608	455	CPMH	493	375		
RTMHMD	363	268	545	393	RTMHMD	285	213		
SUBMD	367	267	367	267	SUBMD	367	267		
RETMD	367	267	367	267	RETMD	367	267		

	Existing Conditions		Future Conditions Without Retention			Future Conditions With Retention		Effective vs.	
	6-hr	24-hr	6-hr	24-hr		6-hr	24-hr	Existing Condition 8	Future Condition 51
RETMD	311	183	311	183	RETMD	311	183		
CPMD	391	298	673	488	CPMD	327	246		
DIJB1	80	62	137	100	DIJB1	67	51		
DIMDJB	311	236	537	388	DIMDJB	259	195		
DIMFX	311	236	537	388	DIMFX	259	195		
DIMDMF	0	0	0	0	DIMDMF	0	0		
SUBMI	681	503	1042	764	SUBMI	1042	764		
					FLOWMI	1042	764	FALSE	FALSE
RETMI	483	362	402	195					
RETMI	681	503	1042	764					
SUBMG	202	150	249	183	SUBMG	249	183		
					FLOWMG	249	183	FALSE	FALSE
RETMG	183	150	179	134	RETMG	242	181		
RETMG	200	118	249	183	RETMG	178	110		
CPMG	836	616	1290	943	CPMG	1206	841		
RTMGJB	590	398	875	631	RTMGJB	755	506		
SUBJB1	160	117	443	317	SUBJB1	443	317		
					FLWJB1	393	245	FALSE	EFFECTIVE
DRJB	80	62	137	100	DRJB	67	51		
RDIJB1	72	55	111	82	RDIJB1	58	43		
~CPJB1	1262	1151	2321	2130	~CPJB1	1574	1399		
DIED	1262	1151	2321	2130	DIED	1574	1399		
DIED	0	0	0	0	DIED	0	0		
SUBSA	811	594	894	654	SUBSA	894	654		
					FLOWSA	894	654	FALSE	FALSE
MCSARH	789	574	867	633	MCSARH	862	631		
D-B91A	789	574	867	633	D-B91A	862	631		
BAS91A	0	0	0	0	BAS91A	0	0		
SUBRH	285	218	666	489	SUBRH	666	489		
					FLOWRH	630	362	FALSE	EFFECTIVE
TEMP	211	211	380	475	TEMP	296	349		
~@CPRH	662	652	1255	1249	~@CPRH	558	645		
D-B91B	212	202	805	799	D-B91B	108	195		
91PASS	450	450	450	450	91PASS	450	450		
MCRHOG	450	450	450	450	MCRHOG	450	450		
SUBRG	376	276	376	276	SUBRG	376	276		
					FLOWRG	376	276	FALSE	FALSE
RETRG	134	23	134	23	RETRG	134	23		
CPRG	376	276	376	276	CPRG	376	276		
RTRGRF	93	81	93	81	RTRGRF	93	81		
SUBRF	652	500	1175	884	SUBRF	1181	888		
					FLOWRF	1181	888	FALSE	FALSE
~CPRF	730	577	1163	905	~CPRF	1168	909		
MCRFOG	723	569	1143	888	MCRFOG	1148	891		
SUBOG	699	513	880	642	SUBOG	887	646		
					FLOWOG	887	646	FALSE	FALSE
CPOG1	1214	987	1810	1514	CPOG1	1808	1521		
D-B99A	1035	808	1631	1335	D-B99A	1629	1342		
BAS99A	179	179	179	179	BAS99A	179	179		
~CPOG	628	628	629	629	~CPOG	567	530		
MCOGOF	626	625	629	629	MCOGOF	559	524		
SUBOF	608	445	750	549	SUBOF	752	550		
					FLOWOF	752	550	FALSE	FALSE
SUBRE	268	203	708	514	SUBRE	710	516		
					FLOWRE	701	508	FALSE	EFFECTIVE
RTREOF	257	194	633	451	RTREOF	439	308		
~CPOF	838	836	1127	1098	~CPOF	833	796		
MCOFOB	834	831	1115	1074	MCOFOB	808	769		

	Existing Conditions		Future Conditions Without Retention			Future Conditions With Retention		Effective vs.	
	6-hr	24-hr	6-hr	24-hr		6-hr	24-hr	Existing Condition 8	Future Condition 51
SUBOB	990	716	1260	916	SUBOB	977	916		
					FLOWOB	977	916	FALSE	FALSE
~CPOB	965	1013	1258	1461	~CPOB	850	1097		
SUBRD	233	170	778	565	SUBRD	782	568		
					FLOWRD	767	554	FALSE	EFFECTIVE
DIOB	93	68	311	226	DIOB	307	221		
DIRDOB	140	102	467	339	DIRDOB	460	332		
RTRDRC	70	48	189	127	RTRDRC	78	60		
SUBRC	392	299	1409	1081	SUBRC	1409	1081		
					FLOWRC	1383	1055	FALSE	EFFECTIVE
CPRC	369	297	1295	1087	CPRC	1271	1050		
RTRCRB	279	211	831	631	RTRCRB	417	342		
SUBRB	391	288	1346	991	SUBRB	1347	993		
					FLOWRB	1347	993	FALSE	FALSE
CPRB	323	284	1145	1073	CPRB	1038	983		
DIKA3	162	142	573	536	DIKA3	519	491		
DIRBKA	162	142	573	536	DIRBKA	519	491		
RTRBRA	140	109	443	345	RTRBRA	198	175		
SUBRA	150	110	540	391	SUBRA	541	392		
					FLOWRA	541	392	FALSE	FALSE
CPRA	139	110	451	414	CPRA	355	384		
DIKA4	114	87	420	383	DIKA4	325	354		
DIRAKA	25	25	31	31	DIRAKA	29	30		
DIAFX	25	25	31	31	DIAFX	29	30		
DIKAAF	0	0	0	0	DIKAAF	0	0		
CPOB2	93	68	311	226	CPOB2	307	221		
RTDIOB	32	22	80	59	RTDIOB	33	27		
@CPOB	965	1013	1257	1464	@CPOB	846	1097		
MCOBLE	925	940	1245	1321	MCOBLE	807	981		
SUBLE	223	162	800	584	SUBLE	800	584		
					FLOWLE	776	584	FALSE	FALSE
~CPLE	1047	1093	1424	1448	~CPLE	937	1079		
D-B111	347	393	724	748	D-B111	237	379		
111PAS	700	700	700	700	111PAS	700	700		
MCLEKD	700	700	700	700	MCLEKD	700	700		
SUBKD	316	241	1052	792	SUBKD	1055	795		
					FLOWKD	895	697	FALSE	EFFECTIVE
~CPKD	892	920	1390	1471	~CPKD	1257	1379		
MCKDKA	885	908	1369	1424	MCKDKA	1141	1198		
SUBKA	227	162	227	162	SUBKA	220	162		
RETKA	227	162	227	162	RETKA	220	162		
RETKA	198	107	198	107	RETKA	182	107		
CPKA3	162	142	573	536	CPKA3	519	491		
RTDIKA	148	115	497	387	RTDIKA	220	188		
CPKA4	114	87	420	383	CPKA4	325	354		
~CPKA	963	1042	1559	1597	~CPKA	1181	1221		
CPKAAF	4350	4848	5683	6257	CPKAAF	2387	2740		
SUBLC	324	235	324	235	SUBLC	316	236		
					FLOWLC	316	236	FALSE	FALSE
RETLC	324	235	324	235	RETLC	316	236		
RETLC	68	7	68	7	RETLC	5	5		
RTLCLA	6	3	6	3	RTLCLA	1	2		
SUBLA	490	351	704	503	SUBLA	704	503		
					FLOWLA	704	503	FALSE	FALSE
RETLA	490	351	704	503	RETLA	704	503		
RETLA	441	255	650	413	RETLA	490	232		
CPLA	387	254	613	410	CPLA	429	231		
RTLAKB	160	87	248	142	RTLAKB	149	64		
SUBKB	503	364	672	482	SUBKB	672	482		

	Existing Conditions		Future Conditions Without Retention			Future Conditions With Retention		Effective vs.	
	6-hr	24-hr	6-hr	24-hr		6-hr	24-hr	Existing Condition 8	Future Condition 51
					FLOWKB	647	368	FALSE	EFFECTIVE
CPKB	432	359	574	476	CPKB	481	354		
CPAFKB	4410	4941	5863	6601	CPAFKB	2487	3030		
SUBGA	356	255	356	255	SUBGA	355	253		
					FLOWGA	355	253	EFFECTIVE	FALSE
CPAFGA	4411	4942	5878	6620	CPAFGA	2495	3040		
SUBEC	24	18	93	68	SUBEC	94	68		
					FLOWEC	67	42	FALSE	EFFECTIVE
CPECSR	4418	4955	5898	6650	CPECSR	2508	3063		
SUBOE	560	405	1123	812	SUBOE	1126	814		
					FLOWOE	1126	814	FALSE	FALSE
RETOE	88	10	28	12	RETOE	549	485		
RETOE	560	405	1123	812	RETOE	1126	814		
CPOE1	106	78	198	144	CPOE1	198	144		
RTDIOE	35	26	49	36	RTDIOE	25	19		
@CPOE	560	406	1123	815	@CPOE	1126	814		
DIOD	92	67	182	132	DIOD	182	132		
DIOEOD	468	339	942	683	DIOEOD	943	682		
RTOEMF	256	186	402	288	RTOEMF	204	149		
SUBMF	590	479	1264	995	SUBMF	1264	995		
					FLOWMF	1175	903	FALSE	EFFECTIVE
CPMF	311	236	537	388	CPMF	259	195		
RTMDMF	253	188	383	284	RTMDMF	194	138		
CPMF1	676	557	1263	1036	CPMF1	1141	900		
DIEB	313	258	561	479	DIEB	512	416		
DIMFEB	363	299	654	558	DIMFEB	597	484		
RTMFMC	305	243	499	403	RTMFMC	243	176		
SUBOD	681	504	1229	898	SUBOD	1234	901		
					FLOWOD	1234	901	FALSE	FALSE
RETOD	13	6	20	9	RETOD	165	290		
RETOD	681	504	1229	898	RETOD	1234	901		
DROD	92	67	182	132	DROD	182	132		
RTDIOD	53	40	80	58	RTDIOD	43	34		
CPOD	681	504	1229	902	CPOD	1234	901		
DIOC	123	91	221	162	DIOC	222	162		
DIODOC	558	414	1008	740	DIODOC	1012	739		
RTODMC	351	262	487	347	RTODMC	286	212		
SUBMC	683	555	1688	1362	SUBMC	1690	1364		
					FLOWMC	1685	1356	FALSE	EFFECTIVE
CPMC1	819	682	1400	1384	CPMC1	1388	1342		
DIMB	313	261	534	528	DIMB	529	512		
DIMCMB	506	421	866	856	DIMCMB	859	830		
RTMCIE	479	398	775	705	RTMCIE	551	486		
DREB	313	258	561	479	DREB	512	416		
SUBEB	149	112	304	223	SUBEB	304	223		
					FLOWEB	287	169	FALSE	EFFECTIVE
CPEB	373	289	821	615	CPEB	689	472		
RDIED	1262	1151	2321	2130	RDIED	1574	1399		
MCJBED	1256	1146	2232	2019	MCJBED	1431	1270		
SUBED1	198	145	498	359	SUBED1	498	359		
					FLWED1	462	275	FALSE	EFFECTIVE
SUBED2	59	44	141	103	SUBED2	141	103		
					FLWED2	139	89	FALSE	EFFECTIVE
~CPED1	1535	1262	2886	2211	~CPED1	1734	1370		
~CPED2	1856	1505	3283	2541	~CPED2	1874	1510		
MCED95	1833	1492	3224	2497	MCED95	1831	1471		
D-B95	783	442	2174	1447	D-B95	781	421		
95PASS	1050	1050	1050	1050	95PASS	1050	1050		
MC95ID	1050	1050	1050	1050	MC95ID	1050	1050		

	Existing Conditions		Future Conditions Without Retention			Future Conditions With Retention		Effective vs.	
	6-hr	24-hr	6-hr	24-hr		6-hr	24-hr	Existing Condition 8	Future Condition 51
SUBID1	169	131	344	252	SUBID1	344	252		
					FLWID1	333	221	FALSE	EFFECTIVE
SUBID2	226	164	542	387	SUBID2	542	387		
					FLWID2	463	281	FALSE	EFFECTIVE
~CPID1	1174	1138	1712	1564	~CPID1	1085	1082		
SUBIE	250	195	518	379	SUBIE	518	379		
					FLOWIE	501	337	FALSE	EFFECTIVE
CPID2	1691	1607	2602	2557	CPID2	1535	1321		
MCIDIB	1669	1588	2564	2489	MCIDIB	1485	1310		
SUBIB	357	272	753	548	SUBIB	753	548		
					FLOWIB	713	420	FALSE	EFFECTIVE
SUBIC	227	165	575	412	SUBIC	575	412		
					FLOWIC	503	322	FALSE	EFFECTIVE
~CPIB1	1839	1754	3324	3243	~CPIB1	1829	1531		
SUBOC	613	449	785	574	SUBOC	788	576		
					FLOWOC	788	576	FALSE	FALSE
DROC	123	91	221	162	DROC	222	162		
RTDIOC	50	39	64	49	RTDIOC	36	30		
CPOC	613	449	785	577	CPOC	788	576		
RTOCMB	316	221	342	238	RTOCMB	260	202		
SUBMB	674	546	1552	1244	SUBMB	1552	1244		
					FLOWMB	1515	1205	FALSE	EFFECTIVE
DRMB	313	261	534	528	DRMB	529	512		
RTDIMB	268	219	399	326	RTDIMB	208	174		
@CPMB	819	729	1552	1293	@CPMB	1865	1205		
RTMBIB	738	648	1151	1031	RTMBIB	727	633		
@CPIB2	2526	2378	4311	4142	@CPIB2	2475	2098		
MCIBIA	2496	2342	4225	4017	MCIBIA	2361	2023		
SUBME	268	193	492	352	SUBME	489	349		
					FLOWME	489	346	FALSE	EFFECTIVE
RTMEIA	163	109	279	179	RTMEIA	157	89		
SUBIA	347	254	578	419	SUBIA	578	419		
					FLOWIA	578	419	FALSE	FALSE
~CPIA	2554	2426	4450	4240	~CPIA	2427	2121		
MCIAHB	2529	2407	4383	4155	MCIAHB	2322	2040		
SUBHB	358	258	627	447	SUBHB	627	447		
					FLOWHB	627	447	FALSE	FALSE
SUBDA	318	235	539	392	SUBDA	539	392		
					FLOWDA	539	392	FALSE	FALSE
~CPHB1	2530	2427	4488	4266	~CPHB1	2326	2077		
SUBLD	465	333	431	309	SUBLD	431	309		
					FLOWLD	431	309	EFFECTIVE	FALSE
RTLDMA	428	300	403	279	RTLDMA	383	263		
SUBMA	185	132	430	305	SUBMA	430	305		
					FLOWMA	425	265	FALSE	EFFECTIVE
CPMA	601	426	703	475	CPMA	613	418		
RTMAHB	358	236	437	284	RTMAHB	287	169		
~CPHB2	2600	2516	4720	4521	~CPHB2	2432	2211		
SUBLB	171	124	417	297	SUBLB	417	297		
					FLOWLB	385	231	FALSE	EFFECTIVE
RTLBHA	144	97	314	211	RTLBHA	171	84		
SUBHA	143	104	296	214	SUBHA	295	213		
					FLOWHA	285	174	FALSE	EFFECTIVE
CPHA	2641	2583	4896	4733	CPHA	2469	2289		
MCHACB	2608	2559	4775	4566	MCHACB	2278	2131		
SUBEE	385	304	866	670	SUBEE	866	670		
					FLOWEE	803	607	FALSE	EFFECTIVE
CPEE1	93	76	131	120	CPEE1	122	109		
RTDIEE	87	71	120	99	RTDIEE	87	69		

	Existing Conditions		Future Conditions Without Retention			Future Conditions With Retention		Effective vs.	
	6-hr	24-hr	6-hr	24-hr		6-hr	24-hr	Existing Condition 8	Future Condition 51
CPEE	386	304	868	672	CPEE	803	607		
RTEEEA	179	117	341	217	RTEEEA	106	83		
SUBEA	541	453	1322	1086	SUBEA	1322	1086		
					FLOWEA	1213	961	FALSE	EFFECTIVE
CPEA	491	449	1200	1085	CPEA	1123	954		
MCEADC	478	435	1134	1008	MCEADC	794	600		
SUBDC	546	427	1135	890	SUBDC	1135	890		
					FLOWDC	1107	789	FALSE	EFFECTIVE
~CPDC	703	645	1538	1318	~CPDC	874	762		
MCDCCC	689	630	1505	1282	MCDCCC	797	590		
SUBDD	142	104	293	210	SUBDD	293	210		
					FLOWDD	244	153	FALSE	EFFECTIVE
RTDDCC	98	70	185	126	RTDDCC	80	41		
SUBCC	780	621	1213	964	SUBCC	1213	964		
					FLOWCC	1213	964	FALSE	FALSE
~CPCC	1007	939	2096	1830	~CPCC	1149	948		
MCCCCB	1004	929	2054	1794	MCCCCB	1083	879		
SUBCB	315	260	686	530	SUBCB	686	530		
					FLOWCB	686	529	FALSE	EFFECTIVE
~CPCB1	3113	3242	6349	6229	~CPCB1	2764	2686		
SUBGD	657	521	1340	1048	SUBGD	1340	1048		
					FLOWGD	1340	1048	FALSE	FALSE
SUBKC	199	143	488	348	SUBKC	488	348		
					FLOWKC	431	257	FALSE	EFFECTIVE
RTKCGD	102	69	229	146	RTKCGD	88	49		
SUBGC	339	243	408	294	SUBGC	408	294		
					FLOWGC	408	294	FALSE	FALSE
RTGCGD	298	207	359	249	RTGCGD	350	249		
CPGD1	796	659	1573	1318	CPGD1	1522	1286		
RTGDCB	627	496	1107	846	RTGDCB	727	542		
~CPCB2	3402	3606	7078	6978	~CPCB2	3061	2961		
MCCBCA	3065	3192	5266	5096	MCCBCA	2355	2309		
SUBCA	584	479	1271	1006	SUBCA	1272	1007		
					FLOWCA	1272	1007	FALSE	FALSE
~CPCA1	3068	3210	5265	5119	~CPCA1	2348	2306		
SUBGB	309	220	364	259	SUBGB	365	261		
					FLOWGB	365	261	FALSE	FALSE
RTGBCA	240	162	198	126	RTGBCA	208	142		
~CPCA2	3067	3211	5277	5145	~CPCA2	2348	2315		
B-DRCC	2965	3111	5177	5045	B-DRCC	2240	2216		
P-DRCC	100	100	100	100	P-DRCC	100	99		
MCCABC	100	100	100	100	MCCABC	99	99		
SUBBC	327	244	829	610	SUBBC	851	626		
					FLOWBC	851	626	FALSE	FALSE
~CPBC	285	326	576	675	~CPBC	562	671		
CPAFBC	4413	5104	5995	7083	CPAFBC	2616	3487		
SUBAD	176	129	388	281	SUBAD	388	281		
					FLOWAD	384	248	FALSE	EFFECTIVE
BSNAD	9	8	9	9	BSNAD	8	8		
SUBAC	290	209	567	408	SUBAC	567	408		
					FLOWAC	567	400	FALSE	EFFECTIVE
CPAC	285	215	546	413	CPAC	544	400		
BSNAC	58	8	213	59	BSNAC	14	6		
SUBAB	346	250	621	448	SUBAB	621	448		
					FLOWAB	621	448	FALSE	FALSE
CPAB	306	247	540	445	CPAB	538	443		
BSNAB	12	4	173	16	BSNAB	5	4		
SUBAA	198	139	198	139	SUBAA	198	139		
					FLOWAA	198	139	FALSE	FALSE

	Existing Conditions		Future Conditions Without Retention			Future Conditions With Retention		Effective vs.	
	6-hr	24-hr	6-hr	24-hr		6-hr	24-hr	Existing Condition 8	Future Condition 51
CPAA	174	138	284	138	CPAA	174	138		
SUBBB	209	159	375	276	SUBBB	375	276		
					FLOWBB	375	261	FALSE	EFFECTIVE
RTBBBA	128	93	129	93	RTBBBA	73	48		
SUBBA	221	159	353	251	SUBBA	353	251		
					FLOWBA	353	251	FALSE	FALSE
CPBA	215	158	345	251	CPBA	345	250		
HCTR1	305	257	369	309	HCTR1	280	246		
BSNAA	26	4	173	40	BSNAA	4	2		
SUBWT1	1347	1000	1347	1000	SUBWT1	1354	1005		
SUBWT2	423	306	423	306	SUBWT2	425	308		
DUR	4453	5165	6332	7658	DUR	2841	3768		

Appendix B
Design Calculations & Cost Estimates

Sub-Basin	Developed Area (sm)	Maricopa County Volume Req'mt (ac-ft)	Effective Volume (ac-ft)	Retention Basin Land Area @ 2' deep (ac)	Open Space Land Area (ac)	Net Developable Land Area (ac)	Retention Basin Land Value ($)	Additional Residential Units	Storm Drain Cost to Developer	Estimated Benefit to Developer
					5%		$40,000 $/ac	7.3 du/ac	$3 ($/dia inch)/ft	$75,000 $/du
SUBOD	0.28	32.42	25.93	16.2	9.0	7.2	$289,810	53	$142,560	$4,117,560
SUBOC	0.11	12.38	9.91	6.2	3.4	2.8	$110,709	20	$0	$1,500,000
SUBMB	0.96	77.65	62.12	38.8	30.8	8.0	$321,835	59	$570,240	$4,995,240
SUBMC	0.93	77.92	62.33	39.0	29.7	9.3	$372,275	68	$712,800	$5,812,800
SUBME	0.26	14.61	11.69	7.3	8.4	0.0	$0	0	$95,040	$95,040
SUBHB	0.22	16.19	12.95	8.1	6.9	1.2	$47,718	9	$261,360	$936,360
SUBIA	0.18	13.34	10.67	6.7	5.7	0.9	$37,664	7	$617,760	$1,142,760
SUBIB	0.53	39.76	31.81	19.9	17.0	2.8	$113,630	21	$997,920	$2,572,920
SUBIE	0.30	22.54	18.03	11.3	9.7	1.6	$64,405	12	$427,680	$1,327,680
SUBID1	0.21	15.75467	12.60	7.9	6.8	1.1	$45,013	8	$0	$600,000
	3.98	**322.57**							**$3,825,360**	**$23,100,360**

Storm Drain Cost

PIPE ID	Drainage Volume (ac-ft)	Drainage Volume (ft^3)	Design Flow Rate (cfs)	Target Velocity (fps)	Target Pipe Size (in)	Design Pipe Size	Design Velocity	Storm Drain Length	Storm Drain Cost to Developer
A	16.21	706040.2	5.45	5	14	18	3.08	2640	$142,560
B	32.42	1412080.5	10.90	5	20	24	3.47	2640	$190,080
C	19.48	848507.0	6.55	5	15	18	3.71	2640	$142,560
D	71.37	3109094.4	23.99	5	30	30	4.89	2640	$237,600
E	19.48	848507.0	6.55	5	15	18	3.71	2640	$142,560
F	110.33	4806108.4	37.08	5	37	36	5.25	2640	$285,120
G	15.75	686273.3	5.30	5	14	18	3.00	2640	$142,560
H	148.63	6474305.4	49.96	5	43	42	5.19	2640	$332,640
I	168.51	7340310.7	56.64	5	46	48	4.51	2640	$380,160
J	12.38	539423.8	4.16	5	12	12	5.30	2640	$95,040
K	19.41	845644.8	6.53	5	15	18	3.69	2640	$142,560
L	51.21	2230713.4	17.21	5	25	24	5.48	2640	$190,080
M	19.41	845644.8	6.53	5	15	18	3.69	2640	$142,560
N	90.04	3922003.0	30.26	5	33	36	4.28	2640	$285,120
O	278.43	12128319.0	93.58	5	59	60	4.77	2640	$475,200
P	7.36	320694.5	2.47	5	10	12	3.15	2640	$95,040
Q	21.97	957139.8	7.39	5	16	18	4.18	2640	$142,560
R	313.74	13666514.4	105.45	5	62	66	4.44	1320	$261,360
									$3,825,360

Channel Cost

30%

Plan Element ID	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Design Invert Slope (ft./ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Fenced? (Y/N)	Excavated Volume (cy)	Unit Cost ($/cy)	Excavation Cost	Unit Cost ($ per crossing)	Utilities Relocation Cost	Channel Length (ft)	Left Access Road Width (ft)	Right Access Road Width (ft)	6" ABC Access Road Unit Cost ($/sf)	Access Road Cost	Total Corridor Width-Channel+Access Rd (ft)	Existing Right-of-Way Width (ft.)	New Right-of-Way Width Required (ft.)	Landscape Unit Cost ($/sf)	Total Landscape Cost	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Contingencies Cost	Total Construction, Land, Landscape, and Contingencies Costs
A	449	449	2640	0.0009	E	0.0300	15.0	4.1	6	6	N	22877	$6	$137,259	$3,000	$1,000	2640	16	16	$0.65	$54,912	108.4	0	120	$1.80	570,240	7.3	Res / Ag	$0.99	$313,632	$193,171	57,951	$1,134,995
B	681	681	2640	0.0019	E	0.0300	20.0	3.9	6	6	N	24145	$6	$144,870	$3,000	$1,000	2640	16	16	$0.65	$54,912	111.5	0	130	$1.80	617,760	7.9	Res / Ag	$0.99	$339,768	$200,782	60,235	$1,218,545
C	681	681	2640	0.0009	E	0.0300	25.0	4.3	6	6	N	30942	$6	$185,651	$3,000	$1,000	2640	16	16	$0.65	$54,912	122.7	0	140	$1.80	665,280	8.5	Res / Ag	$0.99	$365,904	$241,563	72,469	$1,345,216
D	681	681	2640	0.0019	E	0.0300	20.0	3.9	6	6	N	24145	$6	$144,870	$3,000	$1,000	2640	16	16	$0.65	$54,912	111.5	0	130	$1.80	617,760	7.9	Res / Ag	$0.99	$339,768	$200,782	60,235	$1,218,545
E	681	681	2640	0.0009	E	0.0300	30.0	4.1	6	6	N	30855	$6	$185,131	$3,000	$1,000	2640	16	16	$0.65	$54,912	124.1	0	140	$1.80	665,280	8.5	Res / Ag	$0.99	$365,904	$241,043	72,313	$1,344,540
F	1325	1325	2640	0.0019	E	0.0300	30.0	4.8	6	6	N	39701	$6	$238,206	$3,001	$1,000	2640	16	16	$0.65	$54,912	135.2	0	150	$1.80	712,800	9.1	Res / Ag	$0.99	$392,040	$294,118	88,235	$1,487,193
G	379	379	2640	0.0009	E	0.0300	10.0	4.1	6	6	N	20403	$4	$81,610	$3,001	$1,000	2640	16	16	$0.65	$54,912	103.5	0	120	$1.80	570,240	7.3	Res / Ag	$0.99	$313,632	$137,522	41,257	$1,062,651
H	1700	1700	2640	0.0009	E	0.0300	55.0	5.3	6	6	N	61487	$6	$368,924	$3,000	$1,000	2640	16	16	$0.65	$54,912	166.6	0	190	$1.80	902,880	11.5	Res / Ag	$0.99	$496,584	$424,836	127,451	$1,951,751
I	1700	1700	2640	0.0009	E	0.0300	75.0	5.3	0	0	N	49345	$4	$197,378	$3,000	$1,000	2640	16	16	$0.65	$54,912	107.0	0	120	$1.80	213,840	7.3	Res / Ag	$0.99	$313,632	$253,290	75,987	$856,749
J	619	619	2640	0.0019	E	0.0300	15.0	4.0	6	6	N	22657	$6	$135,945	$3,000	$1,000	2640	16	16	$0.65	$54,912	108.1	0	120	$1.80	570,240	7.3	Res / Ag	$0.99	$313,632	$191,857	57,557	$1,133,286
K	619	619	2640	0.0009	E	0.0300	20.0	4.4	6	6	N	28950	$6	$173,700	$3,000	$1,000	2640	16	16	$0.65	$54,912	118.6	0	140	$1.80	665,280	8.5	Res / Ag	$0.99	$365,904	$229,612	68,884	$1,329,680
L	654	654	2640	0.0019	E	0.0300	15.0	4.1	6	6	N	23633	$4	$94,530	$3,000	$1,000	2640	16	16	$0.65	$54,912	109.6	0	130	$1.80	617,760	7.9	Res / Ag	$0.99	$339,768	$150,442	45,133	$1,153,103
M	619	619	2640	0.0009	E	0.0300	20.0	4.4	6	6	N	28950	$6	$173,700	$3,000	$1,000	2640	16	16	$0.65	$54,912	118.6	0	140	$1.80	665,280	8.5	Res / Ag	$0.99	$365,904	$229,612	68,884	$1,329,680
N	1200	1200	2640	0.0019	E	0.0300	45.0	4.9	0	0	N	27421	$6	$164,529	$3,000	$1,000	2640	16	16	$0.65	$54,912	77.0	0	90	$1.80	427,680	5.5	Res / Ag	$0.99	$235,224	$220,441	66,132	$949,477
O	3135	3135	2640	0.0009	E	0.0300	110.0	5.4	6	6	N	100512	$6	$603,070	$3,000	$1,000	2640	16	16	$0.65	$54,912	223.8	0	250	$1.80	1,188,000	15.2	Res / Ag	$0.99	$653,400	$658,982	197,694	$2,698,076
P	366	366	2640	0.0019	E	0.0300	4.0	3.9	6	6	N	15846	$6	$95,079	$3,000	$1,000	2640	16	16	$0.65	$54,912	94.5	0	110	$1.80	522,720	6.7	Res / Ag	$0.99	$287,496	$150,991	45,297	$1,006,504
Q	419	419	2640	0.0019	E	0.0300	4.0	4.1	6	6	N	17565	$4	$70,262	$3,000	$1,000	2640	16	16	$0.65	$54,912	97.8	0	110	$1.80	522,720	6.7	Res / Ag	$0.99	$287,496	$126,174	37,852	$974,242
R	3091	3091	2640	0.0009	E	0.0300	110.0	5.4	6	6	N	99511	$6	$597,064	$3,000	$1,000	2640	16	16	$0.65	$54,912	223.1	0	250	$1.80	1,188,000	15.2	Res / Ag	$0.99	$653,400	$652,976	195,893	$2,690,268
																																	$24,884,501

Culvert Cost

30%

Plan Element ID	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)	Tailwater (channel) Depth (ft.)	Allowable HW depth (ft)	Allowable HW (elev.)	Computed Headwater	Computed HW/D	Allowable HW/D	Control	Length of Pipe/ Box Culvert (ft.)	Unit Cost ($/ft.)	Pipe/Box Culvert Cost	Inlet Headwall	Unit Cost (Ea.)	Inlet Headwall Cost	Outlet Headwall	Unit Cost (Ea.)	Outlet Headwall Cost	Culvert Materials Cost	Culvert Contingencies Cost	Total Land, Construction, and Contingencies Costs
OD1	449	449	110	0.0010	RCBC	0.0120	2	5	ft.	8	RCBC	Wingwall	5.00	6.00	6.00	5.70	1.14	1.20	TW	110	$800	$88,000	1	$5,700	$5,700	1	$9,900	$9,900	$103,600	$31,080	$134,680
OD2	898	898	110	0.0010	RCBC	0.0120	3	5	ft.	10	RCBC	Wingwall	5.00	6.00	6.00	5.80	1.16	1.20	TW	110	$1,575	$173,250	1	$6,050	$6,050	1	$10,500	$10,500	$189,800	$56,940	$246,740
MC1	340	340	110	0.0010	RCBC	0.0120	1	5	ft.	12	RCBC	Wingwall	5.00	6.00	6.00	5.70	1.14	1.20	TW	110	$400	$44,000	1	$4,800	$4,800	1	$8,300	$8,300	$57,100	$17,130	$74,230
MC2	681	681	110	0.0010	RCBC	0.0120	2	5	ft.	12	RCBC	Wingwall	5.00	6.00	6.00	5.70	1.14	1.20	TW	110	$800	$88,000	1	$4,950	$4,950	1	$8,600	$8,600	$101,550	$30,465	$132,015
MC3	340	340	110	0.0010	RCBC	0.0120	1	5	ft.	12	RCBC	Wingwall	5.00	6.00	6.00	5.70	1.14	1.20	TW	110	$400	$44,000	1	$4,700	$4,700	1	$8,100	$8,100	$56,800	$17,040	$73,840
MC4	1388	1388	110	0.0010	RCBC	0.0120	4	5	ft.	12	RCBC	Wingwall	5.00	6.00	6.00	5.73	1.15	1.20	TW	110	$1,600	$176,000	1	$5,500	$5,500	1	$9,500	$9,500	$191,000	$57,300	$248,300
ID1	252	252	110	0.0010	RCBC	0.0120	1	5	ft.	8	RCBC	Wingwall	5.00	6.00	6.00	5.91	1.18	1.20	TW	110	$400	$44,000	1	$6,200	$6,200	1	$10,700	$10,700	$60,900	$18,270	$79,170
ID2	1704	1704	110	0.0010	RCBC	0.0120	4	5	ft.	12	RCBC	Wingwall	5.00	6.00	6.00	6.15	1.23	1.20	TW	110	$1,600	$176,000	1	$4,800	$4,800	1	$8,300	$8,300	$189,100	$56,730	$245,830
OC1	576	576	110	0.0010	RCBC	0.0120	2	5	ft.	12	RCBC	Wingwall	5.00	6.00	6.00	5.47	1.09	1.20	TW	110	$800	$88,000	1	$8,900	$8,900	1	$15,400	$15,400	$112,300	$33,690	$145,990
MB1	619	619	110	0.0010	RCBC	0.0120	2	5	ft.	10	RCBC	Wingwall	5.00	6.00	6.00	5.86	1.17	1.20	TW	110	$1,050	$115,500	1	$9,300	$9,300	1	$16,100	$16,100	$140,900	$42,270	$183,170
MB2	619	619	110	0.0010	RCBC	0.0120	2	5	ft.	10	RCBC	Wingwall	5.00	6.00	6.00	5.86	1.17	1.20	TW	110	$1,050	$115,500	1	$9,300	$9,300	1	$16,100	$16,100	$140,900	$42,270	$183,170
MB3	309	309	110	0.0010	RCBC	0.0120	1	5	ft.	10	RCBC	Wingwall	5.00	6.00	6.00	5.86	1.17	1.20	TW	110	$525	$57,750	1	$8,900	$8,900	1	$15,400	$15,400	$82,050	$24,615	$106,665
MB4	1273	1273	110	0.0010	RCBC	0.0120	4	5	ft.	10	RCBC	Wingwall	5.00	6.00	6.00	5.92	1.18	1.20	TW	110	$2,100	$231,000	1	$8,300	$8,300	1	$14,400	$14,400	$253,700	$76,110	$329,810
IB1	1700	1700	110	0.0010	RCBC	0.0120	5	5	ft.	10	RCBC	Wingwall	5.00	6.00	6.00	6.06	1.21	1.20	TW	110	$2,625	$288,750	1	$8,300	$8,300	1	$14,400	$14,400	$311,450	$93,435	$404,885
IB2	2908	2908	110	0.0010	RCBC	0.0120	7	5	ft.	12	RCBC	Wingwall	5.00	6.00	6.00	6.09	1.22	1.20	TW	110	$2,800	$308,000	1	$6,400	$6,400	1	$11,100	$11,100	$325,500	$97,650	$423,150
LD1	305	305	110	0.0010	RCBC	0.0120	1	5	ft.	10	RCBC	Wingwall	5.00	6.00	6.00	5.83	1.17	1.20	TW	110	$525	$57,750	1	$6,400	$6,400	1	$11,100	$11,100	$75,250	$22,575	$97,825
ME1	366	366	110	0.0010	RCBC	0.0120	1	5	ft.	12	RCBC	Wingwall	5.00	6.00	6.00	5.82	1.16	1.20	TW	110	$400	$44,000	1	$6,700	$6,700	1	$11,600	$11,600	$62,300	$18,690	$80,990
IA1	3135	3135	110	0.0010	RCBC	0.0120	8	5	ft.	12	RCBC	Wingwall	5.00	6.00	6.00	5.96	1.19	1.20	TW	110	$3,200	$352,000	1	$6,050	$6,050	1	$10,500	$10,500	$368,550	$110,565	$479,115
																															$3,669,575

Detention Basin

Location/ Description	Basin Excavation Volume (cy)	Unit Cost ($/cy)	Detention Basin Excavation Cost	Length of Drain Pipe/ Box Culvert (ft.)	Unit Cost ($/ft.)	Pipe/Box Culvert Cost	# Of Manholes	Manhole Unit Cost ($)	Manhole Total Cost ($)	Headwall	Unit Cost (Ea.)	Headwall Cost	Inflow Spillway Area (ft^2)	Inflow Spillway Unit Cost ($/sf)	Inflow Spillway Cost ($/sf)	Utility Relocation Cost	Basin Top Area (ac)	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Total Land Acquisition Cost	Landscape Restoration (sf)	Landscape Unit Cost ($/sf)	Landscape Cost	Total Construction Cost	Total Contingency Cost	30% Total Landscape Cost	Total Construction, Land, Landscape, and Contingencies Costs
Central Basin	887,333	$4	$3,549,332	5280	$55	$290,400	14	$4,500	$63,000	1	$1,100	$1,100	12646	$5	$63,230	$0	110	143.0	Res / Ag	$0.99	$6,166,789	6229080	$1.80	$11,212,344	$3,967,062	$1,190,119	$11,212,344	$22,536,314