

APPENDIX F — COMPARISON OF COMMERCIAL GEOCODING SERVICES

APPENDIX F compares three leading commercial geocoding services and their ability to provide latitude and longitude information for 53 street addresses in Houston, Texas. The names of the three services were deliberately withheld from this report because Dewberry believes that erroneous conclusions could be drawn from ranking the quality of services, i.e., each could perform differently in other communities, but they all appear to utilize interpolation procedures that cause positioning errors of several hundred feet. They are referred to herein as "Service A", "Service B" and "Service C."

The "ground truth" coordinates were provided by Michael Walters, GIS Section Leader of the Harris County Flood Control District who cooperated with Dewberry in several aspects of this report and whose support is greatly appreciated. For 53 street addresses provided by Dewberry (from actual ECs), Mr. Walters utilized county GIS files that linked street addresses to tax parcels. He then overlaid the tax parcel polygons over digital orthophotos to manually identify the rooftops of the principal structure within each parcel polygon. Lastly, he placed a centroid point near the center of each rooftop and provided Dewberry with the latitude and longitude of each centroid (coordinates embedded in the digital orthophotos) linked to its street address.

The commercial geocoding services were then utilized to georeference (geocode) the street addresses and zip codes so as to provide latitude and longitude for each address. The results are at the spreadsheet that follows.

Service A was able to address-match 50 of 53 addresses, Service B matched 52 of 53 addresses, and Service C matched all 53 of 53 addresses. The addresses not matched are highlighted in yellow at the bottom of the spreadsheet.

The most important statistics are summarized in the colored boxes at the bottom of the spreadsheet.

- ◆ For Service A, the average error in Northing was 129.80 ft, the average error in Easting was 362.97 ft; and the dataset tested 575.99 ft horizontal accuracy at the 95% confidence level.
- ◆ For Service B, the average error in Northing was 152.97 ft, the average error in Easting was 206.37 ft; and the dataset tested 787.86 ft horizontal accuracy at the 95% confidence level.
- ◆ For Service C, the average error in Northing was 178.79 ft, the average error in Easting was 212.68 ft; and the dataset tested 684.24 ft horizontal accuracy at the 95% confidence level.
- ◆ In each case, the largest outliers are highlighted in their appropriate columns. Addresses that could not be matched were excluded from the accuracy statistics.

The most important conclusion from this data is that the commercial geocoding services are not accurate enough to distinguish one house from neighboring houses or those across the street. Therefore, such services should not be used to geocode existing ECs (where addresses are known but latitude and longitude are unknown) or reverse-geocode remote sensing data (where latitude and longitude are known but addresses are unknown) if the intent is to accurately position a structure inside or outside a SFHA or compute its BFE.

When commercial geocoding services are used, for example in populating the LOMA 2000 database, the elevation registry will require some form of qualifier to indicate that such geographic coordinates are *estimated* rather than *surveyed* coordinates. The same would pertain to the digitization of existing hardcopy ECs which normally do not include geographic coordinates, should FEMA decide to geocode those addresses in order that the registry may be spatially enabled.

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ID	Street Address				Latitude	Longitude	Service A					
	No.	Address Nam	Suffix	Dir	Decimal Deg	Decimal Deg	Latitude	Δ Lat	Δ N (ft)	Longitude	Δ Long	Δ E (ft)
1	1519	25th	Street	West	29.809044	-95.427025	29.808760	0.000284	100.60	-95.426160	-0.000865	283.93
2	10010	Clay	Road		29.832656	-95.543650	29.831940	0.000716	253.06	-95.567060	0.023410	7684.08
4	5923	Glen Lee	Place		29.961247	-95.302836	29.960990	0.000257	90.97	-95.303460	0.000624	204.78
5	6018	Woodview			29.961642	-95.301300	29.961830	-0.000188	66.60	-95.301560	0.000260	85.34
6	5927	Glen Lee	Place		29.961247	-95.302683	29.960990	0.000257	90.97	-95.303400	0.000717	235.24
7	4929	Bowman	Street		29.836956	-95.393531	29.837170	-0.000214	75.84	-95.393200	-0.000331	108.50
9	2210	Bellefontaine			29.704761	-95.409869	29.704690	0.000071	25.15	-95.409310	-0.000559	183.63
10	1525	25th	Street	West	29.808972	-95.427294	29.808760	0.000212	75.05	-95.426270	-0.001024	336.26
12	5951	Marwood			29.963900	-95.302303	29.963770	0.000130	45.98	-95.302590	0.000287	94.28
13	5955	Marwood			29.963783	-95.302192	29.963700	0.000083	29.47	-95.302520	0.000328	107.77
14	7631	Thurrow			29.693414	-95.289503	29.692720	0.000694	245.40	-95.289830	0.000327	107.41
15	5947	Marwood			29.964033	-95.302431	29.963910	0.000123	43.62	-95.302690	0.000259	85.16
16	5939	Glen Grove			29.963769	-95.302794	29.963190	0.000579	204.92	-95.303380	0.000586	192.20
17	6843	Beechnut	Street		29.691044	-95.505586	29.690940	0.000104	36.94	-95.504600	-0.000986	323.68
18	5930	Morningdale			29.963919	-95.302961	29.963940	-0.000021	7.27	-95.304050	0.001089	357.42
19	6010	Woodview			29.961644	-95.301686	29.961840	-0.000196	69.16	-95.301890	0.000204	66.92
20	1522	26th	Street	West	29.809486	-95.427197	29.809780	-0.000294	103.94	-95.426230	-0.000967	317.48
21	6014	Woodview			29.961644	-95.301492	29.961830	-0.000186	65.62	-95.301730	0.000238	78.23
22	1515	25th	Street	West	29.809092	-95.426933	29.808760	0.000332	117.30	-95.426100	-0.000833	273.53
23	4301	Talina	Way		29.832919	-95.542978	29.833140	-0.000221	78.00	-95.542830	-0.000148	48.51
24	4954	Heather Glen	Drive		29.677250	-95.463750	29.677090	0.000160	56.58	-95.462370	-0.001380	452.97
25	1327	23rd	Street	West	29.806922	-95.423294	29.806690	0.000232	82.13	-95.422850	-0.000444	145.88
26	7134	Flamingo	Drive		29.669458	-95.301136	29.669290	0.000168	59.53	-95.301710	0.000574	188.37
27	3642	Maroneal	Street		29.702531	-95.433292	29.702130	0.000401	141.66	-95.432420	-0.000872	286.12
28	3210	Underwood	Street		29.699936	-95.428222	29.699650	0.000286	101.18	-95.427560	-0.000662	217.37
29	1327	23rd	Street	West	29.806922	-95.423294	29.806690	0.000232	82.13	-95.422850	-0.000444	145.88
30	8170	River	Drive		29.684106	-95.269086	29.683000	0.001106	390.98	-95.270160	0.001074	352.49
31	2337	Bluebonnet			29.700503	-95.413011	29.700760	-0.000257	90.97	-95.412930	-0.000081	26.62
32	4926	Bowman	Street		29.836808	-95.393033	29.837160	-0.000352	124.37	-95.393200	0.000167	54.71
33	1514	26th	Street	West	29.809517	-95.426953	29.809790	-0.000273	96.67	-95.426100	-0.000853	279.92
34	7027	North	Loop	East	29.807511	-95.300358	29.807650	-0.000139	49.12	-95.301380	0.001022	335.35
35	1518	26th	Street	West	29.809514	-95.427044	29.809780	-0.000266	94.11	-95.426160	-0.000884	290.31
36	1416	24th	Street	West	29.807475	-95.424781	29.807720	-0.000245	86.65	-95.424390	-0.000391	128.20
37	1404	24th	Street	West	29.807461	-95.424408	29.807720	-0.000259	91.56	-95.424180	-0.000228	74.95
38	15	Greens Edge	Drive		30.032836	-95.177506	30.032270	0.000566	200.21	-95.177290	-0.000216	70.75
39	27	Kingwood Green	Drive	South	30.032375	-95.178375	30.035360	-0.002985	1055.66	-95.182940	0.004565	1498.41
40	4623	Falls	Street		29.803033	-95.330928	29.802220	0.000813	287.64	-95.330740	-0.000188	61.64
41	3306	Glen Haven			29.701653	-95.428717	29.701360	0.000293	103.54	-95.428490	-0.000227	74.40
42	5522	Drakestone			29.604158	-95.465697	29.604000	0.000158	56.00	-95.465130	-0.000567	186.18
43	5519	Gatewood			29.604508	-95.465750	29.604780	-0.000272	96.08	-95.465210	-0.000540	177.25
44	5426	Cavalcade			29.799936	-95.315667	29.800250	-0.000314	111.01	-95.316400	0.000733	240.71
45	5515	Gatewood			29.604497	-95.465572	29.604780	-0.000283	100.01	-95.465120	-0.000452	148.44
46	5614	Ingomar	Way		29.602492	-95.466875	29.602460	0.000032	11.20	-95.467290	0.000415	136.22
47	4	Greens Edge	Drive		30.032217	-95.176944	30.032090	0.000127	44.80	-95.177440	0.000496	162.66
48	5610	Ingomar	Way		29.602383	-95.466689	29.602420	-0.000037	12.97	-95.467190	0.000501	164.48
49	1122	Bayou	Island		29.750072	-95.540194	29.750090	-0.000018	6.29	-95.539170	-0.001024	336.26
50	917	Little York		West	29.865200	-95.422214	29.865770	-0.000570	201.58	-95.422430	0.000216	70.94
51	3711	Durness			29.694367	-95.434147	29.694580	-0.000213	75.45	-95.433860	-0.000287	94.28
52	3936	Herald	Avenue		29.798561	-95.277317	29.797340	0.001221	431.85	-95.275960	-0.001357	445.31
53	14033	Question			29.622308	-95.441222	29.623220	-0.000912	322.42	-95.441610	0.000388	127.28
3	1521	25th	Street	West	29.809011	-95.427108	0.000000	0.000000	0.00	0.000000	0.000000	0.00
11	8778	Airport			29.653075	-95.261714	0.000000	0.000000	0.00	0.000000	0.000000	0.00
8	1640	T.C. Jester	Blvd	Bldg 12	29.798600	-95.426186	0.000000	0.000000	0.00	0.000000	0.000000	0.00

129.80 = ΔN average (ft) 362.97 = ΔE average (ft)
 360.13 = ΔN 95th percentile 449.52 = ΔE 95th percentile
 1055.66 = ΔN max error (ft) 7684.08 = ΔE max error (ft)
Horiz accuracy at 95% confidence level= 575.99 ft

Service B						Service C					
Lat	Δ Lat	Δ N (ft)	Long	Δ Long	Δ E (ft)	Lat	Δ Lat	Δ N (ft)	Long	Δ Long	Δ E (ft)
29.808714	0.000330	116.86	-95.426433	-0.000592	194.32	29.808424	0.000620	219.42	-95.426225	-0.000800	262.59
29.832416	0.000240	84.72	-95.539507	-0.004143	1359.90	29.832503	0.000153	53.95	-95.541885	-0.001765	579.34
29.961048	0.000199	70.46	-95.303556	0.000720	236.30	29.960603	0.000644	227.83	-95.303186	0.000350	114.85
29.961833	-0.000191	67.67	-95.301271	-0.000029	9.52	29.961397	0.000245	86.53	-95.301252	-0.000048	15.76
29.961048	0.000199	70.46	-95.303504	0.000821	269.38	29.960603	0.000644	227.83	-95.303119	0.000436	143.00
29.837100	-0.000144	51.08	-95.393302	-0.000229	75.02	29.836537	0.000419	148.02	-95.393431	-0.000100	32.68
29.704619	0.000142	50.26	-95.409472	-0.000397	130.46	29.704452	0.000309	109.32	-95.409416	-0.000453	148.84
29.808714	0.000258	91.32	-95.426514	-0.000780	256.17	29.808430	0.000542	191.76	-95.426328	-0.000966	317.23
29.963726	0.000174	61.54	-95.302421	0.000118	38.81	29.963394	0.000506	178.95	-95.302177	-0.000126	41.29
29.963687	0.000096	34.07	-95.302382	0.000190	62.47	29.963361	0.000422	149.36	-95.302112	-0.000080	26.15
29.692887	0.000527	186.34	-95.289757	0.000254	83.45	29.692615	0.000799	282.53	-95.290133	0.000630	206.86
29.963891	0.000142	50.34	-95.302584	0.000153	50.37	29.963716	0.000317	112.23	-95.302507	0.000076	25.09
29.963183	0.000586	207.40	-95.303505	0.000711	233.23	29.963131	0.000638	225.79	-95.303166	0.000372	121.96
29.691244	-0.000200	70.57	-95.505312	-0.000274	89.97	29.690148	0.000896	317.03	-95.503249	-0.002337	767.13
29.963891	0.000028	10.06	-95.304093	0.001132	371.53	29.963567	0.000352	124.64	-95.303755	0.000794	260.59
29.961833	-0.000189	66.68	-95.301534	-0.000152	49.93	29.961397	0.000247	87.51	-95.301582	-0.000104	34.17
29.809705	-0.000219	77.41	-95.426512	-0.000685	224.92	29.809675	-0.000189	66.80	-95.426367	-0.000830	272.51
29.961833	-0.000189	66.68	-95.301403	-0.000089	29.10	29.961397	0.000247	87.51	-95.301417	-0.000075	24.51
29.808714	0.000378	133.56	-95.426379	-0.000554	181.95	29.808420	0.000672	237.54	-95.426157	-0.000776	254.82
29.833153	-0.000234	82.60	-95.543003	0.000025	8.28	29.833199	-0.000280	98.87	-95.542717	-0.000261	85.60
29.677211	0.000039	13.79	-95.462242	-0.001508	494.98	29.677183	0.000067	23.69	-95.462321	-0.001429	469.05
29.806708	0.000214	75.76	-95.423111	-0.000183	60.21	29.806503	0.000419	148.26	-95.422862	-0.000432	141.95
29.669374	0.000084	29.82	-95.301692	0.000556	182.46	29.669317	0.000141	49.98	-95.301806	0.000670	219.88
29.702163	0.000368	129.99	-95.432396	-0.000896	293.99	29.702184	0.000347	122.56	-95.432346	-0.000946	310.41
29.699721	0.000215	76.08	-95.427629	-0.000593	194.72	29.699603	0.000333	117.81	-95.427298	-0.000924	303.37
29.806708	0.000214	75.76	-95.423111	-0.000183	60.21	29.806503	0.000419	148.26	-95.422862	-0.000432	141.95
29.682954	0.001152	407.25	-95.270295	0.001209	396.80	29.682937	0.001169	413.27	-95.270364	0.001278	419.45
29.700756	-0.000253	89.55	-95.413087	0.000076	24.91	29.700794	-0.000291	102.99	-95.412834	-0.000177	58.13
29.837083	-0.000275	97.14	-95.393267	0.000234	76.70	29.836510	0.000298	105.51	-95.393473	0.000440	144.32
29.809706	-0.000189	66.96	-95.426404	-0.000549	180.13	29.809683	-0.000166	58.82	-95.426234	-0.000719	235.93
29.805889	0.001622	573.67	-95.298135	-0.002223	729.79	29.807039	0.000472	166.96	-95.301349	0.000991	325.18
29.809706	-0.000192	67.94	-95.426458	-0.000586	192.49	29.809679	-0.000165	58.39	-95.426300	-0.000744	244.36
29.807682	-0.000207	73.21	-95.424363	-0.000418	137.06	29.807597	-0.000122	43.15	-95.424439	-0.000342	112.11
29.807683	-0.000222	78.47	-95.424199	-0.000209	68.71	29.807597	-0.000136	48.06	-95.424229	-0.000179	58.86
30.032387	0.000449	158.83	-95.177254	-0.000252	82.57	30.032900	-0.000064	22.59	-95.177200	-0.000306	100.30
30.035562	-0.003187	1127.10	-95.182852	0.004477	1469.53	30.032800	-0.000425	150.30	-95.179100	0.000725	237.97
29.802395	0.000638	225.75	-95.330685	-0.000243	79.69	29.802125	0.000908	321.24	-95.330513	-0.000415	136.15
29.701401	0.000252	89.04	-95.428394	-0.000323	105.91	29.701402	0.000251	88.69	-95.428310	-0.000407	133.48
29.603958	0.000200	70.85	-95.465461	-0.000236	77.54	29.603988	0.000170	60.24	-95.467319	0.001622	532.33
29.604763	-0.000255	90.06	-95.465503	-0.000247	81.08	29.604847	-0.000339	119.77	-95.465300	-0.000450	147.71
29.800275	-0.000339	119.85	-95.316437	0.000770	252.85	29.800297	-0.000361	127.63	-95.316287	0.000620	203.62
29.604764	-0.000267	94.35	-95.465439	-0.000133	43.73	29.604857	-0.000360	127.24	-95.465216	-0.000356	116.93
29.602110	0.000382	134.98	-95.466580	-0.000295	96.83	29.602726	-0.000234	82.87	-95.467706	0.000831	272.77
30.032196	0.000021	7.31	-95.177313	0.000369	120.97	30.032900	-0.000683	241.66	-95.177200	0.000256	83.88
29.602086	0.000297	105.15	-95.466528	-0.000161	52.81	29.602705	-0.000322	113.76	-95.467670	0.000981	322.04
29.750975	-0.000903	319.27	-95.539886	-0.000308	101.24	29.751575	-0.001503	531.46	-95.540288	0.000094	30.71
29.865620	-0.000420	148.53	-95.422474	0.000260	85.38	29.865464	-0.000264	93.36	-95.422508	0.000294	96.54
29.694625	-0.000258	91.36	-95.434170	0.000023	7.48	29.694539	-0.000172	60.95	-95.433802	-0.000345	113.32
29.797731	0.000830	293.57	-95.276197	-0.001120	367.52	29.797296	0.001265	447.41	-95.275688	-0.001629	534.59
29.624599	-0.002291	810.11	-95.441639	0.000417	136.80	29.624839	-0.002531	894.98	-95.441700	0.000478	156.83
29.808714	0.000297	105.07	-95.426460	-0.000648	212.81	29.808426	0.000585	206.93	-95.426260	-0.000848	278.46
29.654369	-0.001294	457.63	-95.262653	0.000939	308.25	29.653243	-0.000168	59.41	-95.260796	-0.000918	301.29
0.000000	0.000000	0.00	0.000000	0.000000	0.00	29.801100	-0.002500	884.14	-95.424500	-0.001686	553.45
152.97 = ΔN average (ft) 206.37 = ΔE average (ft)						178.79 = ΔN average (ft) 212.68 = ΔE average (ft)					
509.85 = ΔN 95th percentile 600.65 = ΔE 95th percentile						428.63 = ΔN 95th percentile 533.35 = ΔE 95th percentile					
1127.10 = ΔN max error (ft) 1469.53 = ΔE max error (ft)						894.98 = ΔN max error (ft) 767.13 = ΔE max error (ft)					
Horiz accuracy at 95% confidence level = 787.86 ft						Horiz accuracy at 95% confidence level = 684.24 ft					