Appendix C.

Measuring horizontal positional accuracy in a data set that contains features of multiple accuracies

Washington County Parcel Database

Project Team

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Descriptions of the Project

The objective of this project was to analyze and determine the positional accuracy of Washington County's recently completed parcel base data set. This data collection covers 425 square miles with approximately 82,000 parcels of land ownership. The data set contains features typically found in half section maps, including plat boundaries, lot lines, right-of-way lines, road centerlines, easements, lakes, rivers, ponds and other features required in county land record management.

An estimation of the parcel data's positional accuracy has existed for some time. It has been more of a prediction, established through limits and standards used to develop the data set. The County wanted the ability to report positional accuracy in a standardized format for the following reasons:

- In order to create complete and high quality metadata for the parcel base data set
- To improve communication of the accuracy of the data in sales and exchange of digital data with customers
- To aid in decision making when the parcel base is merged or combined with other data collections - a typical use of this data set.

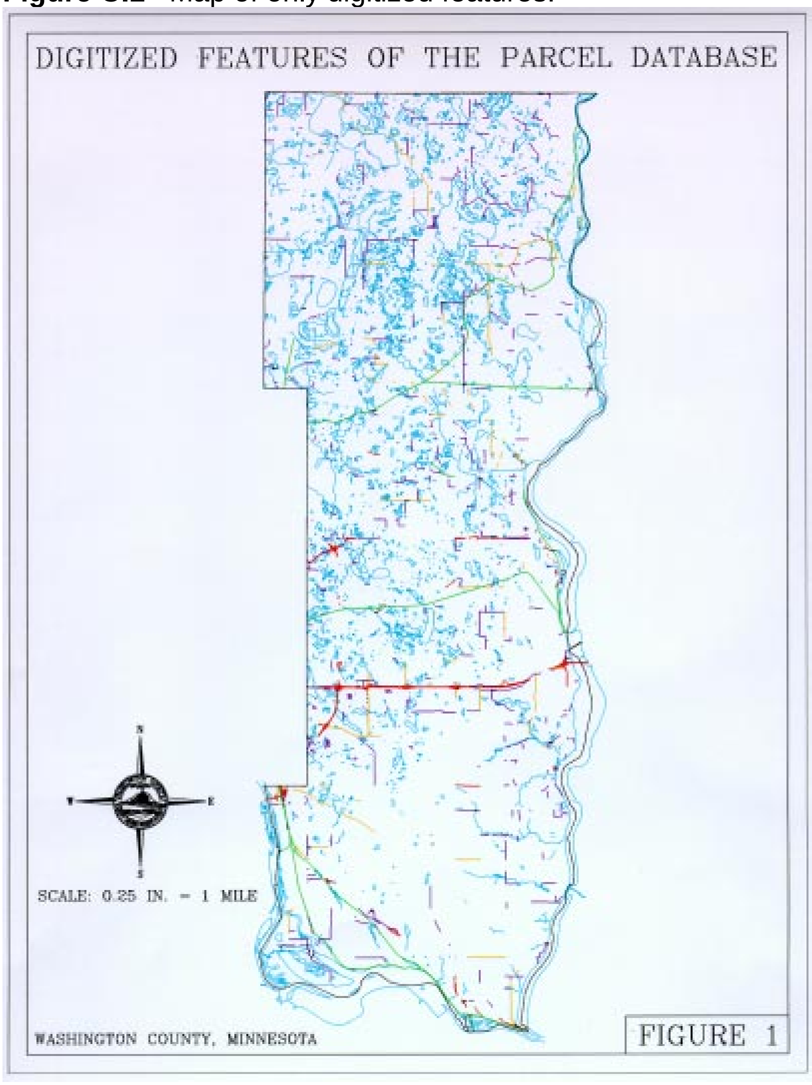
In this last case, convenient and standardized positional accuracy information can help the formation of metadata for hybrid data sets and applications supported by the parcel base.

Description of the Data Set

Features shown in Washington County's parcel map are derived from a variety of source documents. Most documents are fairly complete with angle and distance information describing their design. They include: subdivision plats, registered land surveys, condominium plats, certificate of surveys, right of way plats and Auditor's metes and bounds parcel descriptions. Sources range in date from the 1850's through the present.

The locations of parcel boundaries were derived using coordinate geometry (COGO) analysis. This work was primarily referenced to the Public Land Survey System (PLSS). Field verifications were not performed on discrepancies found in the analysis of documents. Undefined features such as undocumented road locations were located by a digitizing process using partially rectified aerial photographs at a scale of 1-inch equals 200 feet. This group of digitized features is comprised primarily of hydrographic features with some roads. It is estimated that less than 5% of all features in the database were digitized. See Figure C.1

Figure C.1 Map of only digitized features.



The potential exists for a significant difference in accuracy between digitized features and those created by a coordinate geometry process. Therefore, the accuracy of each group was computed and reported separately. For organizational purposes the following terms are used to distinguish the two groups. *Test Data/Digitized* and *Control Data/digitized* are used to reference the digitized elements. *Test Data/COGO* and *Control Data/COGO* are used for referencing the non-digitized feature group.

Description of the Control Data

Control Data/Digitized
The County is not aware of any appropriate, existing control data set. The County decided to create a control set based on corresponding points identified in the test data. Readily available GPS equipment capable of producing sub-meter results, prompted use of field measured locations for control. Such a level of accuracy would easily exceed the "three times greater accuracy" stipulation of NSSDA.

Because of the availability of real time differential GPS equipment and its ease of use, more than the minimum of 20 control points were collected. To identify potential control points, a plot of the entire county parcel database was generated, with only digitized features shown. This was possible due to the unique design of the database where features are coded based on their quality. The selection set consisted of primarily water and road features. The overall number of easily identifiable right angle intersections was small compared to what exists in the COGO data set. All of the following types of points were designated as potential control points:

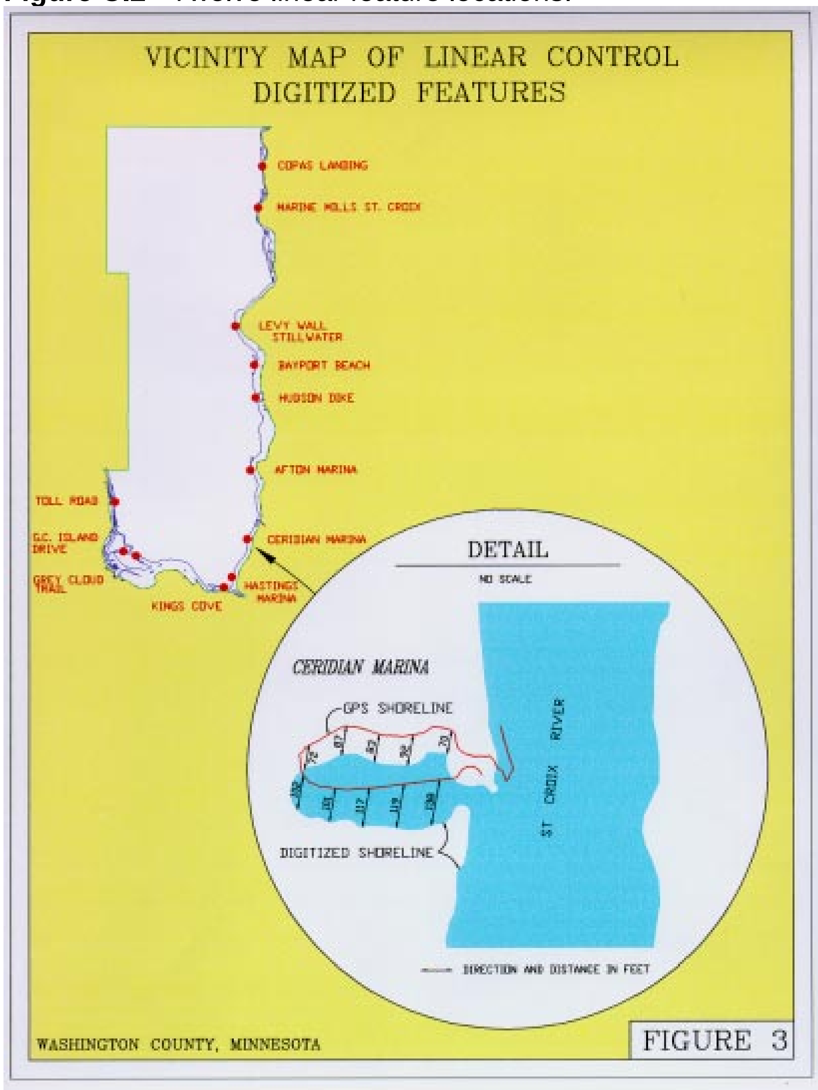
- water line at bridge abutment
- intersection of road and creek/ditch (culvert)
- road intersection
- intersection of road and power line
- road/trail intersection
- stream outlet at lake or river
- ditch intersection
- stream/railroad intersection
- road/railroad intersection

Of these, approximately 175 were identified as possible candidates on the map. This number gave the field crew freedom in making their selection. Significance was not given to precise spacing of points due to the high number to be collected.

Areas of high vertical relief within the county, such as the bluff areas along the Mississippi and St. Croix Rivers, have less positional accuracy in the data set. This is due to a shortage of aerial photo control in these areas. Unfortunately, these areas contained few right angle points to collect from the digitized group. Even though points in the river valleys were given a higher priority for collection, few control points were actually collected there. Without considering accuracy in the river areas, it was felt that users of the data could be seriously misguided.

To overcome this dilemma, a plan was developed to use the GPS equipment's ability to trace linear features by collecting points in continuous mode. In this mode a point was collected every second as a person walked the boundary line of a physical feature. These lines could then become a form of linear control and compared with corresponding linear features that had been digitized. Staff devised a method of comparing points at even intervals along the selected features and reporting a difference in their location as compared to their position on the map. Twelve evenly spaced areas along the river shoreline were identified in the digitized data set and could be easily found on the ground. Preference was given to using features that would not vary due to seasonal changes and would match the spring season conditions that existed at the time of the aerial photographs. See Figure C.2.

Figure C.2 Twelve linear feature locations.



Control Data/COGO

As with the digitized data, a suitable control data set was not known to exist for the COGO data. Again, GPS equipment owned by Washington County (capable of survey quality accuracy) was available for use in this study. This equipment was capable of generating points to an accuracy of 2 centimeters using a post-processed differential mode. However, collecting data three times more accurate than the highly accurate COGO processed parcel data, was to become a substantially more difficult task than with the digitized data.

Like the digitized data, closer examination of the COGO data revealed a mix of data accuracy. First, the COGO data contained PLSS section lines that were mapped based on Public Land Survey Corners. The PLSS corners had been located in a measurement process which was based on GPS control. Secondly, parcel lines were mapped by interpreting property descriptions of record and applying coordinate geometry (COGO) analysis to define their position. The Public Land Survey System was the supportive framework for these land descriptions. The situation did not permit actual boundary surveys or field verification of individual parcel boundary lines, although that would have been extremely helpful. Therefore, this mixture of field positions (PLSS corners) with paper records (recorded legal descriptions) did not lend itself to the straightforward development of a single positional accuracy statement.

One might expect a pattern of higher levels of accuracy along PLSS section lines with lessening accuracy toward the interior of a PLSS section. Even if an inward rate of change could be predicted, more complications arise due to the nature of land descriptions of public record. The position of features such as boundary corners described in these documents may not always match the position of their physical counterparts on the ground. (See the "Observations and Comments" section below for more discussion on why these disparities exist.) These circumstances presented a situation of such significance that it was difficult to apply and use the NSSDA under its literal definition. Because the positional accuracy of our data set was not uniform, we did not feel that a single positional accuracy value could properly communicate the positional accuracy of the entire data set.

Due to this concern, Washington County chose to conduct a study of the COGO data set using some methods of the NSSDA. The result of this study would then be combined with an observation statement in the metadata.

County survey field crews selected and analyzed 21 random property corners in a study area of a single PLSS township. See Figure C.3. Points were evenly spaced throughout the township and were of a mixture of platted and metes and bounds parcels. Post processed differential GPS techniques were used to collect the points. A general comparison was made to see if any of the 21 points were near PLSS corner positions recovered in more recent years (i.e. PLSS positions recovered subsequent to subdivision development and/or boundary monumentation in their vicinity). See Figure C.4. It appears none of the control points were influenced by incorrectly assumed PLSS corner positions.

Figure C.3. COGO Control Points

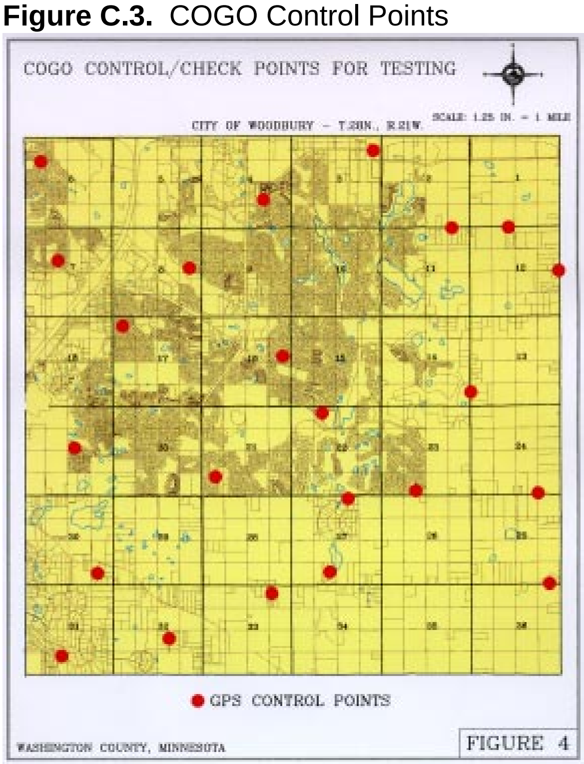
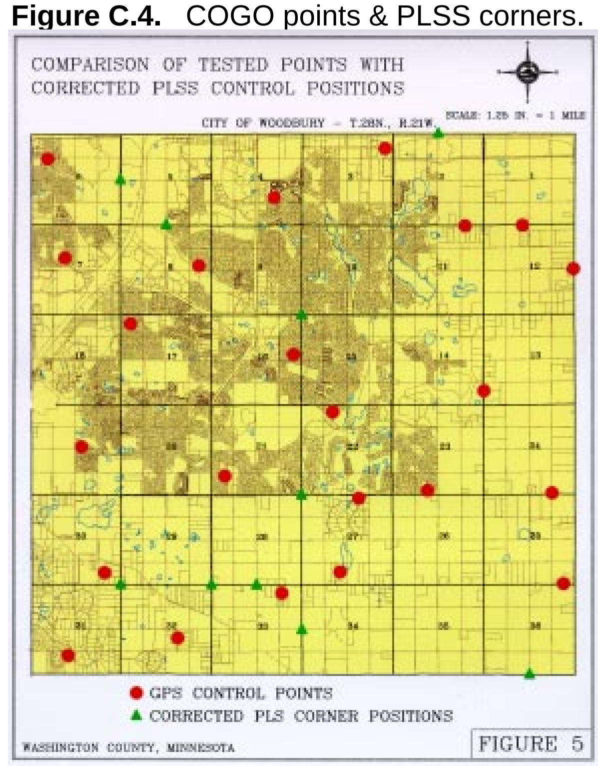


Figure C.4. COGO points & PLSS corners.



Filling out the Work Sheet

From the list of points collected as control with GPS equipment, an AutoLISP script was created to import these points into the AutoCAD drawing containing the features. A second AutoLISP script was written to select the feature points that correspond to the GPS control points and import those coordinate values into a text file. This coordinate text file was then inserted into the spreadsheet table where calculations could be performed.

For linear features identified in the river valleys, points were selected at regular intervals from both the GPS control values and the check point data set. The number of points collected from each feature area ranged from 4 to 22 depending on the nature of the selected feature. These points were fed into an individual spreadsheet template. Two of the spreadsheet tables are provides as examples (Tables C.1 and C.2).

Table C.1. Coordinate data/coordinate geometry point comparison.

Point #	Point Descr.	x (control)	x (test)	diff in x	(diff in x)2	y (control)	y (original)	diff in y	(diff in y)2	(diff in x)2 + (diff in y)2
10751	r/w & lot line (m&b)	486062.125	486061.709	0.4	0.2	168699.106	168698.974	0.1	0.0	0.2
1100	r/w & lot line (platted)	480383.263	480380.433	2.8	8.0	168103.428	168103.496	-0.1	0.0	8.0
11730	r/w & lot line (m&b)	491133.630	491133.362	0.3	0.1	153041.796	153041.828	0.0	0.0	0.1
1382	r/w & lot line (platted)	462816.265	462816.057	0.2	0.0	166767.786	166767.874	-0.1	0.0	0.1
1397	r/w & lot line (platted)	470589.879	470588.959	0.9	0.8	166326.072	166325.827	0.2	0.1	0.9
1490	r/w & lot line (m&b)	492381.275	492381.352	-0.1	0.0	166191.528	166191.305	0.2	0.0	0.1
2901	r/w & lot line (m&b)	487165.209	487165.039	0.2	0.0	159005.809	159005.818	0.0	0.0	0.0
6180	r/w & lot line (platted)	461796.422	461795.986	0.4	0.2	172592.941	172593.162	-0.2	0.0	0.2
7100	r/w & lot line (platted)	466652.141	466651.230	0.9	0.8	162901.920	162901.132	0.8	0.6	1.5
lot_1_2	r/w & lot line (platted)	481423.044	481422.194	0.8	0.7	173240.868	173240.547	0.3	0.1	0.8
11840	r/w & lot line (platted)	491813.966	491813.949	0.0	0.0	147708.306	147708.645	-0.3	0.1	0.1
3960	r/w & lot line (platted)	483922.111	483922.116	0.0	0.0	153178.492	153178.429	0.1	0.0	0.0
4041	r/w & lot line (platted)	479920.587	479920.492	0.1	0.0	152711.877	152711.858	0.0	0.0	0.0
5120	r/w & lot line (platted)	475454.065	475453.940	0.1	0.0	147133.085	147133.258	-0.2	0.0	0.0
5549	r/w & lot line (platted)	469407.975	469407.927	0.0	0.0	144480.696	144480.912	-0.2	0.0	0.0
6391	r/w & lot line (platted)	463062.352	463062.426	-0.1	0.0	143447.557	143447.761	-0.2	0.0	0.0
6576	r/w & lot line (platted)	463813.337	463813.443	-0.1	0.0	155699.943	155700.107	-0.2	0.0	0.0
8009	r/w & lot line (platted)	472135.343	472135.103	0.2	0.1	153996.576	153996.484	0.1	0.0	0.1
9336	r/w & lot line (platted)	478399.063	478399.053	0.0	0.0	157767.858	157767.940	-0.1	0.0	0.0
9378	r/w & lot line (platted)	478840.112	478839.711	0.4	0.2	148370.597	148370.816	-0.2	0.0	0.2
4786	r/w & lot line (platted)	465173.302	465173.120	0.2	0.0	148308.262	148308.520	-0.3	0.1	0.1
									sum	12.5
									average	0.6
									RMSE	0.8
									NSSDA	**1.3**

Table C.2. Control data/digitized

Point #	Point Descr.	x (control)	x (test)	diff in x	(diff in x)2	y (control)	y (original)	diff in y	(diff in y)2	(diff in x)2 + (diff in y)2
34	152nd-stream 3	459897.8245	459900.2241	-2	6	254995.3250	254990.1862	5	26	32
35	132nd-Isleton 4	475603.3345	475602.9600	0	0	244363.6045	244371.4900	-8	62	62
36	155th-Manning 5	489350.1000	489350.1700	0	0	256106.3855	256110.1900	-4	14	14
37	180th-Keystone 6	483572.5260	483572.5700	0	0	269361.1230	269357.1800	4	16	16
38	May-RR 7	494171.3170	494160.1307	11	125	238673.6400	238666.0810	8	57	182
40	Otchipwe-94th 9	505295.9165	505293.1600	3	8	223453.3670	223446.1800	7	52	59
41	Neal-BrwnsCr. 10	497444.6805	497461.9147	-17	297	218442.2285	218479.5031	-37	1389	1686
42	75th-Keats 11	481800.0900	481797.1300	3	9	213775.5375	213762.8200	13	162	170
43	Irish-RR 12	475144.8540	475146.2412	-1	2	233082.6265	233082.4062	0	0	2
44	Linc-Robert 13	466236.2490	466238.0000	-2	3	211022.1690	211022.2500	0	0	3
45	C.R. 6-Stream 14	475253.3275	475247.4079	6	35	189933.5615	189931.4246	2	5	40
46	4th-Grd.Ang. 15	472999.8705	473000.8200	-1	1	175394.1410	175391.2300	3	8	9
47	Lake-Century 16	461164.5183	461162.2000	2	5	163210.0978	163207.3600	3	7	13
49	65th-Geneva 18	460948.6040	460948.0200	1	0	140008.1990	140006.2700	2	4	4
50	50th-ditch 19	496582.6795	496567.2195	15	239	147523.4710	147536.9953	-14	183	422
51	Jama-EPDR 20	474434.7155	474434.5700	0	0	126212.9210	126207.5300	5	29	29
52	Pioneer-GCID 21	460963.7915	460964.1100	0	0	118776.1925	118775.1700	1	1	1
53	127th-NB10 22	493944.2820	493949.9100	-6	32	106859.0630	106859.2000	0	0	32
54	Wash-Frontg 23	500142.5240	500140.4300	2	4	206064.7665	206062.9800	2	3	8
55	Point-RR 24	513038.7305	513036.5199	2	5	203149.2675	203144.4737	5	23	28
56	30th-Norman 25	498843.6095	498848.6000	-5	25	189987.0710	189984.8500	2	5	30
57	Rivercrest-Riv 26	516059.2450	516059.0524	0	0	180143.2225	180136.5409	7	45	45
58	Ramp-S.B.15 27	492428.0940	492427.6400	0	0	173572.2310	173557.3200	15	222	223
59	Indian-Hud. 28	500207.7530	500207.0900	1	0	173314.2015	173312.5700	2	3	3
60	VllyCr.-Put. 29	512300.0370	512306.3396	-6	40	162002.5330	162005.9951	-3	12	52
62	87th-Quadrant 30	513787.7670	513805.4900	-18	314	128008.0970	128011.9900	-4	15	329
2	Road-RR	512838.5425	512832.1230	6	41	265305.5275	265304.6426	1	1	42
3	Road-Road	513804.5885	513779.1351	25	648	265288.9815	265292.0679	-3	10	657
4	Road-RR	506995.3440	506986.9698	8	70	259036.2875	259039.1469	-3	8	78
5	Road-Road	505890.0345	505900.1300	-10	102	267608.0790	267586.4100	22	470	571
6	Road-Road	499522.8775	499516.9900	6	35	268070.4880	268057.5600	13	167	202
7	Road-Road	500886.3235	500889.8827	-4	13	277084.7130	277076.8184	8	62	75
9	Road-Road	506832.2160	506832.9800	-1	1	284524.2900	284524.2300	0	0	1
15	Road-Road	512469.9380	512494.5300	-25	605	300556.4700	300550.1500	6	40	645
16	Road-Road	499541.7365	499542.9300	-1	1	295469.7610	295470.3500	-1	0	2
19	Stream-Road	495674.4090	495672.6012	2	3	295158.3380	295155.4875	3	8	11
20	Road-Road	493348.3880	493356.4200	-8	65	283897.9365	283893.6900	4	18	83
21	Road-Road	486511.0920	486512.7100	-2	3	275873.6795	275878.2400	-5	21	23
22	Road-Road	483617.1320	483617.8700	-1	1	275899.2500	275902.5300	-3	11	11
23	Stream-Road	479455.9240	479472.6850	-17	281	291709.0365	291683.7402	25	640	921
24	Road-Road	469037.3285	469025.2000	12	147	298365.8860	298366.1900	0	0	147
25	Road-Road	456160.0730	456172.3500	-12	151	300964.3090	300970.9900	-7	45	195
26	Road-Road	453048.3560	453051.8400	-3	12	300995.9335	301016.3400	-20	416	429
31	Road-Road	471995.9350	472007.9600	-12	145	289610.8105	289606.5200	4	18	163
32	Road-Shoreline	471828.5090	471845.6500	-17	294	289748.0805	289734.9000	13	174	468
33	Stream-Road	473084.1800	473083.8500	0	0	283256.8455	283250.2300	7	44	44
36	Stream-Road	467667.6425	467674.1085	-6	42	272602.0220	272610.5601	-9	73	115
37	Stream-Stream	452112.0170	452108.5500	3	12	277310.9820	277322.2800	-11	128	140
38	Road-Road	451973.4935	451977.1198	-4	13	269628.2735	269625.6395	3	7	20
41	Road-Road	473066.7460	473069.3294	-3	7	264154.8040	264153.7500	1	1	8
									sum	8545
									average	171
									RMSE	13
									NSSDA	**23**

The Statistic

Digitized Points

A preliminary comparison was made of the digitized part of this data set. Several divisions of the overall 50 points were made. Separate spreadsheets comparing each were prepared. Points were grouped by: north half of the county; south half of the county; 25 of the 50 points selected at random; and all 50 points. The results were; 25 feet, 20 feet, 23 feet, and 23 feet, respectively. This shows good uniformity.

Digitized Linear Features
Although unique, the result shown for the special linear features did produce a result matching estimates developed years earlier from experience in mapping these areas. A horizontal error of up to 120 feet can be expected for the digitized features in the high relief areas.

COGO Features
The method chosen to compare values between control and data checkpoints does not entirely conform to the NSSDA. Limiting the scope of control to a single township was intentional due to the nature of the COGO data set. For this reason, the potential cost as compared to the final value could not be justified in locating control countywide. Apparently by chance, results of the study area seem to indicate that none of the 21 points selected for control are related to a recovered PLSS corner position type. From experience in building the parcel database, the 1.3 foot result (Table C.1) meets expectations. We believe this is a realistic representation of what exists over most of the County in areas not influenced by a corrected section corner position.

The Accuracy Statement and the Metadata

We thought it would be useful and informative for potential data users to understand the methods used to derive the accuracy statements. For this reason we included a brief description of the test used when filling out the positional accuracy portion of the metadata. In addition, we included some language pointing the reader to other sections of the metadata where more information can be found.

In the case of our COGO data, we believed a specialized summary statement can more appropriately communicate the positional accuracy of the data than can the accuracy reporting statement of the NSSDA. Although this is not as simple and standardized as the short NSSDA "tested…" statement, this method does provide a higher level of information to the user. It is hoped this will increase the users confidence in the data and allow the data to be used more appropriately. It is believed this is one of the main intentions of the NSSDA.

Horizontal Positional Accuracy	Digitized features of the parcel map database outside areas of high vertical relief tested 23 feet horizontal accuracy at the 95% confidence level using modified NSSDA testing procedures. See Section 5 for entity information of digitized feature groups. See also Lineage portion of Section 2 for additional background. For a complete report of the testing procedures used contact Washington County Surveyor's Office as noted in Section 6, Distribution Information. Digitized features of the parcel map database within areas of high vertical relief tested 119 feet horizontal accuracy by estimation as described in the complete report noted above. All other features are generated by coordinate geometry and are based on a framework of accurately located PLSS corners positions used with public information of record. Computed positions of parcel boundaries are not based on individual field survey. Although tests of randomly selected points for comparison may show high accuracy between field and parcel map content, variations between boundary monumentation and legal descriptions of record can and do exist. Caution is necessary in use of land boundary data shown. Contact the Washington County Surveyor's Office for more information.
Vertical Positional Accuracy	Not Applicable

Observations and Comments

Optional Method of Collecting COGO Control
This optional method of collecting COGO control was considered but not used by Washington County, but it may be instructive to others attempting to implement the NSSDA.

The county was divided into quadrants. Five points were selected within each quadrant. Consideration was given to areas of greater feature density, occasionally concentrating more points in these areas. A buffer of 2 miles (the diameter of 4 miles is approximately equal to 10 percent of the diagonal distance across the data set) was generated around each point. The NSSDA calls for a minimum of 20 points. The following types of points were designated:

- railroad crossing with highway
- lot corner in subdivision plat
- lot corner (old plat or metes/bounds) based on certificate of survey
- road intersection
- road intersection at PLS corner
- intersection of projected right of way line and road centerline
- radius point on cul-de-sac
- road R/W limit at “B” corner

The parcel map was developed one PLSS section at a time. Typically the cartographer relied on the PLSS system as the foundation for information created. As a result, the positioning of points at the section corners and along the outer edges was more reliable than within the interior. Understanding how a section is normally subdivided one can imply that the weakest of the mapped parcels were located near the interior of each quarter and quarter/quarter section. Expecting exterior section points to be the most accurate, we focussed on interior points in order to appreciate the worst case accuracy. Corners of property ownership make up an estimated 90% of the parcel database. For this reason it seemed appropriate to have a proportionate representation. The allotment of points was defined as follows:

- subdivision plats, 6 points, 30%
- metes and bounds parcels, 6 points, 30%
- R/W corners, road intersections, RR/highway intersections, 6 points, 30%
- PLSS, 2 points, 10%

Where possible these three groups were further divided into categories by 50-year intervals. For example sources between: 1850 to1900; 1900 to 1950; and 1950 to 1998.

Incorrectly used PLSS Corner Positions
The following discussion exemplifies only a single aspect of why land descriptions do not always match their positions on the ground and what impact this can have in trying to apply the NSSDA.

Increased activity in the monument maintenance of the Public Land Survey System to support GIS development over the past 15 to 30 years has provided for a high rate of consistency between land parcels and their descriptions of record. Actually older parcels dating back 100 to 150 years are also quite consistent in comparison of ground position and written documents of record. Unfortunately, inconsistencies do exist. The inconsistencies come from situations where subdivision plats and metes and bounds parcels were established based on an incorrect PLSS corner position. In areas where an ongoing maintenance program of the PLSS has not existed, the likelihood of this occurrence is much greater. Where an incorrectly assumed PLSS position has caused land occupation to be inconsistent with a property description of public record, laws exist that may protect the landowner and can sometimes help to remedy the situation. Unfortunately, the legal record is not always changed. In these areas, statements of expected positional accuracy using strict application of the NSSDA could mislead the digital data user. More information is required in the metadata to keep the data user properly informed.

PLSS Corners – a Study

A single PLSS corner can control the position of parcels in up to four PLSS sections. This is essentially the limit of potential impact for a single discrepancy in PLSS corner position. A study within a single township (36 PLSS sections) randomly selected from within Washington County was made to estimate the frequently of these occurrences. Of the 138 PLSS corners in the township, 10 on record had been corrected from a previously established incorrect position. The length of positional adjustment varied from 0.5 feet to 34 feet. It is known that at least as many others have also existed but clear documentation of their details does not exist. Unfortunately it is possible that parcel boundaries were established on the ground based on these incorrect PLSS positions. The lack of information about the time period in which these incorrect positions were used, further complicates the issue. Relative accuracy may be very high in these situations (e.g., all monuments in a given subdivision) while absolute accuracy is significantly less. This situation can seriously affect the validity of applying the NSSDA to a parcel boundary data set.

Mixed Meaning of Positional Accuracy

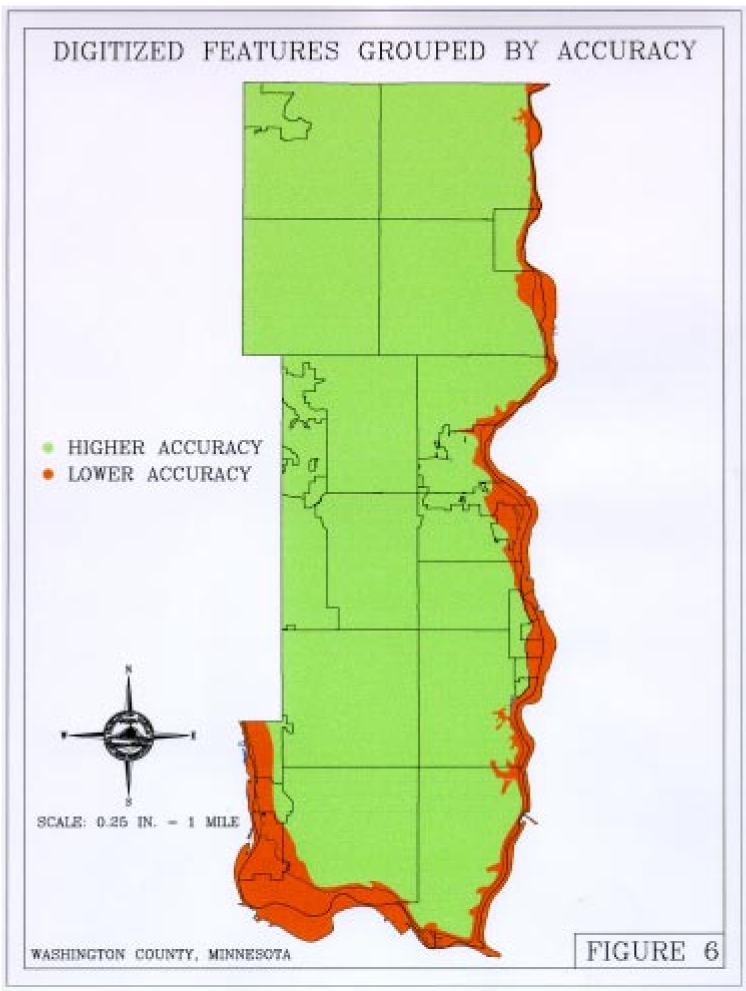
What do the results mean when random field monumented property corners are chosen for controlling position when compared against Washington County's method in establishing its base map. At every PLSS section corner positional accuracy is at its best. Here ground position was used as the starting base for digitally mapping the legally recorded documents. As one moves to the interior of a section, ground position compared to the legal record may or may not diminish. Mapping the interior of the section primarily follows more of a theoretical record. A blind comparison of a mapped parcel corner with a randomly selected corresponding monumented ground position can easily be performed. However, a discrepancy does not necessarily dictate that the relative positional accuracy of the parcel boundary is anything less than perfect when ground truth is in disagreement with the legal record.

With legal rights based many times on possession, errors in legal records or flaws in measurement methods may not actually reduce the accuracy of occupied ownership. Laws provide protection under certain circumstances. There are legal mechanisms to protect owners within a subdivision, for example, from all having to relocate their homes, physical improvements and land boundaries because an incorrect PLSS corner position was involved. When the NSSDA standard is applied to this situation, solutions to address some of the standard's components are not so straightforward. It is difficult to find a control point three or more times greater in accuracy than something that is theoretical. This becomes further clouded, when the ambiguity increases as conditions of law are interjected as in the situations described. Although difficult to grasp for the nonprofessional who is not familiar with land records and surveying methods, it is vitally important for the common user of parcel based land information to have a certain confidence level when making decisions based on information from GIS analysis.

General Comments

The nature of a parcel data set presents some unique challenges. The idea of grouping data types or features of differing accuracy, especially if presented to the user as a graphic, can communicate the quantity and location of error quite effectively. See Figure C.5. As land boundaries have evolved since the mid 1800's in Washington County, so have the measurement methods. Land settlement and corresponding boundary development have been random but some consistent patterns may be found. Groups of accuracy can perhaps be tied to parcels reflecting their original measurement quality, e.g., from Gunter's chain, to steel tape, to computerized electronics and satellites. Collections of parcels may owe their associated accuracy to whether the terrain is level or hilly. The added characteristics of place in time, or the nebulous facets of law make for additional complications.

Figure C.5. Digitized features grouped by accuracy.



This example project required good familiarity with the subject data set to properly apply the NSSDA according to its specifications. Spatial features of the database were known to be of varying accuracy and were selectively grouped in some cases. In other instances, applying the standard became difficult. A standard designed to address the vast range of GIS data types can, at times, have a "one size fits all" feeling. To avoid this impression and still accomplish the task, the underlying intent must be considered, with reasonable and straightforward approaches explored and applied. This was the intention when applying the NSSDA to the Washington County parcel base. The major obstacles encountered were a result of the nature of the features being represented in the parcel base and the implications of boundary law.

We believe the best solution is to provide as much information as possible by meeting metadata standards and showing thoroughness in critical background information. Utilization of the NSSDA can provide important and needed information but by itself may not give the complete picture in all applications.