REVIEW OF THE EXPANDED AGRICULTURAL LAND ANALYSIS METHODOLOGY

Prepared for

STATE OF NEBRASKA

DEPARTMENT OF REVENUE, PROPERTY ASSESSMENT DIVISION

AND TAX EQUALIZATION AND REVIEW COMMISSION

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1. Executive Summary

Almy, Gloudemans, Jacobs & Denne (AGJD) was selected to review the methodology adopted by the Property Tax Administrator (PTA) for reporting and opining on the need for equalization adjustments to county assessments of agricultural land, which adjustments may be ordered by the Tax Equalization and Review Commission. Recent changes to those methods had engendered unresolved questions and some controversy, resulting in a desire on the part of all stakeholders to resolve the issues before beginning work on the next cycle of data analysis. This report describes the various issues raised, the evidence and other considerations surrounding them, and the conclusions we reached. Our conclusions were based on our discussions with stakeholders, our familiarity with authoritative sources, including the IAAO *Standard on Ratio Studies* (2010) and the practices of other similar jurisdictions, and our analyses of the questioned methodology and supporting data for a sample of six agricultural market areas.

Section 2 of this report discusses the issue of agricultural land sales that include property other than land alone. Section 3 addresses the procedures that have been adopted by the Property Assessment Division of the Department of Revenue (the Division) for adding out-of-county sales and removing sales in order to make the sample more representative. Sections 1.1 and 1.2 below summarize our main recommendations in each area.

1.1 Agricultural Sales with Minimal Value Contributions Apart From Land

Sales of agricultural parcels where land, rather than improvements, constitutes at least 95 percent of the assessed value are treated by default in the analyses of the Division as if there were no contributory value associated with the minor improvements. Some local assessors oppose this policy and believe that if such sales are to be used the sale price should be adjusted using the prior improvement assessment. We find the Division's policy to be fundamentally reasonable. We suggest, however, that the current policy of a rebuttable presumption of nil value be clarified and a mechanism be developed to facilitate an efficient means by which assessors can rebut it and provide the estimate of contributory value required under best practices.

1.2 Methodology for Augmenting Minimal Land Sales in Measuring Value

The Division's methods of remedying small sample sizes have been criticized for being subject to bias, illegitimate, unnecessary, and otherwise unacceptable. We find there to be no grounds for rejecting the methods on their face. We believe that the perceived potential for bias was ill informed and that the sample-expansion efforts were well placed. We also believe that the methodology can be improved in several important respects. The chief improvements we believe can and should be made are to implement weighting as an alternative to random deletions when sales samples contain over-represented strata, to consider the development of a statewide CAMA model to enable market-based value estimates of virtually all agricultural land, to implement a practice of adjusting sales for time, and to develop more formal decision rules regarding sample expansion efforts and thereby clarify the rationale and legitimacy of the procedures.

2. Agricultural Sales where the Non-Agricultural-Land Component of the Sale Is less than 5 Percent of the Sale Price

2.1 Background

The Property Assessment Division of the Department of Revenue (the Division) has long had a history of including in its agricultural land analyses sales other than those that were pure land sales, i.e. those that were unaffected by any other contributions to total value, such as may arise from buildings or other improvements. As a result of uncertainties attendant on removing the contributory value of such other improvements from the undifferentiated total sale price reported for the transaction, the practice of using such sales was temporarily curtailed. It was recently reinstated as a result of concerns that the small sample sizes that resulted from requiring land-only stringency would not be adequately representative for the purposes of measuring land values and hence the need for equalization adjustments. In response to earlier experiences, when improvement value contributions on occasion greatly exceeded the current five-percent threshold, the Division currently limits its use of such sales to those under 5 percent. It also undertook research to determine the extent to which the non-land components of such transactions influenced the total sale price and the extent to which the assessed value of the non-land components, if systematically removed from the sale prices, would have affected the results of the Division's processes for measuring value and hence reaching conclusions about the counties' needs for an equalization adjustment.

2.2 Issues and Analyses

At least three issues can be distinguished with respect to the use of improved agricultural sales:

- Should such sales be used?
- Is the 5 percent threshold a reasonable one?
- Does proper use of such sales require that the transaction price be adjusted by the assessed value of the improvement(s) in order to obtain an optimal estimate of the price that was paid for the land alone?

Use of sales minimally influenced by extraneous improvements is unquestionably reasonable. Absolute purity (that is, the absence of any improvements) in agricultural land sales is extremely rare in practice. Thus the number of sales providing indisputable market evidence will be minimal if not zero. This leads to very small samples being available for analyses, and small sample sizes lead to very serious analytical problems, as discussed at greater length below at sections 3.2.3 and 3.2.4.

The 5 percent threshold was selected by the Division as being a conservative response to concerns about the reliability of analyses incorporating their use. Five percent, interestingly, is also a widely used estimate of the inherent variability to be expected in even the best attempts to measure market values for the most easily appraised kinds of real property – sometimes called "market error" in contrast to appraisal error. Consequently, the International Association of Assessing Officers (IAAO) Standard on Ratio Studies suggests that reported coefficients of dispersion less than 5 percent are sufficiently rare that they can signal the potential for sales chasing on the part of assessors. We believe that using agricultural sales in which the influence of improvements apparently amounts to no more

than 5 percent of total value is eminently reasonable, and we can envision the use of such sales when the influences are even greater than 5 percent.

The propriety of using such sales without first deducting the assessed amount of the improvement has been rather strenuously disputed. The Division's research convinces it that buyers generally do not report their offer prices being influenced by the value of such ancillary improvements. Furthermore, the Division's ultimate reports very rarely reach a conclusion that turns on whether or not such adjustments were made to the raw data. Precedent for not adjusting for *de minimis* amounts abounds in assessment administration. It is nearly universal, for example, to ignore the value of personal property, such as appliances, in residential property transactions, attributing the entirety of the sale price to the real estate. We believe there are reasonable grounds, given the low 5 percent threshold, for the Division not to deduct the assessed value of the improvements as a matter of course. We are especially persuaded that the price paid for the land may have been higher in the absence of the trivial improvements rather than lower. An automatic adjustment in the opposite direction would, therefore, constitute a systematic bias in understating land values in comparison to the present policy – which arguably defaults to at least occasionally overstating them, but gives assessors the opportunity to correct the error, if there is one, by rebutting the default. We see the current policy as a middle position and a way of splitting and addressing the errors that arise from the ambiguity of the situation, not as a professional affront or an abuse of power.

We understand the Division's position to be that if a showing can be made that a given improvement positively influenced a sale price, an adjustment reflecting the actual contributory value (not necessarily the prior assessment), can be considered. This strikes us as optimal. A clearer statement of a perhaps more lenient policy of the mechanics by which an adjustment will be made – perhaps a simple statement from the assessor, far short of an affidavit – would help alleviate the rancor surrounding this situation. If such statements invariably match the prior assessment, a reminder that the IAAO Standard calls for a "contributory value" value deduction, not an automatic mechanical one, may be warranted, but all stakeholders should respect the others' perspectives.

2.3 Recommendations

We recommend that the Division continue to use sales of agricultural land as evidence of land value where the assessment of the non-agricultural-land component of the parcel is less than 5 percent of the sale price. We also recommend that the county assessors' statements of the contributory value of the improvements not be unduly discredited. We recommend that such sales continue to entail a rebuttable presumption that the contributory value of the non-agricultural-land component is nil, but that a variety of ancillary facts – not only the deed declarations or affidavits mentioned in conversations with stakeholders – may overcome this presumption. We believe a simple statement from the assessor of the apparent contributory value, citing supporting pro-forma evidence such as the age of the improvement (newer ones being less likely to be obsolete) and whether the facilities on the acquired land are in productive use, should suffice.

3. Enhancing Samples with So-Called Borrowed Sales

3.1 Background

Borrowed sales, perhaps better termed out-of-county sales, are sales of agricultural land that occurred outside the boundaries of the county for which the Division is using them to gauge the accuracy of the subject county's level of agricultural assessments. Using sales outside a county's boundaries to form an indicator of value is unremarkable inasmuch as economic markets do not generally coincide with political boundaries. However, since the Division needs to judge the accuracy of the local assessor's appraisals in a county other than the one in which the sale took place, the feasibility of using out-of-county sales is not necessarily obvious. In practice, however, their usage is rather unremarkable. Based on detailed soil surveys, with consideration of other factors not enumerated here, productive agricultural land has been classified on a uniform statewide basis into 24 land capability groups (LCGs), with 8 quality levels for each of 3 major land uses (MLUs): irrigated, dry, and grass land. (Timber, waste land, and a few other ancillary categories are outside the scope of this discussion.) Each county assessor identifies the number of acres any given parcel has of each of the 24 LCGs. This is true even for the few counties that appraise such land on another basis, such as soil types within parcels rather than LCGs within parcels. The local assessor also delineates market areas within the county, within which the 24 different LCG rates, expressed as dollars per acre per LCG, are effectively uniform. Many rural counties have only one market area, with the vast majority of counties having three or fewer market areas, although three counties approach having two dozen as seen in the Appendix. The Division monitors the counties' rates by LCG and market area, as well as their changes from one year to the next. It is thus an easy matter for the Division to impute an implicit value that would have been assigned to agricultural land sold in one county if it had been located in an adjoining county with an abutting market area and no changes to the combination of LCGs that constitute the parcel. The mechanics of making such implicit appraisals, in fact, are so generally accepted among stakeholders that no one raised any issues about the validity of the appraisals during our onsite discussions. The points of contention instead revolve around finer points of statistical sampling and ratio-study procedures.

Our understanding of the expanded methodology and its historical criticisms is as follows. In the first year of the expanded methodology, effective for assessments as of 1/1/2010, so-called borrowed sales were added from abutting townships in counties adjoining the subject county's market area exhibiting a dearth of sales, i.e. there was a maximum 6-mile distance over the county border to the sale for a given county's market area (CMA). This first expanded methodology was criticized for supposedly abandoning pure random samples and substituting samples that were perceived to have at least the potential for operator bias. It was also criticized for perceived discrepancies or inconsistencies in testimony concerning the procedures that were followed by the several staff members who were responsible for implementing the methodology. In the following year the methodology was augmented so that two procedures were followed: the prior year's methodology and a new methodology. The new methodology added more sales by widening margins, e.g. over-the-border sales could come from a second layer of townships so that a sale could routinely be as much as 12 miles from the subject county's border, although in rare cases the sale might have been even further distant from the subject county. (An undisputed claim was made that in some parts of the state there would be no case for differentiating locational effects for 150 or more miles.) The new methodology also allowed for deletions on a random basis to enhance the representativeness of the samples. In implementing the methodology there was also more

coordination among the Division's field liaisons, and there was a concerted effort to present more coherent testimony on it before the Tax Equalization and Review Commission (TERC). Nevertheless it was again criticized with respect to its unorthodoxy and supposed lack of compliance with IAAO standards. The program was implemented by regional liaisons using Excel with sophisticated templates and embedded macros. The leadership of the Division believes the program has been implemented uniformly among the regions due to the standardized templates and some coordination meetings among the several practitioners. We have reviewed a sample of data, including templates from five counties that would have been under the purview of five different regional liaisons and did not note any inconsistent practices among them.

3.2 Issues

There are a number of separate but intertwined issues involved in the criticisms surrounding this matter, which we address below.

3.2.1 Is the procedure subject to biases?

When the enhanced procedure was first implemented, it was described as attempting to increase the representativeness of a greater variety of potential value influences, such as soil type, water, and proximity, than could intuitively be comprehended, leading to persistent suspicions that subjective selection, rather than random sampling, was governing the selection of samples being analyzed. Our review of how out-of-county sales are chosen largely put those fears to rest. During the most recent year the samples were chosen randomly using an Excel macro from within a pool of sales defined on the basis of their ability to (1) remedy sparse sales by MLUs, (2) remedy sparse sales by year, and (3) be drawn from a township abutting the relevant county's market area (CMA). Thus no undue subjectivity was required, and the additional random inclusions and exclusions incorporated in the enhanced methodology adopted for the second year sought to further allay such concerns.

3.2.2 Is the procedure unrecognized or illegitimate?

The terminology of "borrowed sales," which failed to acknowledge that the out-of-county sales implicitly constituted appraisals, helped obscure two facts: (1) that they were a kind of supplemental appraisal and (2) that sales, whether they occur within the county or outside it, are generally treated as occurring randomly for purposes of ratio-study statistical purposes (although some exceptions are noted, especially having to do with sales of new construction). Thus, although the IAAO Standard fails to explicitly recognize the legitimacy of the course followed, and its authors probably never contemplated anything like Nebraska's methodology,[1] a reasonable argument can be made that the implicit appraisals have validity roughly equal to the appraisals made following the same procedures within the county. Of course neither may satisfy certain stringent requirements, such as those set forth by the Uniform Standards of Professional Appraisal Practice (USPAP), but that is not a criticism unique to the issue at hand. Further, the IAAO Standard sanctions efforts to increase the representativeness of sales for analytical purposes by means of randomly supplementing sales

[1] Particularly its decision to eschew time trending and to address sample representativeness issues by means of out-of-county sales with random exclusions. See below at section 3.2.7 and following.

with appraisals (see section 7.4) and randomly excluding sample elements (see section 4.2). Thus, although we have some reservations about the details of the procedures, to be more fully addressed below, we disagree that there is a prima facie case to be made against their legitimacy.

3.2.3 Are the sample-expansion efforts unwarranted or unnecessary?

The Division's efforts to enlarge the sample size were warranted due to the small sample sizes, the consequent limited reliability of the statistical analyses derived from them, and the significant sums at stake in tax base shifts that can result from the analyses. (In the most recent year, more than 46 million agricultural acres were assessed, aggregating to more than $39 billion of assessed value at a legislated 75 percent level of assessment.) Table 1 below summarizes for five representative counties the sample sizes and reliability of the main equalization statistic, i.e. the 95 percent confidence interval for the median assessment ratio, for both the unexpanded and ultimately expanded samples.

Table 1
Sample Sizes and Statistical Reliability Before and After Sample Expansion for Five Sample Counties

County	CMA	Sample Size Before	Lower 95 Pct CI Before	Upper 95 Pct CI Before	Sample Size After	Lower 95 Pct CI After	Upper 95 Pct CI After
Dixon	26.1	19	64.7	87.3	35	55.66	73.8
	26.2	30	58.49	77.49	45	48.1	73.7
Furnas	33.1	64	68.27	73.68	92	66.00	70.44
Hooker	46.1	12	60.2	73.0	27	63.66	73.44
Platte	71.6	53	65.5	72.2	126	70.99	79.83
Wheeler	92.1	24	61.77	78.68	41	60.6	76.9

The width of the 95-percent confidence interval for the median for the before-enhancement samples (the difference between the upper and lower confidence limits or 22.6 and 19 percentage points, respectively, in the first two lines of the table) illustrates the problem of small samples. When samples are small there are fewer other sample items to dilute the effects of the occasional flukes that inevitably arise. State law requires the level of assessment for agricultural land to be 75 percent, but establishes a tolerance range of six percentage points, 69 percent to 75 percent, the latter being about 8% larger than the former, perhaps thereby establishing a legislatively expected level of reliability. The unexpanded sample has about four times that unreliability, since in the first line the upper boundary of the confidence level is 35% higher than the lower boundary. Such wide margins illustrate how unreliability, resulting from small sample sizes in the presence of inherent variability, impairs measurement and potentially obscures the need for remedial steps.

For a given level of variability in the population being analyzed, the reliability of summary measurements like the mean or median will increase with approximately the square root of the sample size. This will not be clearly illustrated in the table above since the ultimately expanded samples summarized there addressed both sample-size and sample-representativeness issues simultaneously. The issue of sample size alone will be addressed in the following section, but it is clear on the face of things that steps needed to be taken to address poor levels of measurement reliability.

3.2.4 What is the importance of sample size?

Sample size has a direct effect on the reliability of the statistical conclusions drawn from analyzing the sample. The effect varies not linearly, but rather, in general, with the square root of the sample size. Sample sizes for any given stratum of less than 5 are considered absolutely unreliable, with samples of size 20 providing only twice the minimum reliability, which is still unlikely to be reliable. Concrete figures on reliability depend on both the variability of the sample values as well as the sample size. Thus generalizations are hard, but one knows from experience that getting 80% yellow M&Ms is much more likely in a sample of 5 than in a sample of 80. To discuss sample size issues clearly it is necessary to isolate the separate effects of sample variability and sample size. In what follows we will assume that sample variability of values in the population, and by expectation the sample, is fixed and can be estimated by reference to prior years' work, perhaps tempered by interim results. Then the standard operating procedure for controlling sampling error, as described in IAAO's Standard on Ratio Studies at section 7.3 and Gloudemans' *Mass Appraisal of Real Property*, (MARP) IAAO 1999, p. 271-278, is to adopt a conventional level of confidence, typically 95%, determine the likely level of variability based on available data, perhaps from prior years, specify a tolerance for error expressed as a percentage (for example no wider than the legislated tolerance range, i.e. 4.16 when expressed as a percent)[2], and apply the formula to determine the required sample size for such confidence in the estimate of the mean assessment ratio. For example, the coefficients of variation (COVs) of the before-enhancement ratios in Table 1, above, ranged from about 20% to about 35%, (not shown), which, according to the formulas on MARP page 272, would require sample sizes not less than 92 (for a 20% COV) to not less than 282 (for a 35% COV) in order to achieve a measurement-error tolerance for the mean ratio as narrow as the tolerance interval set by the legislature. Specifying in advance the requisite sample size to permit specified confidence intervals for the median, as opposed to the mean, is problematic since the median is a non-parametric statistic. Calculating the confidence interval after the sample is in hand is relatively easy (see Appendix C of the IAAO Standard on Ratio Studies and references there) and encourages some practitioners to enlarge samples in an iterative fashion until the desired parameters are met, although this is not strictly legitimate from the perspective of classical statistics. Since the CI for the median is generally narrower than that for the mean, one reasonable alternative is to apply the formula for the mean to estimate the requirements for the median.

Despite our emphasis on calculating and acting on confidence intervals, we do not believe that confidence intervals should be used to constrain the equalization of farmland when the calculated median falls outside the legislatively established tolerance range. We continue to believe, as we stated in our prior report (2004), that the objective is to *ensure* the uniformity and proportionality of the assessments of real property valuations in the state in accordance with law, not to test whether there is statistically conclusive evidence that it has not been achieved. As a practical matter, given small sample sizes, confidence intervals will often be wider than the legislated tolerance interval. In such cases layering confidence intervals atop the legislative tolerance interval might be taken as support for the view that action should be eschewed except in the most egregious cases. We see this as neither the letter nor intent of the law. But even if confidence intervals are not to be taken to constrain indicated action when

[2] 4.16 percent is derived as follows: The interval 69 to 75 gives a range of 6, half of which is 3; centering the interval on 72, the ends of it are 72 plus or minus 3, and 3 is 4.16 percent of 72.

samples are small, prudence dictates that the measurements should be made as reliably as feasible, which is measured by confidence intervals and accomplished by increased sample sizes.

Sample-size rules of thumb may be used to guide augmentation efforts. For example, one could adopt a target of at least 30 with at least 5 observations in any MLU comprising at least 20% of assessed value, with an additional requirement that any MLU with at least 33% of assessed value have at least 10 sales. Although such rules of thumb would comport well with practices in other jurisdictions, more sophisticated guidelines, based on the variability of ratios and at least a rough equality of confidence levels and intervals among counties as suggested in the first paragraph of this section, would be better supported from the perspective of statistics and decision science. In either case, the Division would benefit from having its decision rules set forth more explicitly.

3.2.5 What role does randomness play – is it necessary and/or sufficient?

The probability theory that supports drawing statistical inferences from sampling is actually based on an assumption of independent draws from an identically distributed set of data (an IID assumption). Randomness helps to ensure that the probability of one sampled item being drawn is not influenced by any other item being drawn or not drawn. Thus, by providing the "independent" part of the IID requirement, randomness is a necessary, but not a sufficient condition for enabling valid inferences about an entire county to be drawn from samples. Randomness can be of many types. In survey sampling random numbers can be used to select respondents from a comprehensive list. This parallels the Division's drawing sales from a pool using Excel's random number generator. Another kind of randomness underlies the use of sales as random samples for assessment purposes. A survey researcher would consider them a sample of convenience rather than a random sample, and some property tax equalization agencies would agree. Most such agencies, however, have decided that the apparently random incidence of most sales, rather than random selection by design, is adequate for their purposes given the level of resources available for the task. In any event, the randomness components of the Nebraska plan do not appear to introduce any problems of bias outside those already present in a sales-based analysis, although the somewhat related issue of sampling variability also needs to be addressed, as discussed above in section 3.2.4.

3.2.6 What role should representativeness play in concert with randomness?

The requirement that the draws be from an identically distributed population reflects the fact that subjects of interest (e.g. land values or voter preferences) may be known to vary across segments of the population (e.g. irrigated vs. grassland or gender and social stratum). Drawing a sample with disproportionate representation from one subpopulation or stratum can easily lead to erroneous conclusions when analyses are extrapolated to populations where the stratum proportions differ from those reflected in the sample. In such cases stratification is used, of which there are two kinds. When the sampling is controllable by the analyst, as in some surveys, the sampling plan can be designed to be proportional. When this is not possible, strata can be identified after the fact and weighted, as is most often done with property sales in assessment equalization. Note that the IAAO Standard on Ratio Studies endorses weighting, and describes procedures for consolidating stratum statistics into an overall estimate that are clearly based on weighting and explicitly supports weighting in section 4.2 of part II. Weighting is also very commonly used even in survey samples, which do not always meet their design goals due to non responses, etc. Weighting, thus, has an

unquestionable place in statistics. Rather than weighting, the enhanced procedure reviewed here has adopted the practice of randomly adding and subtracting out-of-county sales, particularly those from outside the county, as an alternative to weighting. This alternative is also sanctioned by the IAAO standard. The merits of each alternative will be discussed further below at section 3.2.8. To summarize this issue, it is our opinion that the enhanced procedure's attention to sample representativeness as an issue beyond mere randomness was appropriate, although whether the measures adopted were optimal is addressed below at section 3.2.8.

3.2.7 Why emphasize time-period symmetry in designing the sampling quotas?

In designing the random-include and random-exclude provisions of the enhanced procedures under review here, the Division required not only that the sample resemble the population, but also that the years in which the sales incorporated in the analysis occurred be represented approximately evenly. This is not a usual requirement. It seems to stem from reluctance on the part of the Division to develop time adjustments for sales, which have clearly undergone significant trends over the statutorily defined three year period from which the sales are to be analyzed. The law does permit the Division to develop and apply time-adjustment[3] or trending factors, but the dearth of sales and the complexities of capturing potential differences in the trends among MLUs and geographic areas have apparently inhibited this practice. In the alternative, by ensuring that all three years are approximately evenly represented, the levels of value derived are more consistent among the counties, effectively targeting the midpoint of the sale period. Most recently, for example, the sale period was from 7/1/2007 to 6/31/2010, with the objective of measuring values as of 1/1/2011. With no trending and approximately equal representation among the years, it can be expected that the values derived from the analyses more closely reflect those as of 1/1/2009.

While recognizing that the task can be quite difficult, we believe the Division should work expeditiously to develop time trending adjustments and, once these are implemented, to abandon its practice of requiring equal representation among the years from which out-of-county sales are drawn. The Division's current requirement for sale-year symmetry has no other justification based on sampling theory.

The sales ratio trend method would probably provide the simplest method applicable for developing time-trending factors wherever there are sufficient sales. A more comprehensive MRA analysis, with the dependent variable being sale price per acre and independent variables for soil classes or LCGs, other relevant variables including locational data, and time of sale also appears to be eminently feasible, and would have the benefit of not being constrained by the sales available in particular counties. In addition to minimizing the variability in assessment ratios stemming from temporal changes in prices within the three-year window, an additional significant side benefit of time trending would be the possibility of going back up to five years for sales once appropriate adjustments are made for time. Our reading of the law seems to permit additional sales beyond the mandatory three year period, although it would be prudent to confirm or amend the relevant rules if necessary.

[3] Current fashion is to substitute "adjustments for changes in market conditions" for time adjustment or trending. We adopt the simpler phrase in the belief that there can be no confusion of the concept with time-on-the-market considerations.

3.2.8 Are there better alternatives to random exclusions for enhancing representativeness?

The representativeness of a sample can be enhanced both by weighting and by randomly augmenting or pruning the sample in selected strata, as IAAO acknowledges. What are the advantages and disadvantages of each method? When the marginal cost of adding to the sample is trivial, as it is for the Division's out-of-county sales, then adding them is clearly the best solution. Larger samples, provided they are unbiased, permit greater reliability and confidence to be placed in the results and so should always be a high priority. When a super-abundance of one stratum threatens to bias results relative to another stratum, a sensible response is to down-weight the excessively represented stratum or up-weight the deficient one, provided there is sufficient representation in the latter; five is an absolute minimum, with twenty providing twice the reliability (recall it increases with the square root of sample size). Weighting is accomplished with more or less ease in different software. Excel, the software currently used by the Division, is not notably proficient with statistical matters, although it has been used with surprising effectiveness to date. R, SPSS, and SAS all are better suited to routinely handling the complications introduced by weighting, which is conceptually simple, especially for the mean, although it requires some special handling for the median. When random deletions are used instead of weighting, sample sizes are reduced, making the results more subject to sampling error and thereby less reliable.

In the present case, however, it should be noted that the weighting issues are rather unusual. In most studies and opinion polls the subjects (sampling units) belong unambiguously to one stratum or another, whereas in the present case it is not uncommon for any single parcel to include multiple MLUs in varying proportions. Properly handling or weighting each sale thus becomes more problematic. One way of handling the multiple MLU issue is to prorate sales with multiple uses. If a sale had multiple MLUs, its price could be prorated among MLUs for purposes of computing the weighted mean. For purposes of the median, the sale could be prorated based on the percentage of acreage in each MLU. For example, if 30% of acreage were irrigated and 70% were dry land, the sale would be counted as 0.3 irrigated sales and 0.7 dry land sales. As in the usual calculation of the median, the number of sales would be summed and the median computed based on the ratios corresponding to the midpoint of the distribution. The weighted median could then be calculated as a weighted average of the medians computed for each MLU, with the weights being proportional either to the percentage of total acreage or total value in each MLU in the county.

This is illustrated for a hypothetical dataset of 253 sales in the Appendix. The sample contained 3,406 acres of irrigated land, of which the median assessment ratio was found to be 0.499 (interpolating between ratios 0.498 for sampled acres through 1,683 and 0.512 for acres through 1,928). The dry land and grassland medians are computed in a similar manner, and the weighed median (0.629) is found as the MLU-acre-weighted average of the three medians.[4] The weights could also be based on the percentage of value in the three MLUs.

3.2.9 Are improvements possible at reasonable cost?

Although substituting weighting for random deletions would enhance the Division's procedures at minimal cost, it is not the only alternative with such potential. Another

[4] Rather than weighting by MLU acres sold, the weighting could also be done by percentages of MLU acres in each farm sale, as was illustrated in discussions with the stake holders. Doing so is slightly more complicated.

possibility worth considering is the centralized development of a statewide Computer Assisted Mass Appraisal (CAMA) model for agricultural land with locational influences independent of county boundaries. This would permit sales from outside the boundaries of a single county to be used in developing an effectively unlimited number of estimates of value for (unsold) parcels within the counties' boundaries in a fashion that would raise no issues about the compliance of the appraisals with USPAP or IAAO standards. As an at least equally important side benefit, it would provide an excellent basis for the development of the time trending factors discussed above. Although the task may seem to be daunting, there are ample grounds for believing it can be done successfully. A multi-state CAMA model for agricultural land was recently implemented for internal insurance purposes by Farm Credit Services of America. Reports on its development are publicly available.[5] Use of CAMA based appraisals for equalization purposes are similarly well established, having been used in Colorado for several decades.

A more immediately achievable improvement would be to establish explicit targets for sample reliability to guide the sample expansion and weighting efforts. Absent the year-symmetry policy once time trending is put in place, the variability arising from sales occurring in different years will be eliminated and the remaining variability can be used, in concert with sample size formulas, to determine the sample sizes necessary to achieve specified levels of reliability (e.g. confidence interval widths for given levels of confidence). At present, we were told, 95 percent confidence intervals for the median, mean and weighted mean are calculated but not used. Failing to use them to establish sample-size-targets as described in section 3.2.4 above is a deficiency, inasmuch as such calculations, especially for the median, should be the determining factors in the decision rules driving the sample expansion procedures.

3.2.10 Are elected officials being constrained or coerced away from doing what they were elected to do?

Resentment of oversight is almost universal, so comments to the effect that elected county officials felt the Division had pressured them in connection with the use of both minimally improved sales and so-called borrowed sales were not unexpected. Our review of the position of the Division on the minimally improved sale issue leads us to believe it is reasonable, and we are similarly comfortable with the balance of responsibilities between TERC and the Division on the subject of the issuance of equalization orders to the counties. If anything, our impression is that, by failing to adjust sales prices for time, the Division may have been insufficiently assertive rather than overly assertive in the performance of its statutory duties. This observation is not meant to fault any of parties involved. Tension among the checks and balances designed into our system of government are inevitable and a symptom of its health.

3.3 Recommendations

3.3.1 We recommend that significant attention continue to be paid to issues of sample size and representation, and that any pressures to accept the potentially erratic results of small unrepresentative samples in the name of "letting the chips fall where they may" be resisted.

[5] These include *Visual Valuation.* (Chicago, Appraisal Institute, 2010) and several seminar and conference presentations available from the IAAO library.

3.3.2 We recommend that serious consideration be given to developing valid adjustments for changes in price levels between the date of sale and the effective date of the Property Tax Administrator's (PTA's) Report and Opinion.

3.3.3 We recommend that consideration be given to weighting sample elements in preference to deleting them for purposes of increasing a sample's representativeness.

3.3.4 We recommend that consideration be given to developing a statewide CAMA model for agricultural land incorporating variables for time of sale, LCG/MLU considerations, and locational factors not constrained by political boundaries not of economic significance. Such a model could be used to develop market-based appraisals for virtually all agricultural land in each county, thus providing nearly complete coverage and avoiding issues of proportionality among MLUs in sales samples.

3.3.5 We recommend that explicit decision rules be developed to guide the use of out-of-county sales and clarify their legitimacy in terms of target sample size and statistical reliability. Target sample sizes would ideally derive from sample size formulas, but rules of thumb guided by statistical principles and practical criteria may be more realistic.

Appendices

Acknowledgments

AGJD is grateful for the assistance provided by the staff of the Department of Revenue, under the direction of Doug Ewald, Tax Commissioner. We particularly wish to thank Ruth Sorensen, Property Tax Administrator, and her staff, including Jon Cannon, Denny Donner, and Derrick Niederklein. We are also grateful for the insights of the members of the Tax Equalization and Review Commission: Nancy Salmon, Chairperson, Robert Hotz and Thomas Freimuth, Commissioners. Additional insights we appreciate receiving came from Marilyn Hladky, Seward County Assessor, Larry Dix, NACO Executive Director, and the writings of Robert Wickersham, former TERC Commissioner.

Acronyms and abbreviations

AGJD	Almy, Gloudemans, Jacobs & Denne, the authors of this report.
CAMA	Computer Assisted Mass Appraisal
CI 95%	Confidence Interval, the region within which one would expect a statistic (the median in this case) to lie 95 percent of the time if the analysis were repeated a very large number of times, with no changes to the population, but a (potentially) different random sample chosen each time. It is the standard way statisticians quantify the effects of so-called sampling error, independent of any other statistical issues, such as sampling biases.
CMA	County Market Area, a region of a county (perhaps its whole) expected to experience similar economic responses to varying conditions – an economic concept, not a political or governmental one; also known as market areas.
COV	Coefficient of Variation, a measure of the variability of a set of data, computed by dividing the standard deviation by the mean.
IAAO	International Association of Assessing Officers, often more specifically its Standard on Ratio Studies, 2010.
IID	Identically and Independently Distributed, the required characteristics of a set of data that, when met, allow estimates about the whole population to be inferred from a properly drawn sample with a computable degree of reliability.
LCG	Land Capability Group, one of a set of 24 quality-class and MLU combinations.
MARP	*Mass Appraisal of Real Property*, a book by Gloudemans published by IAAO, 1999.
MLU	Major Land Use, the three major types of productive agricultural land, i.e. irrigated, dry, and grassland.
MRA	Multiple Regression Analysis, a particular mathematical technique underlying most sales-based CAMA systems.
PTA	Property Tax Administrator
TERC	Tax Equalization and Review Commission
USPAP	Uniform Standards of Professional Appraisal Practice

Market areas

Distribution of Market Area Counts among the Counties

Market Areas per county	Number of counties
1	37
2	14
3	23
4	7
5	5
6	1
7	2
8	1
17	1
21	1
23	1
Total	93

Illustration of calculating a weighted median[6]

CMA	Ratio	Irrig Acres This Sale	Dry Acres This Sale	Grass Acres This Sale	Total Acres This Sale	Irrig Cummulative	Dry Cummulative	Grass Cummulative
26.1	0.081	-	16	-	16	-	16	-
26.1	0.112	48	29	-	77	48	46	-
26.1	0.158	-	38	-	38	48	83	-
26.1	0.270	-	26	127	153	48	109	127
26.1	0.293	-	75	4	79	48	184	131
26.1	0.293	-	-	44	44	48	184	175
26.1	0.298	-	-	44	44	48	184	220
26.1	0.316	133	17	-	150	181	201	220
26.1	0.326	-	11	141	152	181	212	361
26.1	0.341	-	-	137	137	181	212	498
26.1	0.343	-	-	40	40	181	212	538
26.1	0.359	-	7	11	18	181	219	549
26.1	0.362	-	121	18	139	181	340	567
26.1	0.372	297	210	-	507	478	550	567
26.1	0.379	-	98	45	142	478	647	611
26.1	0.383	-	20	52	72	478	667	663
26.1	0.406	-	213	66	279	478	880	729
26.1	0.414	-	39	20	59	478	919	749
26.1	0.415	-	-	32	32	478	919	781
26.1	0.436	-	30	22	52	478	949	803
26.1	0.442	-	207	-	207	478	1,156	803
26.1	0.443	-	88	20	108	478	1,243	823
26.1	0.455	132	24	-	156	610	1,267	823

[6] Based on all available data for CMA26.1, pretending the ratios have been adjusted for time, which they have not been.

CMA	Ratio	Irrig Acres This Sale	Dry Acres This Sale	Grass Acres This Sale	Total Acres This Sale	Irrig Cummulative	Dry Cummulative	Grass Cummulative
26.1	0.081	-	16	-	16	-	16	-
26.1	0.112	48	29	-	77	48	46	-
26.1	0.464	-	121	-	121	610	1,389	823
26.1	0.465	68	11	-	79	678	1,400	823
26.1	0.466	127	22	-	149	805	1,422	823
26.1	0.470	261	341	17	619	1,066	1,763	840
26.1	0.471	-	153	-	153	1,066	1,915	840
26.1	0.475	-	156	-	156	1,066	2,071	840
26.1	0.476	-	78	-	78	1,066	2,149	840
26.1	0.476	-	-	38	38	1,066	2,149	878
26.1	0.477	129	28	-	157	1,195	2,177	878
26.1	0.481	-	113	-	113	1,195	2,290	878
26.1	0.484	-	80	-	80	1,195	2,370	878
26.1	0.486	-	78	-	78	1,195	2,449	878
26.1	0.492	-	76	-	76	1,195	2,525	878
26.1	0.494	125	31	-	156	1,320	2,556	878
26.1	0.496	-	29	-	29	1,320	2,585	878
26.1	0.496	-	109	10	119	1,320	2,694	888
26.1	0.497	90	85	-	175	1,410	2,779	888
26.1	0.498	59	9	-	69	1,470	2,789	888
26.1	0.498	-	641	67	708	1,470	3,430	955
26.1	0.498	213	22	-	235	1,683	3,452	955
26.1	0.499	-	133	2	135	1,683	3,585	957
26.1	0.503	-	156	-	156	1,683	3,741	957
26.1	0.505	-	39	-	39	1,683	3,780	957
26.1	0.505	-	70	-	70	1,683	3,850	957
26.1	0.510	-	43	31	74	1,683	3,893	988
26.1	0.512	246	31	-	277	1,928	3,924	988
26.1	0.514	-	103	-	103	1,928	4,026	988
26.1	0.515	-	32	-	32	1,928	4,058	988
26.1	0.518	-	28	10	38	1,928	4,086	998
26.1	0.523	-	79	-	79	1,928	4,165	998
26.1	0.524	-	142	-	142	1,928	4,308	998
26.1	0.527	-	191	1	192	1,928	4,499	999
26.1	0.529	-	40	-	40	1,928	4,538	999
26.1	0.530	-	62	15	77	1,928	4,600	1,014
26.1	0.531	-	248	32	280	1,928	4,848	1,046
26.1	0.532	-	50	22	71	1,928	4,897	1,067
26.1	0.537	-	39	-	39	1,928	4,936	1,067
26.1	0.537	-	79	-	79	1,928	5,015	1,067
26.1	0.539	63	13	-	76	1,992	5,028	1,067
26.1	0.540	-	76	-	76	1,992	5,104	1,067
26.1	0.542	-	91	24	115	1,992	5,195	1,091
26.1	0.545	-	-	60	60	1,992	5,195	1,151

CMA	Ratio	Irrig Acres This Sale	Dry Acres This Sale	Grass Acres This Sale	Total Acres This Sale	Irrig Cummulative	Dry Cummulative	Grass Cummulative
26.1	0.081	-	16	-	16	-	16	-
26.1	0.112	48	29	-	77	48	46	-
26.1	0.546	-	39	-	39	1,992	5,234	1,151
26.1	0.552	-	79	-	79	1,992	5,313	1,151
26.1	0.553	-	114	-	114	1,992	5,428	1,151
26.1	0.555	-	91	-	91	1,992	5,518	1,151
26.1	0.557	-	77	-	77	1,992	5,595	1,151
26.1	0.557	-	228	-	228	1,992	5,823	1,151
26.1	0.560	-	155	-	155	1,992	5,978	1,151
26.1	0.566	-	159	-	159	1,992	6,137	1,151
26.1	0.568	-	39	-	39	1,992	6,176	1,151
26.1	0.571	-	379	-	379	1,992	6,555	1,151
26.1	0.571	-	300	-	300	1,992	6,854	1,151
26.1	0.571	-	69	-	69	1,992	6,924	1,151
26.1	0.571	-	148	-	148	1,992	7,071	1,151
26.1	0.575	-	151	-	151	1,992	7,222	1,151
26.1	0.575	-	67	-	67	1,992	7,290	1,151
26.1	0.575	-	172	20	192	1,992	7,461	1,171
26.1	0.577	107	56	-	163	2,099	7,517	1,171
26.1	0.579	-	145	-	145	2,099	7,661	1,171
26.1	0.580	-	76	-	76	2,099	7,738	1,171
26.1	0.580	-	155	-	155	2,099	7,893	1,171
26.1	0.580	-	194	-	194	2,099	8,087	1,171
26.1	0.580	-	72	-	72	2,099	8,159	1,171
26.1	0.581	-	166	29	196	2,099	8,325	1,200
26.1	0.581	-	154	-	154	2,099	8,480	1,200
26.1	0.583	-	99	14	113	2,099	8,579	1,214
26.1	0.584	-	78	-	78	2,099	8,657	1,214
26.1	0.585	-	150	-	150	2,099	8,807	1,214
26.1	0.588	-	128	4	132	2,099	8,934	1,218
26.1	0.591	-	39	-	39	2,099	8,973	1,218
26.1	0.592	-	39	-	39	2,099	9,012	1,218
26.1	0.592	-	172	20	192	2,099	9,184	1,238
26.1	0.596	-	40	-	40	2,099	9,224	1,238
26.1	0.604	-	77	-	77	2,099	9,300	1,238
26.1	0.604	-	77	-	77	2,099	9,377	1,238
26.1	0.609	-	156	-	156	2,099	9,533	1,238
26.1	0.609	69	10	-	79	2,167	9,544	1,238
26.1	0.610	-	146	-	146	2,167	9,690	1,238
26.1	0.610	-	74	-	74	2,167	9,764	1,238
26.1	0.612	-	71	-	71	2,167	9,835	1,238
26.1	0.612	-	69	-	69	2,167	9,904	1,238
26.1	0.621	-	186	-	186	2,167	10,090	1,238
26.1	0.621	-	144	-	144	2,167	10,234	1,238

CMA	Ratio	Irrig Acres This Sale	Dry Acres This Sale	Grass Acres This Sale	Total Acres This Sale	Irrig Cummulative	Dry Cummulative	Grass Cummulative
26.1	0.081	-	16	-	16	-	16	-
26.1	0.112	48	29	-	77	48	46	-
26.1	0.621	-	79	-	79	2,167	10,313	1,238
26.1	0.623	-	25	-	25	2,167	10,338	1,238
26.1	0.629	-	114	-	114	2,167	10,452	1,238
26.1	0.634	-	79	-	79	2,167	10,531	1,238
26.1	0.636	-	99	-	99	2,167	10,630	1,238
26.1	0.639	-	77	-	77	2,167	10,707	1,238
26.1	0.647	-	40	-	40	2,167	10,747	1,238
26.1	0.647	-	38	-	38	2,167	10,785	1,238
26.1	0.654	-	39	-	39	2,167	10,824	1,238
26.1	0.655	60	15	3	78	2,228	10,839	1,241
26.1	0.658	128	28	-	156	2,356	10,867	1,241
26.1	0.659	-	97	39	136	2,356	10,964	1,280
26.1	0.659	-	113	-	113	2,356	11,077	1,280
26.1	0.660	-	79	37	116	2,356	11,155	1,317
26.1	0.662	-	32	-	32	2,356	11,187	1,317
26.1	0.662	-	77	-	77	2,356	11,264	1,317
26.1	0.664	-	37	-	37	2,356	11,301	1,317
26.1	0.667	-	155	-	155	2,356	11,456	1,317
26.1	0.667	-	219	-	219	2,356	11,675	1,317
26.1	0.667	-	73	-	73	2,356	11,748	1,317
26.1	0.669	-	154	-	154	2,356	11,901	1,317
26.1	0.670	-	79	-	79	2,356	11,980	1,317
26.1	0.671	-	120	-	120	2,356	12,101	1,317
26.1	0.671	-	119	87	206	2,356	12,220	1,404
26.1	0.674	-	58	19	77	2,356	12,278	1,423
26.1	0.675	-	19	-	19	2,356	12,296	1,423
26.1	0.675	-	66	-	66	2,356	12,362	1,423
26.1	0.676	-	77	-	77	2,356	12,439	1,423
26.1	0.676	-	150	-	150	2,356	12,590	1,423
26.1	0.678	-	97	-	97	2,356	12,687	1,423
26.1	0.680	-	38	-	38	2,356	12,725	1,423
26.1	0.693	-	74	-	74	2,356	12,799	1,423
26.1	0.696	-	153	-	153	2,356	12,952	1,423
26.1	0.696	-	135	-	135	2,356	13,087	1,423
26.1	0.698	-	38	-	38	2,356	13,125	1,423
26.1	0.700	-	32	-	32	2,356	13,157	1,423
26.1	0.702	129	25	-	154	2,484	13,182	1,423
26.1	0.703	-	76	-	76	2,484	13,258	1,423
26.1	0.704	-	77	-	77	2,484	13,335	1,423
26.1	0.704	-	146	-	146	2,484	13,481	1,423
26.1	0.709	-	79	-	79	2,484	13,560	1,423
26.1	0.709	-	66	-	66	2,484	13,626	1,423

CMA	Ratio	Irrig Acres This Sale	Dry Acres This Sale	Grass Acres This Sale	Total Acres This Sale	Irrig Cummulative	Dry Cummulative	Grass Cummulative
26.1	0.081	-	16	-	16	-	16	-
26.1	0.112	48	29	-	77	48	46	-
26.1	0.710	-	230	-	230	2,484	13,856	1,423
26.1	0.712	-	39	-	39	2,484	13,895	1,423
26.1	0.716	-	74	-	74	2,484	13,969	1,423
26.1	0.721	-	74	-	74	2,484	14,043	1,423
26.1	0.725	-	169	5	174	2,484	14,212	1,428
26.1	0.725	-	116	2	117	2,484	14,328	1,430
26.1	0.730	-	111	7	118	2,484	14,439	1,436
26.1	0.731	-	155	-	155	2,484	14,595	1,436
26.1	0.735	-	40	-	40	2,484	14,635	1,436
26.1	0.735	-	48	34	81	2,484	14,682	1,470
26.1	0.736	-	65	5	70	2,484	14,747	1,475
26.1	0.738	-	107	10	116	2,484	14,854	1,484
26.1	0.738	-	77	-	77	2,484	14,931	1,484
26.1	0.742	-	34	21	54	2,484	14,964	1,505
26.1	0.746	-	18	12	30	2,484	14,982	1,517
26.1	0.750	-	75	-	75	2,484	15,057	1,517
26.1	0.753	115	30	6	151	2,599	15,088	1,523
26.1	0.753	63	52	-	115	2,661	15,140	1,523
26.1	0.754	260	47	-	307	2,921	15,187	1,523
26.1	0.755	-	131	7	139	2,921	15,318	1,531
26.1	0.756	-	69	-	69	2,921	15,387	1,531
26.1	0.756	-	146	-	146	2,921	15,534	1,531
26.1	0.758	-	18	-	18	2,921	15,552	1,531
26.1	0.759	-	19	-	19	2,921	15,570	1,531
26.1	0.760	-	148	3	151	2,921	15,718	1,534
26.1	0.761	-	68	-	68	2,921	15,786	1,534
26.1	0.766	-	65	12	77	2,921	15,851	1,546
26.1	0.767	62	17	-	79	2,983	15,868	1,546
26.1	0.767	-	17	-	17	2,983	15,885	1,546
26.1	0.768	27	7	6	40	3,010	15,892	1,552
26.1	0.769	-	149	-	149	3,010	16,040	1,552
26.1	0.770	-	35	-	35	3,010	16,075	1,552
26.1	0.771	132	25	-	157	3,142	16,100	1,552
26.1	0.773	-	40	-	40	3,142	16,139	1,552
26.1	0.774	-	69	30	100	3,142	16,208	1,582
26.1	0.774	-	4	-	4	3,142	16,212	1,582
26.1	0.778	140	14	-	155	3,283	16,227	1,582
26.1	0.780	-	134	-	134	3,283	16,361	1,582
26.1	0.786	-	78	-	78	3,283	16,439	1,582
26.1	0.791	-	92	16	109	3,283	16,531	1,599
26.1	0.796	-	128	10	138	3,283	16,659	1,608
26.1	0.797	-	299	-	299	3,283	16,958	1,608

CMA	Ratio	Irrig Acres This Sale	Dry Acres This Sale	Grass Acres This Sale	Total Acres This Sale	Irrig Cummulative	Dry Cummulative	Grass Cummulative
26.1	0.081	-	16	-	16	-	16	-
26.1	0.112	48	29	-	77	48	46	-
26.1	0.806	-	133	-	133	3,283	17,091	1,608
26.1	0.807	-	55	-	55	3,283	17,146	1,608
26.1	0.808	-	79	-	79	3,283	17,225	1,608
26.1	0.817	-	134	22	156	3,283	17,359	1,630
26.1	0.819	-	154	-	154	3,283	17,513	1,630
26.1	0.820	-	77	-	77	3,283	17,590	1,630
26.1	0.824	-	12	-	12	3,283	17,602	1,630
26.1	0.825	37	0	2	40	3,319	17,602	1,632
26.1	0.826	-	147	-	147	3,319	17,749	1,632
26.1	0.836	-	95	19	114	3,319	17,844	1,651
26.1	0.844	-	77	-	77	3,319	17,921	1,651
26.1	0.851	-	77	-	77	3,319	17,998	1,651
26.1	0.852	-	79	-	79	3,319	18,077	1,651
26.1	0.852	-	79	-	79	3,319	18,156	1,651
26.1	0.855	-	-	40	40	3,319	18,156	1,691
26.1	0.860	-	92	43	135	3,319	18,248	1,734
26.1	0.862	-	78	-	78	3,319	18,326	1,734
26.1	0.867	-	49	-	49	3,319	18,375	1,734
26.1	0.871	-	76	-	76	3,319	18,451	1,734
26.1	0.871	-	224	8	232	3,319	18,675	1,743
26.1	0.873	-	75	3	78	3,319	18,750	1,746
26.1	0.888	-	38	-	38	3,319	18,788	1,746
26.1	0.892	-	91	24	115	3,319	18,879	1,770
26.1	0.895	-	48	3	51	3,319	18,927	1,773
26.1	0.905	-	98	-	98	3,319	19,025	1,773
26.1	0.909	-	78	-	78	3,319	19,103	1,773
26.1	0.910	-	75	-	75	3,319	19,178	1,773
26.1	0.920	-	75	-	75	3,319	19,253	1,773
26.1	0.932	-	74	-	74	3,319	19,327	1,773
26.1	0.943	-	156	75	231	3,319	19,483	1,848
26.1	0.943	-	59	-	59	3,319	19,542	1,848
26.1	0.946	-	155	-	155	3,319	19,697	1,848
26.1	0.950	86	63	-	149	3,406	19,760	1,848
26.1	0.951	-	44	49	93	3,406	19,804	1,897
26.1	0.960	-	19	-	19	3,406	19,823	1,897
26.1	0.978	-	20	-	20	3,406	19,842	1,897
26.1	0.980	-	150	-	150	3,406	19,992	1,897
26.1	0.986	-	63	14	76	3,406	20,055	1,911
26.1	1.007	-	101	170	272	3,406	20,156	2,081
26.1	1.008	-	79	-	79	3,406	20,235	2,081
26.1	1.022	-	223	-	223	3,406	20,458	2,081
26.1	1.023	-	76	-	76	3,406	20,534	2,081

CMA	Ratio	Irrig Acres This Sale	Dry Acres This Sale	Grass Acres This Sale	Total Acres This Sale	Irrig Cummulative	Dry Cummulative	Grass Cummulative
26.1	0.081	-	16	-	16	-	16	-
26.1	0.112	48	29	-	77	48	46	-
26.1	1.024	-	40	-	40	3,406	20,574	2,081
26.1	1.030	-	60	-	60	3,406	20,634	2,081
26.1	1.041	-	79	-	79	3,406	20,713	2,081
26.1	1.056	-	79	-	79	3,406	20,792	2,081
26.1	1.083	-	98	41	138	3,406	20,889	2,122
26.1	1.089	-	142	-	142	3,406	21,031	2,122
26.1	1.112	-	152	-	152	3,406	21,183	2,122
26.1	1.135	-	187	42	230	3,406	21,370	2,164
26.1	1.143	-	153	-	153	3,406	21,523	2,164
26.1	1.143	-	153	-	153	3,406	21,676	2,164
26.1	1.150	-	8	-	8	3,406	21,684	2,164
26.1	1.157	-	22	-	22	3,406	21,706	2,164
26.1	1.251	-	15	-	15	3,406	21,720	2,164
26.1	1.312	-	194	-	194	3,406	21,914	2,164
26.1	1.376	-	59	13	72	3,406	21,973	2,177
26.1	1.400	-	185	3	188	3,406	22,157	2,180
26.1	1.400	-	185	3	188	3,406	22,342	2,184
26.1	1.414	-	39	-	39	3,406	22,381	2,184
26.1	1.433	-	37	-	37	3,406	22,418	2,184
26.1	1.520	-	67	-	67	3,406	22,485	2,184
Halfway To Acre Total (i.e. median acre)						1,703	11,243	1,092
Floor Ratio		0.498	0.662	0.542				
Interpolated		0.499	0.662	0.542				
Ceiling Ratio		0.511	0.662	0.545				
Total in Abstract		14,334	77,246	7,977	99,557			
Abstract %		0.144	0.776	0.080	1.000			
Median (interp)		0.499	0.662	0.542				
% x Median		0.072	0.514	0.043	0.629			

Weighted Median = 0.144*0.499 + 0.776*0.662 + 0.080*0.0542 = 0.072 + 0.514 + 0.043 = 0.629.