

Section 10—Preparing and assembling

The ratio study

The ratio study determines the necessary factors to be applied to properties that have not sold based on those that have sold to achieve a ratio level of 100 percent of RMV. The assessor makes ratio conclusions for each class of locally valued property and within each appraisal valuation area.

Data may be taken from the ratio study reports and compiled into various statistical studies. Various parties may use individual pages, such as hearing officers, the attorney general's office, and Legislative Revenue. Therefore, the ratio study report must include the data as required by the Department of Revenue. See Section 4.

The study includes:

- The basis for the ratio conclusions.
- Reasoning for the selected ratio if indications (mean, median, and weighted mean) are more than five points apart from the highest to lowest.
- Notation and page number of any supplemental study used to develop the ratio conclusion. Such studies may include a two-year sample, combined market areas, and combined property classes.
- The adjustments the assessor plans to make to each property class to bring its value to 100 percent of RMV.
- Computation worksheets of ratios and ratio conclusions by property class for each market area countywide.
 1. Ratios **before** appraisal, recalculation, and adjustment.
 2. Ratios **after** appraisal, recalculation, and adjustment.
- Actual sales, appraisals, and other data used to arrive at the ratio conclusions.
- Computations and conclusions for any supplemental studies that may be included. Some supplemental studies are bulky. In that case, a copy must be available in the assessor's office so Department of Revenue personnel and others can examine it upon request.
- Summary pages showing the **before** and **after** ratios and the adjustments that will be made to land, buildings, and other components.
- For those counties utilizing recalculation, a supplemental straddle study of sale data that are evenly distributed on either side of the assessment date.

The summarized components of the ratio study are:

1. Table of contents;
2. Certification page;

3. Introduction;
4. County map;
5. Property classification codes, if expanded from state-issued codes;
6. Sale condition codes, if expanded from state-issued codes;
7. Time trend analysis to the assessment date.
8. Summary of adjustments and "after" ratio adjustments;
9. Market area conclusions and adjustment(s) pages;
10. Pages identifying the specific areas and property classes being adjusted, including:
 - "Before" and "after" ratios;
 - Explanations for the selected ratios;
 - Valuation histories of CODs and PRDs;
 - Time adjustments, if applicable;
 - Listings of sales and summaries with condition codes and statistics (mean, median, weighted mean, COD, COV, and PRD);
 - An "After Ratio Study" for areas revalued, re-appraised, or recalculated. The after ratio study is a sales to RMV ratio study that is designed to test whether or not a county's annual valuation program has produced RMVs that meet the statutory requirement to bring all properties to 100 percent of RMV. See OAR 309.200-(B)(12).

The ratio study must include the following:

- **Table of contents;**
- **Certification and analysis of valuation methods and procedures;**
- **Introduction;**
- **County map;**
- **Property class code listing and descriptions.**
- **Time trend analysis;**
- **Summary of adjustments and after ratios (multiple pages).**

(For all property classes/units and market areas, with or without planned adjustments)

- Residential;
- Tract;
- Multi-family;
- Market farm and forest;
- Commercial;
- Industrial;
- Manufactured structures;
- Recreation;
- Other (waterfront, etc.).

- **Market area conclusions and adjustments (multiple pages).**

Preparing the ratio study

Include the following on each page:

— **Identification of market area:** Property class code(s), market area(s), boundary definition, property type(s), or unit type(s).

— **Adjustment calculation summary:**

Sample size

Population—number of accounts.

Sample—number of sales.

— **Weighting calculations (for improved property types only):**

Prior year RMV of sample or population of components (land, on-sites, improvements, etc.).

Weight of the components as a percent of total sample or roll.

— **Ratio selections & adjustment factors:**

Selected ratio from array.

Time trend factor.

RMV before ratio.

Adjustment factors: Overall, land, on-sites, improvements, and other.

After ratio.

— **Selected ratio explanation.**

— **Valuation history (Six-year history—dates shown are examples):**

Year last appraised.

Last four and current year COD before adjustment, if available.

Last four and current year PRD before adjustment, if available.

• **Pertinent sales listings, supplemental studies, and computations of statistical data supporting each market area conclusion and adjustment page:**

— Residential.

— Commercial.

— Industrial.

— Tract.

— Market farm and forest.

— Multi-family.

— Recreation.

— Manufactured structures.

— Other (waterfront, etc.).

• **Additional studies and conclusions:**

— Regression studies.

— Other.

• **Appraisal/valuation plan for the next assessment year;** i.e., the following July 1 (may be prepared as a separate document on or before November 1).

Assessor's ratio study

- Basic guideline format and order **must** be followed.
- Sales listing and statistics **must** be included.
- Individual pages may be formatted to suit county needs.

Questions should be directed to the field office assigned to the county for which the report is to be or has been compiled.

Assessor's certified ratio study

For year _____

County name

Table of contents

20 ____ ratio study, _____ County

	Page #
Certification and analysis of valuation methods and procedures	_____
Introduction	_____
County map	_____
Listing of property class codes and descriptions	_____
Time trend analysis	_____
Summary of adjustments and after ratios (multiple pages)	_____
(Include all property classes and market areas, even those with no planned adjustments.)	
Residential	_____
Rural tract	_____
Multifamily	_____
Market farm and forest	_____
Commercial	_____
Industrial	_____
Manufactured structures	_____
Recreation	_____
Others as necessary	_____
Market area/unit conclusions and adjustments (multiple pages)	_____
(Complete all required items on each page. Behind each, insert pertinent sales listings, graphs, supplemental studies, and computations of statistical data.)	
Residential	_____
Rural tract	_____
Multifamily	_____
Market farm and forest	_____
Commercial	_____
Industrial	_____
Manufactured structures	_____
Recreation	_____
Others as necessary	_____
Supplemental studies and conclusions	_____
Appraisal valuation plan	_____

Certification

20 ____ ratio study, _____ County

Certification & analysis

of

valuation methods and procedures

State of Oregon)
) SS.
 County of)

I, _____, assessor of county _____, State of Oregon, do hereby certify that I have prepared a ratio study for the current tax year, according to ORS 309.200 and guidelines developed by the Department of Revenue. The attached is a complete and accurate copy of the original now on file in my office.

I further certify that the ratios and adjustments identified in this study will achieve 100 percent of RMV for real property and manufactured structures for the current year.

This report is given to the Department of Revenue and will be given to the Clerk of the Board of Property Tax Appeals to provide current knowledge of the adjustment program used by my office.

 Assessor's signature

 Date

 Contact person

 Date

Introduction

20 ____ assessor's certified ratio study, _____ County

The purpose of this ratio study is to:

- Measure the real market value level from year to year.

For this study, that is the relationship between current certified roll real market values and the real market values required for the pending roll. This measurement is the **before ratio** on each "market area conclusions and adjustments" page.

- Identify **adjustment factors** necessary to achieve the required RMVs for the current roll.
- Document the analysis and decision-making process.
- Provide a tool in **managing** the county appraisal and adjustment programs.

Note: It's important to remember that all references in this introduction to value levels **only** pertain to real market values.

Ratio study format

The ratio study format is designed to be flexible and illustrate the adjustment program. The most important pages are the "summary of adjustments and after ratios," beginning on page ____, the "market area conclusion and adjustment" pages with the supporting sales listings and statistics behind them, and the change in market conditions (time) trend analysis.

Scope of this report

Not all property values are actually indexed or trended each year. Personal property, specially assessed property, and some industrial properties are recalculated each year. This ratio study format does not report on values being recalculated but does report on how real market values will be adjusted.

Status of the assessor's adjustment program

The _____ assessor's office will continue to review market information. It is possible that additional data or further analysis will lead to different conclusions than contained in this study. Changes to this study will be reported to the department and to the board of property tax appeals.

Change ("time") trend analysis

The primary purpose of the study is to identify adjustment factors to be applied to sales prices or to the selected ratios. The intent is to estimate the prices at which the property would have sold on the assessment date

(January 1 at 1:00 a.m.). This section includes trend conclusions and the reasons for the trends. The data is usually presented in graphic form by month and or quarter, with some narrative explanations. Change trends may be developed for any property grouping desired, but an adequate sales sample is necessary.

Description of "summary of adjustments and after ratio" page(s)

These pages identify market areas and specify the related study, the page number of the "market area conclusions and Adjustments" page(s), and the adjustment factor(s) required by the study. The market areas are organized to emphasize the relationship between areas.

- Counties that recalculate RMV by property class by market area do not provide adjustment factors.
- Recalculating counties will send this information as "an after ratio" study.

Market areas are divided into four major groups:

1. **Residential**—This section is for residential land, single family dwellings, condominiums, duplexes, triplexes, four-plexes and manufactured structures (mobile homes).
2. **Rural**—This section is for rural property parcels, whether small rural residential or large farm and forest. Besides residential improvements there are adjustment areas specifically for farm and forest buildings.
3. **Income**—This section is for income property. It includes both land and improvements for commercial, industrial, and multifamily properties.
4. **Other**—This section is for land and improvements that do not fit neatly into any of the other categories. Mineral rights [if it is actively being mined as of the assessment date-ORS 308.115 (2)] and site improvements may be found here.

Appraisal areas—The county is divided into _____ appraisal areas.

Insert county-specific information with descriptions of the geographic area boundaries and characteristics.

[Insert countywide map here]

Appraisal areas and/or market areas are needed to manage valuation programs and provide an organized system by which to analyze sales data, apply trends, or revalue as necessary to maintain 100 percent RMV.

Market areas—The assessment system provides for adjusting values by market areas within and across appraisal area boundaries. The following maps display how parts of the county have been stratified into market areas (optional).

[Insert maps here]

Stratification—The technical word for taking a large group of properties and splitting it into separate market areas based on some criteria. This step is taken when there is reason for applying different adjustments to the different market areas. This usually means that the market areas have different ratio indications and the deviation from central tendency will be reduced by the stratification. Conversely, combinations of sales data for similar classes which separately have few or no sales can be justified on the basis of general economic conditions.

“Market area conclusions and adjustment” pages

The name or number is to identify the individual ratio study that produced the adjustment factors to be applied to a market area or unit type. The same study may be used for multiple market areas.

Page #—The number in the lower right corner on the individual ratio study pages named “market area conclusions and adjustments.”

Adjustment (adj.)—This is the factor to be multiplied by the existing value(s). The source of this factor is the individual ratio study. Studies are done to calculate the adjustments needed for each component of a property class to reach an overall result of 100 percent of real market value for the properties. The overall adjustment factor may not accurately reflect the combined adjustments for any specific property because of the various weights of components in individual properties.

After ratio—This is the expected level of RMV assessment after the adjustment process. The _____ County assessor will adjust all real market values to 100 percent of market.

The most effective way to manage a valuation program is to concentrate on **results** rather than the **valuation process**. Consequently, a more direct focus on the “after ratio” is required. Establishing standards to measure results has been a priority, and will provide a basis for determining acceptable performance.

Market area conclusions and adjustments page terms explanations

Individual study pages identify the market area in more specific terms, such as the geographics of the market area and type of properties and conditions. Each study page shows the selected ratio and calculation of the adjustment factor(s) and explanation for the selected ratio. Following each study page are the sales listing and related statistics.

- **Property class/type**—Identifies the type of property, such as residential, commercial, etc.
- **Market area name, number code or unit type**—A

name, number, and code or unit type identified in detail in the market area identification section.

- **Location/description**—A descriptive identification of the market area other than a number or code, such as: geographic location, building/land characteristics, or a description of the properties to be adjusted.
- **Adjustment calculation summary**—This section displays the sample size and weighting quantities involved in calculating adjustment factors for the selected ratio.

Sample size—Number of usable sales divided by the number of accounts or units of the property class in the market area, figured as a percentage to approximate the sample size.

Number of sales—Number of sales used in the calculation of the “Before Ratio.”

Population of accounts or units—This is the total number of accounts or units within the property class by market area for which you are calculating the ratio.

Weighting calculations (for improved property types only)—Increases or decreases in the market may differ for separate components of an improved property class. A percent weight for the land, on-sites, improvements, and other (outbuildings) is computed from the prior year total improved property class or from the current sample computed. **Note:** Counties that do not adjust RMV by trending do not complete this portion.

• Ratio selection and adjustment factors

Selected ratio—An estimate of the level of real market value on January 1. Ratio selection has been based on the following principles:

- A. No one sale should have a large influence on the ratio indication.
 1. Avoid an **arithmetic mean** distorted by extreme ratios.
 2. Avoid a **weighted mean** influenced by high valued properties at either end of the array.
 3. Avoid a **median** when gaps exist in the middle of the frequency distribution.
- B. Split ratios (when an individual study has ratio indications above and below 100) can be the result of being at or near market.
 1. A correct index will result in half the properties being over market and half being under market.
 2. Application of a single index cannot reduce the distribution of ratios within a property class.
- C. The central tendencies (median, arithmetic mean, geometric mean, weighted mean, and mode) are

Preparing the ratio study

analyzed and an appropriate ratio becomes the selected ratio.

Before ratio—a measure of the level of real market value at an established point in time for the tax year, before any trending adjustments are applied.

Total adjustment (or adjustment factor)—the adjustment to bring the certified roll real market values to the statutorily required 100 percent of real market value as of the study's assessment date. For single component property class or unit types it is calculated by dividing 100 by the "RMV before ratio." For improved properties being trended the overall adjustment is broken into the following components:

Land adjustment—The adjustment factor by which land of a given type is to be adjusted. It is usually calculated as 100 divided by the "RMV before ratio" for a class composed of vacant land. The same adjustment is then used for both vacant and improved land in order to maintain equitability.

Site adjustment—The adjustment factor to apply to the site improvement component of the property class that will bring the site improvement component to 100 percent of RMV as part of the overall adjustment.

Improvement adjustment—The adjustment factor to apply to the improvement components of the property class that will bring the improvement component to 100 percent of RMV as part of the overall adjustment.

Outbuildings adjustment—The adjustment factor to apply to the outbuildings component of the property class, which will bring the outbuildings component to 100 percent of RMV as part of the overall adjustment.

Selected ratio explanation—Written reason(s) for the selected ratio. The explanation should discuss why the chosen central tendency best represents the RMV level in the particular property class. If there are other factors that contribute to the support of this measure, they may also be mentioned here.

• Valuation history

- Year last appraised for each "market area conclusions and adjustments" page.
- Coefficient of dispersion (COD), for five years if available. A COD higher than the maximum standard for the property type is an indication of a potential valuation problem.
- Price related differential (PRD), for five years if available. A PRD greater than 1.00 suggests high-value parcels are under appraised, a PRD less than 1.00 suggests high-value parcels are relatively over

appraised. As a general rule, except for small samples, the PRD should range between .98 and 1.03.

Study listings

Study listings are a collection of sales or market data that have been analyzed and determined to be adequate for use in the ratio study. This collection of data is usually identified as sales listing array, organized in a standard format (see below), and printed on a computer printout medium. For most individual studies there is a sales listing. For each sale in the listing, the property is identified, classified and a ratio calculated. At the end of the listing are summary statistics developed from the listing.

A description of major components in the standard format is as follows:

- **Appraisal area or market area**—specific area within the county.
- **Account number**—could be alphanumeric identifying a specific parcel/property.
- **Property class (PC)**—A three digit number designating type of property.

Example: 1-0-0 residential vacant or 1-0-1 residential improved.

- **Condition code (formerly called reject code)**—Identifies which sales have been confirmed and which have not.

33 Confirmed—Sale from this ratio sales year. Usable in ratio study.

32 Confirmed—Sale from prior ratio sales year. Usable in ratio study.

31 Unconfirmed—Sale from prior ratio sales year. Usable in ratio study.

00 Unconfirmed—Sale from this ratio sales year.

00 Usable in ratio study.

etc.

In the current study, ____ percent of sales used have been confirmed.

Total number of sales countywide:

Sales	Used	Confirmed
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_____	_____	_____
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- **Map and tax lot**—Locates the property in the county. Sales that include more than one account display an asterisk (*) after the tax lot number. The other accounts may be found by referencing the multiple account list at the end of this report.
- **Instrument number**—The recording number that identifies the sale document.

- **Total value**—This is usually the real market value from the current certified assessment roll. In some cases it is the value that would have been on the roll although the property has changed. Examples of such changes include construction of buildings and consolidation with other tax lots.
- **Time trend**—A percent adjustment for time made to a sale price. Trends are discussed and calculated in the trend study section of this report.
- **Adjusted sale price**—The estimated sale price for the property if it were to sell **January 1**, assessment date for the current study.
- **Sale number**—Within each sales listing array the sales are ordered by ratio and each is then identified with a number beginning with the smallest ratio. If one sale appears in two different listings, it will usually have a different sale number in that listing.
- **Ratio**—A comparison of the real market value on the certified roll, to the sale price or adjusted sale price expressed as a percentage. **This expresses the real market value level as of the date of sale or as of the January 1 assessment date, if the sales prices were adjusted for time to January 1 for the current year.**

Example: current real market value on the certified roll \$95,000 (as of the January 1 assessment date)
—Sold the following May for \$100,000

$$\$95,000 \div \$100,000 = .95$$

The ratio of 95 percent represents the level of value as of the May sale date.

$$0.57 * 0.64 * 0.76 * 0.8 * 0.82 * 0.93 * 0.95 * 0.96 = 0.154259 \text{ Product of the ratios (the root of)}$$

Excel Formula for nth Root (Geomean)

The following is the general form of the equation
=num^(1/n)

where "num" is the number you want to find the root of and "n" is the count.

Example

To find the nth root of a number, raise that number to the power of 1/n.
For example, to find the cube root of 8 in a cell, type the following:

=8^(1/3) Answer: **2**

OR, as above:

=.154259^(1/8) Answer: **0.79**

Weighted mean—The sum of the total prior year RMVs divided by the sum of the adjusted sales prices or sales prices.

<u>Prior year values</u>	<u>Adjusted sales price</u>	
\$ 48,420	\$ 75,000	
\$ 96,020	\$ 129,500	
\$ 144,440	divide by \$ 204,500	= 71%

Extremely high/low assessed values or sales prices will have the most effect on this measure.

- **Statistics summary** is found at the end of each study listing.
- **Statistics of central tendency**—Measures of the center, middle, or typical element in a grouping of data. **These tendencies measure or reflect the real market value level as represented by this group of data. Questions that could be answered by this information may be, "Are values at 100 percent of real market value?" and, "How much must the values be raised or lowered to bring them to 100 percent of real market value?"**

Median—the ratio value with the same number of ratios above as below. Listings that display sizable gaps near their center have unreliable medians.

Arithmetic mean—traditionally called the average. For listings, this is the sum of the ratios divided by the number of ratios.

Ratios of sales ÷ number of sales

$$(57+64+76+80+82+93+95+96) \div 8 = 80.375 \text{ rounded to } 80$$

The arithmetic mean is distorted by extremely high or low ratios.

Geometric mean—Similar to the median ratio which is not affected by extreme influences. The -nth root of the product of the ratios, where n is the number of ratios in the array.

0.791646 the "nth" root calculation*

0.79 Geomean

- **Statistics of distribution**—Methods for showing how values are spread out in the array. In the case of sales listings, distribution means "how far ratios are from a central tendency." Distribution is a reflection of the RMV levels and the relative stability of the market. Drawing conclusions about distribution from inadequate samples is extremely unreliable.

Frequency distribution—A visual aid used to display how the ratios are distributed; shows the concentration of ratios within certain brackets or intervals, which gives an indication of the degree of uniformity.

Average deviation—Average of the absolute differences between each ratio and the “median.”

Coefficient of dispersion (COD)—The average deviation from the “median” converted to a percentage. This measure of appraisal equity has taken on a greater role in the management of the appraisal program. Helps alert and guide the assessor as to uniformity of real market value levels and may direct decisions for revaluation or special studies.

Standard deviation—Measure of deviation from the arithmetic mean (“average”) for a normally distributed population.

Coefficient of variance (COV)—The standard deviation from the arithmetic mean (“average”) converted to a percentage.

Price related differential (PRD)—The measure of systematic differences in mass-appraisal value levels among properties in the same market area. The PRD is a statistical operation for measuring vertical equity. It is calculated by dividing the mean by the weighted mean. Optimally, appraisals made for property tax purposes would be neither regressive nor progressive. This statistical indication should be close to 100.

Regressive—When low-value properties are appraised at greater percentages of market value than high-value properties.

Progressive—When low-value properties are appraised at smaller percentages of market value than high-value properties.

PRD = arithmetic mean ÷ weighted mean

95 percent confidence interval—A test, if repeated many times. In 95 percent of such tests, the actual population mean will be in the indicated interval. This approximates the common interpretation that there is a 95 percent chance that the mean is in the specified interval. A narrow interval indicates that the mean may be taken as a reliable estimate of the correct figure.

$$\text{Confidence interval 95\%} = \text{mean} + / - \frac{1.96 \times \text{standard deviation}}{\text{Square root of (sample size)}}$$

Recalculated values—Not all RMVs are adjusted or indexed as described above. Specially assessed property, personal property, and many industrial properties are recalculated each year. This ratio study format does **not** report on values being recalculated. However, it does report on how RMVs will be adjusted for farm and forest deferred properties.

County map and maps of market areas as appropriate

Basic property class codes

1-0-0	Residential land only.	1-0-1	Residential property.
2-0-0	Commercial land only.	2-0-1	Commercial property.
3-0-0	Industrial land only.	3-0-1 Cnty	Industrial property county.
		3-0-1 DOR	Industrial property DOR.
4-0-0	Tract land only.	4-0-1	Tract property.
5-0-0	Farm & range land only, not specially assessed.	5-0-1	Farm & range property not specially assessed.
5-4-0	Non-EFU zone land, which is under special assessment by application.	5-4-1	Non-EFU zone farm and range property under special assessment farm use assessment by application.
5-5-0	EFU-zoned farm & range land only, specially assessed.	5-5-1	EFU-zoned farm & range property, specially assessed and market.
6-0-0	Forestland only, classified and specially assessed.	6-0-1	Forest property specially assessed and market.
6-4-0	Forestland only designated by application.	6-4-1	Forest property designated by application, specially assessed and market.
7-0-0	Multifamily land only.	7-0-1	Multifamily property.
8-0-0	Recreation land only.	8-0-1	Recreation property.
0-0-0	Miscellaneous land only.	0-0-9	Real property manufactured structures.
		0-1-9	Personal property manufactured structures.

Property class codes listing and description ORS 308.215 and OAR 150-308.215(1).

(If different than state property class codes, provide a cross-reference listing.)

Change (“time”) trend analysis

for the January 1, 20— Assessment Date

Suggestions of items to include:

- Trend studies:

Resales, regression, other

- Trend conclusions:

Residential, commercial, other

- Graphs:

Sales activity (monthly, quarterly, etc.)

Sales history

20 _____ County certified ratio study

Market area conclusions and adjustments

Property class/type: Market area name/number/code or unit type: _____

Location/description information: _____

ADJUSTMENT CALCULATION SUMMARY:

Sample size

Population of accounts/units number of sales approximate sample size _____%

Weighting calculations (for improved property types only)*

Values on roll	Prior year RMV sample or roll	Weight of sample or roll
Land	\$ _____	_____ %
On-sites	\$ _____	_____ %
Improvements	\$ _____	_____ %
Other (outbuildings)	\$ _____	_____ %
Total	\$ _____	_____ %

Ratio selections & adjustment factors	Ratios	Adj. factors
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Selected ratio from array:	_____	
Time trend factor:**		_____
RMV before ratio:	_____	
Overall adjustment factor:		_____
Land adjustment factor:		_____
On-site adjustment factor:		_____
Improvement adjustment factor:		_____
Other adjustment factor:		_____
After ratio:	_____%	

* Weighting calculations may be based on the market area roll population (% of land, on-sites, improvements and other outbuildings) or the sales listing sample (% of land, on-sites, improvements and other outbuildings). Some counties weight land and on-sites together and (or) improvements and other outbuildings together.

** If sale prices are not adjusted to the January 1 assessment date.

(continues on next page)

Selected ratio explanation: _____

Valuation history

Year last appraised _____

History	200__	200__	200__	200__	200__
Coefficient of dispersion (COD)					
Price-related differential (PRD)					

Date ____/____/____

Page _____

Sales listings and statistics

Sales ratio arrays in ascending order

Frequency distribution

Central tendencies and related statistics

Median

Average deviation

Coefficient of dispersion

Arithmetic mean

Standard deviation

Coefficient of variation

Weighted mean

Price-related differential

Additional measures of central tendency

Geometric mean

Mode

Appraisal/valuation plan for January 1, 20____ and/or 20____

Explanation of appraisal/revaluation activities planned for market areas not trended.

Other formats containing this information may be submitted.

Areas planned for appraisal/revaluation: _____

Reasons: _____

Objectives: _____

Method of appraisal: _____

Target performance measures: _____

