ESTANCIA BASIN GUIDELINES

FOR REVIEW OF WATER RIGHTS APPLICATIONS

OFFICE OF THE STATE ENGINEER

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PURPOSE

The purpose of this document is to provide guidelines to Office of the State Engineer (OSE) personnel on the procedures for processing water rights applications filed within the Estancia Underground Water Basin (Estancia Basin). These guidelines replace the guidelines adopted on June 20, 2002. The guidelines have been revised to allow shallow wells to be deepened into a lower Critical Management Area layer so wells may secure a long-term supply, to update the drawdown limit by taking into account well completion practices employed since 2002, and to apply the best practices developed since 2002 to ensure water rights are not impaired.

HISTORY

The Estancia Basin was declared by the State Engineer on January 31, 1950 with later extensions to the basin on March 28, 1975 and March 14, 1994. The Estancia Basin covers portions of Bernalillo, Santa Fe, Torrance and San Miguel Counties as shown in Figure 1. During the mid-1960s the State Engineer adopted basin criteria for the Valley Fill aquifer which allowed the depletion of a relatively large portion of the saturated alluvial sediments. The criteria allowed new appropriations of groundwater based on a block-inventory system. The criteria did not address the allowable drawdowns to the other aquifers in the basin or the allowable impacts to individual wells. During this time period portions of the basin experienced large rates of water level decline relative to available water columns in wells and the available saturated thickness of the aquifer.

In 2001 the agency finalized a multi-layered groundwater flow model for basin administration. On June 20, 2002 the State Engineer adopted new guidelines which evaluated water columns in basin wells and predicted declines due to existing water rights to define the allowable drawdowns in the principle aquifers. Procedures for the evaluation of local impacts to nearby wells were included in addition to the requirement that wells for new appropriation filed under NMSA Section 72-12-3 be rejected. In addition, the 2002 guidelines prevented the deepening of wells into a lower model layer that was designated as a Critical Management Area.

INTRODUCTION

The State Engineer adopts these administrative guidelines in order to promote the orderly development of water resources in the Estancia Basin while meeting statutory obligations regarding impairment, conservation of water within the state, and public welfare of the state. The guidelines are a reflection of the best practices developed by the OSE for this area over a number of years. However, due to the wide variety of physical conditions that may be encountered, guidelines may need to be applied on a case-by-case basis.

These guidelines apply to applications filed under NMSA 1978, Section 72-12-3, 72-12-7, 72-6-1 through 72-6-7, and 72-12-22 through 72-12-24. With the exception of Section I.E and Section I.I; the guidelines do not apply to the permitting of applications filed under NMSA 1978, Section 72-12-1.1, and 72-12-1.2. All domestic wells under NMSA Section 72-12-1.1 will be administered in accordance with the domestic well rules promulgated by the State Engineer and codified at 19.27.5 NMAC.

The guidelines apply to applications within the Estancia Basin proposing production from the Valley Fill aquifer, Madera Limestone, Abo-Yeso Formation, and the San Andres-Glorieta Formation. The Valley Fill aquifer is up to 400 feet thick and is composed of sand, gravel, clay, and silt but the thickness decreases to a feather edge along the margins of the aquifer. Up to 92 percent of the groundwater pumped in the basin is derived from the Valley Fill aquifer (Longworth et al., 2013). Water level declines up to 5 feet per year have been reported in the Valley Fill aquifer. The other formations in the basin consist of limestone, sandstone, and shale.

Block administration and local assessment methods are applied to prevent impairment. The regional groundwater flow model developed by Balleau Groundwater Inc. (1998) and updated by Keyes and Frost (2001) is available for block administration and may also be applied to assess local drawdown. The model grid is shown in Figure 1. Each groundwater model cell represents an administrative block. The model contains five layers. A 40-year period beginning in January 2018 and ending in January 2058 has been selected for block administration.

To protect water supply wells from excessive drawdown, domestic wells within the Estancia Basin which have been completed within the last forty years are assessed to determine the average water column. For basins with relatively thick aquifers, such as the Estancia Basin, domestic wells are examined as these are generally shallower than other wells and are the most prone to incur supply problems as water levels decline. Although other basin guidelines have examined

water columns within the last 10 years of guideline development, a 40 year period was chosen for the Estancia Basin as this provides a conservative approximation of the average domestic water column.

The average domestic water column in the Estancia Basin is 129 feet based on the New Mexico Water Rights Reporting System (NMWRRS) using wells completed after January 1979. If the allowable drawdown is assumed to be 70 percent of the average water column, a drawdown limit of about 90 feet is obtained based on the procedures presented in New Mexico Office of the State Engineer Hydrology Bureau Report 05-17 (Office of the State Engineer, 2017, Guidelines for the Assessment of Drawdown Estimates by Tom Morrison)[1]. This limit is equivalent to a rate of decline of about 2.00 feet per year over 40 years. The 2002 guidelines set a drawdown limit of 1.50 feet per year.

Modeling evaluations predict portions of the aquifer in the Estancia Basin will experience an average water level decline of 2.00 feet per year or more over the planning period due to the full exercise of existing permits and declarations. To protect water availability, for the exercise of all permits and declarations and all existing licensed or adjudicated water rights over the planning period, those groundwater model cells where the model predicts that water level declines will equal or exceed 2.00 feet per year require a greater protection compared to other areas and are designated Critical Management Areas (CMAs).

Since the Valley Fill aquifer and other underlying geologic units are in hydrologic communication with one another, once a groundwater model cell is designated as a CMA the other cells in the stack of layers also are designated as CMAs. All existing wells within the non-CMAs and CMAs may be allowed to be deepened into underlying formations if the drawdown effects do not exceed the local drawdown limits imposed by these guidelines and all other statutory requirements are met. The boundaries of the CMAs are shown in Figure 2.

Figure 2 provides a general representation of the boundaries of the CMAs by model cell. However, because the model grid and CMA boundaries do not align everywhere with Public Land Survey System (PLSS) sections, the model grid is used to accurately determine whether a given application is located within a CMA. The boundaries are defined by the geographic information system (GIS) layer (based on the model grid) that was used to produce Figure 2. The OSE Hydrology Bureau will maintain and provide both the model and the GIS layer of the boundaries

[1] Hereafter referred to as "OSE Drawdown Guidelines (2017)".

for use by OSE and the public.

No unappropriated water exists within the Estancia Basin by State Engineer order (adopted July 24, 2001). All applications filed under NMSA 1978, Section 72-12-3 for new appropriations will be rejected. In addition, changes in point of diversion from the areas outside of a CMA into a CMA will generally be rejected unless Section II.B.2 applies.

Preventing any level of new impact within a CMA is impractical, as this would result in the denial of all applications causing relatively small impacts. A drawdown allowance has been selected based on an average aquifer thickness (Valley Fill aquifer and underlying saturated rocks) of 400 feet or more to define the relatively small impact that may be allowed to occur on CMA cells by January 2058. Based on this thickness, each application may be allowed to induce an additional drawdown on CMA cells up to 0.10 feet per year times the number of years in the simulation period. The selected drawdown allowance is comparable to the values used for other basins. The simulation period starts January 1 of the calendar year in which the calculations are performed and ends January 1, 2058.

In summary, a groundwater model was used to estimate the drawdown in year 2058 due to the exercise of all permitted, licensed, adjudicated and declared amounts. If the average estimated rate of decline is 2.00 feet per year or more in any model cell, that cell has been classified a CMA and additional allowable impacts thereafter on that cell from any application should not exceed 0.10 feet per year times the number of years in the simulation period. In general, water rights may be moved within a CMA, or supplemental wells and additional points of diversion may be proposed, if the net effect on any CMA cell does not exceed an additional 0.10 feet per year times the number of years in the simulation period, and other statutory requirements have been met. However, water rights may not be transferred from outside of a CMA into a CMA unless Section II.B.2 applies.

For cells which have not been designated as a CMA at the time of application review, an application, in conjunction with the exercise of all permitted, licensed, adjudicated and declared amounts, may cause declines to reach an average rate up to 2.00 feet per year. If declines reach an average rate of 2.00 feet per year, an application may be allowed to induce an additional drawdown of up to 0.10 feet per year times the number of years in the simulation period. The total drawdown should not exceed 2.10 feet per year times the number of years in the simulation period.

In addition to block administration (Section II), applications are also evaluated to assess impacts to nearby wells for impairment determination and to assess whether a proposed well may

produce the quantity of water sought. This local area assessment (Section III) compares the total predicted drawdown to the allowable drawdown an existing well may tolerate. The total predicted drawdown for a well includes: drawdown due to the full exercise of all existing permits and declarations and all existing licensed or adjudicated water rights, drawdown due to the proposed use, and the dynamic drawdown (self-induced drawdown). The dynamic drawdown is compared to the allowable drawdown associated with a proposed well to determine if the well may produce the quantity of water sought (Section III.B.4).

The allowable drawdown is determined for each nearby well of other ownership by taking into account the completion characteristics of that particular well. Two drawdown constraints are considered: economical and physical. The constraint which is highest in a water column represents the allowable drawdown.

The economical drawdown constraint is assumed to be 70 percent of the initial water column as described in the OSE Drawdown Guidelines (2017). The physical drawdown constraint is controlled by the lowest practical pumping level. For existing non-domestic wells, the lowest practical pumping level will be assessed using the procedures presented in the OSE Drawdown Guidelines (2017). For existing domestic wells, the lowest practical pumping level should be at least 20 feet above the base of the lowest water bearing strata encountered by the well or lowest perforated interval, whichever is the highest in the column. Even if the total predicted drawdown results in a 40-year water level that reaches or exceeds the lowest practical pumping level, the application may nonetheless be permitted to induce an additional drawdown up to 0.10 feet per year times 40 years (4.00 feet). This drawdown allowance is allowed so that relatively small predicted effects do not necessitate a negative opinion. If a negative opinion is contemplated, other factors such as whether the existing nearby well can be deepened or is reasonably completed may be taken into account to assess impairment.

Nothing in these guidelines will limit the State Engineer's authority to take alternative or additional actions relating to the management of the water resources of the Estancia Basin as provided by New Mexico statutes, court orders, or regulations, orders or other directives of the State Engineer. Water right decision-makers may weigh other circumstances before rendering a decision as described in the OSE Drawdown Guidelines (2017). A glossary of abbreviations and terms is provided at the end of this document.

ESTANCIA BASIN GUIDELINES

I. GENERAL GUIDELINES

A. New Appropriations: Applications under NMSA 1978, Section 72-12-3 to appropriate water will be rejected. All domestic wells under NMSA 1978 Section 72-12-1.1 will be administered in accordance with the domestic well rules promulgated by the State Engineer and codified at 19.27.5 NMAC.

B. Critical Management Area (CMA): A model cell has been designated a CMA if predicted drawdowns equal or exceed an average decline of 2.00 feet per year over the 40 year period. A model cell may also be designated a CMA if average observed declines equal or exceed 2.00 feet per year over a 5 year period. Once a cell is designated a CMA the other cells within the stack of layers also become a CMA. The designation of a CMA cell is based on the assumption that all existing permits and declarations and all existing licensed or adjudicated water rights are exercised to their full extent. Designated CMA cells are shown in Figure 2. The OSE has the sole responsibility to determine the boundaries of the CMAs and may modify these as applications are processed or as new data become available. Additional CMAs may be designated if the predicted drawdowns equal or exceed an average annual decline of 2.00 feet per year over the simulation period, which extends from the year calculations are performed to January 2058.

C. Extensions of Time to file Proof of Beneficial Use: The provisions in this section will not apply to well permit applications filed and permits issued under NMSA 1978, Section 72-12-1, or to applications filed and permits issued for municipalities, counties, school districts, state universities, member-owned community water systems, special water users' associations and public utilities pursuant to the provisions of NMSA 1978, Section 72-1-9. All other existing well permits, and applications approved following the adoption of these guidelines, will be limited to no more than ten years from the approval date of the permit to file Proof of Beneficial Use. Permit conditions may allow up to four (4) years from the date of approval to file Proof of Beneficial Use. Any additional time needed requires application for an extension of time. NMSA 1978, Section 72-12-8.B allows the OSE to grant extensions of time for a period not to exceed three years for each extension. The following provisions will apply to all requests for extension of time:

1. At the end of four years, following permit approval, if the permittee has not placed the entire permitted amount to beneficial use, the permittee may submit an application for extension of

time. To be considered for approval, the permittee must provide evidence of progress made to put the amount permitted to beneficial use. Evidence of progress may include documents such as well records, meter records, receipts, or pictures of completed infrastructure and/or evidence of partial water rights being put to beneficial use.

2. If the permittee has not placed the permitted amount to beneficial use by the end of seven years following permit approval, the permittee may submit an application for extension of time. To be considered for approval, the permittee must provide evidence as described in Section I.C.1 of progress made to put the amount permitted to beneficial use. If no additional progress has been made the permit may be cancelled. Case-by-case considerations based on fact may be taken into account.
3. At the end of ten years from the date the permit was approved, the permittee should file proof of beneficial use. The OSE will evaluate the progress made to put the permitted amount to beneficial use. The permit may be cancelled if no proof has been submitted.
4. After verification of the proof of beneficial use, a license may be granted for the amount verified.

D. Changes to Existing Water Rights: The OSE determination of the amount of groundwater placed to beneficial use will be the limit of any subsequent permit. Applications may be accompanied with proof of the amount of water beneficially used. A farm delivery requirement (FDR) of 2.13 acre-feet per acre per annum and consumptive irrigation requirement (CIR) of 1.28 acre-feet per acre per annum will be applied (Wilson, 2001). The following limits will be applied:

1. For applications proposing to change the purpose of use of irrigation rights, diversions will be limited to the CIR times the irrigated acreage of the existing right placed to beneficial use.
2. For applications to change purpose of use of spread or stacked irrigation rights, diversions will be limited to the CIR times the irrigated acreage of the existing right placed to beneficial use. The irrigated acreage of the existing right is the acreage irrigated prior to the right being spread or stacked.
3. For applications proposing to change the place of use of irrigation rights, other than spread or stacked water rights, diversions will be limited to the FDR times the irrigated acreage of the existing right.

4. For applications proposing to change the place of use of irrigation rights, where water will be spread, diversions will be limited to the FDR times the irrigated acreage of the original right placed to beneficial use.
5. For applications proposing to change place of use of irrigation rights, where water will be stacked, diversions will be limited to the combined diversion amount.
6. For applications proposing to change the purpose of use from non-irrigation to irrigation, diversions will be limited to the amount placed to beneficial use.
7. For applications proposing the transfer of rights placed in a conservation reserve program, in accordance with NMSA 1978, Section 72-12-8, diversions will be limited to the amount placed to beneficial use prior to the date the water right was placed in the program.
8. For applications to deepen a permitted well, diversions will be limited to the permitted amount. For applications to deepen a declared well, diversions will be limited to the amount placed to beneficial use under the original right.
9. Guidelines for the assessment of groundwater leases and temporary transfers are presented in the OSE Drawdown Guidelines (2017).
10. Applications to change place or purpose of use (without changing the point of diversion) will be considered throughout the basin regardless of CMA designation.

E. Metering Requirements: Meters may be required for wells permitted under NMSA 1978, Section 72-12-1.1, 72-12-1.2, and 72-12-1.3, in accordance with OSE rules and regulations and orders of the State Engineer. All other wells permitted after the adoption of these guidelines will be required to be metered. All new permits issued for supplemental wells or other points of diversion will be conditioned to require metering of each point of diversion (existing and new) covered under the permit.

F. Conservation of Water: Applications will be reviewed to ensure a reasonable technology that is practically available and economically feasible for the intended purpose is used.

G. Supplemental Wells and Additional Points of Diversion: To evaluate the impacts of a well that will be used in conjunction with other wells associated with a permit, pumpage may be equally distributed among existing and proposed wells or a reasonable worst case distribution may be used if appropriate. A determination of whether a distribution is reasonable may be made by

estimating the potential well yield associated with a casing diameter (see Driscoll (1987), Table 13.1) and comparing this to the yield associated with the distributed pumpage. The yield associated with the distributed pumpage should assume 60 percent production time. The OSE may request additional information from the applicant on the pumping distribution. The maximum combined diversion from all authorized points of diversion will be the permitted diversion limit for a permit in good standing or the amount placed to beneficial use for a declaration.

H. Calculation Methods: General methods include:

1. Drawdowns due to a change in point of diversion will be estimated by calculating the water level decline difference (net drawdown) between pumping the move-from and move-to wells. Drawdowns due to supplemental wells and additional points of diversion will be computed by finding the net drawdown between the existing and proposed pumping configurations.

2. Calculations will be made by assuming full production of the requested diversion amount unless the applicant has filed a pumping schedule. If a pumping schedule has been proposed for the application, analyses will be performed in accordance with the schedule. If approved, the permit will be conditioned to limit pumping in accordance with the schedule or as the OSE otherwise determines necessary.

3. The diversion amount for non-irrigation purposes will be considered to be fully consumed unless the State Engineer has approved a return flow plan. For irrigation, the FDR times the irrigated acreage will be used as the diversion amount for proposed irrigation wells
4. Drawdowns due to the full exercise of permitted, licensed, adjudicated and declared amounts will be estimated using the numerical model developed by Balleau Groundwater Inc. (1998) as updated and modified by Keyes and Frost (2001) or other models approved by the OSE.
5. Applications involving dry model cells, or applications outside of the model boundary, will be assessed on a case-by-case basis.

I. Special Well Construction Provision: Due to poor water quality in some areas, all permits granted in the following described areas will have as a condition of approval a requirement that this water be cased off, in a manner acceptable to the OSE, so that it cannot commingle with other waters found in the basin: East ½ of Township 5 North, Range 9 East; East ½ of Township 6 North, Range 9 East; East ½ of Township 7 North, Range 9 East; East ½ of Township 8 North, Range 9 East; all of Townships 5, 6, 7, and 8 North, Range 10 East, New Mexico principal Meridian. An exception may

be made if additional water samples at the drilling site indicate the shallow water to be acceptable for irrigation purposes. OSE representatives will determine the casing and annular seal program necessary to protect known fresh waters. Throughout the basin, annular seals will be required to prevent inter-aquifer exchange of water, to prevent the loss of hydraulic head between hydrogeologic zones, and to prevent the flow of contaminated or low quality water (NMAC 19.27.4.30.A). Additional well construction provisions may be required by the OSE throughout the basin as needed (NMAC 19.27.4).

II. REGIONAL ASSESSMENTS

A. Restrictions for Wells to be Located Outside of a CMA: The following guidelines will be used if a proposed well is outside of a CMA.

1. An application, in conjunction with the full exercise of permits and declarations and all existing licensed or adjudicated water rights, may be permitted to induce drawdowns up to an average rate of 2.00 feet per year on any cell outside of the CMA.
2. If drawdown rates reach an average of 2.00 feet per year, an application may be permitted to induce an additional drawdown allowance of 0.10 feet per year times the number of years in the simulation period. The total drawdown should not exceed 2.10 feet per year times the number of years in the simulation period. The simulation period starts January 1 of the calendar year in which the calculations are performed to January 1, 2058. If the drawdown reaches 2.00 feet per year or more in a model cell as a result of an application, the cell will be designated a CMA if the application is approved.
3. For CMA cells existing prior to an application's evaluation, an application may be permitted provided the drawdown on these cells does not exceed an additional 0.10 feet per year times the number of years in the simulation period.
4. Applications to change point of diversion from a CMA to an area outside of the CMA will be considered.

B. Restrictions for Wells to be Located Within a CMA: For applications where the proposed well is within a CMA, the more restrictive of the following may apply:

1. Applications to move a point of diversion into a CMA from outside of a CMA will be rejected unless Section II.B.2 applies

2. If a permittee owns a primary, supplemental well, move-from well, or additional point of diversion within a cell outside of the CMA, which abuts a CMA, an application for a supplemental well, move-to well, or additional point of diversion within that CMA may be considered. Applications to move or add a point of diversion into an adjacent CMA may be allowed to induce an additional net drawdown in a CMA cell up to 0.10 feet per year times the number of years in the simulation period. Section II.A.1 and II.A.2 will also apply.
3. Applications to change point of diversion within a CMA, other than applications to deepen, may be allowed to induce an additional net drawdown in a CMA cell up to 0.10 feet per year times the number of years in the simulation period. Section II.A.1 and II.A.2 will also apply.

C. Administrative Model: Applications may be evaluated using the Balleau Groundwater Inc. (1998) model as updated and modified by Keyes and Frost (2001), or other subsequent model version selected by the OSE. Model files will be made available for inspection to the public upon request. Applications located in areas where the model is deemed inappropriate by the OSE will be evaluated on a case-by-case basis by applying the Theis equation or other OSE approved method. Observed field conditions may be incorporated in any such analysis.

D. Calculations: The following guidelines will apply:

1. The diversion from any individual well will be simulated from a single model cell and will not be divided among more than one cell. For applications where proposed wells will penetrate more than one layer, pumpage will be assigned to each layer penetrated by applying the following equations: $Q_i = (L_i/(L_i+L_j))*Qtotal$ and $Q_j = (L_j/(L_i+L_j))*Qtotal$

   Where Qtotal = total diversion (af/an), Q_i = diversion from layer i, Q_j = diversion from layer j, L_i = thickness of layer i (ft), and L_j = thickness of layer j (ft).

   Layer thickness may be obtained from the numerical model or by contacting the Hydrology Bureau.
2. Drawdown calculations will be performed by assuming diversions begin in January of the calendar year the calculations are performed to January 2058, unless an alternative schedule has been proposed by the applicant.
3. The rate of drawdown will be computed by dividing the net drawdown by the number of years between the year the calculations are performed and 2058. For applications where proposed wells will penetrate more than one layer, the greatest rate of drawdown for a given

layer will be used.

4. Effects due to existing non-domestic permits and declarations will be made by assuming full production of existing permits and declarations and all existing licensed or adjudicated water rights up to January 2058. If the OSE modifies the amount permitted or found valid, these modifications may be incorporated to update baseline estimates. The amount associated with the use of domestic wells permitted under NMSA 1978, Section 72-12-1.1 should be 0.50 acre-feet per annum unless other values are more appropriate. Stock wells under NMSA 1978, Section 72-12-1.2, and well construction under NMSA 1978, Section 72-12-1.3, should be assigned the pumpage permitted.

III. LOCAL AREA ASSESSMENTS

A. Water Level Decline Restrictions: Local area assessments will evaluate 40-year impacts on nearby wells of other ownership using the procedures in the OSE Drawdown Guidelines (2017) and the following guidelines:

1. Applications, in conjunction with the full exercise of all existing permits and declarations and all existing licensed or adjudicated water rights may be permitted to reduce water levels at existing well sites as follows:
    a. Up to 70 percent of the initial water column. The water column is generally calculated by subtracting the non-pumping water level from the well depth for wells that have screens and water bearing formations extending to the bottom of the well. For other wells, the base of the perforations or water-bearing formation, whichever is higher in the column, may be used as the lower limit of the water column. For wells penetrating multiple production zones, the base of the perforations or water-bearing formation, whichever is higher in the column, in the lower most layer should be used to compute the water column, unless another approach is more appropriate as described in Section III.B.7.
    b. For wells permitted under NMSA 1978, Section 72-12-1, the allowable physical drawdown should be at least 20.00 feet above the base of the perforations or base of the water bearing strata, whichever is higher in the column. An amount greater than 20 feet may be considered if supported.

c. For non-domestic well sites, the allowable physical drawdown will be assessed on a case-by-case basis using the procedures presented in the OSE Drawdown Guidelines (2017), or other OSE-approved method.

d. Other limits as deemed appropriate by the OSE.

2. If the limits in III.A.I are reached due to the use of existing rights alone, or in conjunction with the application, the application may nonetheless be permitted to induce a drawdown up to 4.00 feet over a 40 year time period (0.10 feet per year times 40 years).
3. The State Engineer presumes that pumping from a new replacement well drilled to the same depth as and within 100 feet of the old well will not impair existing water rights. This presumption may be tested by calculation.
4. A determination of whether a proposed well may produce the quantity of water sought will be made using the procedures in Section III.B.4 or other approved methods.
5. Decisions pertaining to local impairment will be made on a case-by-case basis. Failure to meet any limit may be sufficient for rendering a negative decision. Upon recommendation by the District Manager, the Director of Water Rights may also consider the factors presented on page 9 of the OSE Drawdown Guidelines (2017).

B. Calculations: The following methods will apply:

1. Applications will be evaluated on a case-by-case basis to assess predicted impacts to nearby water supply wells which are not owned by the applicant. Wells within the radius determined by using the Theis Inverse Model will be considered nearby. Regardless of their location, impacts to protestant wells will also be considered.
2. Local assessments may be performed using the Theis equation or the numerical model. The numerical model or the Theis equation may be used to estimate the 40-year impacts due to the full use of existing water rights.
3. Applications to deepen a well may be evaluated using the Theis equation or the regional model. The Theis equation may be used to evaluate drawdown for those existing wells within the pumping model cell. If existing wells in the pumping model cell are located in different layers, the composite transmissivity (T) may be computed using the following equations:

$$T = bk$$

$$k = \frac{k_i b_i}{b_{TOTAL}} + \frac{k_j b_j}{b_{TOTAL}}$$

Where:
T = composite transmissivity (ft^2/day),
k = composite hydraulic conductivity (ft/day),
Hydraulic conductivity: k_i = value in Layer i, k_J = value in Layer j
Thickness (ft): b_i = value in Layer i, b_j= value in Layer j.
$b=b_{TOTAL}$ = combined thickness of Layer i and j.

Layer thickness and hydraulic conductivity may be obtained from the numerical model or by contacting the Hydrology Bureau. The storage value for the upper layer should be applied. Other methods may be used as deemed appropriate by the OSE.

4. A determination of whether a proposed well may produce the quantity of water sought should be made using the Theis equation using the procedures in the OSE Drawdown Guidelines (2017). A radius of 0.50 feet and 60 percent of a day (864 minutes) for time should be used unless there is information to the contrary. The flow rate Q should represent the permitted diversion in gpm at 60 percent production time (Qgpm at 60 % = 1.03 x Qaf/yr). The drawdown computed represents the water level decline in the aquifer adjacent to the well. To obtain the drawdown inside the casing (dynamic drawdown), the drawdown obtained from the Theis equation should be divided by a well efficiency of 70 percent (0.70) unless there is information to the contrary. The dynamic drawdown is compared to the allowable drawdown to determine if the well can produce the quantity of water sought. In addition to applying the Theis equation, the water bearing formation yield obtained from a well log for a proposed appropriation may be used to determine whether a proposed well can produce the quantity of water sought. The formation yield in gpm should be converted to acre-feet per year and 60 percent production time should be assumed.
5. Aquifer parameters used to calculate drawdowns on nearby wells may be obtained from OSE-approved groundwater flow models or from reasonable site-specific information, including professional literature and records of the OSE.
6. Drawdown calculations will be computed for a 40-year period beginning at the start of the

calendar year the calculations are being performed.

7. When necessary, a determination of the available water column for a nearby well may consider the estimated yield for each water bearing formation identified in the well record and the required yield to fulfill the permitted amount. For example, the permitted diversion for a nearby well is 100 acre-feet annum (62 gpm at 60 percent production time) which has two water bearing formations. The casing is screened opposite the two formations. The reported potential yield (obtained from a well record) in the upper zone is 100 gpm while the reported yield in the lower zone is 10 gpm. The base of the water column should be the base of the upper zone. If the upper zone is dewatered the well cannot provide the quantity of water sought.
8. If a proposed well is located within a dry model cell the transmissivity should be estimated by assuming a 10-foot saturated thickness.

Adopted this 4th day of January 2021

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State Engineer

REFERENCES

Balleau Groundwater, Inc., 1998, Hydrologic Model of the Estancia Basin: Consultant Report.

Driscoll, F., G., 1987, Groundwater and Wells.

Keyes, E. and Frost, J, 2001, The Estancia Basin Ground Water Flow Model, OSE Model Design and Future Scenarios: OSE Report.

Longworth et al., 2013, New Mexico Water Use by Categories, 2010: OSE Technical Report 54, October 2013.

Office of the State Engineer, 2017, Guidelines for the Assessment of Drawdown Estimates: OSE Hydrology Bureau Report 05-17 by Tom Morrison.

Wilson, B.C., 2001, Estancia Groundwater Basin, Quantification of Irrigation Water Requirements: OSE Report.

GLOSSARY

Abo/Yeso Formation: The Abo geologic formation is predominately red sandstone and shale and is combined in the model with the Yeso geologic formation which contains beds of sandstone, limestone, siltstone and gypsum. These formations underlie a large part of the central basin.

Acre-foot: Quantity of water that will cover one acre of land to a depth of one foot; 43,560 cubic feet or 325,851 gallons of water.

Additional point of diversion: An authorized new point of diversion to an existing licensed or adjudicated water right, or a valid permit or declaration, not to exceed an amount authorized by the State Engineer.

Adjudication: A formal court proceeding that results in the determination of all elements of a water right claim. The Estancia Basin has not been adjudicated as of this date.

Allowable drawdown: The allowable drawdown is computed by taking into account the completion characteristics of each nearby well of other ownership. Two drawdown constraints are considered: economical and physical. The constraint which is highest in a water column represents the allowable drawdown.

Allowable physical drawdown: The difference between the current static water level and the lowest practical pumping level.

Application to change location (replace) of well: Application filed with the OSE requesting a permit to drill a new well to replace an existing well. The applicant must be the owner of the existing permitted or declared well.

Application to change place or purpose of use: Application filed with the OSE requesting to change the place of use of an existing water right from one location to another. For example, a water right holder proposes to stop irrigating a permitted place of use and start irrigating another place of use that is not included in the original water right with the same well. The application may also be used to change the purpose of use. For example, a water right holder proposes to change the purpose of use from farming to industrial use.

Application to change location of a well and place or purpose of use: Application filed with the OSE requesting to move or transfer a water right from one diversion point to another and to change the place and/or purpose of use. For example, a water right holder proposes to stop irrigating acreage from a well and proposes to drill a new well for subdivision purposes at another location.

Application to repair or deepen well: Application filed with the OSE requesting a permit to replace casing, deepen a well, re-perforate the casing or plug the well. Pump repairs, chemical treatments or casing scrubbing do not require an application to repair.

Application to supplement a well: Application filed with OSE requesting an additional well to be used in conjunction with an already permitted well for the diversion of the permitted amount of water. As well yields decline with declining water levels, supplemental wells often become necessary to replace the loss of yield necessary to produce the quantity of water sought.

Aquifer: A saturated underground geologic formation of permeable materials capable of storing water and transmitting usable amounts of water to wells.

Beneficial use: All uses that are beneficial to the public that are not wasteful.

Block administration: A procedure used in many areas of the state to administer water rights on a regional scale. An underground basin is divided into blocks or cells of land and guidelines are applied as a way of determining which applications should be approved or rejected.

Cell: A unit used in a numerical groundwater flow model that simulates part of an aquifer system. Aquifer properties, water levels and flows may vary from cell to cell, but are assumed to be uniform within a cell. Groundwater diversions and aquifer properties are assigned to each cell. Drawdowns are computed for each saturated cell and this information is compared to the guideline restrictions.

Consumptive Use (CU): The unit amount of water consumed on a given area in transpiration, building of plant tissue, and evaporated from adjacent soil, water surface, snow, or intercepted precipitation in a specific period of time. The term includes effective rainfall.

Consumptive irrigation requirement (CIR): The quantity of irrigation water expressed as a depth or volume per acre, exclusive of effective rainfall, that is needed to supply the crop consumptive use.

Critical management area (CMA): Model cells within the regional model boundaries requiring a greater degree of water level decline restriction compared to other areas.

Declared underground water basin: An area designated by the State Engineer in which the water of underground streams, channels, artesian basins and reservoirs or lakes, have reasonably ascertainable boundaries. Following the declaration of a basin by the OSE, applications must be filed to appropriate groundwater or to make changes to an existing water right.

Domestic wells: All wells permitted under NMSA 1978, Sections 72-12-1.l, 72-12-1.2 or 72-12-1.3.

Drawdown: The decline in the groundwater level over a given time caused by well diversions.

Drawdown allowance: The small incremental drawdown allowed on a CMA or individual

well. For the Estancia Basin, the drawdown allowance for a CMA is 0.10 feet per year times the number of years in the simulation period. A drawdown allowance of 4.00 feet over 40 years has been selected for individual wells where drawdowns exceed the economical or physical constraint.

Extension of time: An application asking for additional time to place waters to beneficial use including reasons for the request. Typically permits are conditioned to require proof of application to beneficial use to be submitted up to four years following the permit approval date. If the application of water to beneficial use cannot be filed within the specified time, an application for extension of time must be filed.

Farm delivery requirement (FDR): The quantity of water exclusive of effective rainfall, that is delivered to the farm headgate or is diverted from a source of water that originates on the farm itself, such as a well or spring, to satisfy the consumptive irrigation requirements of crops grown on a farm in a specific time period.

Glorieta/San Andres: The Glorieta aquifer is sandstone whose permeability comes primarily from fractures. The San Andres contains mostly limestone with solution cavities, and some fractured sandstone and siltstone; these formations are combined in the model.

Groundwater: Water located below the surface of the earth that is stored in pores of geologic sediments (sands and gravels), cracks and crevices of rocks (fractures) and solution cavities in limestone.

Groundwater diversion: The amount of groundwater withdrawn by wells.

Groundwater-flow model: A series of mathematical equations representing the water flow in aquifers in the area that are solved using a computer. Models are used to estimate the water level declines due to the use of wells.

Guidelines: A statement of general procedure to be applied in a specific area by OSE personnel to any application to ensure a consistent set of guiding principles is used to evaluate all applications. Due to the wide variety of physical conditions that may be encountered, guidelines may be applied on a case-by-case basis.

Impairment (underground water): A finding by the state engineer of an excessive negative impact to existing water rights based on water level decline and other relevant factors or facts.

Inactive model cells: Areas of the model grid that extend beyond the aquifer system being represented or where the aquifer is eroded away. These cells are not part of the calculation performed by the model.

Licensed water right: Final Proof of Application of Water to Beneficial Use has been filed by the permittee and the OSE has issued a *License to Appropriate.*

Local assessment: The determination and assessment of water level decline on water supply wells in the vicinity of a proposed well.

Move-from well: The well from which the water rights will be transferred.

Move-to well: The well to which water rights are being transferred.

New appropriation: A groundwater diversion permitted under NMSA 1978, Section 72-12-3.

Net drawdown: The difference in drawdown between the move-from and move-to well.

NMSA: New Mexico Statutes Annotated.

Pending application: Any application that was filed with the OSE but has not been acted upon.

Permit: An official document issued by the OSE authorizing the permit holder to use water in accordance with the conditions contained therein.

Pumping schedule: The diversion from a well or wells, as specified by application or permit, or as assumed in a regional or local assessment. May include a changing diversion rate with time for a given well, or diversion rates for multiple wells.

Return flow credit: A credit granted by the OSE for return flow for that amount of water directly returned to the same immediate source from which it was appropriated for non-irrigation purposes, after the water has been applied to beneficial use.

Return flow plan: A report based on factual and acceptable scientific measurements demonstrating return flow credit.

Saturated thickness: Vertical length of the underground zone in which the void spaces in the rocks and soils are filled with water. As water levels decline, the saturated thickness declines.

Spread irrigation water rights: Irrigation water on an acre of land that is less than the amount of water per irrigated acre associated with the average basin-wide CIR.

Stacked water rights: Irrigation water on an acre of land that exceeds the amount of water per irrigated acre associated with the average basin-wide CIR.

Supplemental well: A well that has been added as an additional point of diversion to an existing water right as authorized under 1978, Section 72-12-24.

Theis equation: An analytical method that calculates water level declines due to diversion of groundwater by wells using one set of aquifer parameters.

Theis inverse model: The Theis equation which allows the computation of other variables to the

equation. The model is typically used to compute the radius to the drawdown contour associated with a drawdown allowance. Impacts are computed for the wells within this radius.

Water column: The length of the column of water in a well that is potentially available for production.

Water right: The entitlement to withdraw and beneficially use a specific amount of water.

Well completion: The specific well construction information provided in a well record, such as the depth of a well, perforated interval, casing materials, surface seals, or other relevant data.

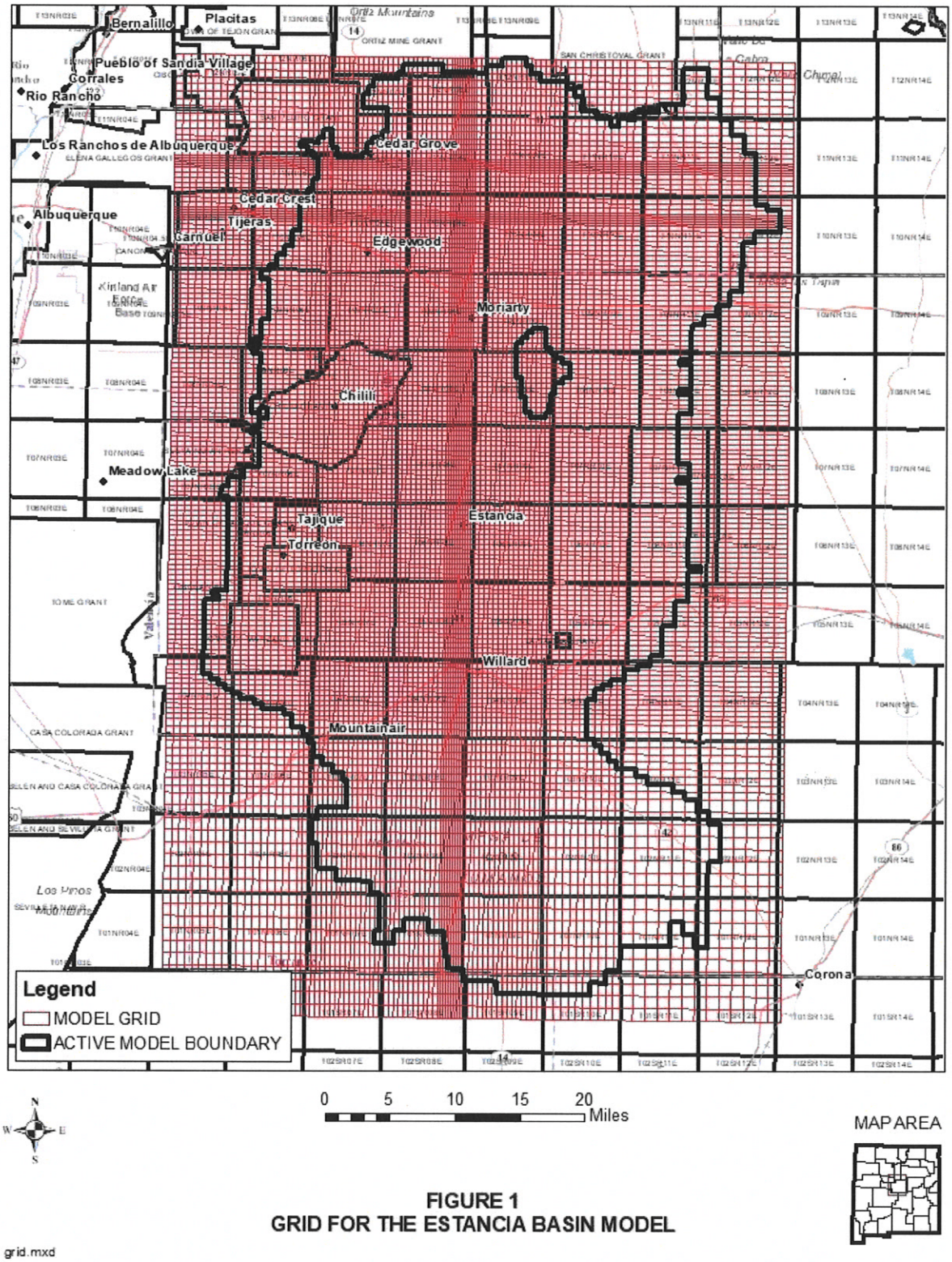

FIGURE 1
GRID FOR THE ESTANCIA BASIN MODEL

grid.mxd

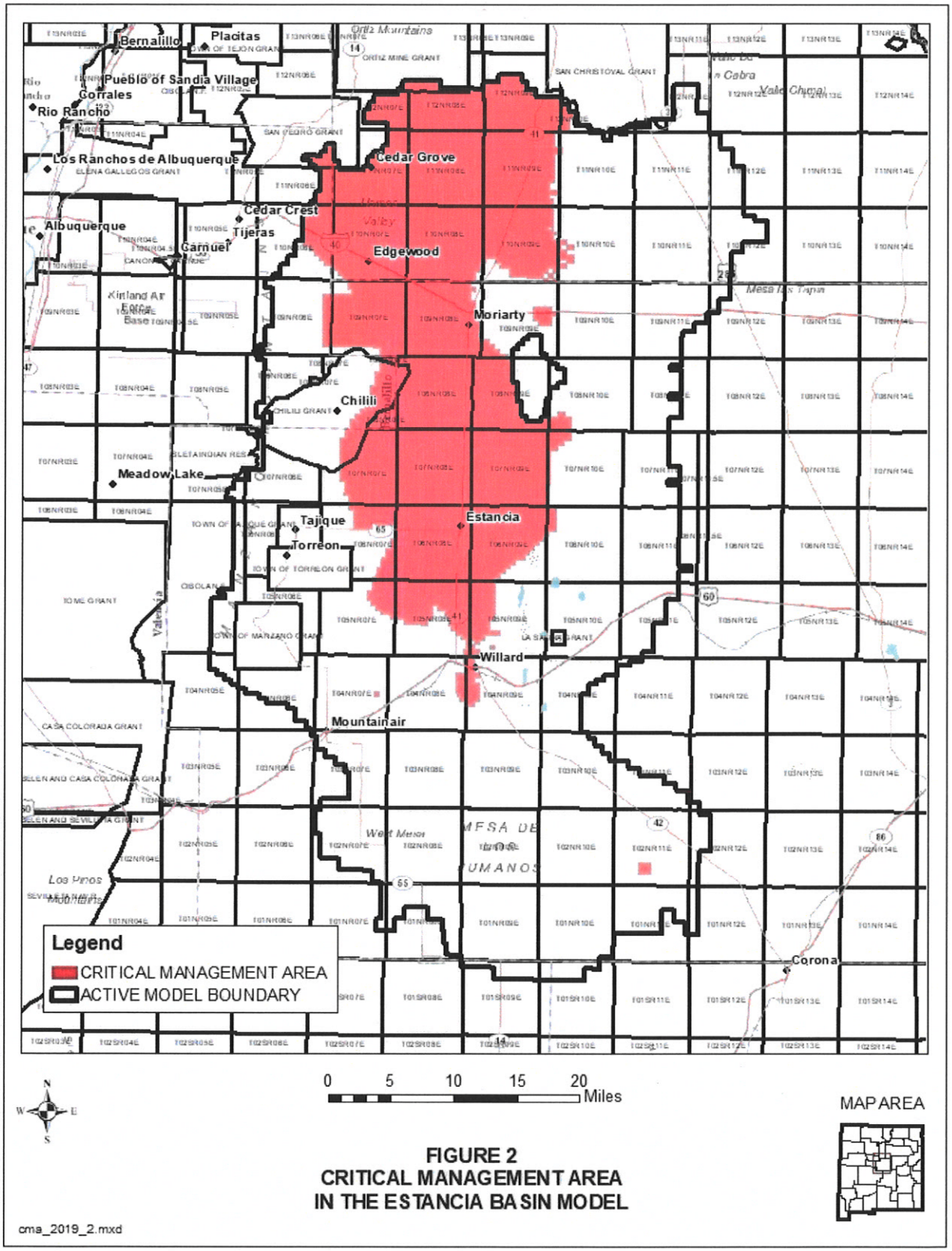

FIGURE 2
CRITICAL MANAGEMENT AREA
IN THE ESTANCIA BASIN MODEL

cma_2019_2.mxd