State of Idaho
DEPARTMENT OF WATER RESOURCES
322 East Front Street • P.O. Box 83720 • Boise, Idaho 83720-0098
Phone: (208) 287-4800 • Fax: (208) 287-6700 • Web Site: www.idwr.idaho.gov

C. L. "BUTCH" OTTER
Governor

GARY SPACKMAN
Interim Director

October 17, 2011

City of Eagle
C/O Bruce Smith
Moore, Smith, Buxton, & Turcke, Chtd.
950 W. Bannock Street, Suite 250
Boise, ID 83702

RE: Second Revised RAFN Evaluation for the City of Eagle in Connection w/ Application for Permit 63-32573

Dear Mr. Smith,

Mr. Jeffrey C. Fereday of Givens Pursley LLP has brought to the attention of the Idaho Department of Water Resources (Department) additional changes that are needed to the *RAFN Evaluation for the City of Eagle in Connection with Application for Permit 63-32573* (RAFN Evaluation) document dated October 4, 2011. The additional changes identified do not result in the modification of any projected RAFN values. Accordingly, the Department has updated the document to reflect the changes described and has hi-lighted them in yellow to make them obvious to reviewing parties.

The revised RAFN Evaluation document is attached with this letter for your reference. If you have any questions regarding this matter please contact John Homan or myself at (208) 342-4800.

Sincerely,

Mathew Weaver, PE
Staff Engineer

Encl.

Sent via electronic mail to:

Bruce M. Smith
Susan Buxton
Jeffrey C. Fereday
David Head
John Thornton
Norman Edwards
Alan Smith

IDAHO DEPARTMENT OF WATER RESOURCES

RAFN EVALUATION FOR THE CITY OF EAGLE IN CONNECTION WITH APPLICATION FOR PERMIT 63-32573

Table of Contents

Appendices

IDAHO DEPARTMENT OF WATER RESOURCES

RAFN EVALUATION FOR THE CITY OF EAGLE IN CONNECTION WITH APPLICATION FOR PERMIT 63-32573

June 1, 2011
Rev. October 4, 2011

PROJECT PURPOSE

M3 Eagle (M3) filed Application for Permit 63-32573 for 23.18 cfs of water for reasonably anticipated future water needs (RAFN). IDWR's hearing officer determined that M3 is not statutorily authorized to apply for a RAFN water right. The City of Eagle, however, can legally apply for RAFN water rights. In April of 2011 the City of Eagle emailed its separate *Reasonably Anticipated Future Needs Water Right Analysis* to a deputy attorney general working with Idaho Department of Water Resources (IDWR). Anticipating that M3 may assign Application for Permit 63-32573 to the City of Eagle, IDWR evaluated the City's estimate of its RAFN. This document describes IDWR's evaluation of the City of Eagle's RAFN analysis. IDWR's evaluation may also be useful for a second RAFN application that may be filed by the City of Eagle in the near future.

RAFN CONCEPT

Idaho law allows a municipal provider to secure water rights for RAFN purposes without relying on immediate diversion and use to establish beneficial use. For a qualified municipal provider, a RAFN estimate has four fundamental components:

- Service Area
- Planning Horizon
- Population Projections within the Planning Horizon
- Water Demand

IDWR's review of the City of Eagle's RAFN request addressed each of these four criteria. IDWR's overall review protocol is Appendix A. The protocol indicates that for Application 63-32573, the RAFN is the amount of water needed to serve the M3 area of the City over the planning horizon, up to 23.18 cfs. Water needed by the City to serve lands outside the place of use for application 63-32573 may be addressed in a second City of Eagle application.

Because the review protocol indicates the RAFN request in Application 63-32573 must be justified based on the M3 portion of the City of Eagle alone, IDWR reviewed M3's requirements as a separate part of the City of Eagle's requirements for each RAFN component.

For a second City of Eagle application, IDWR anticipates that the RAFN would be the amount of water needed to serve the City of Eagle's area of impact over the planning horizon, minus the M3 component of the City because it is addressed in Application 63-32573, minus populations served by Eagle Water

Company (EWC) and United Water Idaho (UWI), and minus populations associated with areas of overlap between the City of Eagle's planning areas and other municipality planning areas.

SERVICE AREA

Idaho Code § 42-202B(9) defines the service area for a municipality as follows:

> "Service area" means that area within which a municipal provider is or becomes entitled or obligated to provide water for municipal purposes. For a municipality, the service area shall correspond to its corporate limits, or other recognized boundaries, including changes therein after the permit or license is issued. The service area for a municipality may also include areas outside its corporate limits, or other recognized boundaries, that are within the municipality's established planning area if the constructed delivery system for the area shares a common water distribution system with lands located within the corporate limits. For a municipal provider that is not a municipality, the service area shall correspond to the area that it is authorized or obligated to serve, including changes therein after the permit or license is issued.

M3

The M3 portion of the City of Eagle's service area is the land it is authorized to develop in Sections 7, 15, 17, 18, 19, 20, 21, 22, Township 5 North, Range 1 East, and Sections 10, 11, 12, 13, 14, 15, 21, 23, 24, 26, 27, 28, and 33, Township 5 North, Range 1 West.

City of Eagle

The place of use described in Application 63-32573 is the M3 development, not the City of Eagle. In its *Reasonably Anticipated Future Needs Water Right Analysis,* the City of Eagle did not provide a map of its service area, but it appears to have used a combination of its area of impact and its North Eagle Foothills Planning Area. On April 12, 2011, the City of Eagle updated its comprehensive land use plan and included a map of its Water Service Planning Area. The Water Service Planning Area comprises, more or less, the area of impact and the North Eagle Foothills Planning Area. The City of Eagle's Water Service Planning Area is an appropriate service area. However, because both UWI and EWC provide municipal water supplies to customers within sub-areas of Eagle's Water Service Planning Area, their active service areas must be excluded from the area to be served by the City of Eagle. Similarly, the M3 area must be excluded because it is being evaluated as an independent piece of the service area. In addition, there are two areas along Highway 16 that are claimed by both the City of Star and City of Eagle in their Comprehensive Plans. Consistent with Idaho Code § 42-202B(8) any areas overlapped by conflicting comprehensive land use plans have been excluded from the City of Eagle's water service area. IDWR's review of the City of Eagle's service area is Appendix B.

PLANNING HORIZON

Idaho Code § 42-202B(7) defines the planning horizon for a municipal provider as follows:

> "Planning horizon" refers to the length of time that the department determines is reasonable for a municipal provider to hold water rights to meet reasonably anticipated future needs. The length of the planning horizon may vary according to the needs of the particular municipal provider.

IDWR contracted with economist Don Reading to evaluate whether the planning horizon for the City of Eagle is reasonable. Dr. Reading's evaluation of the planning horizon is in Appendix C.

M3

M3 submitted information for a development period of 30 years. A narrative description of M3's proposed water use (Attachment A) was included with the amended version of Application 63-32573. The following excerpt from the narrative discusses the anticipated planning horizon associated with the amended application package.

> *Full build-out of the Project is anticipated to take twenty years from the date the water permit is granted. However, because the exact date of full build-out can depend on a variety of factors, this Amended Application seeks a planning horizon of thirty years, which is well within a reasonable planning horizon for a municipal water right.*

City of Eagle

In its *Reasonably Anticipated Future Needs Water Right Analysis*, the City of Eagle also used a planning horizon of 30 years. Dr. Reading found that the City of Eagle's 30-year planning horizon could be considered reasonable and was consistent with the timeframes used by other planning entities. He also stated the longer the planning horizon the less certain are the forecast results. The key term in the RAFN is "reasonable." As the planning horizon increases, the gap between a high and a low "reasonable" population forecast increases.

POPULATION PROJECTIONS WITHIN THE PLANNING HORIZON

Idaho Code § 42-202B(8) indicates that RAFN should be based on "population and other planning data." IDWR contracted with economist Don Reading to evaluate population projections for M3 and the City of Eagle. Dr. Reading's evaluation of the population projections is also in Appendix C.

M3

Dr. Reading indicated that M3 is not likely to reach full build-out within 30 years from now. Due to current economic conditions it is unlikely meaningful construction will begin before 2016. M3 has not specified a start date for their project. Instead, M3 has simply numbered the construction schedule Year 1, Year 2, etc. Accepting their pace of construction and delaying the start date to 2016, the 30-year timeframe yields a population of 16,524 in 2040.

City of Eagle

Appendix B contains IDWR's evaluation of the current population base for the City of Eagle's service area. Using IDWR's evaluation of current population as a starting point, Dr. Reading evaluated the City of Eagle's population projections. Dr. Reading found the City of Eagle's population projection for its service area over the planning horizon to be 34,932, with M3 making up 16,524 of that total.

WATER DEMAND

Projected water demand, or water usage, is the final component of RAFN.

M3

M3 requested a diversion rate of up to 23.18 cfs to supply 6,535 AF annually. IDWR reviewed M3's assumptions and methods and suggests a diversion rate of 22.42 cfs to supply 6,535 AF annually. IDWR's evaluation of M3's water demand calculations is Appendix D.

City of Eagle

IDWR has reviewed the water demand component of the City of Eagle's RAFN analysis. Specifically the Department considered the City's overall methodology, proposed water demand per household (281 gpd), peaking factors (1.7 max day demand and 1.7 peak hour demand), and average persons per household value (2.7). IDWR has found the methods implemented by the City of Eagle to be reasonable. IDWR's evaluation of the City of Eagle's water demand calculations is Appendix F.

RAFN

A RAFN amount is justified by applying water usage projections to a projected population within a service area over a reasonable planning horizon. As described above, the first step is to determine if the M3 portion of the City of Eagle is sufficient to justify the full RAFN amount requested in application 63-32573. Here is a summary of IDWR's review of the RAFN components as applied to the M3 portion of the City of Eagle:

- Service Area — Within M3 PUD
- Planning Horizon — 30 years
- Population Projections within the Planning Horizon — 16,524
- Water Demand within the Planning Horizon — 22.42 cfs

The second step is to determine the future water needs for the remaining City of Eagle service area, minus the M3 portion, the EWC and UWI service areas, and areas of conflicting land use planning, to be pursued by the City in a future RAFN application. Here is a summary of IDWR's review of the RAFN components as applied to the non-M3 portion of the City of Eagle:

- Service Area — Water Service Planning Area minus M3, UWI, and EWC service areas, and Star overlap
- Planning Horizon — 30 years
- Population Projections within the Planning Horizon (34,932 – 16,524) — 18,408
- Water Demand — 3.08 cfs*(in-house demand only)
    - Number of households (18,138 people/2.7 people per household) = 6,818 .
    - Multiplied by 281 gal. per day per household = 1,915,796 gal. per day
    - Divided by 1,440 = 1,330 gal. per minute or 2.96 cfs (average daily demand)
    - Multiplied by a peaking factor of 1.7 = 5.04 cfs (maximum day demand)
    - Multiplied by a peaking factor of 1.7 = 8.56 cfs (peak hourly demand)
    - Minus the City of Eagle's existing water rights of 5.48 cfs = 3.08 cfs

These findings suggest that the City of Eagle's total RAFN is 25.50 cfs (22.42 + 3.08). Of the total amount, 22.42 cfs will be procured under the existing application 63-32573. The remaining amount of 3.08 cfs will need to be procured under a future RAFN application. The City will have an opportunity, if it chooses, to submit additional information at the hearing for application 63-32573 or in a future RAFN application, which could potentially support an increase to its RAFN.

IDAHO DEPARTMENT OF WATER RESOURCES

PROTOCOL FOR EVALUATING REASONABLY ANTICIPATED FUTURE WATER NEEDS FOR THE CITY OF EAGLE

MAY 23, 2011

PROJECT

The Idaho Department of Water Resources (IDWR) must evaluate the City of Eagle's estimate of its reasonably anticipated future water needs (RAFN) submitted in connection with Application for Permit 63-32573, which was originally filed by M3 Eagle (M3). IDWR also anticipates evaluating a second RAFN application that may be filed by the City of Eagle in the near future. This document describes a fundamental protocol for evaluating the City of Eagle RAFN application(s).

Idaho law allows a municipal provider to secure water rights for RAFN purposes without relying on immediate diversion and use to establish beneficial use. For a qualified municipal provider, a RAFN estimate has four fundamental components:

- Service Area (I.C. § 42-202B(9))
- Planning Horizon (I.C. § 42-202B(7))
- Population Projections within the Planning Horizon
- Water Demand

This protocol addresses each one of these four components in order, and then it describes how they will be used to evaluate the City of Eagle's RAFN application(s).

It is important to recognize at the outset that a conservative standard may be appropriate in estimating future needs to justify a RAFN water right. There may be a difference between the supply of water sufficient to sustain an urban population and the supply desirable to keep costs low or to provide aesthetic amenities. A determination by IDWR that a given projected use is not a reasonable component of an RAFN water right would not mean that the use could not be pursued under the statutory appropriation process for non-RAFN water rights.

SERVICE AREA

A municipal provider's service area is its "established planning area" (I.C. § 42-202B(9)) minus "areas overlapped by conflicting comprehensive land use plans" (I.C. § 42-202B(8)). For the City of Eagle, it is appropriate to use the area of impact adopted in the City's 2011 comprehensive plan, minus the land base overlapped by the City of Star's area of impact and any land base overlapped by areas of impact of any other communities. Because their contributions to the City of Eagle's water supply must be factored into the RAFN analysis, the portions of the City of Eagle area of impact served by Eagle Water Company (EWC) and United Water Idaho (UWI) must also be determined. IDWR Staff Engineer Mat Weaver will coordinate this component of the review.

PLANNING HORIZON

A municipal provider's planning horizon is the term of years over which it projects its population change and makes decisions based on its projection. The City of Eagle's RAFN estimate uses a 30-year planning horizon. IDWR has hired economist Dr. Don Reading to evaluate, among other things, whether a 30-year planning horizon is reasonable. Some items to consider include:

- The customary standards of practice for water infrastructure planning
- The original M3 full build-out projection (20 years)
- The City of Eagle comprehensive plan (25 years)
- COMPASS (25 years)
- M3's revised full build-out projection (30 years)
- The City of Eagle master water plan (no defined term)
- Treasure Valley CAMP (50 years)

If a 30-year planning horizon appears not to be reasonable, Dr. Reading will suggest an alternative planning horizon that is reasonable.

The Department must guard against over-appropriation of the resource and against speculative water right filings. Longer planning horizons increase the level of uncertainty associated with predicted values and must be considered with greater caution by the Department.

POPULATION PROJECTION WITHIN THE PLANNING HORIZON

To establish its RAFN, a municipal provider must estimate its future population within its service area at the end of the planning horizon. Because economic factors influence community development, economist Don Reading will also evaluate the City of Eagle's population projection. Dr. Reading will:

- Perform a critical survey of existing contemporary population studies applicable to the local area to establish likely upper and lower boundaries for population growth.
- Project population using standard technical methods, including regression, extrapolation, and cohort survival models. To make extrapolation appropriate, one should account for geography, resource constraints, economic conditions, and other limiting factors.
- Compare the results of the survey and the population projections to the City of Eagle's projected annual growth rate and apply his own professional judgment to evaluate whether the City's projection is likely to occur within the planning horizon and is, therefore, reasonable.

Because Application 63-32573 contemplates a specific place of use, Dr. Reading will also review the M3 Eagle Planned Unit Development within the City of Eagle to evaluate whether the projected population at full build out for the M3 Eagle component of the City is reasonable within the planning horizon. If Dr. Reading's evaluation suggests that the City's overall population estimate or the M3 population estimate is unreasonable, he will propose a reasonable estimate for the planning horizon.

Finally, Dr. Reading will also provide population estimates for those portions of the City of Eagle's service area that will likely be served by EWC and UWI for the reasonable planning horizon. A brief review suggests that currently the EWC service area is relatively densely developed whereas the UWI service area appears to have room for substantial population growth.

WATER DEMAND

There are a number of standard recognized approaches for forecasting water demand (i.e. RAFN) including judgment based predictions, time extrapolation, single-coefficient model development, multi-coefficient model development, and econometric demand model development. Of these, one of the most widely implemented approaches, and the one selected by the City of Eagle, is the per capita requirements method, which is a form of the single coefficient model approach. To determine RAFN utilizing this method, projected per capita or per household water demand must be applied to the estimated future population within the service area at the end of the planning horizon. Application 63-32573 proposes a total future water demand for the M3 development of 23.18 cfs. Mat Weaver will work with City of Eagle staff members to review and evaluate the City's methods for estimating future water demand. Mat Weaver will also review M3's methods for estimating water demand for its residential, non-residential, and irrigation components.

When evaluating water demand, IDWR will have to consider whether higher efficiency standards and water storage should be required in the future (I.C. § 42-203A(5)(f)). Efficiency and conservation measures, specifically the proposed recycling and reuse of wastewater for irrigation are already important components of M3's water demand projection.

RAFN

IDWR will apply its evaluation of the City of Eagle's service area, planning horizon, population projection, and water demand, to determine the City of Eagle's RAFN as follows:

- For Application 63-32573, the RAFN is either:

    1. the amount of water needed to serve the M3 area of the City over the planning horizon, up to 23.18 cfs, or
    2. if the M3 development alone does not justify 23.18 cfs, the amount of water needed to serve the M3 area and the remaining City of Eagle area of impact, minus the EWC and UWI service areas, up to 23.18 cfs.

- For a second City of Eagle application, the RAFN is the amount of water needed to serve the City of Eagle's area of impact over the planning horizon, minus the M3 component of the City because it is addressed in Application 63-32573, and minus the EWC and UWI areas.

For each permit issued by IDWR for RAFN, proof of beneficial use shall be due within five years of permit issuance, or within ten years of permit issuance if the Department grants an extension of time (I.C. § 42-204). When submitting proof of beneficial use, the permit holder shall be required to submit to IDWR a revised description of the service area, a revised planning horizon for the time that remains under the original planning horizon, and a revised estimate of its reasonably anticipated future needs (I.C. § 42-217). In connection with the proof statement(s), the permit holder shall submit a report showing the total annual volume, the maximum daily volume, and the maximum instantaneous rate of flow diverted from the authorized points of diversion. The report shall also show the extent to which the full system capacity necessary to provide water for reasonably anticipated future needs has been constructed and the extent to which planning, design, and investment have occurred for any unconstructed portion of

the system capacity necessary to divert and use water for reasonably anticipated future needs. When evaluating the permit holder's proof of beneficial use statement(s), IDWR will evaluate the information required to be submitted by the permit holder, including the revised service area, planning horizon, and RAFN information and the system capacity and water usage data (I.C. § 42-219).

MEMO (Appendix B)

TO: Shelley Keen

FROM: Mat Weaver

Date: May 31, 2011

RE: City of Eagle RAFN Analysis – Overview of applicable service areas and contemporary associated population bases

As part of the Idaho Department of Water Resources (Department) review of the City of Eagle's reasonable anticipated future needs (RAFN) analysis the Department must determine the following service areas and contemporary population bases.

- City of Eagle Service Area
- Eagle Water Company Service Area
- United Water Idaho Service Area

In my evaluation I was required to address the overlap in service area that exists between the service area boundaries of Eagle Water Company (EWC) and United Water Idaho (UWI) and the City of Eagle (CoE). I addressed this concern by developing what I have referred to as an "active service area". The term "active" refers to the area within the formal service area where water is either actually delivered to end users by the water service provider or it is proposed to be delivered in the future. Future delivery areas were only recognized if there was no conflict with other water service providers or municipality planning boundaries. I was able to determine active service area boundaries by meeting with EWC[1] and relying on their expertise to identify who provided water where in the areas of overlap. By isolating population bases with respect to active service areas the concern of double counting residents and thus skewing the total population numbers associated with any given service provider was avoided.

<u>City of Eagle Boundary Areas</u>

The City of Eagle's (CoE) current water service area appears to be an amalgamation of the City's currently adopted Area of Impact and the City's North Eagle Foothills Planning Area. In evaluating the service area boundary I have attempted to identify areas of overlap with other water service providers within the City (i.e. Eagle Water Company and United Water Idaho) as well as with adjacent municipalities. Municipalities that share planning boundaries with the CoE include Boise, Garden City, Meridian, and Star.

United Water Idaho (UWI) provides water to the City of Eagle as well as to the City of Boise. Review of UWI's service area as revised on 10-21-2010 indicates that there is no overlap between its water service area within the City of Boise and the CoE. This is to say, that no portion of the water service area for the

[1] Personal service area coordination meeting with Norm Revels, the Operations Manager for Eagle Water Company, on May 6, 2011.

City of Boise represents a conflict with the CoE water service area or other CoE recognized planning boundaries. Within the CoE there are large regions of overlap between the CoE water service area and UWI water service area. Based on my review of published planning documents and discussion with Eagle Water Company, I have isolated active service areas for both entities (CoE and UWI), which avoids the duplicate association of the underlying population with both entities.

Within the CoE there are also large regions of overlap between the CoE water service area and the Eagle Water Company (EWC) service area. Based on my review of published planning documents and discussion with EWC, I have isolated active service areas for both entities (CoE and EWC), which avoids the duplicate association of the underlying population with both entities.

My analysis of the City of Eagle service area also included review of the current water service area and planning boundaries for Garden City, the City of Meridian, and the City of Star. I found no conflict between Garden City and the City of Meridian planning boundaries. However, I did find a conflict in planning area overlap between the CoE and the City of Star. Consistent with Idaho Code §42-202B(8) any areas overlapped by conflicting comprehensive land use plans have been excluded from the City of Eagle's active water service area, which specifically applies to the overlap the City of Star and the City of Eagle. Included with this memo are four figures illustrating the results of my research and mapping efforts.

The first figure, Figure 1, depicts the declared City of Eagle water service area as adopted in the 2011 Eagle Comprehensive Plan. Also depicted in this figure are the areas of the Star Overlap, EWC active service area, and the UWI active service area.

Figure 2 depicts the CoE active service area, which represents the City's proclaimed service area less the regions of overlap established in Figure 1. It also depicts the 2010 census block population data associated with the active service area.

Figures 3 and 4 depict the active service areas for the EWC and UWI respectively. Also included in each figure is the respective 2010 census block population data.

US Census Data Breakdown

The following table summarizes the various population numbers associated with the boundaries previously discussed. Also included is the population within the City of Eagle city limits, as they existed at the time of the census. The population numbers are based on US Census Bureau data from the 2010 census as broken down by census block. Using ArcMap I was able to sum the population of all census blocks contained within a specific boundary. The population associated with a census block was included in the total population if the centroid of the census block shape was within the delineation boundary of concern. I then evaluated any census blocks that straddled the boundary line, either adding or subtracting population values as appropriate. For example, if the centroid of a census block shape was within the boundary, but some portion of the shape was outside of the boundary, I would count the

number of lots outside the boundary, multiply the lot count by 2.7 people per lot[2], and subtract that value from the total population. Conversely if a centroid were located outside the census block shape I would count the number of lots inside the boundary, multiply the lot count by 2.7 people per lot and add that value to the total population.

US Census Bureau - 2010 Census Data

Boundary Area Description	Population
Eagle City Limits	19,908
Declared City of Eagle (CoE) Water Service Area	24,035
Eagle Water Co. (EWC) Active Service Area	9,716
City of Eagle (CoE) Active Service Area	7,542
United Water Idaho Active Service Area	6,596
City of Star Planning Area Overlap	193

[2] The person per residence value of 2.7 is based on the value presented by the City of Eagle in their Reasonably Anticipated Future Water Needs Analysis prepared by Holladay Engineering Co. received by the Department on April 27, 2011 (pg. 7).

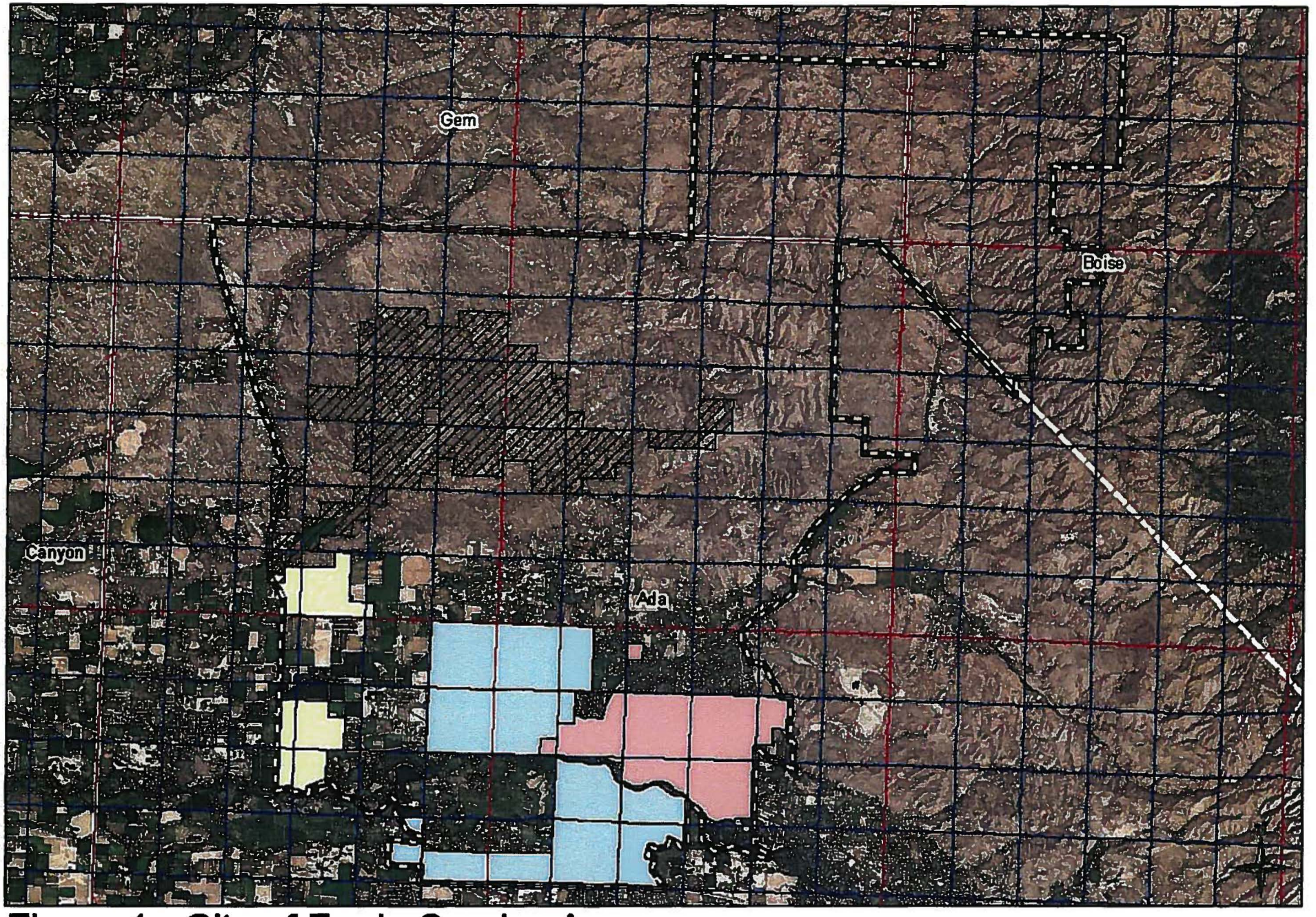


Figure 1 - City of Eagle Service Area

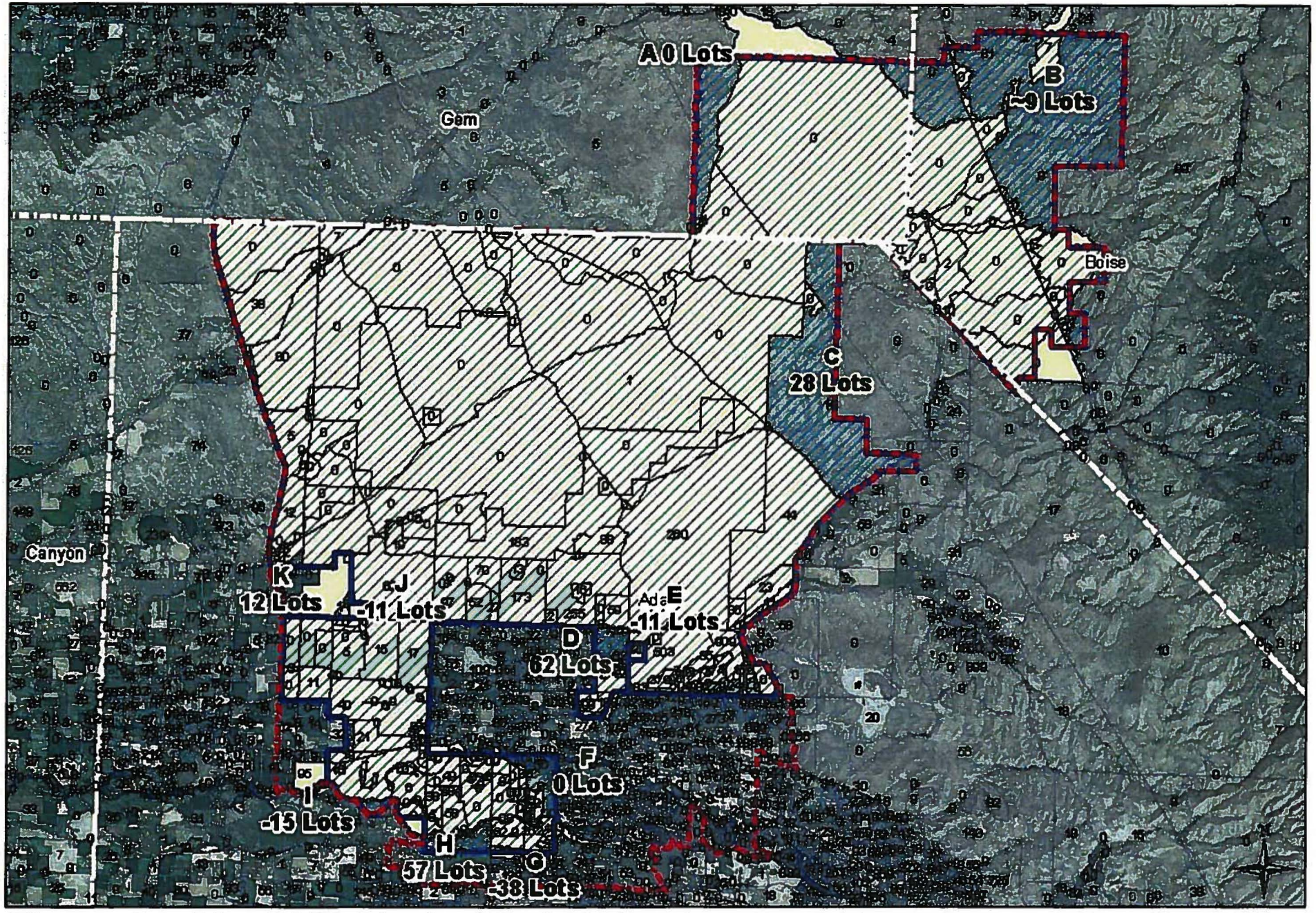


Figure 2 - City of Eagle Active Service Area

0 1 2 4 Miles

CoE WaterServiceArea
CoE ASA
CoE ASA Pop.
Idaho Census 2010

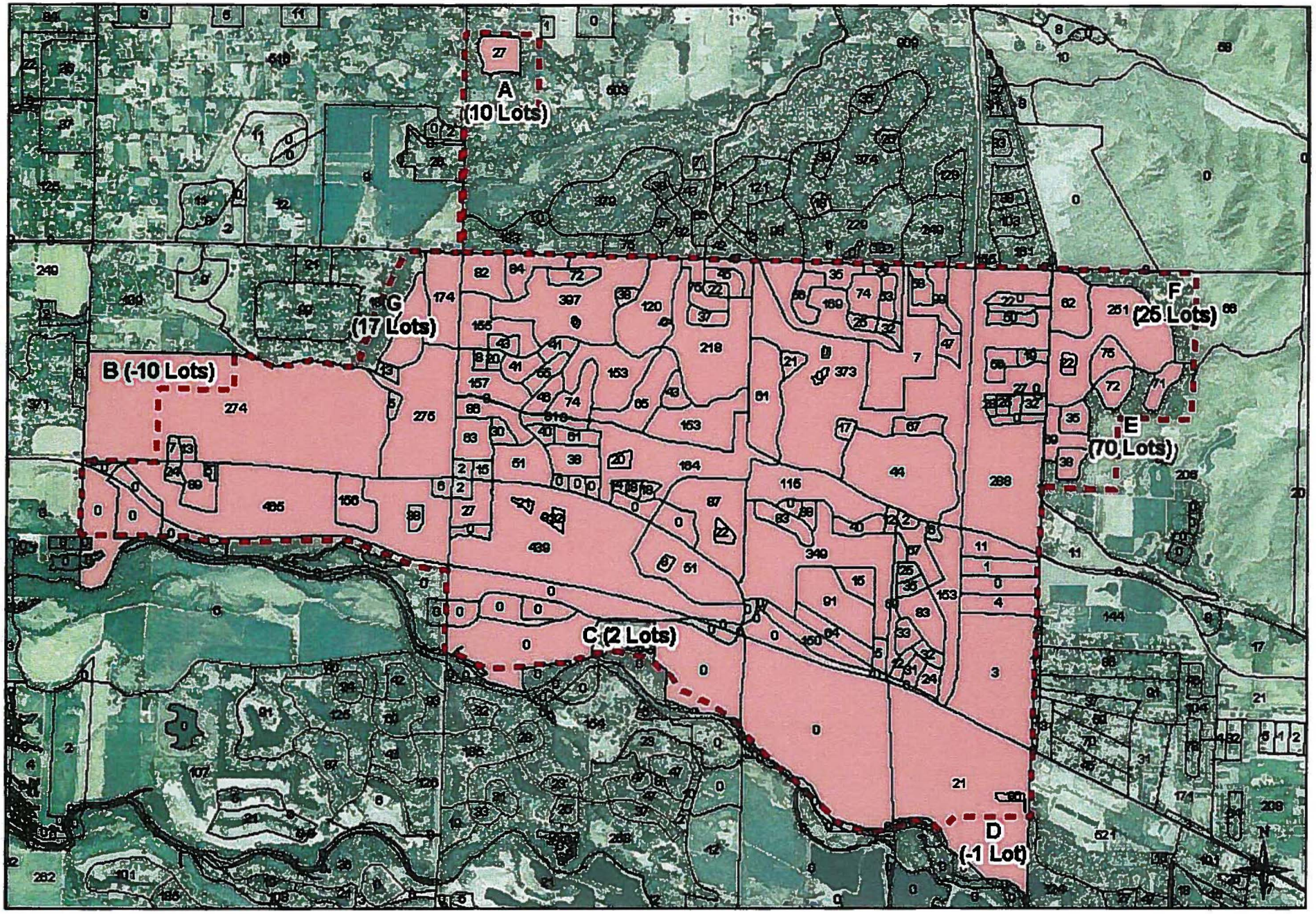


Figure 3 - EWC Active Service Area

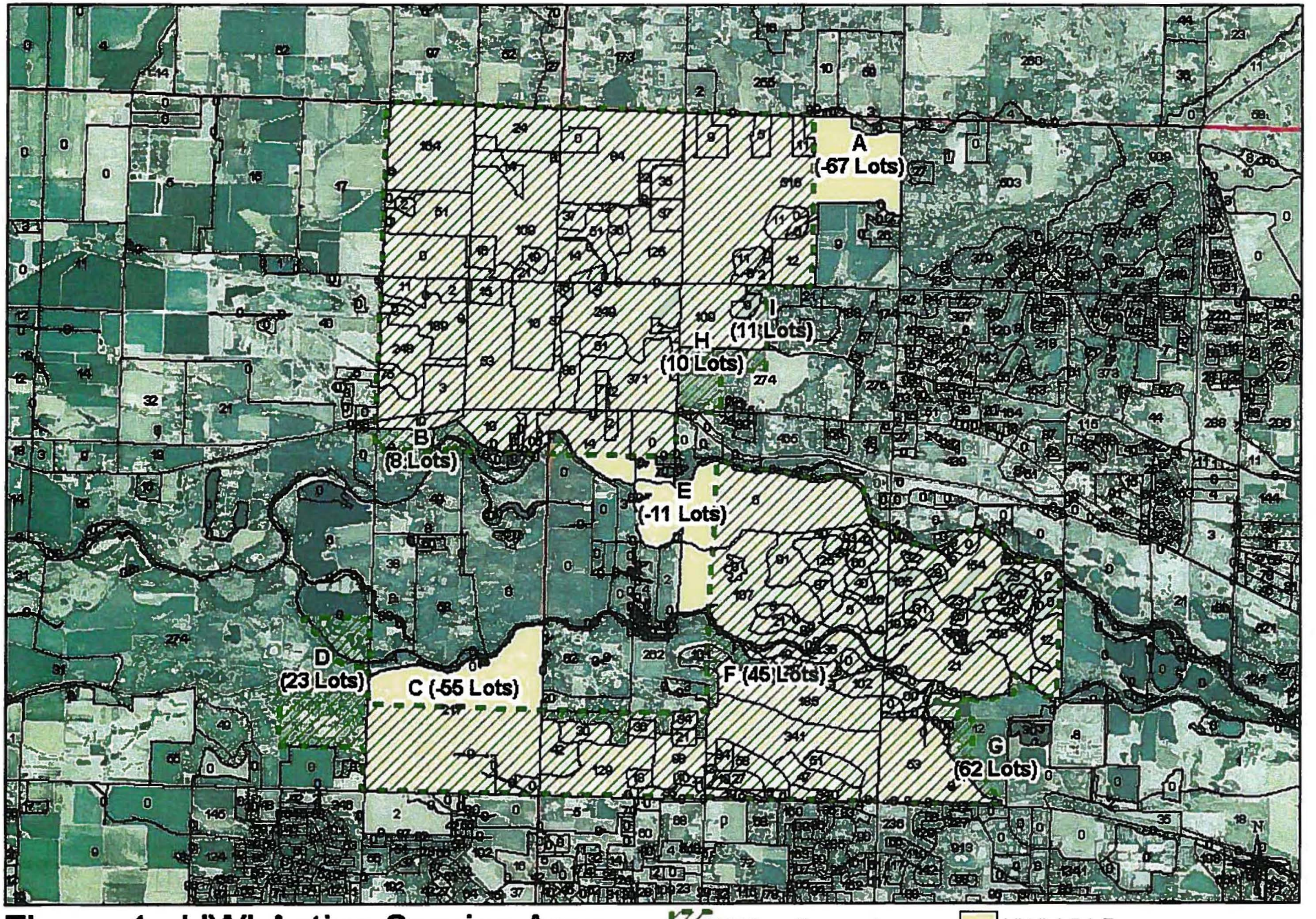


Figure 4 - UWI Active Service Area

APPENDIX C

Reasonably Anticipated Future Water Needs (RAFN) Population Forecast for Eagle, Idaho

Prepared for the Idaho Department of Water Resources by Dr. Don Reading

1) GEOGRAPHICAL SCOPE

Idaho statutes state that a municipality's water provider's service area is its "established planning area" (I.C. § 42-202B(9)) less any overlaps with other entities' comprehensive plans (I.C. § 42-202B(8)). The basis of the population forecast for the Reasonably Anticipated Future Water Needs (RAFN) of Eagle, Idaho (the City), is, therefore, the City's Planning Area less the population of the areas that overlap other entities' Planning Areas and the populations of the service areas of Eagle Water Company (EWC) and United Water Idaho (UWI) that lie within Eagle's Planning Area.

2) PLANNING HORIZON

As Table 1 demonstrates, planning horizons both for water providers and for Comprehensive Plans in general vary dramatically, from 10 to 55 years. The City of Eagle has one of the shortest planning horizons, with a 15 year population forecast.

Table 1: Survey of Planning Horizon Periods

Municipality	Planning Horizon (years)	End of Current Planning Horizon	Planning Document Type
Ada & Canyon Counties	25	2025	IDWR Water Demand Study
City of Coeur d'Alene	20	2019	Comprehensive Water Plan
City of Lewiston	20	2031	Master Water Plan
City of Meridian	50	2056	Master Water Plan
City of Nampa	20	2015	Master Water Plan
City of Pocatello	10	2016	Master Water Plan
City of Rexburg	50	2057	Master Water Plan
City of Twin Falls	30	2035	Water Supply Improvement Plan
Rathdrum Prairie Aquifer	50	2060	CAMP Water Demand Projections Study
Treasure Valley Aquifer	50	2060	CAMP Future Water Demand Study
United Water Idaho	55	2065	MAP Water Demand Study
Eagle Comprehensive Plan	15	2025	Comprehensive Plan (Population)
M3 Build out	20	N/A	Development Plan
M3 Build out	30	N/A	Development Plan

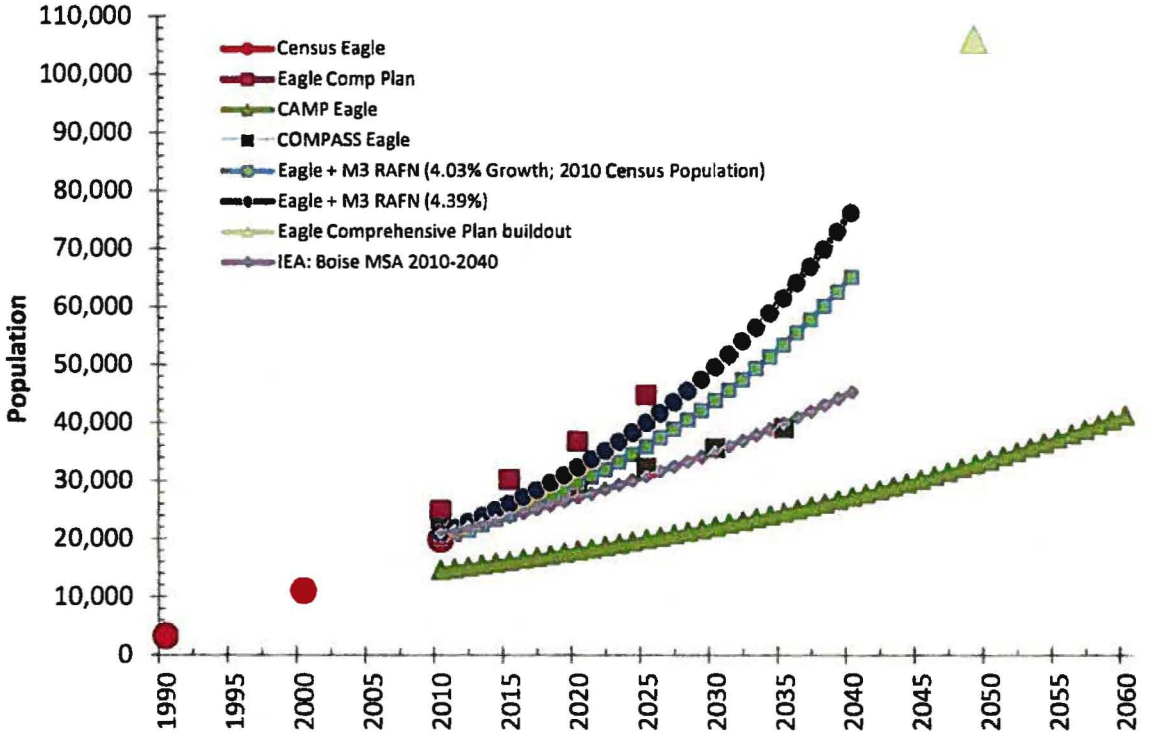
The planning horizons depicted above have an average of 31.8 years. Obviously, forecast uncertainly becomes greater as the planning horizon increases. The key term in the RAFN is 'reasonable.' As the planning horizon increases, the spread between a high and a low 'reasonable' population forecast increases.

The RAFN analysis submitted by Eagle has a planning horizon of 30 years (April 27, 2011). M3 has presented both a 20-year and a 30-year planning horizon, with no defined start year for either one. M3's economist stated that he believes full build-out can occur within a 20-year timeframe, and certainly within a 30-year timeframe, albeit without a specified year as a starting date for construction to begin. (Water Right No. 63-32573, M3 Eagle LLC, Contested Case Hearing, John Church, April 16, 2009) Both a 20-year and a 30-year population forecast are presented below and either could be considered 'reasonable,' with greater certainty for the 20-year forecast.

3) POPULATION FORECAST METHODOLOGY

To arrive at a population forecast for a given area, we first perform a survey of existing contemporary population studies applicable to the local area, and then establish likely upper and lower boundaries for population growth. The existing forecasts applicable for Eagle that we examined are depicted in Graph 1 below.

Graph 1: Eagle Idaho Population 1990-2010 & Existing Population Forecasts



Once these forecasts are analyzed for reasonableness, a variety of forecasting approaches can be used. These include regression, extrapolation, and cohort survival models. To make extrapolation appropriate, we must account for geography, resource constraints, economic conditions and other limiting factors.

The final step is to compare the results of the survey and the population projections to the City's projected annual growth rate. Because forecasting is an art as well as a science, we must apply judgment to determine whether the City's projections are likely to occur within the planning horizon and whether, therefore, they are 'reasonable.'

4) FORECAST ASSUMPTIONS

The 2010 U.S. Census is now available, and gives us 2010 populations for the City of Eagle and its Declared Water Service Area, as well as the service areas for EWC and UWI in Eagle. The following Table 2 summarizes these values along with the population associated with the area of overlap between the City of Eagle's and The City of Star's planning areas.

Table 2: 2010 Census Based Populations	
City of Eagle	19,908
Eagle Declared Water Impact Area	24,035
Eagle Water Co. (EWC)	9,716
United Water Idaho in Eagle (UWI)	6,542
City of Star Planning Area Overlap	193

The City of Eagle's RAFN Water Right Application indicates that they took the average of twelve annual growth rate forecasts and projected an annual growth rate for the City and its Planning Area of 4.39%. There is, however, what appears to be a mathematical error in the calculating of the average. Table 3 below lists the twelve growth rate projections that the City used and yields a simple average of 4.03%, not 4.39% as used in the RAFN.

The average of a set of annual growth rates as used by Eagle in its RAFN is not a valid statistical approach for several reasons. First, there is a mix of time periods included in the projections, ranging from one to 30 years. Forecasts that project growth for one year cannot statistically be compared with those projecting growth for up to 30 years, since there is a wide range of reliability depending on the time period used. Second, the population sizes vary widely and are not comparable to one another. Third, using the City's 2010 Census population of 19,908 not the 21,000 population assumed, its annual growth from 2000 to 2010 was 6.03%, not the 7.50% used in the RAFN. (Since a definitive 2011 population figure is not yet available, the actual 2000 to 2011 growth rate is not known.) Eagle used the COMPASS forecasts for 10 year growth rates rather than the 25 year forecasts available. For Eagle the 10 year growth rate is 3.0%, the 25 year growth rate is 2.3%. Finally, there are overlapping areas for some of the forecasts. For example, the COMPASS Region forecast includes forecasts for Boise, Kuna, and Eagle. Since forecasts for these cities are also contained in other forecasts included in the City's average, the result is double counting.

Table 3: 'Table 1: Average Annual Growth Rates, Draft RAFN	
Eagle Actual 1990-2000	13.00%
Eagle Actual 2000-2010	7.50%
Eagle Actual 2010-2011	1.30%
Eagle Comp Plan 2007-Buildout	4.00%
Compass -CIM:2010 Eagle 2010-2020	3.00%
Compass -CIM:2010 Region 2010-2020	2.76%
Compass -CIM:2010 Boise 2010-2020	1.50%
Compass -CIM:2010 Kuna 2010-2020	6.10%
Moody's Analytics 2011-2014	2.20%
State of Idaho 2011-2014	1.65%
Idaho Economics Annual (Boise MSA) 2010-2020	2.70%
Idaho Economics Annual (Boise MSA) 2010-2040	2.60%
	4.03%

5) FORECAST APPROACH

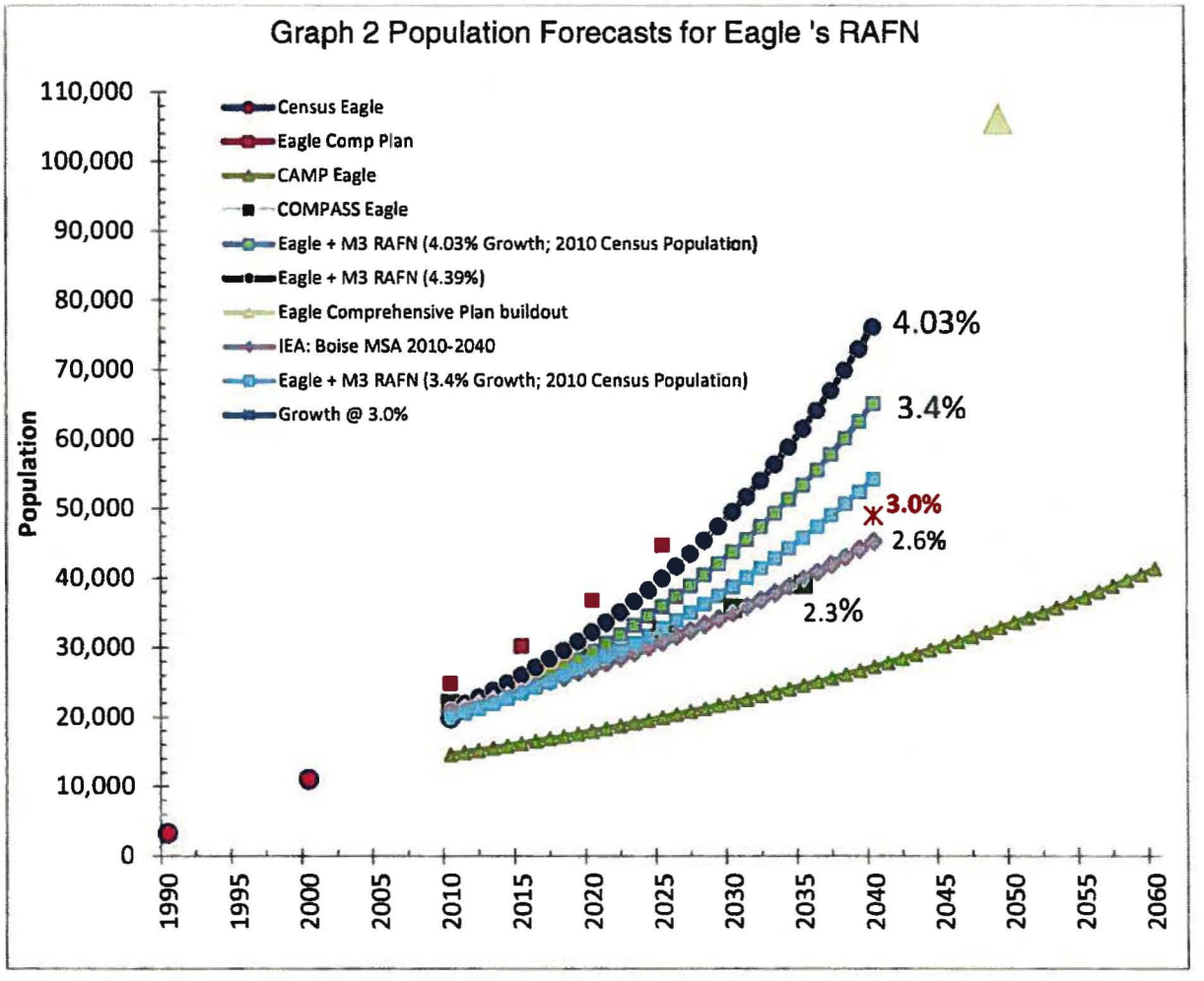
The base used for the population forecast is Eagle's 2010 population for the Declared Water Service Area, which is 24,035 (see Appendix B). From this base, we subtract the populations of EWC's service territory and the portion of UWI's service territory in Eagle, and the overlap of the City of Star's Planning Area, yielding a 2010 population of 7,584 (24,035-9,716- 6,542-193=7,584).

To determine a growth rate, we considered the high and low reasonable forecasts and took the midpoint.[1] As depicted below in Graph 2, a 3.0% growth rate is the midpoint between a high forecast of 3.4% and a low forecast of 2.6%. The low forecast is the annual growth rate found in the Idaho Economics Annual Boise MSA forecast for the 2010-2040 period. The high of 3.4% was obtained by averaging four of the longer range forecasts from the same sources selected by Eagle in their RAFN, as shown in Table 4 below.

Eagle's Comprehensive Plan forecast and the RAFN forecasts of either 4.39% or the corrected 4.03% are unreasonably high for the reasons given above. The Camp Eagle forecast is unreasonably low because its 2010 population assumption of 14,643 is 5,265 less than the actual 2010 population, yielding a relatively low growth rate of 2.1%.

[1] A simple linear regression was molded for Eagle's 1990 to 2010 population growth and yielded a 2.82% annual growth rate with an adjusted R2 of .997 and t-stat of 26.9, meaning it was highly significant.

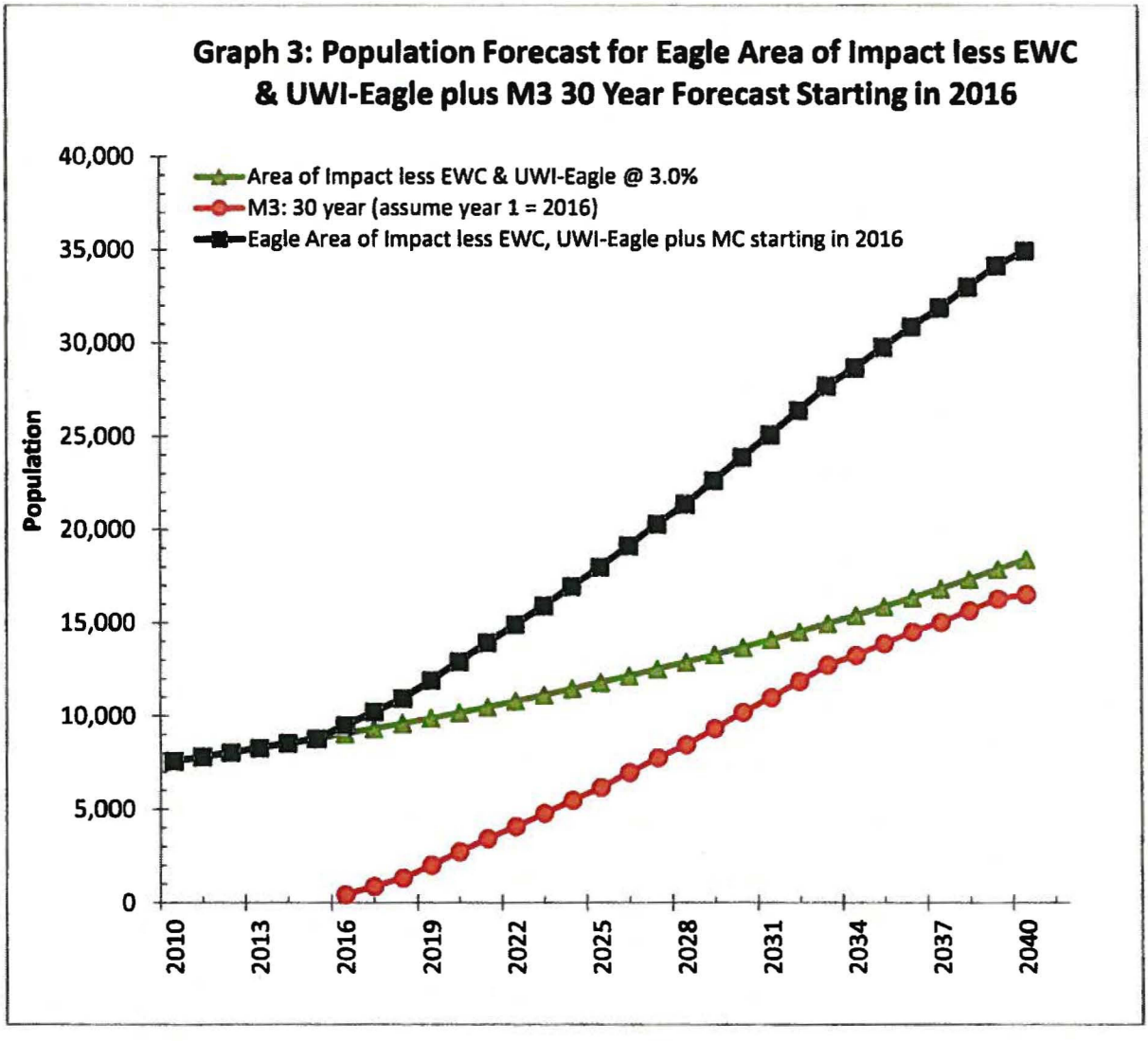
Table 4: Upper Bound Growth Rates	
Eagle Comp Plan 2007 (2025 population)	4.00%
Compass -CIM:2010 Eagle 2010-2035	2.34%
COMPASS-COM 2010 Kuna 2010-2065	4.54%
Idaho Economics Annual (Boise MSA) 2010-2040	2.60%
	3.37%



A critical issue with this analysis is estimating when and how fast the M3 development will develop. M3 does not specify a year they expect their projected development path to begin. Current economic conditions and the oversupply of both residential properties and vacant commercial space (discussed below) undoubtedly mean a delay in M3's timetable for development. Full utilization of the oversupply does not appear likely for some years. For that reason, M3's 30-year build-out scenario as used in this forecast is assumed to begin in 2016. Actual initiation could occur before 2016 or later, but 2016 appears to be a reasonable date for the purposes of this analysis. From 2016 forward, M3's population forecast is based on the developer's assumptions about the pace of building. Future population for M3 is dependent on its development pace that will in turn depend on changing market conditions. While M3's original population

assumptions are optimistic, it is reasonable to assume that a planned community such as M3 that starts essentially from a population base of zero will have a higher percentage growth rate once development resumes. A planned community such as M3 may experience a higher growth rate than other areas of the City because development is organized under a single ownership with a marketing approach that exclusively targets investment within the planned community. Consequently, it appears to be a reasonable assumption that the development will proceed when the economy recovers and the current oversupply of residential and commercial buildings is absorbed by the market.

Graph 3 below depicts the results of the forecast for Eagle's planning area less the population in the Star overlap, the EWC service area, and the UWI service area in Eagle plus M3's population forecast beginning in 2016.



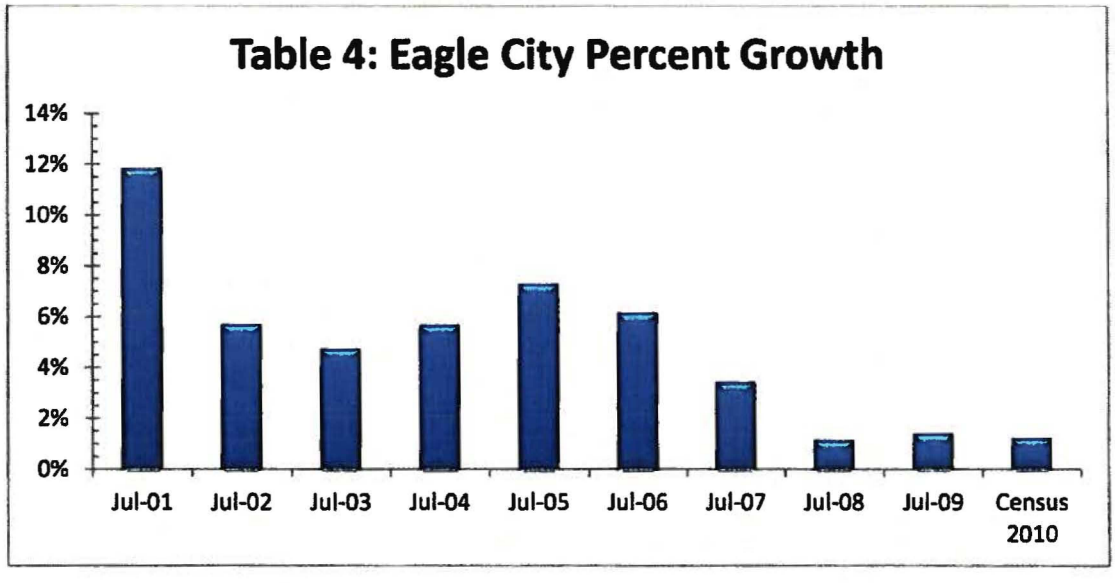
The resulting populations found in the forecast for a 20-year and a 30-year build-out are shown in Table 5 below.

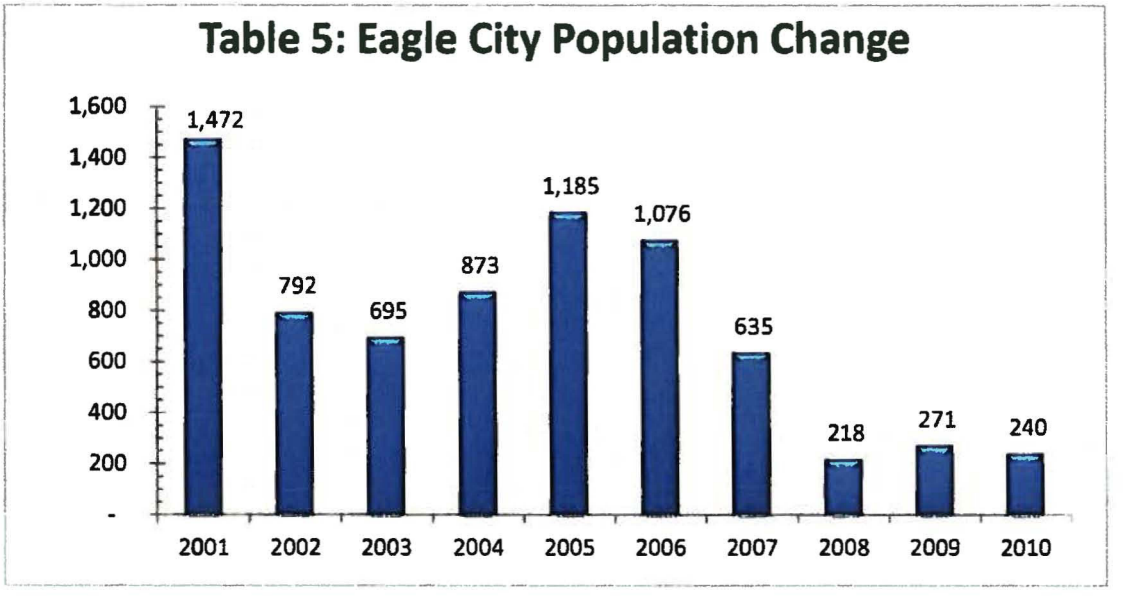
Table 5: Eagle Population Forecasts			
YEAR	Area of Impact less EWC & UWI-Eagle @ 3.0%	M3: 30 year (assume year 1 = 2016)	Eagle Area of Impact less EWC, UWI-Eagle plus M3 starting in 2016
2030	13,698	10,210	23,908
2040	18,408	16,524	34,932

6) CURRENT ECONOMIC CONDITIONS

Over the next 20 to 30 years it is realistic to assume that the economy will recover from the worst economic downturn since the Great Depression. What is uncertain is the pace and timing of the recovery. How soon and how vigorously various sectors of the economy recover will affect the level of population many years from now.

The 3% compound growth assumption used in this forecast is optimistic given current economic conditions. As shown in Graphs 4 and 5 below, population growth in Eagle has slowed dramatically since 2005 and especially in the past three years.





The average growth rate for the City of Eagle for the past three years was 1.3%, adding an average of less than 250 persons annually. The use of compound growth rates over a long period of time implies an ever-increasing number of people added to the population each year. Eagle's RAFN projected a population increase of 922 people for 2011 over 2010, and an additional 3,205 for the year 2040 over 2039.

The Treasure Valley currently has an overstock of residential housing, commercial space, and approved developments that will slow the pace of new development as the economy recovers. According to CoreLogic, Idaho's drop in home sale prices led the nation and were twice the national average in April 2011. In Ada County, there were about 2,000 homes on the market in January 2011.

There is also a high vacancy rate for commercial property in the Treasure Valley. According to Thornton Oliver Keller's 2010 Market Report, Eagle's vacancy rate for office property was 22.4%, for industrial space 20.1%, and for unanchored retail space 27.1%.

The current economic doldrums in Southwest Idaho will affect the rate of population growth. This means that whatever growth rate is used, the near term will no doubt be slower than the average projected over a 20- or 30-year period. It also means that the slower growth in the early years will not necessarily be made up in the later years of the forecast resulting in a lower population estimate at the end of the forecast.

MEMO (APPENDIX D)
TO: SHELLEY KEEN
FROM: MAT WEAVER
DATE: JUNE 8, 2011

RE: DEPARTMENT OF WATER RESOURCES (DEPARTMENT) REVIEW NARRATIVE AND COMMENTS REGARDING THE WATER DEMAND ANALYSIS ASSOCIATED WITH THE M3 EAGLE DEVELOPMENT PERMIT APPLICATION (63-32573)

My analysis included review of the second amended application for permit 63-32573 including Attachment A (narrative) and Exhibit 5.7 (M3 Eagle Water Demand at Build-Out, Based on Projected Uses Spreadsheet Revision Date: January 31, 2008). The focus of my review comments are on Exhibit 5.7 as this represents the spreadsheet document that calculates and details the disaggregate water demand approach used to derive the requested diversion rate and storage volume.

Exhibit 5.7 Review Comments

1. Row 8: M3 proposes an irrigation season from 3/15-11/15 (244 days). The Department's "season of use" map indicates that the M3 property is bisected by two different seasons, 3/15-11/15 and 3/1-11/15. It is reasonable and conservative to use the 3/15-11/15 season, utilization of this season provides a smaller estimate of irrigation requirement than if you used a 3/1-11/15 season length or an average of the two seasons.
2. Row's 11 and 12: M3 proposes a turf irrigation efficiency of 80% and a drip irrigation efficiency of 90%. These values are reasonable assumptions and consistent with existing Department references (Hubble 1991).
3. Rows 13-16: M3 has proposed surface areas and average depth values for a series of proposed aesthetic, operational, and winter storage ponds. The total volume of the ponds in Exhibit 5.7 (1,828 AF) is approximately equal to the storage volume requested by the application (1,836 AF).
4. Rows 26-29: M3 uses published evapotranspiration (ET) values for alfalfa from Allen and Brockway (1983) to estimate the irrigation requirement for the landscaping associated with the development. The proposed weighted average daily ET rate (0.014 ft/day) is reasonable and less than weighted average daily ET values that are calculated using the same method but relying on contemporary ET data from ET_Idaho for alfalfa (0.0151 ft/day), grass-pasture (0.0147 ft/day), or turf (0.0153 ft/day) (Allen and Robison 2009). However, it would be more consistent with current Department practice and guidance to rely on ET data from ET_IDaho (Allen & Robison 2009).
5. Rows 43-49: M3 proposes an average of 2,000 square feet of sprinkler irrigated landscape and 1,500 square feet of drip irrigated landscaping per single family residential lot (n = 5,216). This equates to 26% and 20% of the total lot area respectively and requires about 0.32 AFA of water per residence dedicated to irrigation. These values do not seem overly high or contrary to other residential subdivisions within the Treasure Valley[1]. However, these values may be high in light of M3's goal to maximize water conservation principles within the development, with specific reference to *"mandating xeric landscaping and minimal lawn sizes"* (WR Application Attachment A pg. 4).

[1] For comparison consider the Treasure Valley Future Water Demand study, which identified a range of 2-4 AFA of water per residence as typical for domestic irrigation in the Treasure Valley (WRIME 2010).

6. Rows 51-56: M3 proposes an average of 750 square feet of sprinkler irrigated landscape and 500 square feet of drip irrigated landscaping per single family and multi-family attached residential lot (n = 1,937). M3 indicates that these values are based on 1/3 of single family residential lot requirements; however, 750 square feet of sprinkler irrigated landscaping is 37.8% of the value used for single family, not 33%. M3's proposal equates to approximately 0.12 AFA or water per residence dedicated to irrigation. Once again, although somewhat arbitrary, these values do not seem overly high or contrary to other residential subdivisions within the Treasure Valley. However, these values may be high in light of M3's goal to maximize water conservation principles within the development, with specific reference to *"mandating xeric landscaping and minimal lawn sizes"* (WR Application Attachment A pg. 4).
7. Rows 58-63: M3 proposes that 5% of the total 245 acres planned for commercial development will require irrigation, with 25% of the irrigated area receiving sprinkled irrigation (3.06 acres) and 75% of the irrigate area receiving drip irrigation (9.19 acres). In general, for new commercial development the City of Eagle's planning and zoning ordinances require a minimum landscaping area of 10% of the total developed area[2]. Therefore, M3's proposed values represent a reasonable and potentially conservative assumption for commercial irrigation demand.
8. Rows 71 & 88-90: M3 proposes an indoor commercial water use of 1,200 gallons per day per gross acre of commercially developed land. That translates to a water usage of 0.028 gal/sf for commercial use identified as "light office". As a comparison the reference book Water Supply Planning (Prasifka 1988) has a published planning value of *0.090 gal/sf* for "office" space development. Within this context the proposed value by M3 appears to be reasonable.
9. Rows 74 and 75: M3 proposes a maximum day peaking factor of 1.5 and a peak hour demand (i.e. maximum instantaneous diversion) peaking factor of 2.92. These values are consistent with a number of published values as summarized in the following table.

Summary of Published Values of Peaking Factors

Published Reference	Max Day: Avg. Day	Peak Hour: Avg. Day
Dewberry 2002	1.5 - 3.0: 1	2.25 - 4.50: 1
Fair 1971	1.5 - 3.5: 1	1.5 - 3.5: 1
Harberg 1997	1.4 - 1.7: 1	2.0 - 4.0: 1
Linaweaver 1967	2.0: 1	5.0 - 7.0: 1
Lindeburg 1999	1.5 - 1.8: 1	2.0 - 3.0: 1
Mays 2000	1.5 - 3.5: 1	2.0 - 7.0: 1

10. Rows 79 & 80: M3 proposes an average water demand of 274 gpd per residence. Although a specific derivation of this value is not provided the value is either consistent with or in close agreement with a number of published values as summarized in the first table that follows. It is also consistent with and slightly less than the average residential consumption of other municipalities in Ada County as summarized in the second table that follows.

[2] Personal correspondence with William Vaughan, AICP City of Eagle Zoning Administer on May 23, 2011.

Summary of Published Values of Average Residential Daily Consumption for Design

Published Reference	Avg. Daily Consumption (GPCD)	Avg. Daily Consumption per Home (GPD)
Linaweaver 1967	100	400
Stephenson 2003	50 - 80	150 - 800
Boumann 1998	--	200
Cook 2001	--	194

Summary of Local Average Residential Daily Consumption Values

City	Residential Demand* (GPCD)	Avg. Daily Consumption per Home** (GPD)
Boise	125	324
Eagle	125	324
Garden City	134	347
Kuna	80	208
Meridian	107	277
Average	114	296

*Values obtained from WRIME 2010.

**Values equal to column 2 times 2.59, which is the average persons per household in Idaho as reported in the 2010 US Census (US Census Bureau State and County QuickFacts).

11. Rows 82 & 83: M3 proposes a water demand of 12 gpd/student and is projecting a student population base of 5,480. A value of 12 gpd is twice the published value of *6 gpd/student* from the reference Water-Supply Planning (Prasifka 1988), but is consistent with the published values of *10 gpd/student* (elementary schools no showers) and *16 gpd/student* (high schools with showers) from the reference Land Development handbook: Planning, Engineering, and Surveying (Dewberry 2002). Concerning a student population base of 5,480, the US Census Bureau[3] reports for Idaho that 19% of the population is between the age of 5 and 18 (i.e. school age). This equates to a student population base of 3,317 students for the ultimate build out of the M3 development (0.19*(17,455) = 3,317). This implies that M3 may have overestimated the water need for schools by 65%. However, in light of the overall minor contribution to water demand accounted for by school use (0.17 cfs), and the fact that it is a planning estimate value, I am not recommending that the water demand associated with school use be modified.
12. Rows 85 & 86: M3 proposes a water demand of 120 gpd per hotel room and is projecting a total number of 500 hotel rooms. This value is twice the published values of *50 and 68 gpd per bed* from the reference Water-Supply Planning (Prasifka 1988) for motels and hotels respectively, but is exactly consistent with the published values of *120 gpd per motel room* from the reference Land Development handbook: Planning, Engineering, and Surveying (Dewberry 2002).
13. Rows 106-108: M3 proposes that wastewater generation will be 69%, 75%, and 60% of water demand for residential, school and hotel, and commercial use respectively. These values appear reasonable, and specifically with regard to residential use the proposed value is consistent with published values of residential wastewater generation of 60-70% (Fair 1971) and 70-80% (Lindeburg 1999) of water demand.

[3] Data obtained for all of Idaho from the US Census Bureau's State and County QuickFacts for the 2010 census.

14. Rows 127-132: The calculation of winter effluent and irrigation season effluent volumes seem reasonable and appropriate. However, the calculation of evaporation of winter effluent from the storage pond(s) (row 129) seems excessively high. M3 has proposed an evaporation rate of 3.5 AFA per acre of pond surface. This value is based on consumptive rates associated with the irrigation season when ET is substantially higher than winter months. A more appropriate estimate of this value would be to use ET rates from ET_Idaho (Allen and Robison 2009), which indicates a total loss to ET of 0.31 feet per unit area for a "Open water – shallow systems (ponds, streams)" class type from November 16 to March 14 (120 days). When multiplied by the total surface area of proposed ponds with winter effluent storage (45 acres) a total volumetric ET loss of 14.3 AF can be estimated, this value is quite different from the 158 AF proposed by M3. Utilization of the smaller value (14.3 AF) would increase the total annual effluent volume available for irrigation (row 132) to 1,804 AFA, which roughly supports the annual irrigation of an additional 41 acres.
15. Rows 155-166: After review of the water demand analysis, it is my understanding that of the three flow rate values calculated by M3 (average day, max day, and peak hour), max day values have predominantly been utilized to derive the diversion rate requirement of the proposed water right. This is appropriate because at any given time the maximum diversion rate required will equal the max day values and not peak hour values, as M3 has proposed and designed their storage capacity to accommodate—in most instances—water demand in excess of max day rates (i.e. peak hour rates). I found two instances where max day rates were not used in determining the total maximum daily well diversion rate: (1) cell D157 (residential and commercial potable irrigation max day) and (2) cell D163 (evaporation from aesthetic and operational ponds). In both instances a flow rate based on a 0.02 cfs per acre of irrigated ground and pond water surface respectively, were used in place of the max day rate[4]. It is reasonable for M3 to substitute values for the max day diversion rates in the manner that they have in order to provide ease, convenience, and flexibility in the operation and maintenance of the water supply system when meeting the diversion rates necessary to accommodate the hottest and driest days of the year.

16. Rows 170-187: The water balance summarized in rows 170-187 derives the annual water need volume for M3's proposed water right at the time of licensing. Annual volumes for indoor use, potable irrigation of residential and commercial areas, irrigation, and pond evaporation appear to be reasonably derived.

[4] ***The following justification for the use of 9.74 cfs (cell D157) and 1.10 cfs (cell D163) in M3's calculation of maximum daily well diversions were conveyed to me in my discussions with Dr. Steven Holt concerning these matters. Regarding the use of 9.74 cfs, Dr. Holtz indicated that in providing water for the peak day irrigation demand scenario the use of the 9.74 cfs value allows operational flexibility by M3 that obviates the need for 24-hour pumping or an additional 1 million gallons of storage that would be necessary to meet their desired operating condition of a 12-hour irrigation window. Regarding the use of a 1.10 cfs pond evaporation rate, it was explained to me that this is more accurately described as a peak day pond refill diversion rate. That is to say this diversion rate is necessary to make up evaporative losses from the ponds on the peak evaporative demand day to avoid the drafting of the ponds and the unacceptable aesthetic deterioration of the ponds potentially associated with drafting. This would be necessary on those days when the average daily pond refill rate cannot keep up with the daily evaporation rate.***

Summary of Review

Overall M3 has conducted a rigorous disaggregate-requirements based evaluation of estimating and detailing water demand for the M3 Eagle Development project. M3's narrative, which accompanied their application as Attachment A, extols the virtues of water conservation and in many ways their water demand analysis lives up to these ideals. Examples of this include the planned reuse of as much as 1,804 AFA of treated wastewater for irrigation. Or, the proposed plans to drip irrigate 250 acres of public landscaping, which is nearly 1/3 of the total public landscaped area. In their estimation of indoor water use, M3 consistently proposes water demands that are equal to, or less than existing and historic trends or planning values. This includes a proposed residential in home use of 274 gpd/residence, a school use of 12 gpd/student, a hotel use of 120 gpd/room, and a commercial use of 0.03 gpd/sf. All of which are less than or equal to their respective local averages or design norms which include a residential in home use of 296 gpd/residence, a school use of 10-16 gpd/student, a hotel use of 120 gpd/room, and a commercial use of 0.09 gpd/sf. While additional savings in diversion rate and annual volume might be found by scrutinizing the assumptions and values used in M3's analysis, nothing that they have proposed can be considered unreasonable.

References

Allen, Richard G. and Clarence W. Robison, 2009. Evapotranspiration and Consumptive Irrigation Water Requirements for Idaho: Supplement updating the Time Series through December 2008, Research Technical Completion Report, Kimberly Research and Extension Center, University of Idaho, Moscow, ID.

Boumann, Duane D. et al. Urban Water Management and Planning. United States: McGraw-Hill Companies, 1998.

Allen, Richard G. and Brockway, Charles E. Estimating Consumptive Irrigation Requirements for Crops in Idaho. University of Idaho, August 1983.

Cook, Z. et al. Domestic, Commercial, Municipal and Industrial Water Demand Assessment and Forecast in Ada and Canyon Counties, Idaho. Idaho Department of Water Resources, 2001.

Dewberry, S. O. Land Development Handbook Planning Engineering, & Surveying. 2nd Ed. New York, U.S.: McGraw-Hill, 2002.

Fair, Gordon M. Elements of Water Supply and Wastewater Disposal. 2nd Edition. New York, U.S.: John Wiley & Sons Inc, 1971.

Harberg, Robert J. Planning and Managing Reliable Urban Water Systems. American Water Works Association, 1997.

Hubble. Guidelines for the Evaluation of Irrigation Diversion Rates. Submitted by Hubble Engineering, Inc. and Earth Science, Inc. for the Idaho Department of Water Resources, October 1991.

Linaweaver, F. P., et al. (1967) A Study of Residential Water Use. Johns Hopkins University, for the Federal Housing Administration and the Department of Housing and Urban Development.

Lindeburg, Michael R. Civil Engineering Reference Manual. California, U.S.: Professional Publications, Inc, 1999.

Mays, Larry. Water Distribution Systems Handbook. New York, U.S.: McGraw-Hill, 2000.

Prasifka, David W. Current Trends in Water-Supply Planning. New York, U.S.: Van Nostrand Reinhold Company, 1988

Stephenson, David. Water Resources Management. The Netherlands: Krips the Print Force, 2003.

WRIME. Treasure Valley Future Water Demand. Submitted by WRIME, Inc. for the Idaho Water Resources Board, Nov. 16, 2010.

MEMO (APPENDIX E)
TO: SHELLEY KEEN
FROM: MAT WEAVER
DATE: JUNE 2, 2011

RE: DEPARTMENT OF WATER RESOURCES REVIEW NARRATIVE AND COMMENTS REGARDING THE WATER DEMAND COMPONENT ASSOCIATED WITH THE CITY OF EAGLE'S REASONABLY ANTICIPATED FUTURE NEEDS WATER RIGHTS ANALYSIS PREPARED BY HOLLADAY ENGINEERING CO. AS RECEIVED BY THE DEPARTMENT ON APRIL 27, 2011.

My analysis includes review of the second "Reasonably Anticipated Future Needs (RAFN) Water Right Analysis" prepared by Holladay Engineering Co. (Holladay) and received by the Idaho Department of Water Resources (Department) on April 27, 2011. I also reviewed in part the City of Eagle's Municipally Owned Water System Amended Master Plan (Revised November 2005) and the Master Plan Update No. 1 (March 2008).

Although I prepared a series of specific questions concerning my initial review of the City's RAFN analysis, at the time of this memo I have received no detailed reply from the City of Eagle (CoE) or Holladay.

Water Demand Forecast Methodology: Per Capita Requirements Model

To forecast future water demand in the City of Eagle, the City has relied on a per capita requirements based approach. This is a form of single-coefficient modeling that relies on determining future water use by applying an established per capita of per household water demand to future population estimates within a specified service area and planning horizon. Not only is the per capita requirements approach reasonable, it is a recognized standard approach to water supply planning that represents the most commonly applied method of single-coefficient demand forecasting (Prasifka 1988).

Proposed Average Daily Demand per Home: 281 gpd

The City of Eagle proposes an average water demand of 281 gpd per residence. The derivation of this value is detailed in the City's 2005 Master Plan and is based on a historical time series of actual water usage within the City from January 2002 to September of 2004. This value is further referenced in the 2008 Master Plan Update No. 1. It should be noted that in Section 6.2.1 of the 2005 Master Plan, a preliminary design value of 120 gpd per capita is proposed for the western expansion area. Assuming the City's projection of 2.7 people per household leads to a daily average water demand of 324 gpd, which is more than what is proposed by the City in their current RAFN analysis. Regardless, the proposed average daily demand per household is consistent with a number of published average daily residential demand values as summarized in the first table that follows. It is also consistent with and slightly less than the average residential consumption of other municipalities in Ada County as summarized in the second table that follows. Although it is unclear to what degree the communities summarized in the second table rely on their respective potable water systems for irrigation of residential landscaping.

Summary of Published Values of Average Residential Daily Consumption for Design

Published Reference	Avg. Daily Consumption (GPCD)	Avg. Daily Consumption per Home (GPD)
Linaweaver 1967	100	400
Stephenson 2003	50 - 80	150 - 800
Boumann 1998	--	200
Cook 2001	--	194

Summary of Local Average Residential Daily Consumption Values

City	Residential Demand* (GPCD)	Avg. Daily Consumption per Home** (GPD)
Boise	125	324
Garden City	134	347
Kuna	80	208
Meridian	107	277
Average	112	289

*Values obtained from WRIME 2010.

**Values equal to column 2 times 2.59, which is the average persons per household in Idaho as reported in the 2010 US Census (US Census Bureau State and County QuickFacts).

Within the context of the comparison data presented, the City of Eagle's average daily demand does not seem unreasonable. However, recent evidence from nearby Idaho communities suggests that modern residential subdivisions with pressurized irrigation systems are using less than 250 gallons per day per residence for non-irrigation activities and that in-home uses continue to decrease from historically recognized values.[1] This is consistent with national trends over the past three decades, which also indicate continually decreasing residential water use, primarily due to a declining number of residents per household and an increasing pervasiveness of water-conserving (low flow) appliances in the home.[2]

It will be important for IDWR to consider whether 281 gallon per day is appropriate given the current trend of decreasing in home demand and the requirement that new appropriations must be consistent with the conservation of water resources in Idaho.

Proposed Max Day Demand and Peak Hour Demand Peaking Factors

The City of Eagle's RAFN analysis does not specifically detail the peaking factors used in its demand analysis. However, from the RAFN document I was able to infer a proposed maximum day peaking factor of 1.7 and a proposed peak hour demand (i.e. maximum instantaneous diversion) peaking factor of 1.7. These values were confirmed by Bruce Smith in email correspondence. The derivation of the appropriateness of these values for communities greater than 200 homes is detailed in Addendum A of

[1] Preliminary Order by the Department in the matter of Application for Permit No. 61-12239 Water Resources dated April 13, 2011.

[2] A recent study has found that in identical households the average residential demand in North America has decreased by a total of 11,678 gallons annually since 1978 (0.5% decrease annually or 13.6% decrease compounded over 30 years). Contributing factors considered by the study included climate change, changes in water user classification systems, changes in income, changing demographics, and new water-conservation appliances. The study found that changes in demographics and new water-conservation appliances had the greatest statistically relevant contribution to decreasing water use per household. (Rockaway 2011).

Appendix G in the 2008 Master Plan Update No. 1. The Water Use Table from Section 4.3 of the 2005 Master Plan indicates a max day demand peaking factor of approximately 2.5 and a peak hour demand peaking factor of approximately 1.5. These values are associated with an overall smaller municipal system and it is appropriate that the peaking factors have decreased from 2005 to present with the expansion of the City's municipal water system.

The peaking factor values proposed by the City are less than or consistent with a number of published peaking factor values as summarized in the following table.

Summary of Published Values of Peaking Factors

Published Reference	Max Day: Avg. Day	Peak Hour: Avg. Day
Dewberry 2002	1.5 - 3.0: 1	2.25 - 4.50: 1
Fair 1971	1.5 - 3.5: 1	1.5 - 3.5: 1
Harberg 1997	1.4 - 1.7: 1	2.0 - 4.0: 1
Linaweaver 1967	2.0: 1	5.0 - 7.0: 1
Lindeburg 1999	1.5 - 1.8: 1	2.0 - 3.0: 1
Mays 2000	1.5 - 3.5: 1	2.0 - 7.0: 1

After review of the master plan documents and within the context of the comparison data presented, the City of Eagle's maximum day demand and peak hour demand peaking factors do not seem unreasonable.

Proposed Person per Household: 2.7

The City of Eagle's RAFN analysis proposes the use of 2.7 persons per household as a means of converting population projections into single family residential service connections, which can then be coupled with a single-home average daily demand planning value (281 gpd) to project a combined future water demand for the entire service area. Household demographic data is summarized and made available by the US Census Bureau through their American Communities Survey series.[3] The American Communities Survey reports the following average persons per household values for the City of Eagle: 2.73 (1990), 2.87 (2000), 2.77 (five year average 2005-2009). Within this context the City's proposed value of 2.7 seems quite reasonable.

Summary of Review

Overall I have found all of the water demand forecasting details presented by the City and discussed in this memo to be reasonable. My review was limited to the material submitted by the City and does not consider water demand associated with other potential and legitimate justifications that could potentially be identified in a more rigorous disaggregate-requirements based analysis. My review does not include an evaluation of the total RAFN required by the City of Eagle. In order to determine a City wide RAFN the components discussed in this memo must be combined with a reasonable planning horizon and population estimate. The review and evaluation of the outstanding components of planning horizon and total population are being conducted by Dr. Don Reading and are not addressed in this review memo.

[3] The American Community Survey (ACS) is an ongoing survey conducted by the US Census Bureau that provides data every year—giving communities the current information they need to plan investments and services. http://www.census.gov/acs/www/

References

Boumann, Duane D. et al. Urban Water Management and Planning. United States: McGraw-Hill Companies, 1998.

Cook, Z. et al. Domestic, Commercial, Municipal and Industrial Water Demand Assessment and Forecast in Ada and Canyon Counties, Idaho. Idaho Department of Water Resources, 2001.

Dewberry, S. O. Land Development Handbook Planning Engineering, & Surveying. 2nd Ed. New York, U.S.: McGraw-Hill, 2002.

Fair, Gordon M. Elements of Water Supply and Wastewater Disposal. 2nd Edition. New York, U.S.: John Wiley & Sons Inc, 1971.

Harberg, Robert J. Planning and Managing Reliable Urban Water Systems. American Water Works Association, 1997.

Linaweaver, F. P., et al. (1967) A Study of Residential Water Use. Johns Hopkins University, for the Federal Housing Administration and the Department of Housing and Urban Development.

Lindeburg, Michael R. Civil Engineering Reference Manual. California, U.S.: Professional Publications, Inc, 1999.

Mays, Larry. Water Distribution Systems Handbook. New York, U.S.: McGraw-Hill, 2000.

Prasifka, David W. Current Trends in Water-Supply Planning. New York, U.S.: Van Nostrand Reinhold Company, 1988

Rockaway, P.A. et. al. Residential water use trends in North America. Journal AWWA, 103:2, February 2011.

Stephenson, David. Water Resources Management. The Netherlands: Krips the Print Force, 2003.

WRIME. Treasure Valley Future Water Demand. Submitted by WRIME, Inc. for the Idaho Water Resources Board, Nov. 16, 2010.