Water Requirements and Supply
Ketchum Southern Gateway

Prepared for:

City of Ketchum, Idaho
Blaine County
Sun Valley Water and Sewer District

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Water Requirements and Supply
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Prepared by: Brockway Engineering, PLLC
Date: December 6, 2012

A. Introduction

The area of Blaine County along State Highway 75 south of the City of Ketchum is an area of potentially significant development and an area of concern relative to the availability and reliability of water supplies for current and future subdivisions and facilities. The area includes the St. Luke's Medical Center, McHanville, a developed light industrial area, a mobile home park, a platted subdivision and several unplatted parcels. The Blaine County Community Housing Overlay District includes five (5) sub districts which allow varying types of development and varying densities. Figure 1 shows the Southern Gateway area and the Community Housing sub districts as delineated in the Blaine County zoning ordinance. Each of these sub districts require or will require specific levels of water supply for potable water and landscaping irrigation.

This report outlines the procedures and analysis techniques utilized by Brockway Engineering PLLC in developing water requirements and evaluating potential water supply sources for the various sub districts. The work has been performed under contract with the City of Ketchum and Blaine County and includes an evaluation of the Big Wood River aquifer in the vicinity of the Southern Gateway utilizing existing well data, an analysis of the sustainability of ground water supplies, preliminary analysis of the hydraulic feasibility of alternative water supply sources, field data compilation and analysis to develop estimates of the range of diversion rates, annual volume, and consumptive use requirements.

Data on the Blaine County ordinances, specific sub district and development allowances and constraints was provided by the Blaine County Land Use and Building Service staff and development concerns and limitations relative to The City of Ketchum were provided by The City of Ketchum staff.

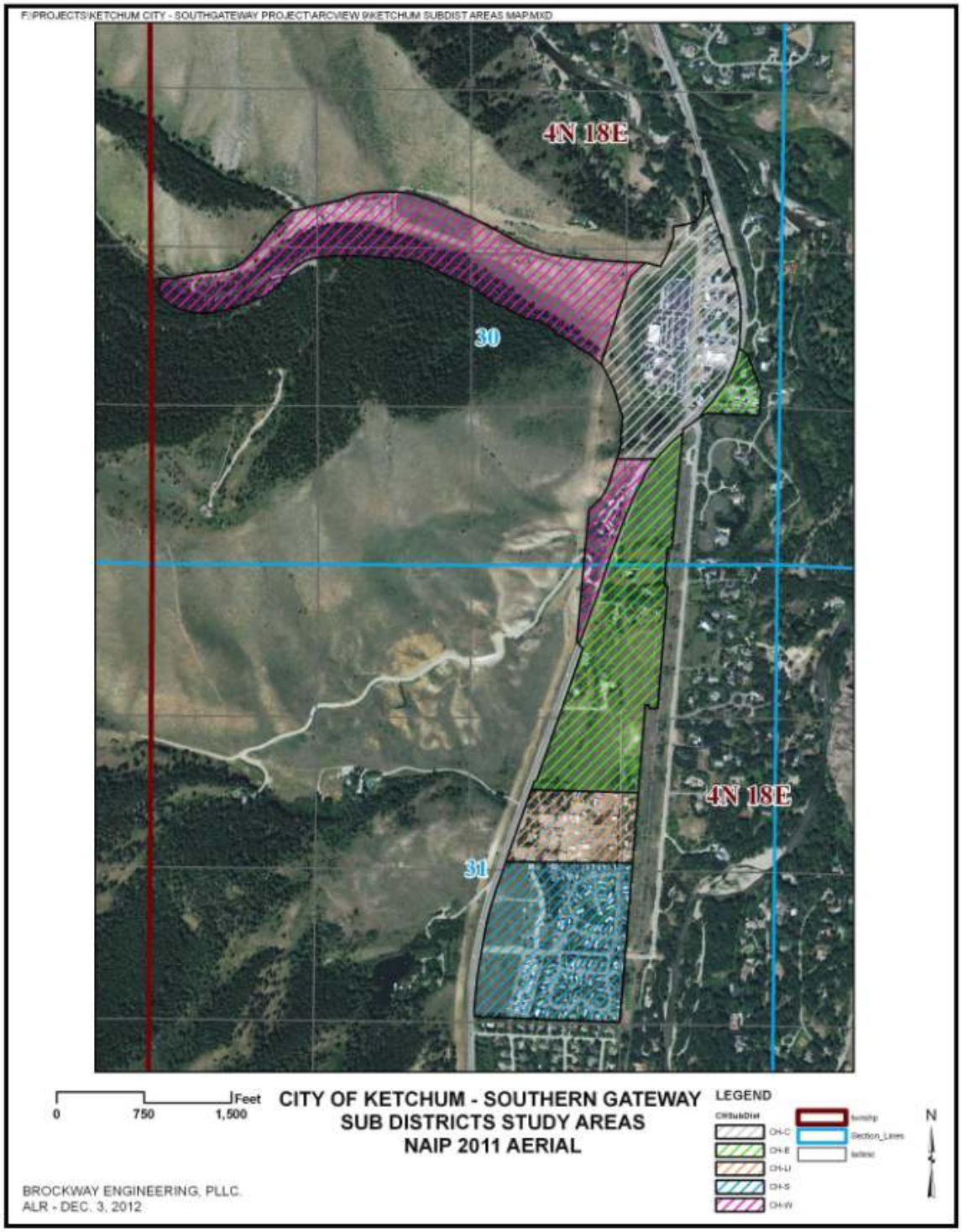

Figure 1: Southern Gateway Area and Sub Districts

A.1. Area of Concern

A1.1 Jurisdiction

The Southern Gateway area is under the jurisdiction of Blaine County and development is guided by the Blaine County Comprehensive Plan and development codes. However, the City of Ketchum is considering including the Gateway area in its Area of Impact. Therefore, each entity has specific concerns relative to water supply availability, sustainability, and service areas of various current and/or future water purveyors. Part of the Gateway area is currently or will be served by the Sun Valley Water and Sewer District (St. Luke's Medical Center, McHanville and Gypsy Trailer Court) and part of the area is served by the Mid Valley Water Company LLC water system. This system currently serves the Meadows Mobile Home Park and is scheduled to serve the Quail Creek Subdivision. Other developed areas within the Gateway area are served by private individual wells. Some of the area is included in sub districts where the aquifer properties likely preclude local aquifer development.

A.1.2 Joint Study Effort

Because of the concerns of both Blaine County and the City of Ketchum, a joint study was undertaken for the Southern Gateway area and joint information meetings have been held between Brockway Engineering, Blaine County, and The City of Ketchum. Sun Valley Water and Sewer District has been contacted and input from the operators of the Mid Valley Water Company LLC has been solicited.

A.1.Community Housing Overlay Sub Districts/ Study Area

The South Gateway area has been designated into five sub districts within the Community Housing Overlay to delineate areas planned for community housing, commercial and light industrial development. Figure 2 shows the delineations of each sub district. The allowed activities in each Sub district considered for this study are based on the draft amendments to the Community Housing Overlay District ordinance obtained from the Blaine County Land Use and Building Services staff.

The CH-W Sub district on the north end of the Gateway area includes the St. Luke's Medical Center and McHanville areas. These areas, along with the Gypsy trailer court are served by the Sun Valley Water and Sewer District and are therefore not included in this study. All other areas of the Community Housing Overlay District as shown in Figure 2 are included.

A.1.4 Water Use Requirements and Sources Evaluation

This study includes evaluation, for each sub district, of the potential water requirements based on type of development, estimates of type and size of residences or commercial/industrial facilities. Potable water requirements include in-house use for personal residences, in-building requirements for commercial facilities, and industrial water requirements. Irrigation water requirements include landscaping and turf for individual or multiple residential units, landscaping for commercial areas including parking lots, and turf for any large common block areas (parks, playgrounds, etc.). This

component includes common areas for each unit as required by the Blaine County criteria for subdivision development.

Any other facilities requiring significant water diversions are included, if known. These can include any manufacturing facilities requiring product water or processing water.

B. Potential Water Sources

B.1. Existing Water Purveyors

Existing water purveyors which may provide potable and/or irrigation water include the City of Ketchum, Sun Valley Water and Sewer District, and the Mid Valley Water Company System. Utilization of any of these potential sources depends on the willingness of the entity to expand, capacity or excess capacity of existing diversion systems, and the hydraulic and economic feasibility of system expansion. There are statutory requirements relative to expansion of service areas for the City of Ketchum and Sun Valley Water and Sewer District and water right requirements for all entities. Development of a new water purveyor utility to serve all or part of the Gateway area is also a possibility. This report outlines the potential entities for water supplies for the Gateway area and known considerations for administrative and water right changes which would be necessary to effect an expansion or development of each system. The report does not explore all of the internal decisions which must be made for each entity.

The Sun Valley Water and Sewer District, SVWSD, serves the City of Sun Valley and areas south of the City of Ketchum including Lane Ranch Subdivision, McHanville, St. Luke's Medical Center, and the Gypsy trailer park. Hydraulically, SVWSD has the capability to serve much, if not all, of the proposed Gateway area. With existing service to the south boundary of St. Luke's, extension to enclose the areas south of Highway 75 and the Cold Springs area would be possible with some distribution system changes. Current water availability to SVWSD to serve the additional units in the Gateway area is not known but additional water rights and sources can be explored.

The City of Ketchum water system service area extends south of the City to the City boundary at Elkhorn Road. The City system could be hydraulically extended south to serve the Gateway area, however; the City water right limits the water service area to the City boundaries. It would be necessary for the City of Ketchum to annex additional subareas with the Gateway area in order to include them in the water service area. At this time, it is not known if the City of Ketchum is considering annexation of this area or not.

Mid Valley Water Company LLC, which currently provides water and sewer service to the Meadows Mobile Home Park and developed parts of the Quail Creek Subdivision has a well at the southeast corner of the Meadows Mobile Home Park. This well, along with a proposed new well in the Park authorized by a new water right permit acquired by Mid Valley Water Company will provide water service to the Mobile Home Park and the

Quail Creek Subdivision. The distribution system could be extended northward to serve the remainder of the Gateway project. This extension will likely require moving the proposed new well, adding at least one additional well and providing booster pumps to service the higher area in the Cold Springs Gulch and crossing HW 75 with the water service line. The existing well at the Meadows has been flow tested and has a confirmed capacity of 785 gpm.

B.2 New Ground Water Developments and Entities

Establishment of a new ground water source, distribution system, and operating entity requires a new municipal or multi/user ground water right from the State through the Idaho Department of Water Resources. The operating entity can be a homeowner's association, a private purveyor, a public utility, or a statutorily formed water district. Contingent upon the aquifer yield available, this entity, if formed, could serve the entire Gateway development whether or not the development took place as separate small subdivisions or as one large unit development.

B.3. Treatment of Surface Water Sources

Surface water sources are not considered feasible for potable water use because of the cost of administration and water treatment requirements. Hydraulically Big Wood River water or spring water from Clear Creek could be made available. However, Division of Environmental Quality criteria would require treatment of either source and continuous monitoring of water quality to assure that water quality standards for drinking water were met.

B.4. Individual Wells

Small wells for individual or grouped units could be utilized if strategically located and an operating entity formed for administration of the numerous wells. No estimate has been made to determine the number of grouped unit, multiple-user wells that would be required to serve the estimated maximum 986 residential and/or 58 light industrial units. Use of multiple smaller wells would disperse extraction from the aquifer throughout the project and would minimize local well interference. However, this concept would require intensive monitoring, administration, and drilling and operation of a large number of wells provides an excess number of potential sources of aquifer pollution which would not be condoned by the Division of Environmental Quality and would be limited by IDWR water rights policy. For these reasons, use of individual or grouped wells is not considered feasible for the Gateway Project.

C Hydrology of the Big Wood River and Aquifer

C.1 General Geology

The water source for any new potable wells will be the Big Wood River Valley aquifer. This aquifer is comprised chiefly of alluvial deposits of sand and gravel, with some relatively thin strata of fine-grained materials. The aquifer is generally unconfined and the depth of the aquifer is not uniform. Width of the alluvial aquifer in the project area

averages about 4000 feet In the area from McHanville south to the Meadows, the depth of alluvial aquifer varies from 5 ft. to about 44 feet with an estimated saturated depth of approximately 88 feet in the area of the Gateway Project. Low-permeability granitic bedrock or consolidated sedimentary rock underlies the alluvium, and essentially forms the bottom of the aquifer (Frenzel, 1989).

C.2. Big Wood River Aquifer Properties

C.2.1. Well Driller's Logs

Well driller's logs are the best source of information on aquifer lithology and properties absent specific test wells. Appendix 1 includes 30 selected well driller's logs available from the IDWR data base and the aerial photograph in Appendix 1 shows the locations of wells for which adequate data are available for aquifer analysis. Each selected driller's log shows the lithology (strata) encountered by the driller, the well depth and casing log, static water level at the completion of drilling, and some estimate of well discharge and drawdown.

C.2.2 Well Yields and Specific Capacities

The well driller's logs from thirty wells from the surrounding area were examined for estimating the aquifer conditions. The thirty wells were selected based on a pump test or well productivity tests that were performed by the well driller at the completion of the well. The three methods used to perform well productivity tests are a pump test, a bailer test and a blown air test (Appendix 2). The depth of the thirty wells varies from a depth 20 feet to 297 feet. The average standing water level in the thirty wells is 14 feet. The average pumping rate for the thirty wells is 64 gallons per minute. The average specific capacity of the thirty wells is 14 gallons of water yield per foot of the drawdown during pumping. The higher producing wells where drilled into the alluvial aquifer.

C.2.3 Aquifer Transmissivity and Hydraulic Conductivity

The permeability of the water-bearing alluvium is very high. Estimates range from 150 ft/day to 500 ft/day (Frenzel, 1989; Luttrell and Brockway, 1982; Smith, 1959). The soils maps and surrounding well logs for this region do not indicate any anomalies in the geologic make-up of the aquifer under the proposed development property and it is likely that any new wells drilled on site would be capable of producing flows of up to 100 gpm. For the purposes of our analysis, we assumed a permeability of 168 ft./day which is a median value observed for wells in the Wood River Valley aquifer near the Gateway area. (Appendix 2)

D. Water Requirements

Potable and landscaping or irrigation requirements were estimated for the sub districts in the Gateway area based on existing zoning and allowable types of development and estimated occupancies and densities in the various zones.

D.1 Analysis Procedure/ Assumptions

A map of the proposed sub district areas was provided to Brockway Engineering by Blaine County. From that map and through analysis of the parcels within the sub districts, the acre amounts for potential development were calculated. The following assumptions are made for the purposes of this study. The West sub district along Cold Springs Gulch will have 13.0 acres that are available for development, Appendix 3. The Estate sub district on the East side of Highway 75 has 39.7 acres that will be available for development. The South sub district includes the Meadows trailer park. The established housing living sites within the Meadows trailer park will not be redeveloped due to this project. Therefore, a 13.1 acre portion of the South sub district was included in this study and is anticipated to be developed. The light industrial sub district includes parcels that are currently utilized by light industrial businesses. For this study, existing businesses will not be changed for this project. There are 3.6 acres within the light industrial sub district that will be developed and are included in this study. An aerial map of the areas within the sub districts is shown in Figure 2.

Figure 2: Sub District Areas Included in Study

Each Community Housing sub district was analyzed for four different units per acre densities. The four densities are 5, 8, 12 and 15 units per acre. The number of persons per unit for all densities is three persons. A value of 69.3 gallons per person per day is used to estimate the potable water demand per housing sub district (EPA, 2002). Fifteen percent of each sub district was identified to be used for roads and walkways through the sub districts. Required common area per unit is 1,000 ft^2 and the required yard setback area per unit is 500 ft^2. Irrigation for common areas and landscaping for the community housing development is expected to have an irrigation efficiency of 65%.

The analysis of the required square foot print for each unit was split into two types of housing. The first housing type is a single structure unit that has an estimated footprint of 2000 ft^2 that includes the unit, storage and parking. The second housing type is a multi-family structure with five units per structure. The estimated average foot print for each unit, storage and parking is 900 ft^2. The foot print estimation for the multi-family units are based on floor plans provided to Brockway Engineering for the McHanville Apartments.

For this study, the calculated common and yard setback areas identified are the only areas that will be irrigated. All of the remaining acres available are assumed to not be developed and will remain vacant acres.

Irrigation water demand is based on turf grass for the Wood River area. Data from the University of Idaho and the Hailey Ranger Station indicated that 1.96 acre feet annually is required to irrigate one acre of lawn. The highest water use month is July.

D.2 Sub districts

D.2.1. Community Housing Estate

The water demand for the Community Housing Estate sub district is dependent on the density of units per acre and the structure type. For a unit density of 5 units/acre with single structured units, the total annual demand for the sub district of potable water and irrigation water is 66.7 acre feet annually. A unit density of 5 units/acre with two level multi-family units has a total annual demand of potable water and irrigation water of 66.7 acre feet annually. With a unit density of 15 units/acre, a two level multi-family structure development would have a total annual demand of potable water and irrigation water of 200.2 acre feet annually.

D.2.2 Community Housing South

The water demand for the Community Housing South sub district is dependent on the density of units per acre and the structure type. For a unit density of 5 units/acre with a single structured units, the total annual demand of potable water and irrigation water is 20.0 acre feet annually. A unit density of 5 units/acre with two level multi-family units has a total annual demand of potable water and irrigation water of 20.0 acre feet annually. With a unit density of 15 units/acre, a two level multi-family structure development

would have a total annual demand of potable water and irrigation water of 66.0 acre feet annually.

D.2.3 Community Housing West

The water demand for the Community Housing West sub district is dependent on the density of units per acre and the structure type. For a unit density of 5 units/acre with single structured units, the total annual demand of potable water and irrigation water is 21.9 acre feet annually. A unit density of 5 units/acre with two level multi-family units has a total annual demand of potable water and irrigation water of 21.9 acre feet annually. With a unit density of 15 units/acre, a two level multi-family structure development would have a total annual demand of potable water and irrigation water of 65.6 acre feet annually.

D.2.4 Light Industrial

The light industrial sub district water demand is based on an average 15.7 gallons of water per employee per day. An estimated value of 4 employees per business was used in the water calculations (EPA, 2002). Each business was estimated to require 2500 ft^2. The business owned and operated by Clear Creek Disposal and Animal Center were included in this study but the parcels of land in which there is a current businesses operating will not be altered due to this project. No irrigation water is expected to be required in the light industrial sub district. The potable water demand for the Light Industrial sub district for development of a unit density of 5 light industrial units (12,500 ft^2) /acre is 1.5 acre feet annually. The water demand for a unit density of 15 light industrial units (37,500 ft^2)/acre is 4.1 acre feet annually. The area available for development within the light industrial sub district is 3.6 acres.

The complete potable water demand and the irrigation water demand calculations for each sub district is outlined in Appendix 4. A summary of the water demands for each sub district is provided in Table 1.

Table 1: Potable and Irrigation Water Requirement Summary

	15 Units/Acre		12 Units/Acre		8 Units/Acre		5 Units/Acre	
Sub District	Single Structure	Multi-Family Structure	Single Structure	Multi-Family Structure	Single Structure	Multi-Family Structure	Single Structure	Multi-Family Structure
	Acre Feet Annaully		Acre Feet Annaully		Acre Feet Annaully		Acre Feet Annaully	
Estate	-	200.2	-	160.1	106.8	106.8	66.7	66.7
South	-	66.0	-	52.8	35.2	35.2	22.0	22.0
West	-	65.6	-	52.5	35.0	35.0	21.9	21.9
Light Industrial	4.1	-	3.3	-	2.3	-	1.5	-
Volume of Water Required Annaully (AFA)	336		269		179		112	

E. Peak Demand Water Use

The combined density of 15 multi-family units/acre was used for all three housing sub districts and 15 units/acres was used for the light industrial density as the highest potable and irrigation water demand for the project. The average daily potable water demand for this project build out would be 208,662 gallons per day or 145 gallons per minute (0.32 cfs) continuous pumping. The peak hourly withdrawal for potable water would be 739.0 gallons per minute or 1.65 cubic feet per second. A total of 34.0 acres would be irrigated in the commons and back yard areas. The 34.0 acres would require a design peak flow rate for irrigation of 351.0 gallons per minute or 0.78 cubic feet per second. The combined potable and irrigation required peak hourly flow rate would be 1090.0 gallons per minute or 2.43 cubic feet per second. Average continuous demand for potable and irrigation water demand is 495.9 gallons per minute. (See Appendix 5)

F. Multiple Well Interference Analysis

Multiple well interference analysis consisted of three proposed production wells and four hypothetical indicator well locations. The locations of all wells in this analysis are identified as a representation of possible conditions and effects.

Pumping from the three hypothetical production wells will induce a local drawdown in the aquifer water table. This drawdown will be a maximum at the well, and will decrease in magnitude with distance from the well. An estimate was made of the drawdown at distances from the well based on estimated aquifer characteristics and estimated pumping rates from community water system wells. The method developed by C. V. Theis, 1963 was used to estimate the drawdown caused by the well, using a hydraulic conductivity of 168 ft./day, a saturated depth of 88 feet, and a storage coefficient of 0.15. Two scenarios were examined: first, the well was assumed to pump continuously for 365 days at the average daily rate of 496 gpm which equates to the average daily demand of 714,000 gpd continuously pumping. Second, the wells were assumed to pump at the peak hourly diversion rate (1090 gpm) for 12 hours. Both of these are very conservative since the well(s) will cycle and not run continuously. For the purposes of this analysis however, the wells are assumed to be running continuously which will provide the worst-case scenario in evaluating potential well impact. Results of the well interference analysis are shown in Appendix 6.

Based on the Theis analysis, the maximum predicted drawdown is estimated to be 1.7 feet at two of the indicator wells after the 496 gpm average daily rate was pumped 365 days of continuously. For the peak diversion rate of 1090 gpm pumped continuously for 12 days, the predicted drawdown is .55 feet at two of the indicator wells. The drawdown calculated in this analysis is not significant and will not interfere with other groundwater users.

Utilization of the Theis method of estimating local well drawdown assumes an infinitely

large aquifer and full penetration of the extracting well. It does not account for laterally terminating geologic structures or impermeable or vertical changes in hydraulic conductivity of the aquifer layers. However, the Theis estimates provide a reasonable estimate of potential interference at the distances available at the Gateway locations.

G. Groundwater depletion

Total groundwater discharge in the Big Wood alluvial aquifer at Hailey has been estimated by Smith (1959), Luttrell and Brockway (1984), Frenzel (1989), and Wetzstein, et al (2000). There is considerable variation in the estimates, but a reasonable average estimate of groundwater underflow based on available data is 40,000 ac-ft per year at Hailey. Big Wood River aquifer gains from below Ketchum to Hailey include East Fork, Indian Creek and Deer Creek. No published estimates of groundwater inflow from these tributaries are available; however, based on the drainage areas of these tributaries, the aquifer gain in this reach is likely less than 10,000 acre feet per year. Therefore, the estimated aquifer underflow at the Gateway Project is 30,000 acre feet per year. The proposed subdivision domestic usage will deplete the aquifer by the estimated consumptive water use or 101.2 acre feet per year (Appendix 5). Based on this value, the depletion of the aquifer by the domestic water usage will be 0.34% of the total groundwater underflow. A depletion of this magnitude is not detectable and will not result in a significant impact on other groundwater or surface water users in the Big Wood River.

H. Water Quality

The quality of water in the aquifer underlying the proposed subdivision is excellent. Frenzel (1989) presented water quality results for wells sampled in 1986 and 1987, and for several previous studies dating back to 1959. Luttrell and Brockway (1984) collected and analyzed water samples from 60 wells during 1983 and 1984. In addition, water quality on the existing Meadows community water system well was evaluated. The water quality data from the 2006 and 2010 public Drinking Water System Inorganic Chemical (IOC) Analysis Report for the Meadows well and distribution system, nitrate data for 2010-2012, and Coliform Bacteria Analysis reports for 2011-2012 are included in Appendix 6. These reports indicate that constituent levels in the aquifer meet all EPA and State drinking water standards. Monthly measured levels for nitrate +nitrite varied from 0.32 to 0.48 mg/l compared to the drinking water standard of 10 mg/l. Fluoride level was 0.46 compared to the MCL of 4.0 mg/l and no other inorganic compound concentrations exceeded MCLs.

All of the data indicates that the groundwater quality is excellent, and is acceptable for potable water usage.

I. Fire Flow Requirements

Fire protection for the area is under the jurisdiction of the Ketchum Rural Fire Department. Mike Elle, Chief of Fire and Emergency Medical Services, provided information relative to required fire flow protection discharges. Fire flow calculations for buildings are based on the construction type, density of structures and the summation of the areas of the three largest successive floors. Any structure with a summation of square footage that is larger than 8,000 ft^2 will require a fire sprinkler system to be installed in the structure in addition to having the required fire flow available.

The minimum discharge for fire protection for a low density build out of single family structures is 500 gpm with a maintained residual pressure at the hydrant of at least 20 psi.

A two level framed constructed structure with a footprint of 4,400 ft^2 will have an approximate fire flow calculated area of 8,800ft^2. Fire flow for this type of a structure will be 2,500 gallons per minute for a duration of 2.0 hours. The structure will also be required to have a fire sprinkler system installed. Structures with additional square footage will require additional gallons per minute and increased duration of flow required (See Appendix 8).

Fire protection discharge requirements can be provided by direct discharge from an aquifer source or by enhancement of discharge capacity using elevated storage tank(s). The minimum storage volume is 30,000 gallons for an elevated storage tank. The 30,000 gallons can be available directly or provide stored water to a pressurized system that provides a hydrant within 1000 feet of every building. Based on the contemplated building types and densities for the Gateway area, elevated storage will likely be required.

Based on the estimated attainable well yields for the aquifer, it is not likely that an individual well will provide the minimum fire flow; however, multiple wells may provide this level of discharge. No recommendations on storage volume requirements or locations for alternative storage facilities are made in this report.

J. Recommended Sources

There are no hydraulic conditions, aquifer or system impediments, which would necessitate individual water supply systems for the various subdivisions. One entity can provide the necessary volumes and peak flows and an integrated supply system will provide economies of scale and hydraulic flexibility. It is recommended that a single operating entity be considered for the entire area. Any existing or new water supply purveyor will likely be required to modify their current service areas and likely update delivery systems and discharge capabilities. Any system changes or service area changes will require modification of existing water rights or acquisition of new water rights. The

extent of changes required in any existing purveyor's system or the configuration of a new operating entity is a design function and not included in this report.

Multiple wells can be utilized to satisfy the water demands for the project sub districts. By having multiple wells, the water demand can be spread between the wells and reduce the local aquifer impact from the increased pumping.

K. Water Rights

The only existing water right within the Gateway area which provides multiple-user supplies is held by the Mid Valley Water Company. The Sun Valley Water and Sewer District authorized service area does not currently include the area nor does the City of Ketchum water rights. Water rights applications to enlarge service areas are not required for the City of Ketchum since their water rights are municipal rights and, as such, their service area is defined as the area within the City which would necessitate annexation of the new areas. Likewise, the SVWSD water rights can be modified to expand the service area but would require annexation into the District or contract for out of district services. Expansion of the Mid Valley Water Company system would require a new permit or a water right transfer to expand the place of use or provide additional discharge. Acquisition of additional water rights or changes in place of use for the type of service anticipated in the Gateway area is likely.

L. Conclusions

1. The recommended water source for the community water system(s) is ground water from the Big Wood alluvial aquifer, which is sufficient to supply the maximum water requirement with minimal drawdown at wells within the development boundary. Consumptive use is estimated to be 0.34% of the total groundwater under flow. New water permits or transfers of existing ground water rights will be necessary to provide the in-house culinary water and residential irrigation supply. A calculated 11.3 acres of irrigation will be required for common and yard setback areas with 5 units/acre density applied to Estate, West and South sub districts. A calculated 34.0 acres of irrigation will be required for common and backyard areas with a 15 units/acre density applied to Estate, West and South sub districts. All remaining acres undeveloped will remain non-irrigated vacant or natural acres.

2. Irrigation requirements could be supplied from surface water sources; however, utilization of Big Wood River surface supplies or Clear Creek would require construction of a separate diversion and delivery system which is not likely economically feasible for the small irrigated area.

3. Ground water pumping to supply in-house domestic and residential irrigation will not significantly impact the aquifer underlying the project.

4. Development of a ground water source for potable water and the common area irrigation will require the acquisition of additional or modification of existing municipal or multiple use domestic rights. If storage is required for fire protection flows, an additional water right may be required. If new permits are secured, they would likely be municipal permits with a domestic and an irrigation beneficial use. The irrigation portion of the permit will not be immune to water calls under proposed conjunctive management rules. The domestic or potable water portion of the water right will be immune to water curtailment. Water right transfers will be required to modify the place of use depending on the selected purveyor.

5. Water quality in the aquifer beneath the site is excellent, and is suitable for potable water usage.

6. Well location and production yield is dependent on the depth of the alluvial aquifer and location within the project area. Test wells are recommended to aid in selecting an adequate production well location.

7. Fire flow calculations for buildings are based on the construction type, density of structures and the summation of the areas of the three largest successive floors. An individual well will likely not provide the minimum fire flow required. Elevated storage for fire flows will likely be required; however, multiple wells may provide the required level of discharge. No recommendations on storage volume requirements or locations for alternative storage facilities are made in this report.

REFERENCES

Bartolino, J.R. 2009. Ground-water budgets for the Wood River Valley aquifer system, south- central Idaho: U.S. Geological Survey Scientific Investigations Report 2009-5016, 36 p. (also available at http://pubs.usgs.gov/sir/200-/5016/.)

Brockway, C.E., and Grover, K.P., 1978 Evaluation of urbanization and changes in land use on the water resources of mountain valleys: Moscow, University of Idaho Water Resources Research institute, 104 p. plus appendix.

Brockway, C.E., and Kahlown, M.A., 1994 Hydrologic evaluation of the Big Wood River and Silver Creek watersheds Phase I: Kimberly, University of Idaho Water Resources Research institute, Kimberly Research Center, 53 p. plus 5 appendices, accessed January 31, 2012, at http://conserveonline.org/docs/2004/06/hydrology_phase1_1994.pdf.

Castelin, P.M. and Chapman, S.L., 1972, Water resources of the Big Wood River-Silver Creek area, Blaine County, Idaho: Boise, Idaho Department of Water Administration, Water Information Bulletin 28, 44p., accessed January 31, 2012 at http://www.idwr.idaho.gov/WaterInformation/Publications/wib/wib28-big_wood_river-silver_creek_area.pdf.

Castelin, P.M., and Winner, J.E., 1975, Effects of urbanization on he water resources of the Sun Valley-Ketchum area, Blaine County, Idaho: Boise, Idaho Department of Water Resources, Water Information Bulletin 40, 86 p, accessed January 31, 2012, at http://www.idwr.idaho.gov/WaterInformation/Publications/wib/wib-40-sun_valley-ketchum_area.pdf.

EPA, 2002, Onsite Wastewater Treatment Systems Manual
United States Environmental Protection Agency. EPA/625/R-00-008

Frenzel, S.A., 1989, Water resources of the upper big Wood River basin, Idaho: U.S. Geological Survey Water-Resources Investigation Report 89-4018, 47 p. (also available at http://pubs.er.usgs.gov/pubs/wri/wri894018.)

Luttrell, S.P., and Brockway, C.E., 1982, Impacts of individual on-site sewage disposal facilities on mountain valleys – Phase I . Idaho Water and Energy Resources Research Institute, University of Idaho. Research Technical Completion Report A-084-IDA. (also available at http://www.webedit.uidaho.edu/documents/198408.pdf?pid=109073&doc=1)

Luttrell, S.P., and Brockway, C.E., 1984, Impacts of individual on-site sewage disposal facilities on mountain valleys – Phase II . Idaho Water and Energy

Resources Research Institute, University of Idaho. Research Technical completion Report WRIP/371403. (also available at http://www.webedit.uidaho.edu/documents/198408.pdf?pid=109073&doc=1)

Moreland, J.A., 1977, Ground water-surface water relations in the Silver Creek area, Blaine County, Idaho Department of Water Resources, Water Information Bulletin 44, 42 p., 5 plates in pocket, accessed January 31, 2012, at http://www.idwr.idaho.gov/WaterInformation/Publications/wib/wib44-weiser_river_basin.pdf.

Skinner, K.D., Bartolino, J.R., and Tranmer, A.W., 2007, Water-resource trends and comparisons between partial development and October 2006 hydrologic conditions, Wood River Valley, south-central Idaho: U.S. Geological Survey Scientific Investigations Report 2007-5258. 31 p., 2 pls., 1 app. (Also available at http://pubs.er.usgs.gov/usgspubs/sir/sir20075258.)

Smith, R.O. (1959). Ground-water resources of the middle Big Wood River-Silver Creek Area, Blaine County, Idaho. U.S. Geological Survey Water-Supply Paper 1478. (Also available at http://pubs.usgs.gov/wsp/1478/report.pdf)

Theis, C.V., Brown, R.H., and Meyer, R.R., 1963, Estimating the transmissibility of aquifers from the specific capacity of wells, in Bentall, Ray, ed., methods of determining permeability, transmissibility of drawdown: U.S. Geological Survey Water-Supply Paper 1536-I, p. 331-341. (Also available at http://pubs.usgs.gov/wsp/1536i/report,pdf.)