PETITION FOR
FOUR CORNERS TEMPORARY CONTROLLED GROUNDWATER AREA

The Four Corners Community Foundation (FCCF) submits this application to the Montana Department of Natural Resources and Conservation (DNRC) for the purpose of designating of a temporary controlled groundwater area (TCGA). A TCGA is an area where water supply and water quality problems have been identified, or where there could be problems in the future. The proposed TCGA in the Four Corners area encompasses an approximate 16 square mile development district in Gallatin County, eight miles east of Bozeman. A petition has been signed by 35 area residents and requests that DNRC:

1) Perform a comprehensive hydrogeologic study of the area as needed to characterize and quantify the current and future availability of ground water;

2) Assess the nature and extent of changes in groundwater quality as a function of current and projected beneficial uses in the proposed Four Corners CGA, in cooperation with the Montana Department of Environmental Quality (DEQ);

3) Temporarily close the area to further appropriation of ground water, except for replacement domestic wells, during the term of the study (2-4 years).

As expressed by numerous members of the Four Corners community and several other organizations (MSU, FWP, Gallatin WQPD, etc.) there are significant concerns regarding impacts to surface- and ground-water resources as a result of the rapid change from agricultural to urban growth in the area. Considering that some reaches of the Gallatin River below Four Corners have been nearly dry during the past several autumn seasons, these concerns should be taken seriously by the DNRC since the Gallatin River is part of the Upper Missouri basin, which is closed to new surface appropriations, including those of ground-water that are directly or immediately connected to surface-water.

Overall, little investigation by either private or public entities has attempted to address the relationship between ground- and surface-water in the area and the long-term sustainability of water resources. Wells used in previous USGS, MBMG, and DNRC studies to collect data for defining ground-water flow are few and far-between (about 1 well per square mile), and such studies have not attempted to quantify any temporal or spatial relationships of the connection between surface-water and ground-water.

Several existing, recently approved, and pending developments in the Four Corners area – listed below – warrant the need to study groundwater sustainability and the potential ground/surface-water interaction.

- North Rainbow and Lower Rainbow residential subdivisions
- Bozeman Hot Springs
- Forest Park Trailer Court
- Simpson Gravel Pit
- Valley Ice Garden

- Four Corners Business Park
- Shedhorn commercial subdivision
- Elk Grove residential subdivision
- Galactic Park commercial and residential subdivision
- Garden Center commercial and residential subdivision
- North Star commercial park and residential subdivision

The CGA statutory criteria are described below, followed by information available from past studies and additional information which could be collected during a future investigation, such as the Renewable Resource Grant application as proposed by Dr. Steve Custer of MSU (May 2004).

1. Evaluation Criteria

A. Groundwater withdrawals are in excess of recharge to the aquifer or aquifers within such groundwater area.

A long period of precipitation and stream flow records, data on potential evaporation and plant use, and soil and bedrock properties are necessary to understand the dynamic role of recharge in sustaining groundwater development. Sporadic information obtained specifically on the Four Corners area is not sufficiently detailed to evaluate long-term recharge. In contrast, studies conducted for subdivision projects contain more detailed information on specific sites but do not describe the role of recharge in determining sustainability of groundwater development in the Four Corners area as a whole. Additional information on the nature and distribution of recharge could be collected in a prospective study.

Hackett (1960) suggested that the alluvial ground-water within the Gallatin Valley was recharged not so much by direct snowmelt and precipitation but rather in large part by infiltration of irrigation and river water. The potential that the river already loses water to the aquifer at Four Corners could be exacerbated by continued future development adjacent to the river corridor.

Kendy (2001) also suggested that the West Gallatin alluvium at Four Corners is recharged by irrigation water diverted upstream from the river, or by the river itself. If this is indeed the case, and considering that the Gallatin River has gone dry in reaches below Four Corners, there is circumstantial evidence that ground-water withdrawals may be in excess of natural recharge to the aquifer.

B. Unsustainable groundwater withdrawals are very likely to occur in the near future because of consistent and significant increases in withdrawals from within the groundwater area.

Whether future groundwater withdrawals will be excessive depends on factors that are not well understood: the extent and pattern of future groundwater development, and changes in recharge to and discharge from the aquifer. A detailed understanding of aquifer boundaries, and the geometry and properties of zones that transmit water are needed to evaluate the response of the aquifer system to future development. Past researchers have mapped deposits and described the history of geologic development of the Four Corners area – information that is necessary to describe the geometry of the aquifer system.

The Gallatin Local Water Quality District (English, 2004) has noted that two recent pump tests on wells at proposed developments have substantiated the concern that ground-water may reduce surface flows in the Gallatin River (i.e., forward projections of pump test analyses indicate that the radius of influence of the wells will intersect the river's edge). A cone of depression intersecting a surface water source will create an adverse effect by drawing water from the surface source due to the inability of the aquifer to sustain well input.

Descriptions of rock properties and water production during drilling of new wells, and water-level drawdown data from pumping tests could be used during a prospective study to characterize aquifer properties. In addition, water chemistry data could be used to evaluate groundwater flow patterns.

C. Significant disputes regarding priority of rights, amounts of ground water in use by appropriators, or priority of type of use are in progress within the groundwater area.

There have been numerous objections to proposed subdivisions and other developments on the basis of water availability and the potential for adverse impacts to water levels and yields of nearby wells. A focus of many of the objections has been methods of aquifer testing, and interpretation of aquifer test results. Fish Wildlife and Parks, Trout Unlimited, and several other agricultural entities are concerned about being able to sustain their prior appropriations (for irrigation and in-stream needs for fish), as evidenced by recent (2003) legal challenges regarding surface rights in the Gallatin River and Fish Creek in response to the proposed Day Ranch/Montana Golf course.

On June 24, 2002, the Gallatin County Commission voted to reject the Riverfront Park subdivision, a proposed 135-home subdivision on 111 acres along the East Gallatin River near Belgrade. Groundwater depletion and its impacts on the Gallatin River system were among the many issues that concerned the commissioners.

On November 19, 2003, DNRC Water Commissioner V. Lighthizer issued a Proposal for Decision to deny a permit for water right application number 41H-30000806, requested by Montana Golf Enterprises, LLC, after receiving 32 valid objections to the application. The applicant proposed to pump 920 gpm (332.2 acre-ft/yr) from the Gallatin Valley alluvial aquifer to supply a golf course and resort on the Tertiary bench to the west. Pumping tests revealed that the proposed withdrawals would deplete water from nearby Fish Creek, a tributary to the West Gallatin River. Although the applicant proposed to augment the depletion by retiring an existing surface water right, the objectors showed that the proposed augmentation was insufficient to offset the expected depletion. Furthermore, the applicant failed to address potential impacts to the West Gallatin River, which the applicant's pumping-test data suggested would be impacted.

Zoot Enterprises will defend its current application to appropriate groundwater on September 23, 2004 Zoot's current pump test analyses indicate that pumping will create a cone of depression that will intersect the Gallatin River, thereby inducing flow from the surface water boundary (the river itself) and creating adverse effects to downstream water rights holders.

In addition, disputes regarding water rights currently are addressed on a case-by-case basis and DNRC does not consider cumulative effects of exempt wells that produce less than 35 gpm and 10 acre-feet of water per year. One objective of a prospective study could be to develop standard testing and analytical methods for evaluating cumulative effects of new water appropriations.

D. Groundwater levels or pressures in the area in question are declining or have declined excessively.

Water levels analyzed for several wells during the past decade possibly indicate an overall declining trend. However, hydrographs from other wells monitored by the MBMG and reports of several dry wells in the Four Corners area indicate water levels have declined from 1998 through 2003, and declining wells coincide with a period of below-average precipitation. However, groundwater withdrawals might have exacerbated declines.

Depending on the methods of interpretation, minor declines in ground-water levels have been suggested by Kendy (2001) and Dunn (1978) and others, although the exact causes – drought versus over-appropriation – have not been studied.

A longer period of monitoring and an improved understanding of aquifer conditions are needed to understand the response of water levels to climatic conditions and changes in groundwater development. Also, depth and construction of wells that were replaced need to be investigated as possible causes of reported well problems.

E. Excessive groundwater withdrawals would cause contaminant migration.

Water samples from wells in the proposed CGA may indicate elevated nitrate concentrations in areas of concentrated older septic systems. No studies have yet identified a direct causal connection between excessive groundwater withdrawals and nitrate concentrations.

Sampling of water from new wells, repeat sampling of wells sampled previously, and data reported for public water system wells can be used to identify spatial and temporal trends that may be related to groundwater withdrawals.

F. Groundwater withdrawals adversely affecting groundwater quality within the groundwater area are occurring or are likely to occur.

There is sporadic evidence of elevated nitrate levels in ground water within the proposed CGA boundaries, but no indication that groundwater withdrawals are causing migration of contaminants. Again, wells can be sampled to identify trends that may be related to groundwater withdrawals.

Two wells in the Four Corners area were used for area-wide water quality monitoring, and some concern was raised regarding nitrate-N median concentrations near 3 mg/L (Kendy 2001). Fleming (2003) also studied nutrient and microbial contamination in the area, although average nitrate-N values between 1.4 and 2.7 mg/L did not indicate significant contamination concerns in domestic wells. Nonetheless, efforts to monitor nitrate-N concentrations in groundwater at this

time will provide an excellent baseline data-set for helping to prevent such problems, rather than trying to mitigate them, as development of the area continues.

G. Water quality within the groundwater area is not suited for a specific beneficial use.

A few samples within the proposed temporary CGA have indicated nitrate concentrations that are higher than the maximum contaminant level (MCL) of 10 mg/L set by EPA for drinking water supplies. There are insufficient data to clearly demonstrate that nitrate levels are increasing; however, studies in other areas demonstrate the potential for increased nitrate concentrations in ground water in areas served by septic systems. Future sampling would provide a better understanding of the prevalence and causes of elevated nitrate in ground water in the Four Corners area.

A recent conflict regarding Bozeman Hot Springs Mixing Zone Groundwater Discharge Permit #MTX000106 and the Cain well provides a good example of the possibility for groundwater contamination. The boundary of a replacement drainfield was sited directly adjacent to a drinking water well, and the well owner was able to recognize the fact prior to the drainfield being built (alerting MDEQ to require modification of the drainfield).

2. Type of Designation or Provision Requested

FCCF seeks a temporary closure of the alluvial aquifer to new groundwater developments in excess of 35 gpm within the proposed boundary area until a local hydrologic/cumulative impacts study is completed to assess the interaction between groundwater and surface water.

FCCF believes that an Environmental Assessment is the appropriate level of DNRC review for the Four Corners TCGA petition, because the proposal in the petition and the alternatives presented in this EA would not significantly affect the quality of the human environment. If the petition were acted on as proposed, the temporary moratorium on new groundwater appropriations would have an economic impact on some. However, the moratorium and associated impacts would be temporary: during the two-year study with a possible extension to four years. Any future proposal to create a permanent CGA in the Four Corners area would require another environmental review in the form of an EA or EIS.

3. Map and Land Ownership List

A map and land ownership database, showing the outline of the potential Temporary Controlled Groundwater Area and all landowners, has been previously provided to DNRC.

Additional Information

Groundwater Resources

Wells in the proposed Four Corners TCGA obtain water primarily from Quaternary age alluvium. A number of wells south of the area obtain water from Tertiary age sedimentary rocks and unconsolidated alluvium where these younger rocks overlay Precambrian bedrock. Alluvium consists of unconsolidated clay, silt, sand and gravel deposits, and Tertiary age rocks consist of semi-consolidated clay, silt, sand, gravel and volcanic ash deposited in streams and lakes. Mifflin (1963) depicts the geology in the proposed TCGA.

Faulting, fracturing, and folding that occurred during mountain building further modified the Tertiary rocks. Numerous other faults have been mapped during various investigations, and countless other faults and fractures have not been mapped because they are obscured or are too small. Because the Tertiary age rocks beneath the Four Corners have been compacted and cemented, faults and fractures are the primary paths for water flow. These faults and fractures interconnect to varying degrees and probably form a system of essentially a secondary, discontinuous aquifer. Ground water flows through this secondary aquifer system from higher elevations toward the Quaternary gravels at Four Corners.

The amount of groundwater development that can be sustained in the Four Corners depends on the properties and boundaries of the alluvial aquifer, the pattern and amount of recharge, and the pattern of groundwater development. Variable and often unpredictable hydrogeologic conditions within the Four Corners, in addition to variable well construction, result in considerable differences in depths and yields of wells, often over relatively short distances. The combination of these factors needs to be considered in order to assess the potential for future groundwater development.

Aquifer Properties

There is little evidence that continuous fault zones transmit considerable amounts of water locally in the Four Corners area. In other instances, fine-grained zones that contain clay or are poorly connected to more coarse-grained zones may transmit significantly less ground water or act as barriers to groundwater flow. In addition, because pore openings are the main paths for ground water in the Four Corners alluvium, the overall yield of the alluvium to store water is somewhat variable but generally high. The volume of water stored in an aquifer affects fluctuations in its water level.

Recharge

Recharge to the Four Corners aquifer system varies considerably as a result of seasonal and decadal cycles of precipitation, variable soil and aquifer properties, vegetation, and terrain. Evaporation and plant needs in the Four Corners are about twice the 16 inches of average annual precipitation. As a result, water only infiltrates past the root zone during intense storms or snowmelt events, or where water infiltrates from streams or ditches. Once water moves past the

root zone it only reaches ground water after soil moisture depleted during dry periods is replenished.

Water may also infiltrate the aquifer through uplands where Tertiary rocks are exposed or are near the surface, and have sufficient storage and water transmitting capacity. Ultimately, the Tertiary aquifer system beneath the Four Corners alluvium is probably recharged infrequently in certain areas possibly followed by extended periods when water levels decline as water drains or is withdrawn from storage.

Development

Wells initially draw water from storage in an aquifer, resulting in some amount of water level decline. The duration and amount of water level decline from new groundwater development in the Four Corners area will depend on the aquifer properties described above, the proximity of wells to areas of groundwater recharge and discharge, and the amount and pattern of recharge. The amount of water level decline from pumping also depends on the amount of pumped water that is consumed and the amount that returns to the aquifer. In the Four Corners area, water used for irrigating lawns, gardens, and crops is probably mostly consumed through evaporation and plant use. In contrast, much of the water used indoors may eventually return to the aquifer through septic systems.

Sustainability of groundwater development in the Four Corners area has not been addressed in past studies. The MBMG monitors water levels in some wells that were concurrently monitored for a valley-wide alluvial study. Water levels measured since the 1990s to present for these wells are available through MBMG's Groundwater Information Center (GWIC), along with corresponding graphs of precipitation data.

Water Quality

Effluent from septic systems that contain nitrates and pathogenic microorganisms can infiltrate groundwater and reach water supply wells. Elevated levels of nitrates in drinking water can cause various health effects including a serious illness in infants known as "blue baby syndrome". Microbial contaminants including fecal coliform, E. coli and cryptosporidium may cause gastrointestinal problems that can be particularly serious in infants and people with compromised immune systems. The U.S. Environmental Protection Agency has designated a Maximum Contaminant Level (MCL) of 10 mg/L nitrate (as nitrogen) and any occurrence of microbial contaminants as thresholds that must not be exceeded in water from public water systems.

Gallatin County began permitting on-site water treatment systems in the 1980s. Prior to that, on-site wastewater treatment systems were not required to meet any standards. In 1993, the State of Montana adopted minimum standards for on-site wastewater treatment systems that mandated all counties in Montana follow the minimum standards. The amount of nitrate released to the environment from a septic system depends on the composition of the wastewater and the design of the septic tank and drain field. Effluent from a properly functioning septic system contains roughly two to seven times the drinking water limit of 10 mg/L nitrate (Wilhelm et al, 1994).

Once released to ground water, the persistence of nitrate and microbial contaminants depends on the physical and chemical conditions in soils and aquifer materials encountered by septic effluent. Dilution and denitrification, a process that uses organic carbon to convert nitrate to nitrogen gas, can lower nitrate concentrations in ground water. Limited dispersion and absence of organic carbon in coarse alluvium such as the Four Corners aquifer system may limit dilution and denitrification.

Elevated concentrations of nitrates in ground water have been documented in areas of concentrated septic systems, including areas of the Gallatin Valley. Nitrate concentrations in wells in the Four Corners area are available from a recent MSU thesis. These data indicate concentrations of nitrates below the MCL in most wells throughout the area, but rapidly increasing development in the area may begin to show elevated concentrations in other wells in the near future.

FCCF does not believe that the subdivision rules of DEQ and Gallatin County require review that is adequate to protect prior water users. The Montana Department of Environmental Quality (DEQ) is responsible for reviewing public water supply systems and public wastewater treatment systems for subdivisions. For public water systems that are supplied by wells, DEQ usually requires the developer to pump-test the well for 24-hours at a rate of 1.5 times the proposed capacity of the system to demonstrate that water is available. For proposed new subdivisions in the Four Corners that do not include a public water system, DEQ has more recently required developers to submit data to demonstrate that ground water is likely to be available for the subdivision.

Minor subdivision proposals of one to five parcels are reviewed by Gallatin County under contract with DEQ. In all cases, DEQ and the county require data only to determine whether there is likely to be enough water for the proposed developments, not to analyze potential impacts to prior water users. The subdivision review process is only required for new subdivisions and not for land that has already been subdivided.

Regarding water quality protection, Gallatin County administers a septic permitting system to ensure that domestic sewage is properly disposed of and treated to protect surface and groundwater supplies. Also, the Gallatin County Water Quality Protection District was created with the mission to preserve, protect, and improve water quality within the district boundaries. To fulfill its mission, the District has the following objectives:

1. Characterize the nature and extent of District water resources;

2. Response to citizens' concerns about water quality problems;

3. Educate the public about local water issues;

4. Facilitate planning for the prudent use of our municipal watersheds; and

5. Develop and implement water quality protection plans.

The District includes all of Gallatin County. Its operations are funded by an annual levy on homes and businesses within the District boundaries. The District monitors several wells in the proposed TCGA consistently for static water levels and periodically for nitrates. The District also monitors static water levels quarterly for a few other MBMG monitoring wells in the proposed TCGA.

Other possibilities would be to have much of the data collection for a study done by MSU students, to have a graduate student work on a study as a thesis project, to have private consultants perform the study, or ideally, to have a combination of public and private entities perform the entire study. If a TCGA were created, DNRC would work with public entities and local groups to study and manage the groundwater resource as best it could with available staff and funding.

PETITION FOR CONTROLLED GROUNDWATER AREA

The people signing below hereby request the Montana Department of Natural Resources and Conservation designate the Gallatin River in the Four Corners area a Controlled Groundwater Area in accordance with MCA § 85-2-506. Some of the reasons for such a designation include that the groundwater withdrawals are in excess of recharge to the aquifer, that excessive groundwater withdrawals are very likely to occur in the near future based on development in the area, that groundwater levels or pressures in the area are declining, and/or that the groundwater withdrawals would cause contaminate migration affecting groundwater quality.

	NAME	SIGNATURE	ADDRESS
1.	Jan Bradley	Jan Bradley	4190 Sourdough Rd. Bozeman, Mt 59715
2.	Cindi LaDuney	Cindi LaDuney	118 Triple Tree Rd. Boz. 59715
3.	Kristin Taylor	Kty	704 S. Willson Ave Bzn 597
4.	LAUREN PECK		7531 JARMEN CR, BOZEMAN 59715
5.	Barb Morton	Barb Morton	6922 Bristol Ln Bozeman 59715
6.	Christine Berger	Christine L. Berger	81515 Gallatin Rd Bozeman 5978
7.	GLENN Hatleberg	Glenn Hatleberg	4565 Monforton School Road Bozeman, MT. 59718
8.	KENNETH BARNHARDT	Kenneth Barnhardt	490 Cobb Hill Rd Boz 80850 Gallatin Rd
9.	Tom Nelson	Tom Nelson	Bozeman, Mt. 59718
10.	TERESA J. KOLNIK	Teresa J. Kolnik	81481 Gallatin Road Bozeman, MT, 59718

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	NAME	SIGNATURE	ADDRESS
1.	Diane M Hansen	Diane M Hansen	30816 Gallatin Rd
2.	Chuck Smith	Chuck SSmith	30878 Gallatin Rd.
3.	Roselee Faust	Roselee Faust	174 Lower Rainbow Rd
4.	Michelle G Gatt	Michelle G Gatt	5590 Violet Rd - Bozeman
5.	Timothy R. Emery	Timothy R Emery	5590 Violet Rd. - Bozeman
6.	KRISTIN VANDEWALLE	Kristin VanDeWalle	408 N. PLUM AVE. BOZEMAN
7.	PHILIP L. HOLT	Philip L. Holt	10 S. YELLOWSTONE #6, BOZEMAN
8.	VIRGINIA HOLT	Virginia Holt	10 S. YELLOWSTONE #6 BOZEMAN
9.	Judy Thompson	Judy Thompson	5600 Violet Rd Bozeman
10.	James McBride	James L. McBride	5550 Violet Rd Bozeman

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	NAME	SIGNATURE	ADDRESS
1.	Jerry Ritter		2631 Magenta
2.	Alan Ripley		80606 Gallatin Rd
3.	Kelly Ripley		80606 Gallatin Rd
4.		Jill Ritter	2631 Magenta
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	NAME	SIGNATURE	ADDRESS
1.	Leslie Kallem	Leslie Kallem	5436 Violet Rd
2.	Terri Kallem	Terri Kallem	5430 N. Violet Rd
3.	Frank Sibyl	Frank Sibyl	5361 Violet Rd
4.	Jimmie Lohmeier	Jimmie Lohmeier	28670 Norris Rd.
5.	TONY FORSYTHE	Tony Forsythe	80840 GALLATIN ROAD
6.	Jayne Forsythe	Jayne Forsythe	30840 Gallatin Rd
7.	DiLyn Arneson	DiLyn Arneson	5 Big Chief Tr
8.	DAN DIXSON	Dan Dixson	30761 Gallatin Rd
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	NAME	SIGNATURE	ADDRESS
1.	Jennifer Strand	Jennifer Strand	5400 Violet Rd
2.	OLAF V. STRAND	O V S	5400 Violet Rd
3.	TAMARA CARLSON	Tamara Carlson	897 COBB HILL RD
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	NAME	SIGNATURE	ADDRESS
1.	PAUL D. SHERRUM	Paul D Sherrum	27795 Norris Rd, Bozeman, MT 59715
2.	SANDRA McMANUS		27743 NORRIS RD, Bozeman MT 59718
3.	GEORGE METCALFE	George Metcalfe	11 CHINOOK TRAIL
4.	DEBRA WAHLBERG	Debra Wahlberg	11 CHINOOK TRAIL
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