

Form 9-1366
(Oct. 2005)

**U.S. Department of the Interior
U.S. Geological Survey
Joint Funding Agreement**

Customer #: 6000000745
Agreement #: 11C4SD864800032
Project #: 00100; 9ZR
TIN #: 46-6000380
Fixed Cost Agreement Yes No

**FOR
WATER RESOURCES INVESTIGATIONS**

THIS AGREEMENT is entered into as of the 1st day of January, 2011, by the U.S. GEOLOGICAL SURVEY, UNITED STATES DEPARTMENT OF THE INTERIOR, party of the first part, and the City of Rapid City, South Dakota, party of the second part.

1. The parties hereto agree that subject to availability of appropriations and in accordance with their respective authorities there shall be maintained in cooperation for operation and maintenance of selected gaging stations and for various hydrologic investigations including hydrogeologic data collection and analysis, applications of groundwater-flow modeling, storm-water monitoring, and continuation of paleoflood study, herein called the program. The USGS legal authority is 43 USC 36C; 43 USC 50; and 43 USC 50b.
2. The following amounts shall be contributed to cover all of the cost of the necessary field and analytical work directly related to this program. 2(b) includes In-Kind Services in the amount of \$0.00.

(a) \$134,450.00 by the party of the first part during the period
January 1, 2011 to December 31, 2011

(b) \$138,000.00 by the party of the second part during the period
January 1, 2011 to December 31, 2011

(c) Additional or reduced amounts by each party during the above period or succeeding periods as may be determined by mutual agreement and set forth in an exchange of letters between the parties.

(d) The performance period may be changed by mutual agreement and set forth in an exchange of letters between the parties.

3. The costs of this program may be paid by either party in conformity with the laws and regulations respectively governing each party.
4. The field and analytical work pertaining to this program shall be under the direction of or subject to periodic review by an authorized representative of the party of the first part.
5. The areas to be included in the program shall be determined by mutual agreement between the parties hereto or their authorized representatives. The methods employed in the field and office shall be those adopted by the party of the first part to insure the required standards of accuracy subject to modification by mutual agreement.
6. During the course of this program, all field and analytical work of either party pertaining to this program shall be open to the inspection of the other party, and if the work is not being carried on in a mutually satisfactory manner, either party may terminate this agreement upon 60 days written notice to the other party.
7. The original records resulting from this program will be deposited in the office of origin of those records. Upon request, copies of the original records will be provided to the office of the other party.

Form 9-1366
continued

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- 8. The maps, records, or reports resulting from this program shall be made available to the public as promptly as possible. The maps, records, or reports normally will be published by the party of the first part. However, the party of the second part reserves the right to publish the results of this program and, if already published by the party of the first part shall, upon request, be furnished by the party of the first part, at costs, impressions suitable for purposes of reproduction similar to that for which the original copy was prepared. The maps, records, or reports published by either party shall contain a statement of the cooperative relations between the parties.
- 9. USGS will issue billings utilizing Department of the Interior Bill for Collection (form DI-1040). Billing documents are to be rendered quarterly. Payments of bills are due within 60 days after the billing date. If not paid by the due date, interest will be charged at the current Treasury rate for each 30 day period, or portion thereof, that the payment is delayed beyond the due date. (31 USC 3717; Comptroller General File B-212222, August 23, 1983).

U.S. Geological Survey
United States
Department of the Interior

City of Rapid City, SD

USGS Point of Contact

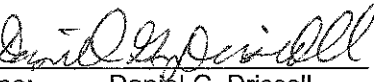
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Signatures

Signatures

By  Date 3/22/11
Name: Daniel G. Driscoll
Title: Acting Director, South Dakota Water
Science Center

By _____ Date _____
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Work plan for USGS activities during 2011
In cooperation with Rapid City, South Dakota

Prepared for

City of Rapid City

by

U.S. Geological Survey

South Dakota Water Science Center

1608 Mountain View Road

Rapid City, South Dakota 57702

November 22, 2010

Introduction

The U.S. Geological Survey (USGS) and the city of Rapid City have had a long-term cooperative relationship to conduct hydrologic investigations to better understand the complex systems that comprise water resources for Rapid City and the surrounding area. The 2011 Work Plan is designed to assist the City with hydrologic data and additional interpretive information that is relevant to (1) providing a sustainable, high-quality, regional water supply; (2) protecting ecological resources; and (3) addressing public safety. Funding will be provided through a 50/50 cost-share arrangement between USGS and Rapid City.

Work plan activities for 2011

Planned activities for 2011 are described in four categories below. Monitoring of Rapid Creek streamflow is described in section (1) *streamflow gaging*. Water-levels and well inventory in the Madison and Minnelusa aquifers and seepage tracing with stable isotopes are described (2) *hydrogeologic data collection and analysis*. Activities to further analyze the Madison and Minnelusa aquifers with a numerical groundwater flow model are described in section (3) *application of groundwater-flow model*. Continued evaluation of stormwater runoff is described in section (4) *stormwater monitoring*. Continued evaluation of storm water runoff is described in section (4) *storm water monitoring*. Continued participation in a paleoflood investigation for the central Black Hills, including Rapid Creek is described in section (5) *continuation of paleoflood study*. The total proposed funding package for the complete program and an approximate distribution of funding between the four individual programmatic areas are discussed in the final section of this work plan.

(1) Streamflow Gaging

Annual inflationary increases of 2 to 3 percent are typical for the streamflow-gaging program; however, inflationary increases are not being applied this year. Thus, the proposed streamflow-gaging program (table 1) for 2011 will essentially be identical to the 2010 program. Total funding from Rapid City for the gaging program would consist of \$21,134 that would be matched by USGS with \$17,584 of Federal Matching Funds and \$3,550 from the National Stream Information Program (NSIP).

Table 1. Proposed streamflow gaging program for water year 2011 – City of Rapid City

Gaging Station and Cooperators	Unmatched Federal	Local & State Cooperators	USGS Match	Total
Rapid Creek at Rapid City				
US Army Corps of Engineers	\$7,100			\$7,100
USGS NSIP Funding			\$3,550	\$3,550
Rapid City		\$3,550		\$3,550
subtotals	\$7,100	\$3,550	\$3,550	\$14,200
Rapid Creek below Sewage Plant				
Rapid City		\$7,100	\$7,100	\$14,200
subtotals		\$7,100	\$7,100	\$14,200
Rapid Creek near Farmingdale				
DENR		\$3,550	\$3,550	\$7,100
Rapid City		\$3,550	\$3,550	\$7,100
subtotals		\$7,100	\$7,100	\$14,200
Rapid Creek at Jackson Boulevard (telemetry and stage record)				
Rapid City		\$2,340	\$2,340	\$4,680
subtotals		\$2,340	\$2,340	\$4,680
Rapid Creek below Pactola Dam and below Deerfield Dam (2 gages)				
USBR	\$6,124			\$6,124
Rapid City		\$4,594	\$4,594	\$9,188
SDGF&P		\$2,297	\$2,297	\$4,594
RVWCD		\$2,297	\$2,297	\$4,594
subtotals	\$6,124	\$9,188	\$9,188	\$24,500
Summary of funding for all gages				
	Rapid City	Others	USGS	Total
Rapid Creek below Sewage Plant	\$7,100		\$7,100	\$14,200
Rapid Creek near Farmingdale	\$3,550	\$3,550	\$7,100	\$14,200
Rapid Creek at Jackson Boulevard	\$2,340		\$2,340	\$4,680
Rapid Creek below Pactola and Deerfield	\$4,594	\$10,718	\$9,188	\$24,500
Rapid Creek at Rapid City	\$3,550	\$7,100	\$3,550	\$14,200
Total Funding	\$21,134	\$21,368	\$29,278	\$71,780

(2) Hydrogeologic Data Collection and Analysis

Water-level monitoring will be continued during 2011 for nine observation wells that are completed in the Madison and Minnelusa aquifers. Synoptic water-level measurements also will continue in a Deadwood observation well south of Rapid City. Inventory of new wells completed in the Madison and Minnelusa aquifers will be continued in 2011 and relevant information will be entered into the USGS groundwater data base. Selected sites will be visited to determine accurate locations of wells and land-surface and water-level altitudes. Technical assistance will continue for collection and analysis of water samples for stable isotopes at selected seepage sites for comparison with stable isotope values for municipal production water. Stable isotope signatures can be substantially different for native groundwater and municipal production water, and such sampling can be useful in helping to evaluate whether areas with groundwater seepage might be influenced by leaks in the municipal distribution system.

(3) Applications of Groundwater Flow Model

Applications for the recently-published groundwater flow model will include updating transient simulations with current data and hypothetical simulations of selected drought stresses and pumping scenarios. The updated transient data sets developed include recharge to the Madison and Minnelusa aquifers from streamflow and infiltration of precipitation on the outcrop for the period from 1998-2009. Pumping withdrawals from the aquifer, and observed water levels were tabulated for the same period. Maintenance of the model with these data sets provides the basis for evaluating how the model can best be used to simulate the effects of hypothetical scenarios such as drought and additional pumping withdrawals. The funding increment identified for 2011 would be used for model simulations with the updated data sets along with selected hypothetical pumping scenarios. It is anticipated that a larger funding increment will be available in 2012 and out years because the paleoflood study described in section 5 will be concluding. The product for this effort would be development and publication of a USGS Scientific Investigations Report that documents the data sets used in model maintenance, comparison of observed heads and spring flows to simulated values, and hypothetical simulations of potential future stresses. It is anticipated that this product would be part of a 5-year cooperative effort with the city that includes other study elements summarized in this work plan. The distribution of funding between study elements and the timeframe for the publication would be based on priorities established in consultation with the city.

Another possible programmatic direction may be participation in a multi-agency effort for development of a regional groundwater flow model of the Madison and Minnelusa aquifers for

the entire Black Hills area that would serve as a framework for embedded detailed models for site specific areas such as Rapid City and other communities. Analysis of future water supply issues in a regional context could be useful for long-term planning. This modeling effort would substantially improve modeling capabilities for the Rapid City area, but would be contingent on participation from other area agencies.

(4) Stormwater Monitoring

Rapid City has implemented programs to improve stormwater quality in response to the 'Phase II Final Rule' stormwater guidelines issued by the U.S. Environmental Protection Agency. In 2008, the City requested that USGS provide assistance in developing strategies for a stormwater monitoring plan and USGS responded by planning and implementing a preliminary monitoring program for the Arrowhead Basin, and expanded the monitoring program to the Meade-Hawthorne basin in 2010. Data collected from 2008–10 indicate concentrations of fecal coliform bacteria and total suspended solids that exceed EPA target goals for Rapid Creek. A comparison of the 2010 water-quality data between the two monitored basins demonstrates the effects of sediment controls (open vegetated channels, detention ponds, or wetlands). Event-mean concentrations were consistently higher in the Meade-Hawthorne basin, characterized by predominantly closed-pipe or concrete channels, in contrast to the predominantly open vegetated channels in the Arrowhead basin.

Preliminary plans for 2011 are (1) continued monitoring within the Arrowhead and Meade-Hawthorne basins at the three sites that were used during 2010; (2) monitoring the efficiency of constructed ponds in reducing concentration of bacteria and TSS; (3) evaluating possible sources of bacteria; and (4) developing datasets needed to create and calibrate a rainfall-runoff water-quality model (SWMM / HEC-HMS) for selected sites. Detailed planning for 2011 activities will be accomplished through discussions of priorities with staff from the Stormwater Program of the Public Works Department.

Another possible programmatic direction may be participation in a regional study of stormwater quality that would include multiple communities within South Dakota and build on efforts initiated by the cooperative study between Rapid City and USGS. The foundation for the concept is that Rapid City and other communities could achieve substantial efficiency by combining resources to evaluate influences in a variety of land-use and developmental settings throughout the state. A concept paper for this potential study effort has been developed by USGS and has been provided to Rapid City Staff and to Al Spangler, who is the coordinator for the state's MS4 stormwater quality program. The concept paper has since been circulated by Al Spangler to other communities, and future discussions are anticipated. USGS will consult with Rapid City staff regarding potential future developments.

(5) Continuation of Paleoflood Study

USGS has been cooperating with several agencies (including Rapid City) on paleoflood investigations for several major drainages in the central Black Hills area, including Rapid Creek. Stratigraphic analyses and age dating of "flood slack-water deposits" have been the primary tools for the investigations, and contingent on availability of appropriate deposits, this tool can yield detailed chronologies for large previous floods. Preliminary results indicate that there is a very rich history of numerous large floods for the reach of Rapid Creek downstream from Pactola Reservoir. Flood evidence is much sparser in the reach above Pactola Reservoir, however, and tends to support a hypothesis of reduced peak-flow potential, relative to the downstream reach.

Results of investigations along Rapid Creek will be included in a USGS publication addressing the central Black Hills area that will be completed as part of the larger-scale project involving multiple cooperators. All field data collection and analytical activities been completed. A preliminary draft of the final completion report was completed in June and was circulated for review to all cooperating agencies. Peer technical reviews also have been performed and the draft report has been undergoing revisions in response to review comments from many sources. The report is expected to be finalized and published early in 2011.

Planned 2011 funding by task

Approximate funding allocations among planned program activities for 2011 are listed in Table 2. Planned work efforts and associated funding are to be on a calendar year basis for 2011, with the exception of Item 1 (*streamflow gaging*), which will be for water year 2011 (Oct. 1, 2010 through Sept. 30, 2011). A 50/50 cost share between Rapid City and USGS will be accomplished for all program components. The proposed distribution of program funding is subject to modification during 2011, depending on possible changes in priorities established through discussions with Rapid City staff.

Table 2. Planned allocation of funding for 2011 work activities

Item number	Proposed activity	Rapid City share	USGS share	Total
1	Streamflow gaging ¹	\$21,134	¹ \$17,584	\$38,718
2	Hydrogeologic data collection and analysis	\$25,000	\$25,000	\$50,000
3	Applications of groundwater-flow model	\$25,000	\$25,000	\$50,000
4	Storm water monitoring	\$58,000	\$58,000	\$116,000
5	Continuation of paleoflood study	\$8,866	\$8,866	\$17,732
Totals to be shown on Joint Funding Agreement		\$138,000	¹\$134,450	\$272,450

¹ Additional funding of \$3,550 for the streamflow gaging program will be provided by USGS through the National Streamflow Information Program, to accomplish an effective 50/50 match.