PROJECT TITLE: **Inventory of salinity and selenium concentrations in surface water, groundwater, and biota of Hailstone and Halfbreed National Wildlife Refuges following the 2011 Hailstone dam breach**

FY	
Requested	Funded
2014	2014

Project Proposal

NWR: CHARLES M. RUSSELL WETLAND MANAGEMENT DISTRICT

Project Type:	Focus:	Scale:
Inventory	Contaminants	Multi-station

☑ Staff Biologist?

☑ This proposal has station support?

☑ FWS protocols were followed regarding data managment?

☑ This proposal supports a priority in a CCP/ HMP or other refuge plan

Hailstone and Halfbreed NWRs were established primarily to protect wetlands for migratory birds and waterfowl. The water quality of Hailstone Reservoir prior to the dam removal created unsuitable risks to waterfowl and shorebirds that resulted in die-offs due to salts and predicted avian embryotoxicity due to elevated selenium levels detected throughout various components of the ecosystem (Nelson and Reiten 2005). The environmental consequences identified under the proposed action in the Hailstone dam removal EA include an elimination of waterfowl and shorebird mortality events by creating a flow through system that reduces the evapoconcentration of salts; salinity and selenium levels at Halfbreed and Big Lakes are not expected to reach levels of concern based on existing data and the predicted increase in the ratio of freshwater to saltwater created by expanding the watershed sizes for both lakes (USFWS 2010). This inventory will be used to evaluate those environmental consequences identified under the proposed action in the Hailstone dam removal EA and if effects are identified, or hazard quotients indicate that some contaminant is above a level of concern, various monitoring needs or management actions could be considered to address those effects. For instance, inventory data could be used to design a monitoring plan designed to quantify contaminant loads contributed by various sources. This could then lead to precise management actions, such as phytoremediation, that could be implemented to enhance selenium volatilization (Bañuelos et al. 2002).Furthermore, a condition of the MOA between the U.S. Fish and Wildlife Service and the Montana Department of Environmental Quality (2009) allowing the Service to open up Hailstone dam and release water was to create a program to document effects of the dam removal. This is stated in the MOA as, “The Service will monitor surface water and groundwater levels and quality before, during and after dam removal. This will be completed using a subset of wells located around Hailstone NWR, the new well located along Hailstone

NWR: CHARLES M. RUSSELL WETLAND MANAGEMENT DISTRICT

Creek below the dam, and the six wells located on Halfbreed NWR. Surface water samples will be collected as the opportunity arises at Hailstone Reservoir, Hailstone Creek, Halfbreed Lake and Big Lake. These samples will be analyzed for major ions as well as selenium." Monitoring costs were previously covered by Refuge Cleanup funds; the refuge has reached the limit of requesting funds and must seek monitoring funds from other sources. This inventory will fulfill the conditions described in the MOA and will not only provide a detailed inventory of water quality throughout Lake Basin, but will provide an inventory of exposure and risk to sensitive wildlife species like waterfowl and shorebirds by quantifying selenium levels in prey items as well as directly measuring selenium concentration in avian embryos to predict a current rate of teratogenesis.

☐ This proposal supports a "Top Region 6 Priority"

PROJECT DESCRIPTION

Hailstone Reservoir dam in Hailstone National Wildlife Refuge (NWR) was breached during the fall of 2011 to reduce the unacceptable risk posed to waterfowl and shorebirds using the refuge. For close to 60 years, contaminants, including salts and selenium, accumulated in the reservoir as a result of agricultural practices in the watershed. The purpose of this project would be to provide a post-dam breach inventory of selenium and salinity levels across various components of the ecosystem at sites located downstream of Hailstone Reservoir, as well as at sites upstream and outside of the influence of Hailstone Reservoir, and to conduct an inventory of teratogenic risk to sensitive avian species. These are all conditions outlined in the Memorandum of Agreement (MOA) between the U.S. Fish and Wildlife Service (Service) and the Montana Department of Environmental Quality (2009) and the Hailstone dam removal Environmental Assessment (EA) (U.S. Fish and Wildlife Service 2010). Hailstone and Halfbreed NWRs, located in Northern Stillwater County, Montana are satellite refuges managed by the Charles M. Russell NWR Complex. They are both found in Lake Basin, a closed basin isolated from the Musselshell drainage to the north and the Yellowstone drainage to the south. Lake Basin is an important waterfowl and migratory bird area for south-central Montana and Halfbreed NWR is recognized as an Important Bird Area under the Important Bird Area program administered by the National Audubon Society. The Yellowstone Valley Audubon Chapter has identified more than 100 species of birds on Halfbreed NWR and during wet years, large numbers of waterfowl (> 20,000) and shorebirds (> 5,000) use the lake and shoreline (Audubon 2013). Since the 1950's, saline-seep development in Lake Basin have impacted the water quality on Hailstone and Halfbreed NWRs. Nelson and Reiten (2005) determined that saline seep induced changes to water quality negatively impacted waterfowl and shorebirds using the Hailstone Reservoir. For example, several mortality events were observed due to salt-encrustation on feathers of ducks during the investigation and a selenium hazard assessment indicated that selenium levels in Hailstone Reservoir had the potential to cause complete reproductive failure in sensitive waterfowl and shorebirds (Nelson and Reiten 2005). In contrast, water quality was consistently better at Halfbreed NWR and no mortality events were ever observed during that study.Cretaceous marine shales that underlie most of the basin, along with shale-derived alluvium and colluvium are the main geologic source of salts and selenium in the soil profile. Conversion of native prairie to crop-fallow farming increases the amount of precipitation that infiltrates the soil profile. Unlike native sod cover, crop-fallow agricultural practices allow precipitation to infiltrate below the root zone leading to the development of a groundwater-flow system on top of low permeability shales that underlie the basin (Holzer et al. 1995). Traveling from the recharge area (or point of infiltration) to the discharge area, groundwater can accumulate approximately 50 mg/L of total dissolved solids per foot of movement depending on flow rate, concentration, and the available salt (Duaime et al. 1991). The predominant soluble constituents picked up by groundwater are sodium, magnesium, sulfate, and nitrate. Trace elements such as selenium are also mobilized by this groundwater flow (Duaime et al. 1991). Thinning alluvium and rises in the topography of impermeable shales force groundwater to the surface creating seeps where selenium and salts are evapoconcentrated at the surface. These are eventually transported to Hailstone Reservoir during runoff events (Nelson and Reiten 2005). Miller et al. (1981) estimated that the levels of sodium and likely other soluble constituents present in the soil profile will sustain existing seeps for the next 25 to 100+ years. Prior to the dam breach, the refuge was unable to manipulate the water levels of Hailstone Reservoir, so surface water carrying seep-derived constituents flowing into the reservoir continued to evapoconcentrate resulting in migratory bird mortality events. Removing Hailstone dam and restoring Hailstone Reservoir to its natural configuration was selected as the best strategy to reduce the risk posed by contaminants that have accumulated in the reservoir to waterfowl and shorebirds using the basin. Prior to the dam removal, Hailstone reservoir was located in the upper hailstone basin watershed that was approximately 32,000 acres in size. In the absence of Hailstone Reservoir, Halfbreed Lake is the first wetland within Lake Basin and receives water from a 170,000 acre watershed, including the upper hailstone basin. The increase in watershed size is expected to allow for dilution of the contaminated water originating from the upper hailstone basin to occur. Furthermore, Hailstone Creek is a low gradient stream that travels 8.7 miles from Hailstone Reservoir to Halfbreed Lake that will allow selenium that is being transported from the upper hailstone basin to bind to stream sediments, and selenium volatilization is expected to occur as the stream channel dries between storm events.Dam removal work began in 2010 in combination with reservoir dewatering efforts. In the fall of 2010, the dam was lowered and a small channel was created for spring runoff-associated water to move downstream. The spring of 2011 was a wet year and water flowed over the dam and through the newly created channel for several weeks. Dewatering efforts continued in 2011 and by the fall, the final dam breach was complete and a new stream channel was created to transmit a 500 year event through the old dam location. Beginning in the summer of 2011, annual surface water and groundwater monitoring has occurred; although, surface water sites were dry in 2013 (2013 groundwater data is not yet available). Benthic macroinvertebrate samples were also collected and analyzed for selenium in 2012 at select sites. Based on Department of Interior (1998) aquatic selenium toxicity thresholds, selenium levels in surface water in 2012 were below levels of concern (<1 μg/L) at Halfbreed Lake, Goose Lake and Grass Lake, while concentrations were slightly above an aquatic toxicity threshold (>2 μg/L) in Big Lake. However, concentrations detected in 2011 were greater than two times of what was detected in 2012 at Halfbreed, Goose, and Grass Lakes. While the dam was not fully breached during this sampling period, it was lowered in 2010 and since 2011 was a high water year, water originating in the upper hailstone basin was no longer retained in Hailstone Reservoir and flowed through the temporary channel to downstream sites. The concentrations detected in the summer of 2011 at sites below Hailstone dam likely reflect the reservoir-associated and upper hailstone basin-associated selenium loads, especially considering that many of the tributaries to Hailstone Reservoir had selenium concentrations as high as or higher than concentrations detected in the reservoir. These were all flushed through the basin during spring runoff. The selenium concentrations in Hailstone Creek in 2011 and 2012, a site immediately below Hailstone dam, exceeded the

Department of Interior (1998) aquatic selenium toxicity threshold (>2 µg/L) and were greater than ten times the pre-dam breach levels. However, the highest selenium concentration detected in Hailstone Creek (11 µg/L) was still close to seven times less than the highest concentration detected in Hailstone Reservoir (73 µg/L) before it was dewatered. There are no clear trends with groundwater selenium data, although some of the wells were slightly elevated compared to pre-dam breach levels. The only post-dam breach macroinvertebrate site that was sampled prior to the breach is at Hailstone Creek. In 2012, the selenium concentration in benthic macroinvertebrates in Hailstone Creek (15 mg/kg dw) was three times higher than the maximum macroinvertebrate selenium concentration detected at that same location prior to the dam breach (3 mg/kg dw). However, the 2012 Hailstone Creek macroinvertebrate selenium concentration was still almost two times less than the average selenium macroinvertebrate concentration detected in Hailstone Reservoir prior to the dam breach (24 mg/kg dw). Selenium concentrations were also quantified in macroinvertebrates sampled from Halfbreed, Goose, Grass, and Big Lakes. Macroinvertebrate selenium concentrations at these sites followed a similar pattern as their respective surface water samples. Concentrations were elevated to levels slightly above a toxicity threshold (>3 mg/kg dw) in 2011 but decreased to levels below that threshold in 2012. The dam was removed to reduce mortality to waterfowl and shorebirds exposed to elevated levels of salts and selenium. A condition of the MOA (USFWS and MTDEQ 2009) between the U.S. Fish and Wildlife Service and the Montana Department of Environmental Quality allowing the Service to open up Hailstone dam and release water was to monitor surface water quality and groundwater quality for multiple years following the dam breach. A plan designed to monitor the surface water and groundwater quality and biota at Hailstone and Halfbreed NWRs was also a component of the Hailstone dam removal EA (U.S. Fish and Wildlife Service 2010). Costs were previously covered by Refuge Cleanup funds; however, the refuge has reached the limit of requesting funds and must seek funds from other sources. This inventory is designed to meet the requirements of the MOA and the EA.

OBJECTIVES

One objective of this project is to provide a post-dam breach inventory of water quality, with an emphasis on salinity and selenium in surface water bodies of the Lake Basin watershed to fulfill the conditions outlined in the MOA between the U.S. Fish and Wildlife Service and the Montana Department of Environmental Quality (2009) and the Hailstone dam removal EA (U.S. Fish and Wildlife Service 2010). Specifically, all surface water bodies below the once existing Hailstone dam including Hailstone Creek located in Hailstone NWR, Halfbreed, Goose and Grass Lakes located in Halfbreed NWR, and Big Lake, the Lake Basin terminus and Montana FWP managed state wildlife management area, as well as sites located upstream or outside of any influence of the reservoir that include the east and west tributaries to Hailstone Reservoir and Cedar Creek, a tributary to Halfbreed Lake, will be sampled annually for three years beginning in 2014 to provide an estimate of current specific conductivities and major ion and selenium concentrations. Hazard quotients, or the ratio of the measured concentration of a constituent to a selected screening value for that contaminant, will be calculated using available toxicity reference values for specific conductivity (Mitcham and Wobeser 1988a), major ions (Mount et al. 1997), and selenium (DOI 1998) for each site and will be used to prioritize future monitoring needs or management actions.Another objective of this project is to provide a post-dam breach inventory of groundwater quality, with an emphasis on salinity and selenium in shallow aquifers immediately below Hailstone Reservoir to fulfill the conditions outlined in the MOA between the U.S. Fish and Wildlife Service and the Montana Department of Environmental Quality (2009) and the Hailstone dam removal EA (U.S. Fish and Wildlife Service 2010). Groundwater sampled will be collected annually using an established monitoring network across Hailstone and Halfbreed NWRs for three years beginning in 2014 and will be used to provide an estimate of current specific conductivities and major ion and selenium concentrations found within shallow aquifers of Hailstone and Halfbreed NWRs, as well as to identify trends in groundwater quality following the dam breach. A final objective will be to provide a post-dam breach inventory of selenium concentrations in benthic macroinvertebrate and bird eggs of two different species representing different sensitivies to selenium. Macroinvertebrates and bird eggs will be sampled in the late spring/early summer of 2014 to provide an inventory of current selenium levels in biota, as well as an inventory of predicted avian teratogenic risk. Based on known occurrences of macroinverterbrates and availability to birds, Hailstone Creek, Halfbreed Lake, Goose Lake, Grass Lake, and Big Lake will be targeted for macroinverterbrate sampling, while Halfbreed Lake and Big Lake will be targeted for bird egg collection because nesting is known to occur at these two sites. Hazard quotients will be calculated for macroinvertebrates and bird embryo selenium concentrations using available toxicity reference values for macroinverterbrate selenium concentrations (Lemly 1996a) and teratogenic concentrations of selenium in birds (NIWQP 2003). All field work will be completed by EC specialists out of the Montana Ecological Services Field Office.

DESIGN AND METHODS

Hailstone and Halfbreed NWRs are part of the Charles M. Russell NWR Complex and are located in Northern Stillwater County, Montana. They are both found in Lake Basin, a closed basin isolated from the Musselshell drainage to the north and the Yellowstone drainage to the south. Prior to the dam breach, Hailstone Reservoir was the terminus of the upper hailstone basin that received water from a number of intermittent tributaries. With the dam breach complete, the tributaries of the upper hailstone basin come to form Hailstone Creek in Hailstone NWR, a low gradient stream that travels 8.7 miles from Hailstone NWR to Halfbreed Lake on Halfbreed NWR. In addition to Hailstone Creek, Cedar Creek is another tributary to flow into Halfbreed Lake and drains the area to the west of Halfbreed outside of any influence of Hailstone reservoir, but subject to agricultural land use practices typical of Lake Basin. To the south of Halfbreed Lake are two other wetlands, Goose and Grass Lakes that are also located within Halfbreed NWR. Big Lake, a state WMA, is the terminus of Lake Basin. During wet years, all of these water bodies are connected via surface water; shallow groundwater-flow systems may interact with surface water bodies as well. Inventory locations will be located within Hailstone NWR, Halfbreed NWR, and Big Lake WMA, as well as at Cedar Creek and upper hailstone basin tributaries. Surface Water Sampling:Single surface water grab samples will be collected every year beginning in 2014 in the late spring/early summer, assuming there is water, for three years at the following sites: East Hailstone Tributary, West Hailstone Tributary, Hailstone Creek, Halfbreed Lake, Goose Lake, Grass Lake, Big Lake, and Cedar Creek. Since all of the sites are relatively small, with regular shorelines and uniform bottom configurations, it will be assumed that single annual samples will be sufficient to describe the distribution and abundance of the targeted constituents (Ward and Hall 1990). However, field duplicates will be collected at a rate of 10% of the total number of samples per parameter, or a minimum of one duplicate if less than ten samples are expected to be collected, for quality assurance (QA) purposes (MTDEQ 2012). Prior to collecting water samples, field water quality measurements will be taken in situ that will include dissolved oxygen, temperature, pH, total dissolved solids, and specific conductivity using a multi-probe (Hydrolab Datasonde MS 5, Hach Corporation, Loveland, CO, USA). Water samples will be collected for lab analysis in an Alconox washed 10% nitric acid and distilled water rinsed 5-gallon plastic bucket. A Geopump Peristaltic Pump and Geotech dipos-a-filter (0.45 µm) will be used to pump and filter water from the bucket to certified chemically-cleaned sample bottles. Filtered samples collected for trace element and major cation analyses will be acidified with trace metal grade nitric acid to a pH < 2 and stored at 4°C until shipment to lab. Filtered samples collected for major anion analyses will be stored at 4°C until shipment to lab. One field blank per analyte group (trace elements, major cations, major anions) will be collected and preserved following identical sampling procedures for each group at the end of each annual sampling event (MTDEQ 2012).

Groundwater Sampling:Groundwater sampling will occur annually in late spring/early summer starting in 2014 for three years at eight groundwater monitoring wells that include two monitoring wells along Hailstone Creek in Hailstone NWR and six monitoring wells located in Halfbreed NWR. Following established monitoring guidelines, single samples will be collected each year with field duplicates collected at a rate of 10% of the total number of samples per parameter, or a minimum of one duplicate if less than ten samples are expected to be collected, for QA purposes (MTDEQ 2012). Prior to collecting samples, wells will first be pumped or bailed until three casing volumes are removed, or when specific conductivity stabilizes. Then, groundwater will be bailed into an Alconox washed 10% nitric acid and distilled water rinsed 5-gallon plastic bucket with a decontaminated bailer. Water samples will then be collected for trace element, major anion, and major cation analyses following the same procedures for surface water sampling. One field blank per analyte group (trace elements, major cations, major anions) will also be collected and preserved following identical sampling procedures for each group at the end of the sampling event (MTDEQ 2012). Field water quality measurements that will include dissolved oxygen, temperature, pH, total dissolved solids, and specific conductivity will also be measured in situ by use of a multi-probe (Hydrolab Datasonde MS 5, Hach Corporation, Loveland, CO, USA). Depth to groundwater measurements will also be taken using a water level meter (Solinst Water Level Meter Model 101, Solinst Canada Ltd., Georgetown, Ontario, Canada)Benthic Macroinvertebrate SamplingBenthic macroinverterbrates will be collected at the sites Hailstone Creek, Halfbreed Lake, Goose Lake, Grass Lake, and Big Lake based on their known occurrence and availability to foraging birds. Samples will be composites representative of the available prey for foraging wildlife. Considering the variability in uptake rates between and within macroinverterbate species, replicate samples will be taken within each unit. A power analysis based on power > 0.8 and α=0.05 using variances and means of data collected previously for each unit has indicated that three replicate samples per unit will provide a sufficient level of precision for this objective. In consideration of costs and sampling effort, a single year of benthic macroinvertebrate sampling will be completed in the late spring/early summer of 2014, unless sites are dry, in which case sampling will occur the next wet year.

Each replicate sampling unit will be randomly selected within each site. Benthic macroinvertebrates will be collected with an Alconox washed D-framed sweep net until >5 grams are collected. Contents of the net will be placed in an Alconox washed 10% nitric acid rinsed 250 µm plastic sieve where non-invertebrate material will be removed and all macroinvertebrates collected will be placed in certified chemically-cleaned glass containers using Alconox washed 10% nitric acid rinsed plastic forceps. Samples will then be frozen until shipment to the lab. Analytical work will be requested to be done by TERL, Texas A&M University, College Station, TX (A Service contract laboratory). Avian Egg Sampling:While selenium is a micronutrient, it can be toxic when only slightly elevated in the environment and selenium exposure in birds can result in deformed embryos and embryo mortality (NIWQP 2003). Measuring selenium concentrations in embryos can provide evidence of exposure and when compared to established teratogenic thresholds, considering the differences in sensitivity between species, a measure of risk can be achieved

(NIWQP 2003). For this project, two species of birds, representing the two groups Anatidae and Recurvirostridae will be targeted for egg collection at Halfbreed Lake and Big Lake. These two groups of birds were selected because species of Anatidae are more sensitive to selenium toxicity than Recurvirostridae are; therefore, this approach will provide a range of predicted effects across different sensitivities. Further, teratogenic-response functions have been calculated for species within these groups (NIWQP 2003). Also, the species that nest at these sites can be highly variable due to fluctuating hydroperiods, so target species may change to insure that some measure of selenium exposure in birds is accomplished during this inventory. Halfbreed and Big Lakes were selected as egg collection sites because nesting is most likely to occur at these two sites within Lake Basin and are hydrogically connected to Hailstone Reservoir. Nesting attempts by aquatic birds of the families Anatidae and Recurvirostridae will be monitored in the spring/summer of 2014, and when nests are located, one egg will be collected, dissected, the embryo examined for abnormalities, and contents placed in chemically-cleaned glass containers and frozen until shipment to the lab. Based on known variability of selenium in bird embryos, a minimum of five eggs from separate nests per species, and not to exceed ten, will be sampled (Joseph Skorupa, pers. Comm). If breeding does not occur in 2014, nest monitoring and sampling will be attempted again in 2015. Analytical work will be requested to be done by TERL, Texas A&M University, College Station, TX (A Service contract laboratory). Chemical AnalysesAnalytical work will be requested to be done by Trace Element Research Laboratory (TERL), Texas A&M University, College Station, TX (A Service contract laboratory). For all water samples, a total metals scan will completed using atomic fluorescence spectroscopy for selenium, cold-vapor atomic absorption spectroscopy for mercury, graphite furnace atomic absorption spectroscopy for arsenic, and inductively coupled plasma optical emission spectroscopy for the remaining elements, including major cations. For anions, chloride and sulfate will be analyzed using ion chromatography while alkalinity will be analyzed using titration method. Benthic macroinvertebrate and bird egg samples will be analyzed for selenium using inductively coupled plasma-mass spectroscopy. QA/QC will consist of procedural blanks, duplicate analysis, and spike recoveries. All reports of QA/QC completed by TERL will also be reviewed by the Service's Analytical Control Facility.

DATA ANALYSIS/MODELS

Prior to any formal analysis, relative percent difference (RPD) will be calculated for surface water and groundwater duplicate samples using: RPD = (X1-X2)x100/(X1+X2)÷2 where X1=the larger of the two values and X2=the smaller of the two values. A RPD control limit will be set at 25% in that duplicate field samples exceeding that limit that have result values >5 times the reporting limit will be flagged (MTDEQ 2012). This means that the analyte was positively identified but the numerical value is an approximate concentration. Flagged analytes will be analyzed with caution.As indicated in the data management section, parameters measured in the field and analyzed in the laboratory, as well as all other data collected at this site prior to this inventory, will be inventoried into a single database. This database will contain data collected prior to the Hailstone Reservoir dam breach, during the dam breach, and after. However, to identify any future monitoring needs or management actions and to prioritize those needs and actions, a hazard quotient approach, or the ratio of the measured concentration of a constituent to a selected toxicity reference value (TRV) for that contaminant, will be implemented to evaluate the level of concern posed by contaminant concentrations found in surface water and biota (USEPA 1998). For surface water, hazard quotients will be calculated using available toxicity reference values for specific conductivity (20,000 µS/cm; Mitcham and Wobeser 1988a) and selenium (2 µg/L; DOI 1998) for each site. Duck mortality and reduced growth has been observed in species exposed to water with specific conductivities at or above 20,000 µS/cm (Mitcham and Wobeser 1988a) and food chain bioaccumulation may occur causing reproductive impairment with surface water selenium concentration at or above 2 µg/L (DOI 1998). Benthic macroinverterbrate hazard quotients will be calculated using the 95% upper confidence limit (UCL) of the average selenium concentration at each site as the numerator and a dietary toxicity reference value for selenium (3 mg/kg; Lemly 1996a) as the denominator. Reproductive failure in fish and wildlife has been observed with diets containing at least 3 mg/kg selenium (Lemly 1996a). Bird embryo hazard quotients will be calculated using the 95% UCL of the average embryo selenium concentration for each species at each site as the numerator and the predicted embryo concentration to cause teratogenesis at a background rate (NIWQP 2003) as the denominator. Based on the background rate of teratogenesis of 0.5%, a concentration of 12.5 mg/kg will be used for species of Anatidae while the range of concentrations 12.5-31mg/kg will be used depending on what species of Recurvirostridae is collected (NIWQP 2003). A hazard quotient >1 indicates that harmful effects cannot be ruled out and that the contaminant is above a level of concern. The number of hazard quotients that are >1 for each constituent across the various ecological components measured will be summed at each site. This approach will be used to prioritize sites based on risk to wildlife. Sites with the greatest number of hazard quotients >1 will pose the greatest risk to wildlife and future monitoring needs or management actions could be developed to address those specific sites. Groundwater does not pose a direct risk to wildlife due to the lack of exposure, but it does serve as a contaminant transport pathway. Therefore, groundwater selenium and major ion concentrations, as well as specific conductivity data from this project, will be used, in conjunction with data collected as part of the refuge cleanup in 2011 and 2012 to complete a trend analysis using the Mann-Kendall trend test (Mann 1945, Kendall 1975) to determine if groundwater quality is changing. A significant positive trend will be considered an adverse effect and future monitoring needs or management actions will then be considered. All procedures will all be completed in Microsoft Excel.

REVIEWERS:

Matt Schwarz - South Dakota ES Field Office EC SpecialistKaren Nelson - Montana ES Field Office EC SpecialistDavid Rouse – Montana ES Field Office EC Specialist (Prepared proposal)Joseph Skorupa – Region 6 EC Specialist (selenium egg concentration section)Brian Sanchez- Colorado ES Field Office EC Specialist

PARTNERS

PROJECT TITLE: Inventory of salinity and selenium concentrations in surface water, groundwater, and biota of Hailstone and Halfbreed National Wildlife Refuges following the 2011 Hailstone dam breach

FY Requested	FY Funded
2014	2014

Project Proposal

NWR: CHARLES M. RUSSELL WETLAND MANAGEMENT DISTRICT

SOURCES OF SUPPORT:

Years Funding Requested: 3

Request From I&M Program:	$51,649.00
Contributed By Station:	$0.00
Contributed By Partners:	$0.00
Allocation Grand Total:	$51,649.00

Salary & Benefits:	$14,007.00
Equipment:	$0.00
Contracts:	$0.00
Travel:	$3,260.00
Other:	$34,382.00

PROJECT TITLE:	Inventory of salinity and selenium concentrations in surface water, groundwater, and biota of Hailstone and Halfbreed National Wildlife Refuges following the 2011 Hailstone dam breach	FY Requested	FY Funded
		2014	2014

Project Proposal

NWR: CHARLES M. RUSSELL WETLAND MANAGEMENT DISTRICT

	Year 1		Year 2		Year 3	
Personnel 1:	EC Specialist	$4,573.00	EC Specialist	$1,575.00	EC Specialist	$1,626.00
Personnel2:	EC Specialist	$2,010.00	EC Specialist	$2,078.00	EC Specialist	$2,145.00
Personnel3:					no position	$0.00
Salary and Benefits Sum:		$6,583.00		$3,653.00		$3,771.00
Equipment:						
Contracts:						
Travel:		$1,576.00		$842.00		$842.00
Other:	Water Metals Scan, Water Ion Analysis, Animal Tissue Metals Scan	$18,842.00	Water Metals Scan, Water Ion Analysis	$7,720.00	Water Metals Scan, Water Ion Analysis	$7,820.00
Project Cost IM:		$27,001.00		$12,215.00		$12,433.00
Station Contribution:						
Partner Contribution:						
Project Cost Totals:		$27,001.00		$12,215.00		$12,433.00
Allocation Totals		$27,001.00		$12,215.00		$12,433.00

PROJECT TITLE:	Inventory of salinity and selenium concentrations in surface water, groundwater, and biota of Hailstone and Halfbreed National Wildlife Refuges following the 2011 Hailstone dam breach	FY Requested	FY Funded
		2014	2014

Project Proposal

NWR: CHARLES M. RUSSELL WETLAND MANAGEMENT DISTRICT

	Year 4		Year 5	
Personnel 1:				
Personnel2:				
Personnel3:				
Salary and Benefits Sum:				
Equipment:				
Contracts:				
Travel:				
Other:				
Project Cost IM:		$0.00		$0.00
Station Contribution:				
Partner Contribution:				
Project Cost Totals:		$0.00		$0.00
Allocation Totals		$0.00		$0.00

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		2014	2014

Project Proposal

NWR: CHARLES M. RUSSELL WETLAND MANAGEMENT DISTRICT

DATA MANAGEMENT:

Description of data entry, verification, editing and software.

Field measurements will be stored in the handheld Surveyor (Hydrolab Datasonde MS 5, Hach Corporation, Loveland, CO, USA) and will also be recorded in a designated field notebook. Date, time, weather, depth to groundwater (for monitoring wells), and other observations will also be recorded in the field notebook. When samples are collected, the time, date, and sample type will also be recorded in the field notebook. Data stored in the handheld Surveyor (Hydrolab Datasonde MS 5, Hach Corporation, Loveland, CO,USA) will be downloaded by an Environmental Contaminants (EC) Specialist at the Montana Ecological Services Field Office into a master data Microsoft Excel spreadsheet. Downloaded data will be crosschecked with the values recorded in the field notebook and data will be exported from excel to a text file. Both file formats, excel and text, will be saved at the EC specialist's work station and backed up on a Montana Ecological Service's Seagate FreeAgent®GoFlexTM external hard drive. Copies of the field notebook entries and all data files will be provided to Charles M. Russell NWR staff.

The analytical results report, as well as raw results, will be available through the Services Environmental Contaminants Data Management System. However, when results become available, the Montana Ecological Services EC specialist will also download that data and enter it into the master datasheet. Both file formats, excel and text, will be saved at the EC specialist's work station and backed up on a Montana Ecological Service's Seagate

Please describe metadata including the who, what, where, and when of the data.

Please describe data security and archiving. Provide the schedule and location for regularly backing up files.

STATUS AND RESULTS

ADDITIONAL INFORMATION:

LITERATURE CITED:

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