

Spencer J. Savage

Engineer



Education and Credentials

B.S., Civil Engineering with Environmental Emphasis, Carroll College, Helena, Montana, 2014

Engineer-In-Training, Montana (License No. 36887)

Continuing Education and Training

Hazardous Waste Operations and Emergency Response 40-Hour Certification (2015; refreshers 2016, 2017, 2020)

Certified SWPPP Administrator and Preparer, Altitude Training Associates (2018)

FHWA-NHI-135095 Two-Dimensional Hydraulic Modeling of Rivers at Highway Encroachments (2017)

Professional Affiliations

American Society of Civil Engineers

Achievements and Awards

Recipient of Pathfinder Award, recognizing excellent performance for teamwork

Recipient of Pathfinder Award, recognizing excellent performance for internal client services

Professional Profile

Mr. Spencer Savage has a wide range of engineering experience relating to water resource engineering, environmental engineering, and construction engineering. As a water resource engineer, he has worked on projects involving hydrologic and hydraulic investigations, 1- and 2-dimensional floodplain modeling, bridge scour analysis, stormwater design and analysis, preparation of stormwater pollution prevention plans (SWPPPs), stormwater permitting assistance, and stormwater design manuals. Prior to working as a water resource engineer, he gained extensive experience in environmental engineering by working on state and federal Superfund projects. These projects involved environmental site assessments, RI/FSs, abandoned mine reclamation, soil-vapor extraction (SVE) systems, pump and treat systems, and environmental sampling. Mr. Savage also worked in the transportation industry.

Relevant Experience

Environmental Site Investigation and Remediation

Abandoned Hard Rock Mine CERCLA Site, Neihart, Montana –

Project engineer for the abandoned hard rock mine sites within the Carpenter-Snow Creek Mining District. Project consisted of approximately 90 abandoned mines with various sources of contamination including waste rock, mine tailings, and mine-influenced waters that resulted in contaminated sediment, soil, surface water, and groundwater. Performed multiple field investigations for the Operable Unit (OU) -2 and -3 RI/FS that included surface water sampling, groundwater sampling, sediment and soil sampling, and tracer-dye tests. Designed and implemented a pilot-scale test to stabilize a portion of the Belt Creek streambank that was adjacent to a temporary repository. Assisted with the design and implementation of a pilot-scale test that utilized an Aquafix passive treatment unit for mine-influenced water.

Former Wood Treating CERCLA Facility, Butte, Montana –

Project engineer for the Montana Pole and Treating Plant project. Coordinated utility surveys, soil sampling activities, and geotechnical investigations, and assisted with the preliminary bid package for the offload remedial action at the land treatment unit. Assisted with revisions to the operations and maintenance (O&M)



manual for the site's water treatment plant. Inventoried all piping, connections, valves, meters, pumps, treatment units, and storage containers within the plant. Revised the process flow diagrams for plant processes and assisted with the site's 5-year review.

Former Silver and Lead Smelter CERCLA Facility, Pueblo, Colorado—Field engineer for the site investigations associated with the OU-1 Community Properties Study Area. Collected sediment and soil samples from residential and commercial properties within the study area using handheld soil augers and soil samplers. Updated field logbooks to document sampling procedures and prepared samples for x-ray fluorescence analysis and laboratory testing.

Contaminated Groundwater Assessment and Monitoring, Great Falls, Montana—Field engineer for groundwater monitoring activities at the Montana Air National Guard facility. Primary chemicals of concern included various metals and petroleum hydrocarbons including benzene, toluene, ethylbenzene, and xylenes; chlorinated hydrocarbons; PAHs; and jet fuel (JP-4), among other volatile organic compounds. Evaluated 30–40 monitoring wells and collected groundwater samples for laboratory analysis using a low-flow purge pump. Assisted with weekly inspections of the mobile SVE system to verify all components were operating.

Phase II Environmental Site Assessment, Bozeman, Montana—Field engineer for groundwater investigations at a former electroplating facility. Assisted with the development of three monitoring wells using variable speed and low-flow purge pumps while recording water quality data using an in-line water quality sonde. Evaluated each monitoring well and collected groundwater samples for laboratory analysis.

Stormwater Management, Treatment, and Design

MS4 Permit Compliance, Yellowstone County, Montana—Assistant project manager and engineer for the development of all aspects of the municipal separate storm sewer system (MS4) program including public education and outreach; public involvement and participation; illicit discharge detection and elimination; and construction site stormwater, post-construction site stormwater, and pollution prevention/good housekeeping for permittee operations. Established the public education and outreach program by identifying key target audiences, developing informational placards, revising the stormwater webpage, and developing an outreach implementation schedule. Established the foundation for the illicit discharge detection and elimination program by coordinating and executing a storm sewer field investigation to identify and map all storm sewer system features within the MS4 boundary using ArcGIS. Developed enforcement response plans and corrective action plans for illicit discharges, construction site stormwater concerns, and post-construction site stormwater concerns. Inventoried all permittee-owned facilities and categorized pollutant-generating activities. Developed facility- and activity-based standard operating procedures to reduce stormwater pollution.

MS4 Permitting Assistance, Helena, Montana—Provided consulting services to update all aspects of the existing stormwater management program. Performed a comparative analysis between the existing program and the requirements prescribed in the 2017–2021 Montana General Permit for Storm Water Discharges Associated with Small Municipal Separate Storm Sewer Systems. Used the



results of the comparative analysis to identify which areas of the program needed to be updated and coordinated with the client to verify that the proposed revisions were sufficient. Utilized ArcGIS to revise watershed delineations, identify new monitoring locations, and update outfall locations. Identified all permittee-owned facilities within the MS4 boundary and assisted with the development of a pollution prevention/good housekeeping program for permittee operations.

Post-Construction Stormwater BMP Design Guidance Manual, Montana—Contributing author, research engineer, and AutoCAD drafter for Volume 1 of the Montana Post-Construction Storm Water BMP Design Guidance Manual. Performed extensive research into the design and analysis of various stormwater best management practices (BMPs) including infiltration basins, bioretention areas, permeable pavement systems, dispersion, bio-filtration swales, extended detention basins, wet detention basins, and mechanical treatment devices. Reviewed existing design guidance manuals from across the nation to determine which design and analysis procedures were applicable to Montana MS4 programs. Assisted with developing Montana BMP fact sheets that outlined design considerations, design procedures, construction considerations, and maintenance concerns. Developed detailed drawings for respective BMP fact sheets.

Westridge Stormwater Infrastructure Design, Bozeman, Montana—Stormwater engineer for the design and analysis associated with infrastructure improvements within the Westridge subdivision. Primary purpose of the project was to reduce sediment loading in stormwater prior to discharging to a regional stormwater pond. Conceptual design consisted of retrofitting the existing storm sewer system with a hydrodynamic separator. Performed a localized hydrologic analysis using the Rational Method to calculate peak flow rates for respective design events. Sized the hydrodynamic separator and new storm sewer piping based upon the calculated peak flow rates. Evaluated the feasibility of installing the proposed design based upon adjacent utilities and applicable easements. Developed a draft plan set using AutoCAD Civil 3D.

Facility Stormwater Maintenance Plan, Ronan, Montana—Stormwater engineer for the development of a facility-specific stormwater O&M plan as required by the Administrative Order on Consent. Identified existing and proposed stormwater management features to be operated and maintained including inlets, piping, open channels, holding tanks, and stormwater ponds. Outlined O&M procedures including personnel training, inspection protocol, maintenance activities and schedules, corrective actions, and communication requirements. Developed facility-specific inspection forms and maintenance logs.

Stormwater Management, Conveyance, and Treatment Design, Missoula, Montana—Stormwater engineer for a proposed development within Missoula County. Outlined a series of project-specific design criteria and developed a preliminary design for stormwater management, conveyance, and treatment. Design included open channels, traditional storm sewer systems, infiltration basins, biofiltration swales, and subsurface infiltration chambers. Performed a localized hydrologic analysis using the SCS Runoff Curve Number method to calculate peak flow rates and peak runoff volumes. Utilized various software including HydroCAD and Bentley Flowmaster to preliminarily size stormwater management facilities and conveyance networks. Developed conceptual schematics for the entire stormwater system using AutoCAD Civil 3D.



Railway Subgrade Stabilization Stormwater Pollution Prevention Plan, Saco, Montana— Drainage engineer for a 3-mile railway stabilization project. Developed the site SWPPP in accordance with the requirements outlined in the Montana General Permit for Storm Water Discharges Associated with Construction Activities. Aspects of the SWPPP included project narrative, site-specific information including impact areas, primary and secondary BMP descriptions, identification of local waterbodies and expected outfall locations, inspection methods and frequency, and final stabilization requirements. Incorporated BMPs into the project plan set. Selected BMPs included vehicle track pads, rock check dams, silt fence, inlet/outlet protection for culverts, and erosion control matting. Provided technical support during and after construction by coordinating with the contractor and the Montana Department of Environmental Quality. Reviewed post-construction inspections to verify final stabilization had been achieved.

Floodplain Investigation and Stream Restoration

Belt Creek Streambank Design, Western Montana—Developed design alternatives to stabilize a portion of the Belt Creek streambank that was eroding and releasing hard rock mine tailings from a temporary repository. Design alternatives consisted of a geomembrane cap, a shot-crete cap, and geosynthetic concrete composite blanket (selected alternative). Performed a localized hydrologic analysis using HEC-SSP and the methodologies outlined in Bulletin 17b to calculate peak flow rates for the contributing drainage basin. Developed a localized hydraulic model using HEC-RAS to evaluate water surface elevations and to determine maximum shear stress values along the streambank. Used the results of the HEC-RAS model to determine the extents of the concrete blanket and to verify that the design would withstand the forces exerted during peak flows. Developed project specifications, a plan set using AutoCAD Civil 3D, procured contractor, coordinated pre-construction meetings, and provided construction oversight.

Grove Creek Floodplain Study, Butte, Montana—Site restoration activities at a former wood treating plant revealed a Zone A special flood hazard area (SFHA) within a portion of Grove Creek that crossed the site. Per the site ROD, treated soils could not be placed within the 100-year floodplain. Performed a detailed hydrologic and hydraulic investigation to calculate peak flow rates and to determine the anticipated inundation limits. Utilized HEC-SSP and the methodologies outlined in Bulletin 17b to calculate peak flow rates for the contributing drainage basin. Developed a localized HEC-RAS model to determine base flood elevations and the 100-year inundation limits. Used the results of the inundation limits to evaluate locations for an onsite repository.

Montana High-Hazard Dam Breach Analysis, Montana—Hydrologic engineer for the dam breach analyses associated with four high-hazard dams in Montana. Reviewed multiple effective flood insurance studies (FIS) to identify all peak flows applicable to the project. When FIS peak flows were not available, calculated a series of peak flow rates along respective dam breach flow paths to account for additional contributing drainage basins and coincidental peaking conditions. Utilized USGS regional regression equations, gage transfer equations, and two-gage log interpolation methods. Considered coincidental peaking conditions between immediate streams and receiving streams by following the guidance provided in the Federal Highway Administration's (FHWA) HEC-22 and revised the hydrologic calculations accordingly. Also estimated the loss of life caused by respective dam breaches using the Graham Method.



East Gallatin Streambank Restoration, Bozeman, Montana—Hydraulic engineer for the restoration design associated with an avulsed streambank along the East Gallatin River. Primary components of the project included streambank reconstruction, irrigation ditch restoration, and channel plug implementation. Bank restoration design included a reconstructed streambank that consisted of compacted core material, a filter layer, riprap armoring, and fiber-encapsulated soil wraps with willow inserts. Project was located within a Zone AE SFHA and required a detailed floodplain analysis. Utilized the effective FEMA HEC-RAS model to develop an existing conditions and post-project conditions model. Performed a no-rise analysis to verify no impacts to the floodway. Developed a letter of map revision package for submittal to FEMA. Package included a detailed report, completed MT-2 forms, hydraulic work maps, annotated flood insurance rate maps, revised floodway data table and flood profiles, and adjacent property owner information.

LaValle Creek Floodplain Study, Missoula, Montana—Performed a detailed floodplain study along a portion of LaValle Creek near I-90 that is mapped as a Zone A SFHA with no defined base flood elevation. Purpose of the project was to identify anticipated inundation limits to verify construction would not occur within the 100-year floodplain. Performed a localized hydrologic analysis to calculate peak flows by using an independent hydrologic regression analysis for LaValle Creek. Developed a hydraulic model using HEC-RAS that included a multiple opening analysis (culverts). Utilized ArcGIS to develop hydraulic work maps that identified modeled cross sections, calculated 100-year water surface elevations, and the associated inundation limits.

Mullan Road Floodplain Impact Study, Missoula, Montana—Evaluated floodplain impacts along O’Keefe Creek and LaValle Creek due to the proposed reconstruction of Mullan Road on the western side of Missoula. The study area consisted of multiple hydraulic structures, multiple split flow locations, and multiple roadway overtopping locations. Utilized the results from the 2-dimensional HEC-RAS model to influence the development of the 1-dimensional HEC-RAS model. Evaluated proposed hydraulic structures using FHWA HY8 to develop design alternatives and incorporated design alternatives into the proposed HEC-RAS model. Summarized the results of the proposed design in a hydraulics report.

Railway Subgrade Stabilization Floodplain Study, Saco, Montana—Evaluated floodplain impacts along Beaver Creek near U.S. Highway 2 in Saco, Montana, as part of a railway subgrade stabilization project. Project was located within a Zone A SFHA. Compiled terrain data and hydraulic data from multiple sources including USGS digital elevation models, LiDAR, field survey, HEC-2 models, and previously developed HEC-RAS models. Developed an existing conditions and proposed conditions HEC-RAS model to verify that the proposed design did not increase the 100-year water surface elevation by more than 0.5 ft as required by Montana law. Summarized the findings of the study in a hydraulics report.

Wigwam Road Bridge Floodplain Study, Tensleep, Wyoming—Evaluated the flood problems associated with an existing stream crossing to determine the location of a new crossing. Performed a hydrologic analysis using USGS regional regression equations to calculate peak flow values. Developed an existing conditions hydraulic model using HEC-RAS to evaluate existing flood problems associated with six corrugated metal pipe culverts and one bridge. Developed a



proposed conditions HEC-RAS model that reflected a new bridge crossing with improved conveyance. Performed a bridge scour analysis to evaluate contraction scour and local scour at the bridge abutments. Summarized the results of the floodplain study in a hydraulics report.

Drainage Ditch Rehabilitation Study, Bozeman, Montana—Performed a feasibility study that evaluated three alternatives to reduce future flooding and to improve conveyance along an existing drainage ditch. Alternatives consisted of an open channel, a closed conveyance system, and a combination of open channels and closed conveyance. Utilized AutoCAD Civil 3D to develop preliminary alignments and profiles for the proposed alternatives. Performed normal depth calculations using Bentley Flowmaster to size respective infrastructure associated with each alternative. Summarized fatal flaws associated with each alternative and developed high-level cost estimates.

Irrigation Drop Structure Design, Havre, Montana—Developed the full plan set for a 250-ft irrigation drop structure along the North Fork of the Milk River. Plan set included an overall site plan, drop structure plan and profile, site grading plans, channel detail drawings, drop structure detail drawings, and access road reconstruction. Utilized AutoCAD Civil 3D to establish the proposed alignments, corridors, and associated site grading.

Roadway Drainage Design and Analysis

Storm Sewer System and Hydraulic Crossing Design, Winnett, Montana—Hydraulic engineer for the design and analysis of a storm sewer system and hydraulic crossings along the main arterials within the Town of Winnett. Hydrologic analysis consisted of regional regression equations, regional frequency analysis, SCS Runoff Curve Number method, and the Rational Method. Utilized Bentley StormCAD software as part of the hydraulic analysis to size, locate, and evaluate inlets and to size, locate, and evaluate the subsurface storm sewer system. Utilized FHWA HY8 software to determine the size and configuration of hydraulic crossings while also satisfying the project design criteria. Summarized the design in a hydraulics report and assisted with preparing the project plans and specifications.

Valentine Road Washout Repair, Valentine, Montana—Hydraulic engineer for the design and analysis of an armored roadway crossing to prevent future washouts. Proposed design consisted of a 9- by 5-ft double-cell box culvert with an armored roadway crossing to convey peak flows in a controlled manner. Armored crossing design consisted of vegetated concrete block matting (Flexamat). Hydrologic analysis included regional regression equations, a regional regression analysis, and the USGS snowmelt method. Developed a hydraulic model using HEC-RAS to verify the proposed design satisfied the project design criteria. Summarized the design in a hydraulics report and assisted with preparing the project plans and specifications.

69 kV/138kV Electronic Pressure Control Transmission Line Access Roads (Hydraulic Crossings), Skin Fork, West Virginia—One of four drainage engineers responsible for the design of more than 100 hydraulic crossings along multiple access roads associated with a transmission line project. Drainage team streamlined the design process by using Arc Hydro within ArcGIS to delineate contributing drainage basins. Established thresholds for sizing hydraulic structures based upon



contributing drainage areas. Performed a detailed analysis for specific hydraulic crossing with large drainage areas using FHWA HY8 software. Also designed permanent erosion control measures for roadside ditches and identified the location and spacing of ditch relief culverts. Assisted with the development of project plans and SWPPPs.

Gateway West Transmission Line Access Roads (Hydraulic Crossings), Wyoming—Drainage engineer responsible for designing more than 15 vented ford crossings along multiple access roads associated with a transmission line project. Performed localized hydrologic analyses using regional regression equations. Designed low-flow culverts using FHWA HY8 software and designed armored spillways using the guidance provided in *Design of Rock Chutes* by Robinson, Rice, and Kadavy. Summarized the designs in a hydraulics report and developed project plans.

State Highway 41 Drainage Design, Post Falls, Idaho—Drainage engineer for the design and analysis of roadway drainage features for a 2.9-mile reconstruction project along State Highway 41. Responsible for locating, designing, and sizing all aspects associated with roadway drainage including storm sewer systems, bioinfiltration swales, curb cuts, drywells, and culverts. Delineated more than 120 contributing basins and calculated peak flow rates using the Modified Rational Method. Designed 60+ roadside bioinfiltration swales, 8 storm sewer systems, 60+ curb cuts, and 60+ drywells. Software used during design included Bentley Microstation, StormCAD, FHWA HY8, and Bentley Flowmaster. Summarized the design in a hydraulics report and developed the project plans and specifications.

Higgins Bridge Rehab Deck Drainage Design, Missoula, Montana—Hydraulic engineer for the design and analysis of a closed drainage system as part of a bridge rehabilitation project. Bridge consisted of multiple superstructure configurations that resulted in a complex piping network. Performed a localized hydrologic analysis using the Rational Method to calculate peak flow rates. Utilized Bentley StormCAD software as part of the hydraulic analysis to size, locate, and evaluate bridge scuppers and to size, locate, and evaluate the closed conduit system. Prepared a final hydraulics report as well as plans and specifications.

Interstate 90 Yellowstone River Bridge Deck Drainage Design, Billings, Montana—Designed a closed-conduit bridge deck drainage system for a 1,000-ft bridge that spans the Yellowstone River. Performed a localized hydrologic analysis to calculate peak flow rates. Developed a StormCAD model to size, locate, and hydraulically analyze all aspects of the bridge deck drainage system. Summarized the design in a hydraulics report and assisted with developing the project plans.

Interstate 90 Clark Fork Bridge Deck Drainage Design, Bonner, Montana—Evaluated multiple design alternatives for a bridge deck drainage system. Performed a localized hydrologic analysis using the Rational Method to calculate peak flow rates discharging from the bridge. Utilized bridge as-built documentation and Bentley Flowmaster to size, locate, and calculate spread values for the proposed bridge scuppers. Summarized the results of the design in a technical memorandum.

