Summer 7-24-2023

Re: Comments on the Draft Butte Priority Soils Operable Unit (BPSOU) Buffalo Gulch 60 Percent Design (dated December 9, 2022)

Nikia Greene

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Ref: 8MO

July 24, 2023

Mr. Josh Bryson
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Re: Comments on the Draft Butte Priority Soils Operable Unit (BPSOU) Buffalo Gulch 60 Percent Design (dated December 9, 2022)

Dear Josh:

The U.S. Environmental Protection Agency (EPA), in consultation with the Montana Department of Environmental Quality (DEQ), is providing comments on the *Buffalo Gulch 60 Percent Design (dated December 9, 2023).* Please address these comments in subsequent design submittals.

General Comments

1. Additional samples with LeapFrog modeling to show areas of uncertainty would be required for a pre-defined excavation surface. Given the relatively low number of samples collected, soil stockpiling and sampling will be required during excavation to determine the appropriate use/destination of the excavated soil.
2. The design documents conclude that a capillary break is not needed below the engineered cap or cover soils outside of the basin area where an impermeable liner will prevent capillary rise. We are concerned that the capillary break analysis is not adequate to determine that the finished site will be safe from accumulation of metal salt slickens. The fact that groundwater is shallow and contaminated, and the site will include unrestricted public access indicates the need for an inherently conservative evaluation of capillary rise potential.
3. Several specific comments on the capillary rise analysis are presented below. To summarize, the capillary rise evaluation does not build in a sufficient margin of safety to account for unknowns in soils and future groundwater elevation. We estimate there are only a few acres of site that are outside of area with impermeable liner or asphalt or concrete and that would benefit from a capillary break. Adding a gravel or crushed rock capillary break to those few acres would be relatively inexpensive (our professional estimate is materials would be on the order of $70,000). Including a capillary break would eliminate the potential for very expensive site reconstruction if the capillary rise assumptions are incorrect. Capillary rise issues have led to expensive fixes required at reclaimed site along Silver Bow Creek and at Arrowhead Park in Deer Lodge. Design

should consider the cost-benefit analysis that would come with eliminating that risk at the Buffalo Gulch site. Alternatively, the design should include a more robust analysis of capillary rise potential that builds in a larger margin for error.

4. Seasonal increases in arsenite concentration in the ponds are a concern and the proposed recirculation system is designed to prevent this. Stakeholders have raised concerns that aerating the water could reduce the ability of the system to treat metals by oxidizing what may otherwise be reduced and attenuated stormflow metals. However, due to concerns about arsenic release, mosquitos, and algae growth the recirculation system is necessary. Furthermore, arsenic is more likely to be attenuated under oxygenated conditions relative to anoxic conditions if sufficient dissolved iron is present and enough residence time is provided. The 60% design includes a subsurface wetland recirculation system that will have added benefit of filtration of particulate metals in the pond water. The subsurface recirculation system may provide additional recirculation and filtration reducing both arsenic and total metals that are in the pond water and that may otherwise be discharged to Silver Bow Creek.
5. The Groundwater Model Report describes a model that has deficient calibration. It is not calibrated to any measured or estimated flow (flux target) and did not calibrate well to head. The report acknowledges these calibration deficiencies, "calibration statistics… indicate an adequate, though not excellent fit with the observed values." And "it is likely that a more precise model could result from different methods for setup and calibration. However, for the purposes of the evaluations predicated on this model, the calibration results are sufficient." It's not clear or stated what the purposes are that the model should be used for given the status of the calibration.
6. The model is unlikely sufficiently developed to make accurate predictions of post-construction groundwater elevations or changes in the flow direction. The sitewide groundwater model being developed by Stantec is being developed to include sufficient site-specific data and calibration targets that would satisfy many of the deficiencies present in the Buffalo Gulch model. The sitewide model will likely be a better tool to evaluate long-term effects from the Buffalo Gulch stormwater ponds on groundwater flow, the BPSOU capture system, and hydraulically connected surface water.
7. For all models (groundwater transport, groundwater geochemical, EVS, etc.), please provide all input parameters, assumptions made and the expected validity of each, sensitivity analyses, results of calibrations, and relevant outputs.
8. Please schedule a meeting with EPA and DEQ to discuss the construction components that are associated with the Butte Mine Flooding Operable Unit's pilot treatment discharge structure that are included in this design. EPA and DEQ are concerned that this work is not appropriate for this Buffalo Gulch design package and should not be included in the Buffalo Gulch FRE.

3.1 - Design Report

Specific Comments

9. Section 2.3 of the Design Report indicates that baseflow from the storm sewer into the proposed Buffalo Gulch ponds is seasonal, averaging about 0.1 cfs. We did not find any additional information on how baseflows will be managed within the ponds. The report should provide information on seasonal baseflow rates and if the baseflow is significant during any portion of the year how that water will be managed, including basin drain down to maintain the required stormflow retention volume.

10. Section 5.3 states, "Where the site conditions do not facilitate the liner placement on a maximum 3:1 slope, retaining walls with liner embedment connections are used to contain the entire volume of the stormwater basin." We do not see this shown in the diagrams provided in the Stormwater Basin Liner and Infiltration Evaluation Report as discussed in comments on that report below. The text in this section and the design drawings should mesh. We do recommend that the basins have an impermeable liner or retaining wall fully encompassing the entire volume to eliminate the potential for basin leakage to negatively affect groundwater chemistry or flow.
11. Section 5.3: Monitoring wells BPS07-23, BPS07-22B, BPS07-22C, BPS07-22 are not included in the list of monitoring wells to be protected during construction here or elsewhere in the Design Report. These wells are indicated to be protected/retained in construction plan C1.6. Please describe plans to retain these wells in the Design Report. These wells provide critical data for monitoring the hydraulic sink created by the BPSOU subdrain that protects Silver Bow Creek from contaminated groundwater. These wells are also potentially useful for leak detection.

3.1.A - Appendix A - PDI Evaluation Report

General Comments

12. The PDIER should mention what the excavation depths would be for the basins, so that the reader knows which layers will be at the bottom of the excavations. Please provide a table showing the layers that will be at the bottom of the excavations.
13. Some of the sections refer to incorrect figure numbers. Please revise all misnumbering.

Specific Comments

14. Pg. 2, Section 1.1 – Please provide a general description of the proposed basin, forebay, and wetlands in terms of the dimensions, areas, and depth below current ground surface and if a liner is proposed for each area or not.
15. Pg. 5, Section 1.2.2, Hydrocarbon Monitoring – Please explain how natural attenuation is facilitating biodegradation according to WET. As written, the sentence makes no sense. Do you mean that biodegradation is the natural attenuation mechanism that is occurring or that some other attenuation mechanism is favoring biodegradation? In general, immobile compounds are less biodegradable than mobile compounds, not more.
16. Pg. 14, Section 2.6 Permeability Testing, last sentence in section – Please provide the calculations used to obtain the hydraulic conductivity values either in the document or within Appendix H.
17. Pg. 15, Section 3.1 and Section 3.1.1, first paragraph – These sections state that the waste identification is only based on 2018 XRF data and 2019 laboratory data. The term "laboratory data" is ambiguous and should more explicitly state the analysis conducted in the laboratory. Excluded are the test pit data collected in 2011 with 108 samples analyzed by laboratory grade XRF (Tables 3, 4, and 5 of the Soil DSR; Appendix A-6 of the 2012 Geotech and Groundwater DSR) and laboratory mercury analysis. This is a large data set that is important to aid in characterization of the site. Even though there are no ICP split analyses and no reported QC, the data were analyzed in a laboratory that has typically provided good quality data. The evaluation of waste extents needs to include these data as supplemental to the ICP data. The test pits are shown on Figure 4 and the data are in Table 2. Are these data actually used or not?
18. Pg. 19, Section 4, first paragraph – The first paragraph of this section indicates that the soil hydrocarbon results will be compared to Montana RBSLs for available analytes. Selection of the exact RBSLs to be used is not explained. It is assumed, but not stated, that the Tier I surface soil (0

to 2 feet) and subsurface soil (>2 feet) and depth to groundwater <10 feet are to be used. Table 10 generally includes these except for semi-volatile hydrocarbons. A different set of screening values are provided with units of µg/kg. What is the source of these screening values for semi-volatiles? Please use the lowest RBSL of the three possible values for each compound.

19. Pg. 20, Section 4.1 Hydrocarbon Impacts on Groundwater, 2nd to last sentence – Presumably, the referenced figures are "5.0 through 5.7" and not "6.0 to 6.7" as stated in the text. Please correct. Also, line graphs, such as presented in figures 5.0 through 5.7, do not show statistical trends. Statistical trend tests such as Sen slope and Mann-Kendall (at an alpha of 0.05) would help to determine trends without relying on visual inspection of line graphs. Please provide if trends are to be discussed. Also, please discuss the differences in sampling procedures and if these may impact apparent trends. The 2017 WET data are suspect due to the low purge volumes (<1 casing volume), lack of QA/QC sampling (no field duplicates or blanks), and inadequate field documentation and are useable for screening purposes only (WET 2018, Appendix C.1 Data Useability Report). The analyses which are screening quality only should be identified when evaluating trends.
20. Pg. 22, Section 5, 1st paragraph on pg. last sentence – Section 5 – There is no Table 12. Please revise all misnumbering.
21. Pg. 23, Section 6, Infiltration Testing – How will surface infiltration rates be used in the design, when the base of the basins will be present within the current subsurface (at the 3-yr max groundwater elevation of deeper)? Based on the excavation depths for the basins do you expect 0.7 in/hr or 8.9 in/hr? How did this factor into the design? Please discuss.
22. Table 3 –What is the 95% CL for XRF? What is "95% C.L. for Single COC 5000 mg/kg"? Are these upper confidence limits? Are these calculated from all locations and depths for each parameter? If so, are the data normally-distributed? If not, a UCL is meaningless. Please discuss, add footnotes, and recalculate UCLs using log-transformed data if appropriate.
23. Table 10 – Please indicate in the footnotes what the yellow highlighting represents.
24. Table 11 – The 3-year high groundwater elevations don't match those on Figure 4. Please resolve.
25. Figure 1.0 – Please indicate what the areas are with the diagonal gray lines (such as along Kaw Ave) within the legend.
26. Figure 4 – The shape of the metals contaminated material polygon does not match Figure 2 of the EVS report. Please resolve. Figure 4 of the pre-design report and Figure 2 of the EVS report indicate a large circular area of non-waste in the western portion of WL-12. This is based on very little data. Consider collecting additional samples to verify the model depiction in this area.
27. Figure 6.0, Groundwater Elevation Plan View - Does this figure show 3-year high water level or a specific measurement event? The flow field does not appear realistic if it is a specific event. Please clarify.

3.1.A.3 - Attachment C to Appendix A - WET Hydrocarbon Plume Report

28. The procedures used by WET lacked adequate QA/QC and documentation, resulting in screening quality data only. Please do not use or reference the WET data or results without adequate qualifications.

    The conclusion of the report that the hydrocarbon plume is being biodegraded should be viewed with caution. The presence of intrinsic biodegradation indicators such as sulfate, nitrate, iron,

manganese, and methane, is suggestive that biodegradation has taken place, but these constituents can also be created by inorganic reactions. In general, oxygen concentrations are low which limits the fastest biodegradation mechanism (i.e. aerobic biodegradation) which is typically orders of magnitude faster than when other electron acceptors are used (ferric iron, sulfate, etc). The fact that toluene is still present in the plume after over 30 years since the release is evidence that biodegradation is not optimized, which is why the state is contemplating oxygen addition as part of a future remedy. In addition, the BTEX concentrations at the well closest to the source (MW-23) are suggestive of the presence of NAPL which will provide a continuing source of dissolved hydrocarbons to groundwater for years to come (absent an effective remedy). Please de-emphasize the importance of intrinsic biodegradation when discussing the CMG plume, although meaningful improvements may be achieved should a new upgradient remedy be implemented by the state.

3.1.A.4 - PTS Pump Test Report

29. During the 2012 pump test, water was treated prior to discharge to SBC. Please provide a similar treatment for construction dewatering in the remedial design documents.

3.1.A.6 - Attachment F to Appendix A – Soils DSR

General Comments

30. Please do not refer to individual property owners by name. Use generic nomenclature such as "Property 1", "Property 2", etc.

31. No laboratory data validation reports or data packages are included. Also, no level A/B forms are included, as required in the CFRSSI Guidance.

Specific Comments

32. List of Tables - The table order in the "List of Tables" does not match the presentation in the report. Please revise accordingly.

33. Pg 1, Section 1, Introduction - There is reference to Figure 1. The figure is not in the report. Please provide the figure.

34. Section 2, Background and Site Description, SAP RFC #1 - More information should be provided on what was the improper laboratory procedures for mercury and/or reference where this is discussed.

35. Pg. 4 - Section 3.21, Field XRF, First Paragraph - The paragraph indicates "The XRF passed all calibration verification tests for arsenic, cadmium, copper, lead, and zinc, all precision QA/QC tests for all COCs." Cadmium failed the CCV on 6/20/2019, and the last part of the sentence is confusing/unclear. Please clarify and edit the text accordingly.

36. Pg. 6, Section 5.1, XRF Data, First paragraph - The paragraph indicates "The calibration verification check…. passed for arsenic, copper, cadmium, lead, and zinc every time…" Cadmium failed the CCV on 6/20/2019. Please clarify and edit the text accordingly.

37. Pg. 6, Section 5.1, XRF Data, Second Paragraph - In the discussion on the dried and sieved samples, there is reference to mercury "leaving preservation/holding requirements." This sentence is confusing. Please update accordingly. Also, mercury results were eventually qualified as rejected based on low calibration criteria. This should be discussed in this section as well.

38. Pg. 8, Section 5.2, Laboratory Data -Please confirm the number of samples for 2019 that were sent to the laboratory. The numbers listed in the second paragraph do not match the information in the rest of the report.

39. Pg. 8, partial sentence – Please update "TREC, Inc's office" to "Woodard & Curran's office (formerly TREC, Inc.)" to avoid potential confusion.

40. Pg. 9, Section 7.0, Summary - Please confirm the 146 samples discussed for the 2018 samples. This does not match the information in the rest of the report.

41. Table 1b, Soil Sampling Laboratory Soil Quality Results - Sample result units should be added to the table.

3.1A.6_1 - Attachment to Soils DSR - XRF/Lab Regression Analysis

General Comments

42. This document does not present the underlying data and calculations; therefore, it is not possible to reproduce the results. Please include a table of the data.

43. This document does not present the upper- and lower-95 percent confidence level coefficients. Please add a table with all results of the regressions.

44. We generally discourage removal of data unless there is good reason. Soil produces data with more uncertainty than other media, so a messy scatter plot is not unexpected. The document does not present the results of the outlier analysis, so it isn't possible to verify that it is appropriate. Please include the calculations and results of the outlier analysis.

    We prefer the use of the Passing-Bablok method for regression of paired analytical results. We used that method in review and obtained a slightly larger number of samples that failed the waste identification criteria. Table 3, however, does not accurately list all of the soil sample results and is different from the actual number of available samples.

Specific Comments

45. Pg. 1, second sentence – This sentence indicated 250 pairs of data were analyzed. Tables 1a and 1b of the Soils DSR contains 162 pairs. what is the source of the other 82 pairs?

46. Pg. 1, third paragraph – This paragraph indicates that the majority of the cadmium sample results were non-detected. Table 1a of the Soils DSR does not contain any U validation qualifiers for cadmium data indicating that all values are detected results. Resolve which samples have detected values and non-detected values and correctly populate Table 1a of the DSR.

3.1.A.7 – Attachment G to Appendix A - Hydrocarbon DSR, including Appendices

General Comments

47. Please follow the *Clark Fork River Superfund Site Investigations (CFRSSI) Pilot Data Report Addendum* (July 2000) (hereafter "CFRSSI guidance") to ensure that all required sections and components of the DSR are included.

48. Please include an Executive Summary including a summary table of analytical results as required by the CFRSSI guidance.

49. The October 2021 Buffalo Gulch Treatability Study QAPP was approved by EPA on November 29, 2021. Was a subsequent version produced in April 2022 as listed in the references and

elsewhere? The treatability sampling began in April 2022, so presumably the final QAPP was in hand well in advance of mobilizing to the site. Please clarify and/or correct the text as appropriate.

50. The results of the treatability study are very difficult to interpret. It is unclear which of the two parts of the treatability study the results are for (oxidant demand vs biodegradation). Presumably, the POX-20X means persulfate oxidation at 20 times the stoichiometric dose of oxidant? If so, what was the stoichiometric dose? The "Sample Identification and Labelling" section included in both the October 2021 Treatability Study QAPP and in the DSR omits the coding for the treatability study treated samples. Please prepare a table of sample identifier information as required in the CFRSSI guidance.

51. Will a separate report be issued with more details? Will you be receiving a separate report from the vendor who performed the biodegradation studies? Where will the information be provided that was listed in the goals of the October 2021 QAPP. For example, part of the second goal of the October 2021 QAPP reads:

    The results of this study will include total oxidant demand, optimal tested oxidant and pH adjusting amendment dose, and post experiment analyses of the baseline properties from Step 1. The total oxidant demand is determined by measuring the consumption of persulfate throughout the study. If there are elevated concentrations of other reduced species in the soil that consume the oxidant, the TOD study will indicate if the dose of the chemical oxidant as a pre-treatment step is impracticable. The treated soil will be included as a sample in Step 3.

    Are these data available to be included in the DSR or will they be presented in a subsequent report? If so, please indicate in the text that a third-party report or other data are pending or will be included within an interpretive report.

52. Figures should be presented which show the treatability study data in a graphical format for selected parameters or parameter groups (PAHs, EPH, etc.). Differences between oxidized samples and controls could be seen much easier graphically than in tabular form.

53. As commented on in the 30% Design document, please remove references to the names of private landowners.

54. Data results are spread over multiple appendices making it difficult to track which data is being summarized in different sections of the reports. Consider adding a table that indicates what samples were collected (and their associated analysis) during each sampling round and what data is applicable/discussed.

Specific Comments

55. Title – Please add to the title the treatability study component of the report such as "Buffalo Gulch Groundwater and Soils Hydrocarbon Characterization and Treatability Study Data Summary Report"

56. TOC - Confirm if Figure 5 in the report needs to be labeled as Figure 3.

57. Pg. 1, 1st paragraph, 1st sentence – Please also refer to the October 2021 QAPP.

58. Pg. 1, Section 1 – Introduction – Moisture content, depending on the storage method of the samples, may be lower than when the samples were collected (following 2 yrs in storage). A certain soil saturation is specified in the FRESOW, but as mentioned in the PDIER, this is to be done in the field during construction to account for seasonal variation. Moisture content was apparently only included because it was measured as part of the method selected for determining

organic content (ASTM D2974-20). Please clarify in the text that moisture content may be in error due to the long storage, but that moisture content will be measured in the field during construction and added as needed to meet soil saturation requirements. Also, please refer to the Soils DSR for the results.

59. Pg. 2, Section 2.1 Purpose and Objectives, first full sentence on page – Please call out the locations of the private properties (name as "Private Property 1, 2, etc." or other naming convention), Wetland Demonstration Area, and other properties on Figure 1 and reference the figure following this sentence.

60. Pg. 2, Section 2.1 Purpose and Objectives, 1st paragraph, last sentence – Please add lead to the list of soil COIs. Lead is a BPSOU COC for soil and was analyzed for soil as part of the study.

61. Pg. 4, Section 2.2, Past Studies - In the last sentence there is reference to 2017 sampled well results shown in Table 1. It appears these results are shown in Table 5. Please confirm and update text and table accordingly.

62. Pg. 4, Section 2.2 Past Studies – It is unclear what is meant by "natural attenuation is facilitating biodegradation". Do you mean that some natural attenuation mechanism such as adsorption is facilitating biodegradation? Or do you mean biodegradation is the main natural attenuation mechanism? Please clarify.

63. Pg. 4-5, Section 2.4, Soil Sampling Network - The 2018-19 worst case samples should be named and provided in this section. Confirm that all sample locations are presented on Figure 3 (see previous comment on figure name as well).

64. Pg. 5, Section 2.3 Groundwater Sampling Network – Please provide a table which includes the information within this section. Table heading would include well ID, Location, type (well vs temporary auger hole), and Date Installed.

65. Pg. 5, Section 2.4 Soil Sampling Network, 1st sentence – Same comment as for Section 2.4.

66. Pg. 5, Section 3 – Please cite the relevant SAP/QAPPs for further details on sampling methods as required by the CFRSSI guidance.

67. Pg. 5, Section 3.1 Water Level Measurements – So the temporary boreholes (2-6 ft deep, hand augered?) were left open as uncased wells and the water levels measured from September 2018 to August 2019? Is this correct? Were these same open boreholes sampled for water quality in October and in November for three of the locations? Please clarify both here and in Section 3.2 where water sampling is discussed.

68. Pg. 6, Section 3.2, Water Quality Measurements, Last Paragraph - Confirm if BPSO7 was also resampled. Please update the text if required.

69. Pg. 9, Section 3.5 – Please include the procedures used for calculating oxidant doses as well as an appendix containing the actual calculations, as required in the CFRSSI guidance.

70. Pg. 10, Section 4.1, Results - Please confirm the sentence stating, "Detailed sample information and hydrocarbon and dissolved lead results are presented in Table 4." Table 4 is not listed in the TOC of the report nor is it presented in the report.

71. Pg. 11, Section 5.1, Results - Please confirm/clarify information in the first paragraph. Section 5.2 presents screening and enforcement quality percentages/counts for the 2022 Treatability soils. this information should be included in Section 5.1 for the hydrocarbon soil sampling. Soil summary tables presented in this report do not include any samples collected in July 2019. July 1st samples

are presented in Appendix F and were only analyzed for metals. Please confirm dates and counts presented in the text as the current text information appears to be applicable to the hydrocarbon analysis only.

72. Pg. 11, Section 5.2, Treatability Results – Please reference the relevant data tables.

73. Pg. 12, Section 6, Deviations from the Hydrocarbon QAPP – Please indicate/cite the relevant QAPP for each deviation. Also please indicate if approvals for the deviations by EPA/DEQ were obtained as required by the CFRSSI guidance.

74. Pg. 13, Section 7, Summary, Second Paragraph, First Sentence - The first sentence of the paragraph indicates samples were collected Between June 17 and June 30 which is contrary to the information reported in Section 5.1 Results. Confirm the sampling dates and update the text if required.

75. Pg. 13, Section 7, Summary, Second Paragraph - The sampling dates indicate samples were collected between June 17 and June 30 (should be July 1). Please clarify whether the counts in this paragraph include the soil XRF and metals analysis reported in Appendix F.

76. Pg. 13, Section 7, Summary, Fourth Paragraph - Please confirm the dates of the treatability soil sampling to reflect what is presented in Tables 10a through 10e.

77. Pg. 13, Section 7, Summary, Fourth Paragraph - The second to last sentence indicates; "Twenty-four of the screening quality data points were assessed as estimated because the result was between the MDL and the RL." As indicated in previous comments for the 60% design report; sample results that are qualified as estimated results by the laboratory that are between the method detection limit and the method reporting limit, and do not require qualification for any other reason can be considered to be enforcement quality data. Please confirm whether the counts in this paragraph include these screening quality data points, if so please re-evaluate the number of screening quality results.

78. All Tables – Please include footnotes that identify all acronyms, abbreviations, and codes. For example, Sample Type, "FG" "FG-N", etc. Most readers can probably guess what these are, but it would be better to provide the abbreviations in footnotes under each table.

79. Table 5, 2018 Groundwater Hydrocarbon Monitoring Water Quality Results – Analytical - Sample result units should be presented in this table.

80. Table 7, 2019 Soil Hydrocarbon Monitoring Soil Quality Results – Volatile Petroleum Hydrocarbons - Sample result units should be presented in this table. There is a column for the Level A/B evaluation, but it is not filled in for all the sample results. This column should be fully populated.

81. Table 8, 2019 Soil Hydrocarbon Monitoring Soil Quality Results – Volatile Organic Compounds - Sample result units should be presented in this table. There is a column for the Level A/B evaluation, but it is not filled in. This column should be populated.

82. Table 9, 2019 Soil Hydrocarbon Monitoring Soil Quality Results – Extractable Petroleum Compounds - Sample result units should be presented in this table. There is a column for the Level A/B evaluation, but it is not filled in. This column should be populated.

83. Tables 10a-e – Please provide a treatability study descriptor such as oxidant dose, and other data so the reader knows what part of the treatability study the data represent.

    Also, please make sure that the units are indicated in all tables (such as Table 5), within the

column headings, as footnotes, or in the table title as appropriate.

84. Figures 1 through 3 – The annotations are very difficult to see. Please make the points solid and use thicker lines on the text. Also, as mentioned previously, the different properties should be delineated using different colors and labeled.

3.1.A.7_A - Hydrocarbon DSR - Appendix A – 2018-19 DQA

General Comments

85. Level A/Level B forms, laboratory data validation reports, and/or data packages, which are required within the CFRSSI Guidance, were not included. Please add.

Specific Comments

86. List of Tables - The table order in the "List of Tables" does not match the presentation in the report.

87. Section 1, Introduction, First Bullet - There is a new version of the EPA National Functional Guidelines established in 2020. Confirm whether the latest version of the EPA National Functional Guidelines for validation was used. Please update the text and references if required. Please also update the next version of the QAPP when available.

88. Section 1, Introduction, Fourth Bullet - There is a new EPA SOW. Please confirm the version used in this report and update the text and references if required. Please also update the next version of the QAPP when available.

89. Section 1, Introduction, Third Paragraph - Confirm what version of the TREC SOP guidance was followed for validation. There is a new version available. Please update the text and references if required.

90. Section 3.0 Data Quality Assessment, Second Paragraph - There is discussion of using the PARCC parameters. Sensitivity is part of the PARCCS parameters and should be evaluated in the report.

91. Section 3.2.1, Laboratory and Field Duplicates - There is discussion that "if sample results were less than five times the CRQL and the RPD was greater than 20% for aqueous samples or 35% for solid samples, the difference between the natural sample and duplicate sample must be less than the CRQL to have acceptable precision." The appropriate procedure for evaluating precision when one or both sample results are less than 5x the CRQL is to calculate the difference between the results which should be less than the CRQL for water and less than 2x the CRQL for soil in order to be acceptable. The RPD is not taken into account in this situation. Please confirm what process was followed. Going forward please ensure the appropriate procedure is followed and identified in the next version of the QAPP.

92. Section 3.2.1, Laboratory and Field Duplicates, Second Paragraph - It is noted that one data result was qualified for poor laboratory precision. It should be identified what media this is for.

93. Section 3.2.1, Laboratory and Field Duplicates, Third Paragraph - There are no 2018 groundwater/soil results in the tables. Please confirm whether these results are supposed to be part of this report and/or reference where the data can be located. This comment is applicable to all other sections of the report (holding times, surrogates, etc.).

94. Section 3.2.1, Laboratory and Field Duplicates, Fourth Paragraph - Please confirm the sentence stating, "there were not qualifications warranted for field duplicate results that did not meet acceptable criteria" since the previous sentence stated "11 field duplicate results were not within

acceptable precision criteria." Please confirm the percentage of results that were acceptable and for what year of data and media.

95. Section 3.3, Accuracy - Surrogates should be added to the list of laboratory accuracy reviewed items.

96. Section 3.3.1, Sample Preservation and Holding Time - Information should be provided on groundwater holding times and for the associated year of data. Confirm the number of natural data points that were qualified for holding time criteria.

97. Section 3.3.2, Reporting Limits - As done on other sites for this program, sample results that are qualified as estimated results by the laboratory that are between the method detection limit and the method reporting limit, and do not require qualification for any other reason can be considered to be enforcement quality data.

98. Section 3.3.3, Surrogates - It should be noted which six natural sample data points were qualified based on surrogate criteria (year and media). Please provide.

99. Section 3.3.4, Blanks - Equipment blanks and field blanks address field sampling contamination. The language in the report referencing "total field and laboratory source of contamination" should be modified as "total field source of contamination." There were also soil method blanks that should be addressed in this section.

100. Section 3.3.4.1, Equipment contamination Blanks and Field Blanks, Last Paragraph - Please confirm the number of results qualified as nondetect.

101. Section 3.3.4.2, Trip Blanks - It should be noted in the text that only C9-C12 results were qualified based on trip blanks and the 1,4-dichlorobenzene and benzene applicable results were qualified based on method blanks.

102. Section 3.3.4.3, Method Blanks - Please confirm what years of data are being referenced. The last paragraph is confusing. Please clarify what qualifications were required.

103. Section 3.3.4.4, Continuing Calibration Blanks - This section should only address continuing calibration blanks. The last paragraph discusses continuing calibration verifications. There should be a separate section for calibrations.

104. Section 3.5, Completeness - Information should be provided on whether any results were rejected.

105. Section 3.7, Data Usability - This section should discuss the various media and data collected in 2018 and 2019 and identify the percentages of enforcement/screening and/or rejected results.

106. Section 4.0, Data Assessment Summary - Soil information should be provided in this section (second paragraph). Discussion of rejected data should be presented in this section and/or it should be stated that no results were rejected.

107. Table A1e, 2019 Soil Hydrocarbon Monitoring Soil Quality Results – EPH - Sample result units should be added to the table. There is a column for the Level A/B evaluation, but it is not filled in. This column should be populated.

108. Table A3a, Buffalo Gulch Groundwater and Soils Characterization Data Quality Assessment – Field Duplicates - No 2018 results are presented in this table. No groundwater results are reported in this table. Please address.

109. Table A3b, Buffalo Gulch Groundwater and Soils Characterization Data Quality Assessment – Holding Times - The header row needs to be presented on each table page. There is a column for

media but it is not consistently filled out. Please populate that column for each result. Sample result united should be added to the table.

110. Table A3c, Buffalo Gulch Groundwater and Soils Characterization Data Quality Assessment – Field Blanks: Groundwater sample results from 2018 are presented in the table. Soil results are from 2019 only.

111. Table A3d, Buffalo Gulch Groundwater and Soils Characterization Data Quality Assessment – Trip Blanks - The header row needs to be presented on each table page. 2018 groundwater results are in the table. 2019 soil results are in the table. There are sample names that say Trip Blank with a soils unit. Please confirm if these are the correct sample names. Trip blanks are usually always a water sample to identify possible contamination in the cooler during shipping.

112. Table A1a, 2018 Groundwater Hydrocarbon Monitoring Water Quality Results – Analytical - Sample result units should be presented in this table.

113. Table A1c, 2019 Soil Hydrocarbon Monitoring Soil Quality Results – Volatile Petroleum Hydrocarbons - Sample result units should be presented in this table. There is a column for the Level A/B evaluation, but it is not filled in for all the sample results. This column should be fully populated.

114. Table A1d, 2019 Soil Hydrocarbon Monitoring Soil Quality Results – Volatile Organic Compounds: Sample result units should be presented in this table. There is a column for the Level A/B evaluation, but it is not filled in. This column should be populated.

3.1.A.7_D Hydrocarbon DSR - Appendix D - Data Quality Assessment, Draft BPSOU, Buffalo Gulch Hydrocarbon Characterization Sampling Data Summary Report, December 2022

General Comments

115. No laboratory data packages are presented in the report. Validation reports could not be reviewed. Please provide. Please remove all instances of "Error! Reference source not found".

Specific Comments

116. Section 3.0, Data Quality Assessment - In the third paragraph, there is reference to Tables 10a-e showing sample results, lab flags, data validation flags, data validation codes, and data usability codes. These tables are not provided in Appendix D. Please provide these tables for review and reference.

117. Section 3.0, Data Quality Assessment - In the second paragraph, last sentence, it states "Error! Reference source not found." Please update the text with the correct information.

118. Section 3.1, Level A/B – In the future, please provide a written Level A/B assessment, rather than relying on verbal communication.

119. Section 3.3, Accuracy - There is discussion that limited data packages were submitted for data validation. Depending on the stage of validation required for the data, the appropriate data package needs to be provided by the laboratory.

120. Section 3.3.1, Sample Preservation and Holding Time - Please confirm why two VPH results were qualified as nondetect for holding time and assigned enforcement quality. The results would not become nondetect based on holding time exceedance and they should be considered screening results.

121. Section 3.3.2, Results between Method Detection Limit and Reporting Limit - Clarification of this process needs to be provided. The laboratory identifies results between the MDL and the RL as estimated "J." If these results are not qualified for any other reason after validation, then they can be considered enforcement quality data. If one of these results was qualified based on validation criteria, then it is considered screening quality. Adding a project specific code as indicated by the guidance documents ("A" for example) is acceptable. Confirm what this sentence is stating: "Therefore, inorganic data which met all field and laboratory criteria were not qualified for results between the MDL and RL."

3.1.A.10 – Attachment J to Appendix A - FEMA Maps

Specific Comments:

122. FEMA's National Flood Hazard Layer (Official) Figure - The figure could be improved to better support the PDI/design discussion and to make it more apparent where the project is. Consider resizing the figure to 11x17 and adding additional information (e.g., project extents/boundaries, key components/locations, etc.).

General Comments:

123. To support/accompany the figure, consider adding a short amount of text describing where the project is located within the figure and flood hazard zones. For example, "The Buffalo Gulch Remedial Site is located within the FEMA-designated Zone X – Other Areas, and is determined to be outside the 0.2% annual chance floodplain as shown on the NFHL FIRMette for Silver Bow County, Montana."

124. Considering adding the full FEMA Firm Panel to Attachment J.

3.1.A.15 - Attachment O to Appendix A - Earth Volumetric Studio (EVS) Report

Specific Comments

125. Pg. 3, Section 2.1.2, 1st paragraph – This paragraph refers to "the XRF to ICP Correlation Calculation Brief attached to the BG Design Report." Please clarify the location of this document.

126. Pg. 3, Section 2.1.2, last sentence – Based on the comments on Table 2, the statement "The attached Table 2 depicts the conversion of the XRF concentrations to predicted ICP concentrations" is incorrect. Table 2 needs to be replaced in its entirety with XRF data that doesn't have a paired ICP value and the predicted ICP values based on the regression coefficients.

127. Pgs. 7-10, Section 3.3 and 3.4 – The purpose of hydrocarbon sampling and analysis is "to determine if a special handling or treatment plan is needed to address hydrocarbon impacted soils or groundwater." (PDI Evaluation Report) The hydrocarbon impacted soil will be excavated for construction of the site ponds; therefore, a decision is needed regarding the disposition of the excavated soil: Can the soil be reused or does it need to be treated and/or moved off site? It appears the selected screening criteria vary based on in situ soil depth. These screening values do not answer the question. Section 3.4 indicated "The model depicted where any COC failed the maximum waste criteria…" What is the maximum waste criteria? The model seems to be set up to address in-situ soil only to identify if a release has occurred, not soil for the disposal or reuse question. Perhaps the currently available soil data can be used to identify and quantify soil that fails any screening value and must be moved off site for treatment. The remaining soil can be stockpiled for retesting to determine reuse based on shallow or deep placement. Please revise and clarify how hydrocarbon screening is to be conducted.

128. Pg. 7, Section 3.3 – This section indicates "…a comprehensive table containing all contaminant concentrations at their respective interval was generated…" and "The resulting contaminant summary table, included as Table 5 was used as the input to EVS."; however, Table 5 is missing a lot of the samples listed in Tables 7, 8, and 9 of the Hydrocarbon DSR or Table 10 of the PDI Evaluation Report. Why were data omitted from a "…comprehensive table containing all contaminant concentrations…"? Does this omission affect the EVS model output?

129. Table 1 – The regression coefficients shown in this table are not exactly the same as those shown on the figures in the XRF-ICP Regression Analysis attached to the Soils DSR. What is the source of these coefficients?

130. Table 2 – Most of the samples in this table were analyzed for both ICP and XRF. There is no purpose in predicting the ICP values when ICP results are readily available.

131. Table 2 – For the samples beginning SS-BG-SP, all of the values under the headings Arsenic XRF, Copper XRF, Cadmium XRF, etc. are not XRF concentrations. These are laboratory ICP values taken from the Soil DSR Table 1b. The values under the headings Arsenic Conversion Conc, Copper Conversion Conc etc. are invalid.

132. Table 2 – For the samples beginning SS-PZ-BG, none of the values under the headings Arsenic XRF, Copper XRF, Cadmium XRF, etc. are XRF results from the Soil DSR. These are also not ICP result from the Soil DSR. It is not clear what these values are taken from.

133. Table 2 – Given that no XRF data are actually presented, all of the "Conversion Conc" values are invalid. The entire table contains no usable information.

134. Table 3 – There are 8 samples where predicted ICP values are used when actual ICP results are available. These include: SS-PZ-BG-01-090518-0102, SS-PZ-BG-02-090418-0910, SS-PZ-BG-03-090518-0506, SS-PZ-BG-04-090518-0405, SS-PZ-BG-05-090718-0001, SS-PZ-BG-06-090618-0607, SS-PZ-BG-07-090618-0102, and SS-PZ-BG-08-090618-0304. Use the ICP results for these samples.

135. Table 3 – This table does not include the laboratory XRF results presented in PDI ER Table 2. While there weren't any ICP split results available, the laboratory grade XRF data from Ashe Analytical were typically used as equivalent to ICP due to extensive sample processing and ongoing calibration. These also help to fill in the site to provide a greater sample density. This table also does not include any of the laboratory CVAA mercury analyses of test pit soil samples from the 2012 Geotech and Groundwater DSR. Please include these in Table 3 and the EVO model.

3.1.A.16 – Attachment P to Appendix A - Cultural Resource Protection Recommendations

General Comments:

136. The recommendations for Buffalo Gulch do not align with the Draft Cultural Survey Report dated 090321. The Cultural Resource Preservation Recommendations dated June 14, 2021 recommend preserving in place the slag-walled segment between Northern Pacific Railroad line and truss plant. However, the September 3, 2021 Cultural Survey Report just states that it is not eligible for the national registry and makes no mention of preservation as part of the final remedial action. Additionally, construction drawings for Buffalo Gulch do not specifically state to preserve any portion of the slag-walled portion of the ditch. Please confirm whether the portion of the slag-wall is intended to be preserved and indicate on construction drawings as appropriate.

3.1.B - Appendix B – Calculation Briefs

137. Calculation Brief BG-006 - It is difficult to compare the nodes within the model results and the figure provided. Examples include J11, J12, and JCT-759, which are shown in the peak value results but not the figure. Please also include the labels for the storage nodes in the figure as well.

138. Calculation Brief BG-017 – The volumes in Section 5 do not match those in Attachment A. The Attachment A values were carried into the design report. Please resolve which are correct.

139. Calculation Brief BG-020 – While the redox state and speciation of arsenic plays an important part in the mobility, of greater importance is the precipitation of iron oxyhydroxide. The rate of iron oxyhydroxide precipitation, and the coprecipitations of metals and arsenic, is controlled by the pH and alkalinity of the water. The higher the pH and alkalinity, the higher the rate of ferrous iron oxidation and precipitation of iron oxyhydroxide. Oxygenation of the water is important, and it was good that this was included in the analysis and design, however, the precipitation rate of iron oxyhydroxide should also be considered. Is there sufficient dissolved ferrous iron to remove the metals and arsenic? Is there sufficient residence time within the basins for iron oxyhydroxide precipitation to occur at pH 6 vs pH 8? The pH could also decline due to initial precipitation of iron oxyhydroxide (depending on the buffering capacity of the storm water), limiting subsequent precipitation.

    Also consider that if the basins are not designed to take advantage of the available volume, the flow may simply travel straight from the input point to the output without adequate mixing with the more stagnant areas of the basins. The effective residence time would be much shorter than calculated due to short circuiting of the flow within the basins. The planned recirculation should help, but this needs to be discussed. Please also include an evaluation of the amount of iron present in the inflow and the kinetics of iron oxyhydroxide precipitation to determine if the basin volume/residence time is sufficient to remove the metals and arsenic or if the wetland sediments will be impacted, requiring O&M.

    The reference for the BOD in mixed storm water should be “EPA 1983, Table 6-12”. There is no Table 4-1 in the document. Also, please add EPA 1983 to the references list. As commented on previously (30% Design Comments), use of a rule of thumb for typical urban parking lots is not applicable to mine impacted waters.

    Additional methodology for meeting the goals should be considered where applicable such as treatment via percolation through soil and phytoremediation as indicated in the guidance, as previously indicated in the 30% Design Comments. Please discuss.

140. Figure 1 – Please discuss the kinetics of arsenic oxidation. Figure 1 is based on the assumption that equilibrium is reached. This is often not the case for arsenic oxidation. Photooxidation near the water surface would likely lead to rapid arsenic oxidation if the water is not too turbid. Please discuss.

141. First sentence following Figure 1 – Please change “oxygen demand” to “oxygen added”.

142. Calculation Brief BG-022, Attachment D, 3rd Box and Whiskers plot – The median of 10.5 days reported in the summary box does not agree with the value shown in the plot.

143. Calculation Brief BG-028 Buffalo Gulch Capillary Break Calculation Brief - This calculation brief evaluates capillary rise at seven unique locations to determine if a capillary break is needed. The

calculations are based on theoretical conditions and limited field sampling from those seven locations. The following comments are noted on the analysis:

a. The brief uses a capillary rise cutoff of 1.5 feet below the surface, i.e. the thickness of the engineered cap, to determine if metal wicking is likely to reach the surface. The 1.5 foot deep cutoff is not conservative. There are too many unknowns and simplifications in the analysis to not include a more conservative cutoff factor including: the sparse and limited soils characterization, unknown future groundwater depth, the equations used are theoretical, and plant rooting depth is not included. An additional margin of error is needed.

b. Predicting capillary rise is challenging using with limited field data and theoretical equations as is done in the calculation brief. Either empirical data or professional experience with slicken formation in the watershed may be useful in this assessment. It may also be more useful to use conservative estimates of capillary rise for the soil types encountered (e.g. Fetter, 1994 Table 6.1).

c. A map of predicted depth to groundwater from the finished ground surface would help with evaluating capillary wicking potential. It would also assist the evaluation to provide a map showing location of all lithologic borehole/test pit sites, and indicate those sites that have "granular layers that act as capillary breaks" and the thickness of those layers. (referred to in the Design Report Section 5.1.8).

d. The capillary rise calculations appear to be point calculations at the piezometer/test pit location. We do not see that the methods attempt to predict the elevation of capillary rise continuously over the project site in a manner that would evaluate wicking potential at low points in the finished topography including the bypass drainage ditches. This should be done.

e. Table 1: What is the basis of the capillary rise elevation? Is it measured high groundwater? Is it modeled future groundwater depth? The analysis should be based on measured high groundwater and modeled future rise in groundwater due to basin construction if needed.

f. Calculated capillary rise is higher than the finished ground surface elevation in at least one sample at three of the seven locations evaluated (PZ-BG-04, PZ-BG-06, PZ-BG-08). The brief then recalculates capillary rise for these locations which demonstrate potential problems using data from other sample sites. It is inherently not conservative to use data from other samples where the site-specific data does not give a desired answer. We recommend a more conservative approach, if existing data for the location shows capillary rise will intercept the cap, then plan a capillary break into the design. If existing data for these locations is insufficient, new data should be field collected, not assumed from other sampling locations.

g. Section 2 of the brief states, "Locations with high capillary action will be additionally reviewed for groundwater quality in the vicinity as related to migration" and Section 3, "If deep-rooted plant species are proposed in areas of poor water quality, or even shallow rooted species in area with significant capillary rise and poor groundwater quality, the effect on the vegetation may need to be evaluated." Neither of these are evaluated at the three sample locations that fail to meet the 1.5-foot capillary rise depth in the original calculation using the site-specific data. These factors should be evaluated.

h. It does not appear that modeled rise in groundwater levels upgradient of the stormwater basins are included in the capillary rise calculations. This should be included. We recommend improvements to the Buffalo Gulch groundwater model or using the sitewide groundwater model if it is more appropriately calibrated for this.

144. Calculation Brief BG-029, Attachment A, Stokes Law Settling – Please provide the values used in the equation. A velocity of 0.0083 ft/s was obtained using:

$g = 9.81\ m/s^2$
$\rho_s = 2650\ kg/m^3$ (for quartz)
$\rho = 997\ kg/m^3$
$d = 0.00005\ m$
$\eta = 0.0008891\ Pas$
Temp = 25°C (77F)

The equation shown in the calculation brief vs 0.013 ft/s (a difference of about 1.6x). The settling rate corresponds to an approximately 4 minute time required to settle through 2 ft of water (vs 2.4 minutes in the calculation brief). For the 2 µm particle size, the settling velocity is 1.3×10^{-5} ft/s, or 42 hrs to settle through 2 ft of water (vs 26 hrs in the calculation brief). At 15C (59F) the velocity and time to settle for 50 µm particles are 0.0064 ft/s and 5.2 minutes and for 2 µm particles 1.0×10^{-5} ft/s and 54 hrs, respectively. This calculation appears to have been performed correctly within the SWMM, but the result provided within the calculation brief cannot be evaluated without including input parameters. A summary of velocities and settling times vs temperature for 2 µm particles is shown in the table below.

Summary of Settling Velocities and Times vs Temperature

Temperature	32.2C (90F)	25C (77F)	15C (59F)	10C (50F)	4.4C (40F)
g (m/s^2)	9.81	9.81	9.81	9.81	9.81
ρ_s (kg/m^3)	2650	2650	2650	2650	2650
ρ (kg/m^3)	994.98	997.05	999.06	999.65	1000
d (m)	2.00E-06	2.00E-06	2.00E-06	2.00E-06	2.00E-06
Ŋ (Pa-s)	7.64E-04	8.89E-04	1.16E-03	1.31E-03	1.55E-03
v (m/s)	4.72E-06	4.05E-06	3.12E-06	2.75E-06	2.33E-06
velocity (ft/s)	**1.55E-05**	**1.33E-05**	**1.02E-05**	**9.02E-06**	**7.63E-06**
Time to settle 2 ft (hrs)	**35.9**	**41.8**	**54.4**	**61.6**	**72.8**
Time to settle 2 ft (min)	**2152**	**2507**	**3261**	**3695**	**4368**

The results show that settling times more than double from 35.9 hrs on a 90F summer day to 72.8 hrs for a 40F fall day, due to increases in the dynamic viscosity of water. This temperature dependency on settling rates and times should be highlighted in the SWMM and the calculation brief. Please include. Also, please include the assumptions associated with Stoke's Law, such as laminar flow (no turbulence) and small particles.

145. The existing WDA Pond 11 is proposed to be used for settling and water treatment of construction dewatering discharge. The settling pond sizing narrative states that the top two feet of WDA Pond 11 will be used to meet the necessary detention time to remove the silt fraction during the peak flow of 108.13 gpm. Please provide details for how the existing pond and discharge channel will be modified to accomplish this.

3.1.E – Appendix E - HEC/RAS Modeling Report

General Comments:

146. Nowhere in the text does it discuss channel characteristics. For example, there could be a section describing the channel shape, average slope, average bottom width, side slopes, etc.
147. Consider adding a labeled figure at the end of the modeling report showing a general overview of the site, model extents, flow paths, etc.
148. Consider adding labeled figures at the end of the modeling report showing the HEC-RAS geometries with cross sections, flow lines, bank lines, background aerial imagery, etc.

Specific Comments

149. Section 1. Introduction - The text states, "While reconstruction of uSBC is expected to occur in the future, the existing channel will be used for design purposes." It seems illogical to design a long-

term system/improvements based on a channel that is pending reconstruction. Following reconstruction of uSBC, will these models be revisited/reevaluated to address changes to the hydrology/hydraulics?

150. Section 2.2 HEC-RAS Terrain Setup - The text states, "HEC-RAS requires terrain data to be imported as contours from an AutoCAD Civil 3D shape file. For the existing uSBC channel, contours were exported from LiDAR survey data of the area, cut to include the confluence of the channel with Blacktail Creek for reference." This is only true for 2D models. For 1D models, survey/LiDAR data are needed to define model cross sections and geometry. Assuming the model is 1D, how were subsurface (i.e., bathymetry) data obtained, because typically LiDAR does not penetrate water. Was a survey done?

151. Section 2.3.1 Flow Rate Inputs – Outlet Model - The text states, "Flow inputs to the uSBC channel were considered for two different scenarios: the first being when the Buffalo Gulch stormwater basin is installed, but the Diggings East stormwater basin is not yet installed and thus the full upgradient (of the Buffalo Gulch basin) drainage contributes to uSBC, and the second being when both the Buffalo Gulch and Diggings East stormwater basins are installed and thus only the detention basin discharge from the basins plus runoff from the surrounding area is contributing to uSBC." The description of these two scenarios would benefit from the addition of a simple figure. Consider adding an aerial figure that shows contributing flows/areas for each scenario.

152. Section 2.3.2 Flow Rate Inputs – Forebay Model - The text states, "Flow input to the forebay overflow channel assumed the 100-year storm flow with the railroad culverts 50% clogged, resulting in a flow of 92.5 cfs (see Calculation Brief BG-009)." Why were the culverts assumed to be 50% clogged? Is this to be conservative?

153. Section 2.3.2 Flow Rate Inputs – Forebay Model - The text states, "This flow was summed with the forebay overflow for a total flow out of 617.5 cfs." Technically, it is incorrect to simply sum flows together for a total flow. The flows likely have different hydrographs (i.e., the graphs of discharge over time) and therefore the peak combined discharge may be quite different. Please consider this comment and revise the text.

154. Section 2.3.3 Boundary Conditions - The text states, "The furthest upstream point modelled, river station 18+87, is used as a downstream water level boundary condition for SBC." Please reword and/or revisit/correct this sentence. If understood correctly, it should say something similar to, "a stage (water level) series was used as the downstream boundary condition for the furthest downstream cross section modelled, river station 18+87." The sentences following it seem to clarify this point.

155. Section 2.3.3 Boundary Conditions - The text states, "The 10-year peak flow water level of 5444.4 feet above mean sea level (amsl) in the BRW channel portion was input to the Outlet Model as a downstream water level boundary condition. Similarly, the 100-year peak flow water level of 5445.2 feet amsl was input to the Forebay Model as a downstream water level boundary condition." Where did these peak water levels come from (calculated, from gage data, etc.)? Please provide this information.

156. Section 2.3.4 Main Channel, Bank Lines, and Cross-Sections – Outlet Model - The text states, "These bank lines denote the transition from bankfull flow to overbank flow, conditions which necessitate different roughness coefficients due to the dissimilarity of the channel surface." The USACE suggests these channel forming discharges: 2-year flood for perennial streams, 10-year flood for ephemeral streams, bankfull discharge, or effective bed load sediment carrying discharge.

Ensure that bank lines/points were drawn appropriately according to USACE recommendations because, as was said, the location of roughness change plays a key role in calculated discharges.

157. Section 2.3.6 Manning Roughness Coefficients - The text states, "As mentioned in Section 2.4.4, different n-values are generally used for bankfull and overbank flow, but these conditions were not observed in this model, so a uniform roughness was used." What is meant by "these conditions were not observed in this model"? Manning's roughness values can be very different from channel bottom to channel sides to overbank floodplains, and it is important to represent them accurately in modeling. If overbank flow does occur, have appropriate Manning's n values been applied? Have future conditions been considered? Please address this comment.

158. Section 3.2 Forebay Outlet Channel Model - The text states, "Model results confirm that the overflow channel as graded has sufficient capacity to convey the 100-year storm overflow with at least one foot of freeboard (5449 ft amsl channel sides minus approximate 5448 ft amsl maximum channel depth)." This needs to be reworded. Modeling never "confirms" anything; modeling is solely there to support and assist in calculations and predictions. Better word choices would be "indicate" or "demonstrate". Why was one foot of freeboard the target? Is this standard practice for open-channel storm drains?

159. Section 3.2 Forebay Outlet Channel Model - The text states, "The Forebay Model results show slightly higher channel velocities when compared to the Hydraflow Express outputs for the channel in Calculation Brief BG-009, but in general, the depth, velocity, and water surface elevation modeled by HEC-RAS do not substantially differ from those modeled by Hydraflow." Consider adding a table, or better yet, add a section to the text discussing the results from Hydraflow. This would be a valuable second line of evidence for the modeling.

160. Section 4. Conclusions - The text states, "The maximum downstream velocity for pre-Diggings East construction and high tailwater conditions is above 5 ft/s at 5.5 ft/s, but this is acceptable, as these conditions will not be permanent and will not exist long enough for significant scour." Who has deemed this acceptable? How long is construction expected to go on for?

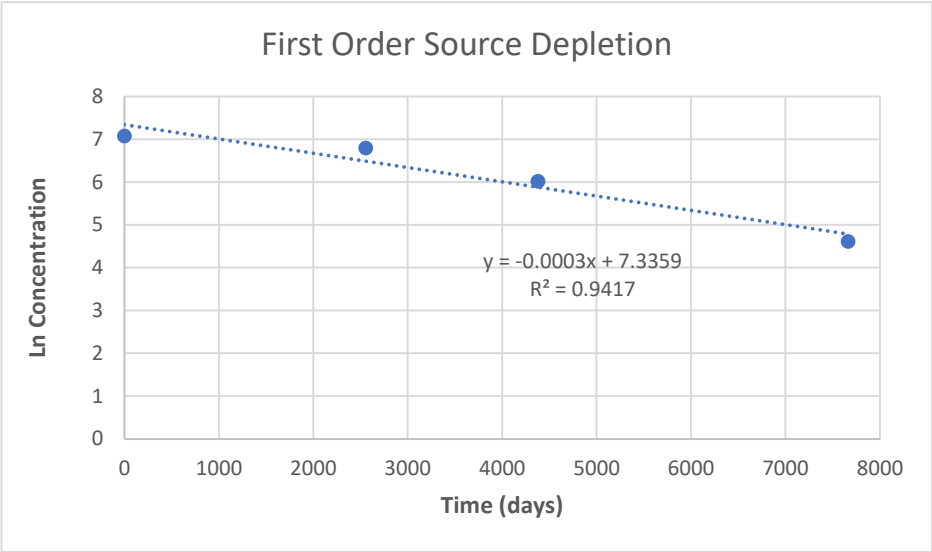
161. Section 4. Conclusions - The text states, "The model also confirms that no unexpected flooding will occur in these conditions, and that the channel modeling results largely do not differ between Hydraflow and HEC-RAS." See other comment above discussing the problem with using the word "confirm" with modeling. Also, as recommended above, consider adding and comparing the Hydraflow results to the HEC-RAS results.

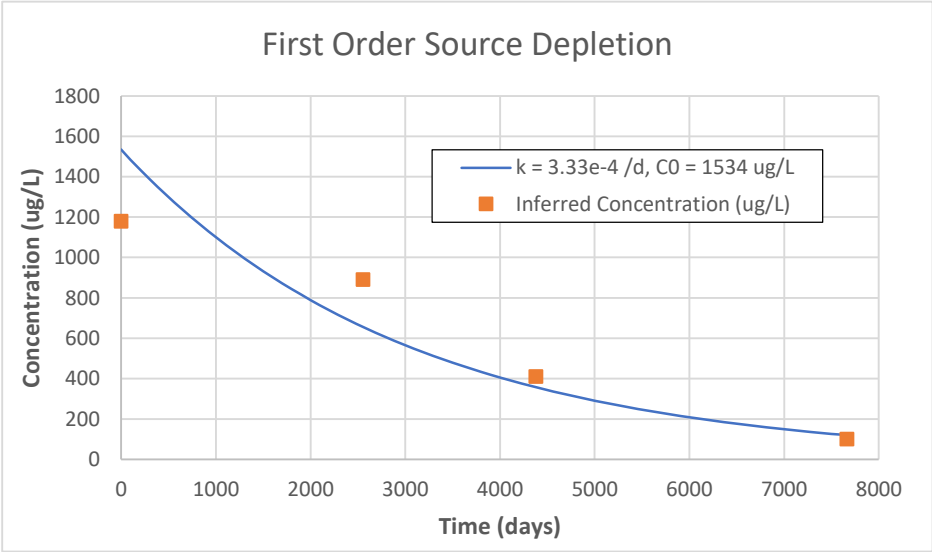
3.1.H - Appendix H - Buffalo Gulch Liner Evaluation Report

General Comments

162. A general conceptual site model discussion would be helpful for understanding the expected outcomes of the model. For instance, the mounding mentioned as a potential outcome should be discussed. Presumably mounding would not be anticipated for the lined scenario, but only for the unlined basins. Also, please discuss the reason for the lower benzene concentrations at stream interface 1 for the unlined scenario vs the lined for model 3. In the unlined scenario, does the basin water flow into the groundwater, diluting the benzene concentrations? Please discuss and provide some loadings to the stream for various times.

163. The modeling appears to represent normal conditions when evaluating potential impacts to the subdrain and residences. What would the groundwater contours look like for the 10 year high water condition? Please add a sensitivity analysis. The sensitivity analysis should be used to develop a factor of safety for the liner.





Specific Comments

164. Pg. 8, Figure 2.0 – It is unclear how the first order fit was obtained. The x-axis has a variable time scale. Typically, the first order degradation rate and initial concentration are obtained by plotting time vs the natural log of the concentration. The rate constant (k) is then equivalent to -slope and ln Co is the intercept, as shown in the figure to the right. The exact times were not provided in the figure, only dates, so the exact rate constant and initial concentration provided above may vary slightly compared to when using the actual times. However, this is a correct procedure. Please indicate what process was used to obtain the first order fit and correct if necessary. What do the circles represent in this figure? Please explain.

165. Pg. 10, Section 3.1.4 Benzene as a Proxy for Hydrocarbon Contamination, last sentence – Please discuss in terms of benzene loading to the creek in addition to concentrations.

166. Pg. 13, Section 3.2.3 Evaluating Impacts to Neighbors, second sentence – Please discuss that the impact of the liner on groundwater flow is due to the over-excavation required for the liner ballast and for years when the groundwater elevation is higher than the 3-year maximum. Also discuss the

impact of the liner for years with groundwater elevations higher than the 3-year maximum, such as the 10-year maximum groundwater levels.

167. Pg 16, Section 4.1Impact to Surface Water – Again, the conclusion that the liner is not expected to substantially impact the water quality of the stream would be better supported if loadings were supplied.

168. Figures 1.0-1.2 show the basin liner directly underneath the 10-year high water level (HWL) but the retaining wall does not go up to top of HWL in sections A-A', B-B', E-E', F-F', and the main profile east-west. The retaining wall should extend up to the 10-year HWL and be impermeable to prevent infiltration of high stormwater. The legend in these drawings indicates the fat flue line to be "RETAINING WALL EXTENSION TO 10-YR HWL" but those lines to not extend to the 10-year HWL. Our understanding is the intention is to construct a completely impermeably lines 10-year storm basin. These figures should show that.

169. Figures 7.0, 8.0, 10.0, and 12.0 – Please make the annotations easier to see, particularly the stream interfaces. Two stream interfaces are indicated in Figure 10.0 by the text annotations, but there is only one "X" in the area. Perhaps use smaller solid dots. Also, for some reason the base air photos are very pixilated making it difficult to see the features. Please make the figures easier to read. Also, please add a label to the contour in the lower left of figures 10.0 and 12.0.

3.1.I Appendix I - Buffalo Gulch Groundwater Model Report

General Comments

170. **Assumptions.** The basis for each model assumption is not clear. Please spell out the rationale for each assumption and discuss the validity for each.

Flow model boundary conditions. The model estimated flow rate required to achieve dewatering of the gulch area could be significantly influenced by model boundary condition assignments.

General head boundary condition cells (GHB) are shown to be located northeast and southeast of the gulch. The GHBs are said to be located and defined based on interpreted head contours, but the rationale for where GHBs are located, and not located, is not clear. The report states that these are the "driving force" supplying most of the inflow to the model. However, the magnitude and vertical distribution of these flows (or any flows) is not provided, and there is therefore no analysis presented to indicate that the simulated GHB flows are appropriate.

The simulated inflow (or outflow) at GHBs is computed using GHB parameters reference head and conductance. Theoretically, a GHB reference head refers to a constant fixed head condition at some distance from the GHB, and the conductance represents aquifer flow conveyance capacity between the fixed reference point and the GHB location. It is not clear how the parameter values were selected and what they represent in terms of physical features of the aquifer.

It is also not clear why the GHBs were not extended down to include layers 7 and 8. Boundary inflow to these layers is thereby precluded.

No-flow boundary conditions are presumably applied elsewhere along the perimeter of the active model area. Is this reasonable? It seems likely that there would be inflow along the north and south model boundaries to the west of the GHBs. Groundwater inflow also seems likely from the east in the area north of the river and south of the GHB line. The entire western boundary appears to be no-flow. It is hard to tell how reasonable this is.

Hydraulic properties. The hydraulic conductivity (K) values were assigned (Table 1) based largely on model calibration. As such, the calibrated K values depend on the magnitude of inflow to the model. This non-uniqueness is recognized in the report. This uncertainty should be recognized when applying the model to future dewatering simulations.

Vertical hydraulic conductivity (Kv) is much higher relative to horizontal conductivity (Kh) than expected in layers 4, 6, 7 and 8. Is this reasonable? How much is this outcome affected by the assumed river and drain boundary condition parameters and the calculated vertical distribution (and maybe also horizontal distribution) of inflow to the model? Are the model application results sensitive to this?

The specific storage parameters shown in Table 1 are high. Is it possible that these are storage coefficient values, consistent with no units (i.e. dimensionless) shown for this parameter in Table 1? This parameter does not affect steady state simulations and has little effect on the calibration simulation. Impact on dewatering simulations is uncertain, but likely small.

Flow model calibration. In Figure 6 it appears that the simulated hydraulic gradient in the critical area downgradient of the contaminant source is nearly twice the observed gradient, based on the head contours. This apparent discrepancy could affect contaminant transport and dewatering simulations and should be examined.

The calibration, as reported, does not demonstrate that simulated groundwater inflow rates from the GHBs and the model perimeter are representative. There is, similarly, no assessment presented of simulated stream and drain outflows. Were measured flow data for Blacktail/Silver Bow Creeks and, especially, the subdrain used to evaluate the accuracy of model simulated flows? If so, these evaluations should be presented in the report.

The flow calibration focusses on a 2019 water level dataset, presumably reasonably representative of current conditions. To validate the application of the model to estimate aquifer response to changing stresses, e.g., dewatering at the gulch, it would be helpful if there were a way to test the model simulated response to changed stresses. Is there data available from another time period, say, prior to operation of the subdrain, that could be used for model validation. Simulation of the PTS pumping test (or other tests?) might also be helpful.

Note that GHB parameters influence model response to changes in aquifer stresses. Head and flow computed at boundary conditions may be appropriate for one condition or set of aquifer stresses but not for a changed condition with different aquifer stresses.

Transport Model. The model could be improved by including a sensitivity analysis. The fate and transport model also does not take into account the competition for electron acceptors between benzene and other more rapidly biodegraded hydrocarbons present within the groundwater at higher concentrations, such as toluene. This is pointed out in Appendix D, but should be at least mentioned within the body of the text. The high benzene concentration at the boundary (1750 mg/L) may offset to some extent the unrealistically high benzene degradation rate.

There appears to be a consistent error in the text where ferrous iron (Fe^{+2}) is confused with ferric iron (Fe^{+3}) and vice versa. Hopefully this only exists within the description and is not confused within the model design. Please correct all instances in the text and check the model to make sure it is properly set up.

The use of a linear isotherm (K_d) in the model for benzene adsorption, which assumes an infinite adsorption capacity, does not take into account the eventual saturation of adsorption sites on the organic material, especially after a minimum of 37 years since the release. As part of a sensitivity analysis, adsorption of benzene onto the soil should be assumed to not occur for at least one of the modeling runs. Also, the Kd listed in the report, 0.015 ft^3/lb (0.946 L/Kg) is very high for benzene in a sandy soil. This is equivalent to retardation greater than 5, depending on soil porosity. Is this the value that was actually used?

The transport calibration focused on dispersivity and benzene degradation parameters. There is also a considerable range of uncertainty associated with the advection and adsorption parameters, effective porosity and Kd (or retardation). These parameters should also be tested in the calibration.

If feasible, simulations should be conducted for a relatively conservative constituent, MTBE for example. By removing the degradation variables, calibration of the transport velocity and validation of the simulated groundwater flow field and contaminant source assumptions could be simpler and more reliable. Also, when assessing dewatering impacts, the transport response of more conservative constituents could be faster than benzene.

In Figure 1 of the 6/2022 version of the report, two wells located approximately 700 and 1,300 feet downgradient of the source near the BG Site, BPS11-PW01 and PZ-BG-05, are shown to have elevated TPH concentrations in 2012 of 891 and 658 ug/L. The simulated 2012 benzene concentration at well BPS11-PW01 is 6 ug/L, compared with measured values ranging from 228 to 311 ug/L. Table 5 does not include any readings before 2018 for well PZ-BG-05, but the extent of the 2009 simulated benzene plume contours shown in Figure 7.4 is approximately 400 feet short of well PZ-BG-05. Does this indicate that simulated benzene transport is significantly slower than actual? Reasonable representation of contaminant transport velocity is likely important to assessment of groundwater contaminant migration due to dewatering.

By October 2018, Table 5 indicates that benzene was not detected at well PZ-BG-05 (no detection limit given). Could this apparent large concentration reduction be related to rapid cleanup at the CMG source in the early 1990s? An order of magnitude decrease in benzene concentration from 2012 to 2018 at MW-1, just downgradient of the CMG source, is noted in the report. Per Table 5, this concentration decrease is not replicated in the model simulation.

The simulated start of the upgradient source is the same as the CMG source, 1982. The simulated upgradient source appears to be on a different site than the CMG source. Is it possible that the actual timing of the upgradient source is significantly different from the CMG source, i.e., much more recent? The first readings shown in Table 5 for upgradient wells MW-23 and MW-25 is 2013.

Check the Kd value (0.015 ft^3/lb) presented in the report. Probably slipped a digit due to typographical error.

The kinetic model used is valid when the assumptions of the model are met. Lu et al., 1999 list five assumptions inherent in the model. Please list each of the five and discuss the validity of each for the Site.

171. Please be consistent in the use of “MTDEQ”, “MDEQ”, or “DEQ”.

Specific Comments

172. Pg. 1, Section 1.2 - Background, 2nd sentence – The text states that construction dewatering is required to facilitate excavation below the groundwater table. The text later states (Page 2, 1st complete paragraph, 2nd sentence) that tailings, wastes, and contaminated soils will be excavated to the maximum observed groundwater elevation in the most recent 3-year period. Please correct.

173. Pg. 1, Section 1.2 - Background, 2nd paragraph, last sentence – When first used in the report, Montana Department of Environmental Quality is defined with the abbreviation "DEQ", and this abbreviation is included in the list of acronyms and abbreviations. Elsewhere in the report (e.g., Page 4), the abbreviation "MTDEQ" is used to represent the Montana Department of Environmental quality. Please be consistent.

174. Section 3.2.2 appears to suggest the model layers have homogeneous properties: "the model was split into nine layers; each with independent properties." Is there geologic data that shows a 9-layer hydrogeologic system with continuous and consistent hydraulic parameters? The model report should include figures showing the hydraulic conductivity array, so a reviewer can evaluate the hydraulic conductivity array against measured values and the site conceptual model.

175. Section 3.3 Boundary Conditions does not discuss the boundary for the simulated dewatering pumping. This section should include discussion of the pumping boundary set up and how it relates conceptually to actual dewatering plans.

176. Section 3.3.2 indicates the model uses RVR boundaries to simulate Silver Bow and Blacktail Creeks. RVR does not account for stream exchange (groundwater gain/loss). Stream exchange is a critical consideration given the model is intended to show if either construction dewatering or installation of the storm basin will change groundwater flow in a manner that would contribute to water quality impacts to the creek. The modeling should use zone budget to check RVR stream exchange and calibrate stream exchange to measured values. Alternatively, the modeling could use the STR or SFR packages which specifically account for flow including stream exchange.

177. Section 3.3.3 describes the drain boundaries used for the BPSOU subdrain and dewatering pumping. This section appears to indicate that drain elevations are based on topography: "A vertical offset was then applied assuming a constant burial depth, based on the typical cross section shown in the as-builts." The subdrain is a critical boundary at the scale of this model. Elevations should be based on survey elevation of the subdrain itself, interpolated to each model cell.

178. Section 3.4.1 states, "groundwater recharge was set to 0.0005 feet per day (0.183 ft/year or 2.19 in/year) based on well recharge rather than total precipitation." It's not clear what well recharge is or why this is an appropriate recharge rate. Is the recharge seasonal in a realistic pattern for the Upper Silver Bow Creek watershed?

179. Section 3.4.2 indicates the model uses literature values for hydraulic conductivity. It is stated that model development disregarded aquifer test results because they did not match literature values. The model should be based on site specific data wherever available including the WET slug tests and results of the 72-hour aquifer test. Textbook values are not an adequate source for model parameters to which the model flow and water level (head) predictions are extremely sensitive.

180. Pg. 13, Section 3.5.1, MT3D-USGS Terms, 2nd to last paragraph, first sentence – Presumably you mean "carbon dioxide reduction" and not "methane reduction". Please correct.

181. Pg. 14, Section 3.5.2.2, Main Bullet – Please provide a reference for the Koc value used to calculate the Kd value for benzene.

182. Pg. 15, 3.5.2.4 Special Values, 1st bullet – the maximum ferric iron concentration of 5.0 mg/L is orders of magnitude higher than the aqueous solubility of ferric hydroxide at the pH of the groundwater. Some complexing of ferric iron with organic ligands does occur, but likely not enough to increase the solubility to 5.0 mg/L. Please discuss and re-evaluate the value used with the aqueous solubility of ferric iron in mind and possibly add to the requested sensitivity analysis. The Lu et al., 1999 reference indicates that the max concentration should be for ferrous iron and not ferric (i.e. [Fe^{+2}_{max}]) and this is the maximum observed ferrous iron concentration in the groundwater. At the near-neutral pH of the groundwater essentially all of the dissolved iron should be ferrous. Please indicate which well/date corresponds to the 5.0 mg/L dissolved iron and correct "Fe^{+3}" to read "Fe^{+2}".

183. How was CH_4 max determined to be 2.0 mg/L? Please explain.

184. Pg. 15, 3.5.2.6 Inhibition Coefficient – KI, 3rd bullet – Shouldn't "$K_{I\text{-}Fe2}$" be "$K_{I\text{-}Fe3}$"? Ferrous iron is not generally an electron acceptor except under very reducing conditions. Please discuss or correct.

185. Pg. 16, Section 3.5.2.7, bullet list – The bullets state that "Ferric iron is created when ferrous iron is reduced" and "Carbon dioxide is created when methane is reduced". Please change "reduced" to "oxidized" in both sentences.

186. Pg. 17, bullet list – Methane and ferrous iron are not electron acceptors. Please correct.

187. Pg. 18, Section 4.1.2 Stress Period 2 – LUST Release Period, 2nd to last paragraph – The effective solubility for benzene within a gasoline should be near 1% of the solubility for benzene alone. In this case about 17.5 mg/L (1750 mg/L * 0.01 = 17.5 mg/L). Interestingly, the 2017 benzene concentration at source well MW-23 was 17.5 mg/L, consistent with the presence of LNAPL. There is a handy calculator on the USEPA website: https://www3.epa.gov/ceampubl/learn2model/part-two/onsite/es.html. 60-80 mg/L for effective solubility of benzene in gasoline seems high. Please re-evaluate and correct as required.

188. Section 4.1.2 indicates that benzene release is simulated using "constant head boundary conditions", while Section 3.6 indicates the contaminant source is modeled using a constant concentration boundary, which is a reasonable approach. Please revise as necessary.

189. Pg. 21, Section 5.1 FLOW CALIBRATION – Please add PEST to the list of Acronyms and abbreviations.

190. Figure 6 - In the northern portion of the area with equipotential contours (north of the Civic Center) the flow is modeled towards the east. What boundary is water in this location flowing towards? It appears to be in between the general head boundary (GHB) and no-flow boundary at the edge of the model active cells. It does not make sense that water would be modeled to flow east here. The report would benefit from a figure showing the modeled flow field with boundary conditions and grid boundaries.

3.2 - Construction Plans (RAWP Attachment B)

191. C2.5.2 to C2.5.5 show the 3-year high groundwater level intersecting Silver Bow Creek and Upper Silver Bow Creek. If this is accurate, and given the waste left in place and contaminated groundwater in this area, we recommend evaluating whether groundwater capture should be installed as part of project construction.

3.4 – Construction Quality Assurance Plan (RAWP Attachment D)

- Comments on this document will be provided under a separate cover letter.

3.5 – Construction Monitoring QAPP (RAWP Attachment E)

- Comments on this document will be provided under a separate cover letter.

3.6 - Health and Safety Plan (Attachment F)

General Comments

192. Please remove editorial changes from word version as track changes are showing on the pdf file (i.e., lines within margin, editorial strikeouts/changes) throughout document.
193. Please correct page numbering in both the TOCs and in subsequent sections as the page numbering is incorrect, check throughout.
194. The HASP appears to be an overarching H&S program document that lacks specific information regarding the work to be conducted for Buffalo Gulch and hazards/mitigation measures associated with the specific work. At a minimum, please include a site map of Buffalo Gulch work site area and specific Task Risk Assessments specific to the work being conducted as stated within the HASP.
195. Appendices not complete; Appendix F and Appendix H has no information on them. Please add appropriate forms and information for these Appendices.

Specific Comments

196. Pg. HS-1, Objective, 1st paragraph - Please remove question mark punctuation on first sentence. As the title of the document suggests, this HASP is for the Buffalo Gulch (BG) Remedial Action work. Please revise this sentence to correlate to the BG remedial action work to be conducted. If this is an overarching HASP to cover the entire BPSOU then please revise to the language in this section and the document title to specifically state that.
197. Pg. HS-1, Objective, 2nd paragraph - Please define "W&C" at first instance of acronym.
198. Pg. HS-1-2, 1.1 Emergency Procedures, 2nd paragraph - Please define "FAF at first instance and indicate where this form is located and/or provide a hot link to the form.
199. Pg. HS-1-4, 1.2 Initial Reporting, 1st paragraph - The third sentence states that the org chart is included in Section 3.6, however, no org chart exists. Please provide org chart as indicated within text.
200. Pg. HS1-6, 1.4.1 Life-Threatening Medical Care, 2nd paragraph - Please remove "Great Falls" in the first sentence.
201. Pg. HS-1-5, 1.8.1 Fire Extinguisher - Sentence states that "Site personnel shall be trained in the use of a fire extinguisher, please clarify if all personnel will be trained or if a group of selected personnel will be trained.
202. Pg. HS-2-1, Incident Reporting, 1st paragraph - The HSM is identified as having a key role in reporting and must be contacted when off-site medical treatment occurs. Please include contact information for the HSM in an appropriate place within the HASP.
203. 3.7.1.1 RM Liability Manager Authority - Please clarify what "RM" stands for, this may be a typo.
204. Hazardous Materials/Hazard Communication - SDS's should be readily available, it is recommended specific SDSs for chemicals stored or materials present be specifically attached to Appendix C, rather than a link to a generic lookup tool.

3.7 - Greener Cleanup Report (RAWP Attachment G)

General Comments

205. The document should establish metrics for measuring and/or reporting achievement of green remediation goals during the remedial design and remedial action, in alignment with the ASTM International *Standard Guide for Greener Cleanups* (ASTM 2017). Listing potentially applicable best management practices (BMPs) in the report and planning to review contractors' proposals is different than providing clear metrics within the report that can be used to evaluate contractor proposals. Furthermore, clear requirements for the contractor to report achievements of green remediation goals should be provided in this report. Please revise the document to include metrics for measuring and reporting achievements.

206. The document generally lacks any discussion of how ARARs required monitoring can be integrated into overall project metrics. Revise the text to describe how improved function will be measured in terms of particular metrics in support of this document's principles and the overall ARARs compliance for this CERCLA cleanup [e.g. CW A 404(b)(1), E.O. 11988, 11990] For example, documentation of habitat improvement through wetland delineation before and after the project is undertaken using the Wetland Rapid Assessment Procedure (WRAP; 1997; https://www.sam.usace.army.mil/Missions/Regulatory/Mitigation/) as well as species usage of the habitat could be two measures of improved ecosystem function as well as ARARs compliance regarding overall ecosystem benefit from the cleanup relative to the short-term cleanup disturbance.

Specific Comments

207. Pg. 7, Executive Summary - Provide a succinct, project-relevant definition of the term "nature-based solutions."

208. Pg. 9, Section 1, Introduction - Revise the Regulating bullet section to include increased biodiversity of pollinator and plant species. Additionally, not all vegetation effectively reduces erosion – revise this bullet to clarify how the restoration of appropriate vegetation will reduce erosion.

209. Pg. 10, Section 1, Introduction - Revise the report to describe why baseline and ongoing monitoring is "voluntary" rather than required relative to applicable ARARs, such as the Clean Water Act (CWA).

210. Pg. 10, Section 1, Introduction - Revise the report to explain how qualitative assessment of BMPs is sufficient for applicable sections of the CWA such as sections 401 and 402 and how it is possible to "fully" incorporate green remediation measures without the metrics to document its relative level of success. For example, if a particular BMP is insufficient to meet water quality standards, revise the report to note how this will be measured and documented.

211. Pg. 11, Introduction - Revise the sentence in the first paragraph about careful habitat selection – the items listed in the parentheses are not habitats.

212. Pg. 14, Section 5.2, Site Preparation and Land Restoration - Revise the report to discuss how native species planting success will be documented, and how non-native species will be monitored and removed during the establishment period to ensure native species have the opportunity to take hold to particular percent cover tolerances by growth year. Discuss the strategy for long-term monitoring to ensure novel populations of invasive species do not colonize the restoration area in

the future. Explain what measures will be taken to prevent metals sequestered by the plants from entering the food chain.

213. Pg. 15, Section 5.3, Materials and Waste - Revise the report to document quantitatively how train transport "was considered" but found to be a higher footprint than truck travel.

214. Pg. 15, Section 5.3, Materials and Waste - Revise the report to describe how offsite topsoils will be treated to prevent the introduction of invasive plant species to the project site.

215. Pg. 17, Section 6.1.2, Vehicles and Equipment - It is highly unlikely a contractor will voluntarily commit financial resources to steps such as vehicle retrofits which typically cost several thousand dollars per vehicle from being "encouraged" without any renumeration. Revise the text to include contract requirements that would meaningfully provide contract targets that must be met.

216. Pg. 17, Section 6.1.3, Power and Fuel - Use of ultra-low sulfur (ULSD) fuel is legally mandated and should not be described in this section as a greener remediation step as it is simply a basic legal requirement. Low-sulfur diesel has not been allowed in on- or off-road vehicles for some years and should be removed from the text. Revise the text accordingly. Also revise the text to quantitatively discuss the potential benefit of bringing alternative fuels to the site against the cost of bringing them on-site.

217. Pg. 17, Section 6.1.3, Power and Fuel - Revise the report to include the use of solar energy to power staff trailers during the construction phase of the project.

218. Pg. 18, Section 6.1.4, Materials and Waste - Revise the text to describe how successful performance of the "track out" device will be quantitatively proven with right-of-way (ROW) samples before and after the project. Include remedial steps if adjacent roadways are recontaminated above applicable clean up levels.

219. Pg. 18, Section 6.1.5, Site Preparation and Land Restoration - Revise the text to describe what existing conditions assessments were or will be performed to ensure rare, threatened, and/or endangered species will not be negatively impacted by project construction activities.

220. Pg. 18, Section 6.2.1, Project Planning and Team Management - Revise the text to incorporate examples of what documentation will be provided via the "strict submittal and approval process" to document that "equipment and material vendors with production and distribution centers near the site to minimize fuel consumption" and how this will be compared to the next closest vendor to show compliance.

221. Pg. 18, Section 6.2.1, Project Planning and Team Management - Revise the text to include discussion of how measurements specified in a Construction Quality Assurance Plan will be utilized to achieve sustainability requirements both in this section and in Section 6.2. Revise the document to reference *Green Cleanups Contracting and Administrative Toolkit* (EPA 2011). This guidance should be referenced because it includes sample contract language and criteria for sustainable materials management that may be incorporated into Contract Specifications, e.g., monitoring heavy duty diesel engine hours vs idle time, electric vehicle usage that displaces fossil fuel usage, kilowatts generated goals for on-site green energy, minimum coverage of native species, maximum coverage of non-native species, controlling as-built elevations closely to ensure various habitat types of higher ecosystem value are created (i.e., wetland vs upland), NPK specifications for soil building including minimum compost content, and ensuring water discharges are less than state/federal chronic water quality standards for COCs as well as turbidity.

222. Pg. 19, Section 6.2.2, Vehicles and Equipment - Revise the text to include specifics of what the idle reduction plan will include. Simple verbal recommendations are not as effective as engine cut off devices. Discuss these pros and cons in the revised text and how the required, specific idle time maximum will be chosen for each piece of equipment.

223. Pg. 19, Section 6.2.3, Materials and Waste - Quantitative calculations and comparisons are preferable to qualitative judgements regarding the level of emissions. Revise the report to provide actual comparisons between specific options to be trucked from a relatively closer vendor versus one that is farther away that could potentially be conveyed efficiently by train to document these plausible but unsubstantiated opinions in the current text.

224. Pg. 19, Section 6.2.3, Materials and Waste - Include reference to *Green Remediation Best Management Practices: Excavation and Surface Restoration* (EPA 2019). Revise the text to note that chemical fertilizers, herbicides, or pesticides will be substituted with non-synthetic inputs, integrated pest management methods, and soil solarizing techniques during vegetation planting, transplanting, or ongoing maintenance. Revise the text to include methods for the disposal of plant materials selected for metals sequestration capabilities. Some species uptake contaminants into the vegetative structure of the plant (flower/stem/leaf), thereby increasing the risk that the metals will enter the food chain. Provide an explanation of how the harvest and appropriate disposal of these species will effectively reduce the exposure of organisms to contaminants.

225. Pg. 19, Section 6.2.3, Materials and Waste - Revise the report to include requirements for materials such as coir logs and erosion matting to be manufactured from biodegradable materials.

226. Pg. 19, Section 6.2.3, Materials and Waste - Revise the report to describe how construction oversight and accountability measures will be implemented during the construction phase to ensure contractors do, in fact segregate and recycle waste generated from construction activities and other daily administrative and staff processes on site.

227. Pg. 19, Section 6.2.4, Site Preparation and Land Reclamation - Revise the text to specify how site resiliency will be quantitatively measured, e.g., percent vegetative cover relative to slope angle as an indicator of erosion potential. Revise the tools to specifically discuss any tools or models that are expected to be employed to make resiliency assessments. Include extreme heat and drought in the list of natural disturbance events.

228. Pg. 20, Section 7.3, Site Preparation and Land Reclamation - Revise the text to include time-of year restrictions for noise and other construction related impacts to minimize disturbance to sensitive species, especially during breeding seasons.

229. Pg. 20, Section 7.3, Site Preparation and Land Reclamation - Revise the text to specify what trigger points and corrective measures are to be employed for "adaptive management." In addition, revise the text to provide specific time steps (e.g., "Year 1 survey will include x, Year 2 survey will include y, After Year 2 surveys will include z and be conducted every 3 years…") and particular survey techniques (e.g., transects, point counts) to be conducted at specific periods of time after construction rather than the existing text of "within the first few years."

230. Pg. 20, Section 7.3, Site Preparation and Land Reclamation - Please revise the text to discuss how it will be confirmed that water quality standards are being met before discharging to Silver Box Creek per CWA Section 401 substantive requirements to minimize short term impacts from the project.

231. Pg. 20, Section 8, Long-term Monitoring and BMP Evaluation Process **-** Revise the text to emphasize the plan to conduct *thorough* as well as efficient Biological Monitoring, with standardized reporting protocols to accurately measure the performance of the site.

232. Pg. 20, Section 8, Long-term Monitoring and BMP Evaluation Process **-** Revise the report to correct the incorrect statement that the "five-year review will generate information necessary to determine if the remedy is effective…". It is incumbent on the O&M plan and reporting to highlight information related to meeting RAOs and ARARs to inform the five-year review.

233. Pg. 20, Section 8, Long-term Monitoring and BMP Evaluation Process - Revise the text to include the use of native, adapted plant species in the discussion of the resilient qualities of nature-based solutions.

Specific Comments on *Attachment 2: Buffalo Gulch Greener Cleanup BMP Opportunity Assessment*:

234. Pg. 28, Buffalo Gulch Stormwater Basin Attachment 2 **–** Please revise the report to articulate that in cabin heaters/air conditioning and idle reduction plan are a contract requirement versus a voluntary effort. If these are not contract requirements, it is unlikely that they will be delivered as they cannot be enforced. Also see above comment about ULSD being legally required.

235. Pg. 28, Buffalo Gulch Stormwater Basin, Attachment 2, Greener Cleanup BMP Assessment **–** Please revise the Site Preparation and Land Restoration BMP column during excavation, construction, and clean up phases to include time-of-year noise and construction restrictions to minimize impacts to sensitive species.

3.8 - OM&M Plan and Manual (Attachment H)

Specific Comments

236. Section 3.1.4 outlines the winterization procedures for the Pond 3 outlet structure to prevent damage to the gate, motor, sensors, and piping. This sections states that the front hand gate should be fully lowered to block flow into the outlet structure. Please provide detail on how the pond will function during the winter and early spring prior to de-winterization. How will the system function in the event of an unusually warm period resulting in significant snowmelt runoff?

237. Please provide specific details how sediment will be removed from the permanent pools without damaging the liner and creating disturbed conditions that could resuspend sediment during a subsequent event. Details should include methods and equipment.

30% Design Report (Based on Previously submitted Comments on the 30% Design which are Relevant to 60% Design)

The following comments were provided for the 30% Design Report and associated documents but were not addressed within the 60% design report. In some cases, modifications were promised within the AR comment responses, but the actual change was not made to the 60% design. In other cases, the comment response made no sense or was based on a misinterpretation of what was requested within the comment. The 30% design comments which have not been adequately addressed and which have bearing on the 60% design are included below.

238. General Comment #2 – The original comment requested that all references to private property owners be removed from the 30% design, but these names are still present within the 60% Design report, figures, tables, and drawings. Please remove all references to private property owners in the

design report, appendices, attachments, tables, figures, drawings or anywhere else where they appear.

239. General Comment #3 – The comment requested, among other things; “mitigation measures and treatment/remediation options for hydrocarbon impacted groundwater and soil in the project area”. The impacted soil is the subject of the treatability study report to be completed in accordance with RFC BG-2023-01 (dated 5/15/23). However, the 60% Design appears to assume that the groundwater pumped from the excavation will be discharged to SBC and will be subject to in-stream standards and the associated mixing zone. Previous investigations conducted by AR at Buffalo Gulch, such as the 2012 pumping test, incorporated end of pipe treatment prior to discharge to SBC, and EPA expects a similar procedure to be followed for the upcoming construction dewatering. Please include end of pipe treatment in the next version of the design.

Specific Comments

240. Section 2.4 – Section 2.3 of the 60% design report still references DEQ-7 criteria, rather than ROD performance standards as requested in the 30% design comments.

241. Section 2.5 - A specific method for water treatment needs to be provided rather than a list of options from WET 2018. Again, dilution by SBC cannot be relied upon as "treatment". An instream waiver of the Federal standards should not be assumed.

242. Section 3.2.1 – The original comment requested information regarding the potential repository location and associated haul route(s) prior to the 60% Design. However, this has not been received. It is EPA's understanding that the repository has been selected and that the transportation plan is still being developed. Please confirm. Also, please provide the Materials Logistic Plan for review by EPA, in consultation with DEQ, 60 business days prior to the submittal of the 100% design.

243. Section 3.2.2 – The original comment requested additional details regarding the onsite hydrocarbon removal treatment system. The Design Report states that a waiver of the Federal standards will be sought to allow discharge of untreated water to SBC. If not, Alternate methods will be considered. This is inadequate. First of all, the discharge standards will be for end of pipe and will not consider dilution by SBC as calculated in the Calc Brief supporting the Design Report. Second, treatment of the water prior to discharge is required and a definitive treatment method needs to be developed and presented. Please provide.

244. Section 3.4.1 – Similar comment as 3.2.1 above.

245. Section 4.3.4 – The original comment requested an explanation for why re-routing of the sewer main around the Buffalo Gulch stormwater facility was not being proposed. EPA recommends replacement and re-routing of the line around the facility. However, if AR chooses to leave the line in place it will be AR/BSB’s responsibility to maintain the remedy if the sewer line fails or needs to be replaced in the future.

246. Section 4.4, Seventh Bullet – The original comment requested additional detail on the proposed conveyor system due to the complications associated with the construction of a conveyor through an urban area. Please make sure that this is included within the Materials Transportation Logistics Plan, which the agencies will need to review and approve prior to approval of the design.

247. Section 4.4, Ninth Bullet – The original comment requested additional details on which parts of the Master Plan will be included in the end land use design and citation to the plan. Upon review of the 60% design, the end land use plan does not seem to match the plan set, specifically in the area northwest of the forebay. Please resolve.

248. Section 4.6, First and Second Bullet – Similar to comment on Section 3.2.1 regarding haul routes and repository.

249. Section 5.1.1 - Similar to comment on Section 3.2.1 regarding haul routes and repository.

250. Section 5.2, Number 7 – The original comment requested clarification on how permanent pool #4 retains its retention volume given that the elevation of pool #4 is above pool #3. A related question is how will the outlet structure control pool elevations during discharge of the polishing plant treated water into SBC? Currently, it appears as though the outlet culvert will be submerged during periods of polishing plant discharge. Please evaluate and explain.

251. Section 5.7 – The original comment requested details on hydrocarbon treatment which have not been included within the 60% design. Please provide.

252. Section 5.8 - The original comment requested information on the soils treatment method for hydrocarbons. EPA understands that a treatability study for soils treatment for hydrocarbons is currently underway (RFC BG-2023-01) and that the results will be included within an upcoming Waste Management Plan. Please confirm.

253. Section 5.13.1, Second Paragraph - Please provide a signed version of the variance form from BSB by 100% RD.

254. Section 5.16 – Similar to comment on Section 4.4, Ninth Bullet, regarding the End Land Use Plan and the apparent change in the land use northwest of the forebay. Please resolve the apparent conflict and if a change in land use is proposed, please indicate how this change will be communicated to the public.

30% Design Report – Appendix A

General Comments

255. General Comments 1.1 and 1.2 – The original comment requested the following elements within the PDIER;

    a) What conclusions or recommendations result from the geotechnical investigation, such as design parameters and criteria?

    b) What is the recommendation for handling waste lenses that are layered periodically between reusable material?

    c) What metric for removal should be used to ensure that waste material is not entrained in clean reusable material during excavation?

    d) What depth of reusable material is manageable to extract from waste material?

    e) What conclusions or recommendations can be drawn from the infiltration testing that will inform the design?

    The PDIER attached to the 60% Design Report does not include all of these elements and reads more like a DSR than an evaluation report. Please include in detail in the Materials Handling and Reuse Plan and provide a summary in the revised PDIER. The EVS model requires revision and is not suitable in the current form. If the EVS model is to be retained and used in the 95% Design documents then it needs to be revised per the comments provided above on Attachment O of the PDIER of the 60% Design.

256. General Comment #4 – The original comment requested a section on groundwater contamination by metals. The response by W&C was that the section on metals would be included within the

Groundwater modeling report. The groundwater modeling report includes only a discussion on benzene as a surrogate for hydrocarbon contamination. Please include a section on groundwater metals contamination within the PDIER.

Specific Comments

257. Section 1.2.2 - The PDIER continues to suggest that biodegradation is occurring and is responsible for steep declines in hydrocarbon concentrations. This is unlikely, given the low DO concentrations within the groundwater. If biodegradation was a major process there should be no toluene present after nearly 40 years since the reported release. Toluene is biodegraded very quickly under favorable conditions. The lack of sufficient oxygen is the reason that the state is implementing a program to increase DO concentrations. The original comment requested that the trend figures be removed due to the use of different sampling methods for different sampling rounds. The 2017 WET data, according to the Data Usability report, indicates that due to the insufficient purging of some wells and the lack of any QA/QC data, the results are, at best, screening quality and at worst useful only for determining if hydrocarbons are present or not. Please remove the 2017 data from the plots or consider removing the plots altogether.
258. Section 2 - The DOWL (May 2022) and Pioneer investigation (May 2022), reports stated recommendations need to be added to the "General" geotechnical specification as "supplemental information". Also please provide the ConeTec data that was collected in October 2022.
259. Section 2.2 - It is unclear from the Geotech report the depth of unclassified fill in the forebay, main stormwater basins(s), and asphalt trails. Please provide this information in revised EVS model summary report. Also, in the parking area, it is unclear if 6.5 feet or 12 feet removal of unclassified material is required.
260. Section 3 - Please document that the Material Handling Reuse Plan needs to address the uncertainty with the EVS model. The EVS model needs to be revised. After the new model has been produced, EPA will review the output to make a determination on whether this comment has been addressed. Furthermore, a robust (high frequency) sampling program will be need to be implemented for all material reused at the site.
261. Section 4.1 – See comment above regarding trend plots.
262. Table 2 – The labels listed in the footnotes R, F, UC, etc. are still not included in the table. Please add.
263. Table 10 – The original comment requested that note 1 be revised to include a qualification that groundwater sampling data reported in Abbreviated Corrective Action Report for the Petroleum Release at Former CMGC (WET, 2019) is not consistent with the QAPP. This has not been done. Please add. The original comment also requested that a footnote be added to the hydrocarbon data tables stating what concentrations were used as triggers for follow-up fractionation and PAH analyses. This was not done. Please add.
264. Figures 5.0 through 5.7 – As discussed previously, the data used to construct figures 5.0-5.7 was collected using methods inconsistent with the QAPP. In addition, the 2017 WET data are screening quality only. Please remove the 2017 data from the figure, or better yet, remove the figures entirely.
265. Figures 6/7 - The title was supposed to indicate that the groundwater elevations represent the 3-yr maximum elevations. However, the title has not been corrected and still reads "GROUNDWATER

ELEVATIONS PLAN VIEW". The explanation given that the 3-yr maximum occurs at different times depending on the area does not make sense. Please revise.

If you have any questions or concerns, please call me at (406) 457-5019.

Sincerely,

NIKIA GREENE

Digitally signed by NIKIA GREENE
Date: 2023.07.24 18:16:16 -06'00'

Nikia Greene
Remedial Project Manager

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