Final

CONTINGENCY PLAN FOR CONTAMINATION OF DRINKING WATER SUPPLY OR EARLY WARNING MONITORING WELLS

Milltown Reservoir Sediments Site

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1.0 INTRODUCTION

This contingency plan develops the set of actions to be considered if Remedial Action (RA) activities and/or other ongoing loading from the Milltown Reservoir Sediments Operable Unit (MRSOU) cause exceedance of the 10 µg/L arsenic drinking water quality standard at current drinking water supply wells located within, or immediately downgradient/downstream of, the RA project area (note that "downgradient" includes those neighborhoods such as Plitzville that may be temporarily affected by water level changes in Sediment Accumulation Areas (SAA) IV and V as a result of RA project implementation). This plan also identifies the process for evaluating additional best management practices (BMPs) and other controls to reduce source loading in the event that groundwater monitoring in accordance with the Remedial Action Monitoring Plan (RAMP, Envirocon 2006a) confirms exceedance of statistically-determined arsenic background concentration trigger levels in one or more "early warning wells". The plan includes one decision process for selecting the action to be taken for addressing contamination of local drinking water wells and a second process for determining the type of additional BMP or other control, if any, to be employed in response to statistically significant increases in early warning well arsenic concentrations based on the cause (i.e., contributing activity or source), nature, duration and extent of the increase. Specific to changes in arsenic concentrations at early warning wells, the additional BMPs evaluation considers the potential benefits (e.g., expected reduction in groundwater arsenic concentrations) against the costs (e.g., budget, schedule and short term adverse environmental and worker/public safety impacts) of implementing one or more mitigative measures.

While this contingency plan specifies detailed processes for determining whether the cause of increased arsenic or contaminant concentrations is RA activities, an effective plan to address such increases will require that actions be taken quickly. If EPA, in consultation with the State, determines that exceedance of a standard is threatened (i.e., warning limits are exceeded), and that additional mitigative measures can reduce that threat, EPA may require that additional mitigative measures be implemented while further evaluations under the contingency plan are being evaluated.

As background to the contingency actions analysis, this plan first provides a brief overview of the conceptual model for the site's hydrogeologic system that has resulted in the current arsenic groundwater plume and how that system may be changed by proposed RA activities (see Section 2.0). Secondly, this plan identifies the numerous BMPs, other controls and other mitigative measures already planned to be included in the basic design to mitigate the potential for increases in groundwater arsenic concentrations due to RA activities (see Section 3.0). Thirdly, the plan summarizes the sampling program developed in the RAMP that will be used to monitor for changes in groundwater quality and provide feedback for considering if additional mitigative measures are needed based on either detecting arsenic concentrations above 10 µg/L in existing local water supply wells or observing statistically significant increases in arsenic concentrations in RAMP early warning monitoring wells (see Section 4.0). Fourthly, the plan describes the process proposed to identify the likely cause (i.e., RA activity, non RA activity or natural conditions) of a groundwater quality impact (see Section 5.0). Finally, the plan identifies the additional mitigative measures, such as providing replacement water for an impacted water supply well user or implementing additional BMPs or other controls for addressing increases in early warning well arsenic concentrations, that would be considered in the event that, despite the planned protective measures, groundwater quality impacts related to RA activities still occur (see Section 6.0). The Settling Defendants (SDs) are responsible for implementing additional mitigative measures to the extent that RA activities contribute to the groundwater quality impact. In addition, the SDs continue to be responsible for mitigation of domestic wells that are discovered to have dissolved arsenic concentrations above 10 µg/L due to loading from the MRSOU even if the loading is not directly related to RA activities.

2.0 SOURCE, FATE AND TRANSPORT OF DISSOLVED ARSENIC IN LOCAL GROUNDWATER

The sources, fate and transport of dissolved arsenic loading to the local alluvial aquifer groundwater were evaluated in detail as part of the Remedial Investigation (RI, ARCO, 1995). The RI found a portion of the reservoir sediment, located in SAA I, to be the primary source of arsenic loading to the alluvial aquifer beneath, and downgradient of, the reservoir. Geochemical conditions in the reservoir result in mobilization of arsenic from these "source" sediments to pore water where reservoir head pressures transport it downwards into the underlying alluvial aquifer groundwater. Once in the aquifer the arsenic follows the local groundwater flow path first north and then west with concentrations decreasing due to dilution and geochemical reactions to below the 10 µg/L drinking water standard within about a half mile from the reservoir. Ongoing groundwater monitoring has shown that, although arsenic concentrations within the plume can vary seasonally and annually, the overall extent of the 10 µg/L plume has remained relatively constant for at least the past 25 years.

A secondary potential pathway for arsenic loading to the alluvial aquifer was identified to be release of dissolved arsenic to surface water which then recharges the alluvial aquifer downstream of the reservoir via leakage through the river bed. However, USGS's long-term monitoring has shown dissolved arsenic concentrations in the river downstream of the reservoir has historically remained below 10 µg/L and the site does not typically add to existing dissolved arsenic loads coming from upstream. Therefore, under current (i.e., pre-RA) conditions the surface water recharge pathway was not considered to present a potential risk for causing exceedance of drinking water standards in the downstream alluvial aquifer.

As part of RA activities the source sediments will be progressively dewatered (through a combination of reservoir drawdown and active pumping) and then excavated; thereby removing the primary source of arsenic to the local groundwater. As source dewatering and removal progresses during the RA, it is expected to result in a steady reduction in loading of dissolved arsenic from the sediments to the underlying alluvial aquifer groundwater which should gradually reduce the total size of, and maximum concentrations within, the arsenic plume. However, although the overall plume would be expected to shrink rather than increase in size during the RA, it is possible, although unlikely, that fluctuating reservoir water levels could result in sufficient changes to the current hydrogeologic/geochemical system to result in the potential for localized, temporary increases in groundwater arsenic concentrations outside the current plume extent. In addition, discharge of water from sediment dewatering operations and/or scour of reservoir sediments due to reservoir drawdown could potentially temporarily increase dissolved arsenic concentrations in downstream surface water. Intensive monitoring, combined with a requirement to consider implementing additional mitigative measures when downstream arsenic concentrations exceed 8 µg/L, should prevent RA activities from causing downstream groundwater arsenic concentrations to increase above the drinking water standard due to surface water recharge. However, it is possible that RA activities could result in lesser increases in downstream surface water dissolved arsenic concentrations which, in turn, could result in the potential for increases in arsenic concentrations in the adjacent groundwater. The contingency measures described in this plan are meant to address the unlikely occurrence of a statistically-significant increase in arsenic concentrations in areas outside the current plume extent.

3.0 PLANNED BMPS AND OTHER CONTROLS

As previously noted, numerous BMPs and other controls to be routinely implemented during construction (i.e., to be employed even when exceedances are not threatened) are already planned to be included in the basic design. Some of the key planned BMPs/controls are described here to provide background for the discussion of additional controls that may be considered in the event these planned controls are not sufficient on their own to prevent RA-related exceedances of arsenic drinking water standards at existing water supply wells or arsenic trigger levels at RAMP early warning wells. Additional BMPs and other controls beyond those identified in this section may also be identified and developed during the design process.

3.1 Reservoir Drawdown BMPs

Monitoring during previous reservoir drawdowns and modeling of the expected impact of the RA drawdown both predict minimal potential for increases in dissolved arsenic concentrations in downstream surface water due to scour associated with reservoir drawdown (Envirocon, 2004a). It is recognized that there are some significant differences in the planned RA drawdown as compared to previous drawdowns. The RA drawdown would be initiated in June, during higher flow conditions than previous drawdowns. The Stage 1A portion of the drawdown will extend for a period of approximately 16 months, a longer period of time than previous drawdowns. It will extend through the winter, which has not occurred in the past and may present unique challenges associated with ice scour. Also the Stage 1 portion of the drawdown will be followed by additional drawdown stages that will lower reservoir levels below what has historically occurred. Nonetheless, the combination of the modeling results and previous drawdown data provides some confidence that, the potential for significant increases in arsenic concentrations in downstream groundwater due to recharge of surface water with elevated dissolved arsenic concentrations is likely to be remote. However, BMPs are planned for mitigating scour-related impacts to downstream surface water quality associated with reservoir drawdown and removal of Milltown Dam and these BMPs will also serve to help protect groundwater quality. These planned surface water quality protection BMPs include implementing the drawdown in a series of steps staged over time and isolating reservoir sediments from flowing surface water prior to dam removal.

As previously noted, RA activities such as reservoir drawdown are expected to progressively decrease direct loading of arsenic to the local groundwater. An evaluation was completed to predict the maximum amount of arsenic loading to the local alluvial aquifer from the passive draining of sediment pore water during reservoir drawdown (Envirocon, 2004b). The evaluation determined that even if all the sediment pore water released ultimately reach the aquifer at the expected rate of sediment draining it would represent a lower loading rate than the current loading rates from the reservoir sediments under full pool conditions. Therefore no mitigative measures are planned as part of the basic RA design to address the direct loading to groundwater pathway.

3.2 Sediment Dewatering and Stormwater Runoff BMPs

Similar to reservoir drawdown, planned BMPs for mitigating the potential for contaminant release from sediment dewatering and stormwater runoff to surface water indirectly also help to protect downstream groundwater quality from being impacted by surface water recharge or local groundwater from being impacted by infiltration. Planned sediment dewatering and stormwater runoff BMPs include:

- contain and collect runoff from sediment excavations/stockpiles and other disturbed areas and route it through constructed sedimentation ponds prior to discharge;
- preventing run-on to the work area (e.g., by installing flood control berms along the existing channels);
- placing silt fences, hay bails or other erosion controls around construction areas or at strategic runoff concentration locations;
- using raised roads and pads for accessing soft or wet ground areas; and
- minimizing the extent of disturbed area exposed at any one time via grading, cover placement and revegetation.

In addition, the planned active dewatering pumping of groundwater during the RA from wells and excavations, although not specifically designed as a groundwater quality protection BMP, will reduce the water table in SAA I during the RA thereby reducing the hydraulic head that is currently resulting in flux of arsenic from sediment pore water into the underlying aquifer.

4.0 GROUNDWATER MONITORING FEEDBACK SYSTEM

A comprehensive groundwater monitoring program will be implemented during the RA to provide the information needed to:

- document progress towards cleanup of the existing MRSOU arsenic plume by sampling “compliance” wells (note: as identified on page 3 of the Performance Standards included as Attachment 1 to the RD/RA Statement of Work [Envirocon, 2005] full compliance with numeric groundwater quality standards within the existing plume is not required until 10 years after completion of all RA and restoration construction activities);

- monitor the potential impact of remedial action construction activities on the groundwater in the area by sampling "early warning" wells and use the results to provide feedback to direct the application, if any, of additional BMPs and other controls to reduce the potential impact of construction activities on the groundwater; and
- provide feedback data to ensure no one using local groundwater for potable water purposes is utilizing water above 10 µg/L dissolved arsenic by sampling certain "public health" wells and providing for free arsenic concentration testing of other private and small public supply wells on a voluntary, if requested, basis.

Changes in arsenic concentrations during the RA at the compliance wells will likely not be used for determining if additional measures should be evaluated and are needed to protect groundwater since they are located within the existing 10 µg/L arsenic plume and are not being used for water supply. However, sample results for early warning wells and public health wells will be used as part of an analytical feedback system to identify when evaluation of further actions may be required because changes in groundwater arsenic concentrations result in exceeding either: 1) the 10 µg/L drinking water standard at a monitored potable water supply well; or 2) a statistically-determined trigger level at a monitored early warning well. Further actions could include:

1. additional sampling to confirm the exceedance (see below discussion);
2. evaluating concurrent sampling data for other groundwater and surface water monitoring locations along with reviewing what RA or other activities are going on at the time to determine the likely cause of the exceedance (see Section 5.0); and/or
3. evaluating if additional mitigative measures are required (see Section 6.0).

RA groundwater sampling requirements specific to early warning and public health wells are detailed in the RAMP and briefly summarized below.

The RAMP requires quarterly sampling of 21 early warning wells located around the fringe of the existing MRSOU arsenic plume and near the CFR river downstream of the reservoir (see Figure 7 of the RAMP for well locations) with the potential for increasing to biweekly sampling if increased arsenic concentrations are detected in some of the wells or if surface water arsenic concentrations at the CFR above Missoula station exceed 8 µg/L. The RAMP also requires semi-annual sampling of eleven public health wells (see Figure 7 of the RAMP for well locations). Quarterly early warning well samples are laboratory analyzed for dissolved arsenic, iron and manganese concentrations and field monitored for water levels, Eh, pH, temperature and conductivity. Biweekly early warning monitoring well samples are only laboratory analyzed for dissolved arsenic while bi-weekly early warning domestic well and semi-annual public health well samples are analyzed for both dissolved and total arsenic.

5.0 GROUNDWATER IMPACT CAUSE DETERMINATION

5.1 Assessing if RA Activities are Adding Dissolved Arsenic to Groundwater

Implementation of additional BMPs, other controls and/or replacement water supplies as part of the RA will only be considered if RA activities or other ongoing loading from the MRSOU (applicable to newly discovered domestic wells with arsenic concentrations > 10 µg/L) are determined to be the likely cause of, or a contributing cause to, exceedance of drinking water standards at existing water supply wells or trigger levels at early warning wells. Therefore, as shown graphically on Figure 1, assuming groundwater sampling confirms exceedance of drinking water standards or trigger levels at these locations, the first action under this contingency plan will be to assess the degree to which RA activities are causing or contributing to the exceedance. Depending on the nature, extent and timing of the exceedance this could involve assessing if:

- The increase in groundwater dissolved arsenic concentrations at wells located near the CFR downstream of the MSROU correlates to RA-related increases in downstream surface water dissolved arsenic concentrations;

- The increase in groundwater dissolved arsenic concentrations at wells located near the fringe of the current MRSOU plume correlates to increases in arsenic concentrations at wells installed within the reservoir and/or at compliance or other wells located on the current flow path between the affected wells and the reservoir;

- The increase in groundwater dissolved arsenic concentrations at wells located near the fringe of the current MRSOU plume correlates to measured changes in groundwater flow paths from MRSOU that can be associated with RA reservoir drawdown/dam removal activities;

- The timing of the increase in groundwater dissolved arsenic concentrations correlates to the timing of implementing or modifying an RA activity that has the potential to increase dissolved arsenic loading from the site to the underlying aquifer; and/or

- The increase in groundwater dissolved arsenic concentrations is outside historic norms and cannot be explained by potential arsenic loading to groundwater from other non-RA activities ongoing at the time or by other unusual conditions.

It is recognized that given the complexities of the hydrogeologic system and the various non-RA (including natural) sources that can affect local groundwater quality, it will likely be difficult to conclusively determine the degree to which RA activities are responsible for an exceedance. This likely uncertainty may make it more difficult to identify effective measures for addressing the exceedance and needs to be considered in this process.

5.2 Assessing which RA Activities are Adding Contaminants to Groundwater

Assuming the methodology described in Section 5.1 determines that the RA is likely contributing to exceedance of the arsenic drinking water standard and/or trigger levels at public health or early warning wells then prior to evaluating what, if any, additional actions (beyond immediate notification and/or provision of replacement water supply in response to exceeding drinking water standards at a water supply well) may need to be taken to reduce arsenic loading to groundwater it is necessary to assess which RA activities may be responsible. This assessment will include the following steps:

- Identify the RA activities that are/were occurring at the time of the exceedance;
- Compare the signature (i.e., location and timing) of the exceedance versus the groundwater contamination signature typically associated with each of the RA activities ongoing at the time; and
- Based on this comparison identify, to the degree practicable, the likely contributing RA activity or activities.

Based on available information the typical groundwater contamination signatures associated with the primary RA activities that could potentially contribute to exceedance of groundwater quality standards are summarized in Table 1. It should be noted however, that these signatures are only approximate and may be overshadowed by other impacts or by simple natural variability of a complex system.

Table 1 – Typical Groundwater Contamination Signatures for RA Activities

Activity/Source	Expected Location of Exceedance	Expected Timing of Contaminant Release
Increase in surface water dissolved arsenic concentration due to sediment scour associated with reservoir drawdown	Shallow groundwater adjacent to downstream CFR	Varies with rate and degree of drawdown. Slow reduction with time after maximum drawdown level for each stage reached. May also vary with flow conditions.
Increase in surface water dissolved arsenic concentration due to sediment dewatering discharge (from wells, excavations or collected stockpile drainage)	Shallow groundwater adjacent to downstream CFR	When discharging to surface water. Identifiable when surface water concentrations, after accounting for dilution by river flows, correspond to discharge sample concentrations and flow rates.

Increase in arsenic flux into underlying alluvial aquifer at MRSOU site	Groundwater immediately downgradient of existing MRSOU plume	During, and immediately following: 1. Changes in water table level and hence geochemical/hydrogeologic conditions in contaminated sediment areas, 2. Precipitation, snow melt or grading events that increase infiltration in contaminated disturbed areas, and 3. Excavation and stockpiling of contaminated sediment.
Changes in local groundwater flow paths due to reservoir drawdown/dam removal	Groundwater south and west of existing MRSOU plume fringe	Varies with amount of reservoir drawdown. May also vary seasonally or with flow conditions.

Note: The above activities/sources represent what are considered to be the more likely causes of potential groundwater exceedances but the project may have other activities/sources that could potentially affect groundwater quality, many of which will be more thoroughly evaluated in the design process.

6.0 EVALUATION OF MITIGATIVE MEASURES

Additional mitigative measures will be considered when a groundwater quality exceedance is: 1) observed at a public health or early warning well, 2) confirmed with additional sampling/analyses (if it is a marginal exceedance [as determined by EPA in consultation with the State and Missoula City-County Health Department] or the data is otherwise suspect), and 3) determined to be caused by RA activities or other ongoing loading from the MRSOU (applicable to newly discovered domestic wells with arsenic concentrations >10 µg/L). Analyses completed as part of preliminary design work have predicted that RA activities are not expected to result in groundwater exceedances. In addition, given the numerous BMPs already planned as part of the baseline design, the opportunity for significantly reducing groundwater arsenic concentrations while the RA is ongoing through implementation of additional BMPs, other controls or treatment of discharge water may be limited. The sections below describe the process that will be used to identify and evaluate additional mitigative measures to be considered in the event RA activities or other ongoing loading from the MRSOU (applicable to newly discovered domestic wells with arsenic concentrations >10 µg/L), cause, or contribute to, exceedance of groundwater quality standards or trigger levels at the various monitored early warning or public health wells.

6.1 Evaluation Process

Since time will be of the essence, the process for evaluating what, if any additional contingency measures should be taken to mitigate exceedance of groundwater standards or trigger levels due to RA activities or other ongoing loading from the MRSOU (applicable to newly discovered domestic wells with arsenic concentrations >10 µg/L) needs to be streamlined. The evaluation process will compare the expected effectiveness (in preventing potable use of groundwater with arsenic concentrations over 10 µg/L and/or in reducing groundwater dissolved arsenic concentrations to below trigger levels in a timely manner) provided by the various potential options available is compared to their cost and implementability. Evaluating the expected effectiveness, if any, of additional BMPs and other controls to reduce groundwater dissolved arsenic concentrations to below trigger levels needs to consider:

1. limitations on the ability to improve groundwater quality in a timely manner inherent in most of the additional BMPs and other controls available;
2. limitation associated with trying to predict effectiveness of additional BMPs and other controls targeted to specific sources or activities when the degree to which these sources or activities are contributing to the exceedance is likely to be uncertain;
3. the likely time lag between when changes in RA-related arsenic loading would be reflected in changes in early warning well dissolved arsenic concentrations (including the potential for the early warning well dissolved arsenic concentration to drop back below its trigger level before the effect, if any, of additional RA BMPs and other controls even reaches it); and
4. the likelihood of contaminating additional water supply wells if corrective action is not taken.

As shown on Figure 1, contingency measures considered for exceedance of the 10 µg/L arsenic standard at current drinking water supply wells will initially focus on notification and providing a clean replacement water supply with evaluation of additional measures (i.e., BMPs and other controls) to reduce dissolved arsenic loading to groundwater, if required, to follow. Contingency measures, if any, considered for exceedance of the arsenic trigger levels at early warning wells will be limited to evaluating additional BMP and other control measures for reducing RA-related arsenic loading to groundwater.

Impacts to the project schedule and the potential for adverse effects on the environment, workers or the community associated with implementing a mitigation measure will also be considered as balancing factors. Greater weight may be given to schedule impacts and costs in evaluating the need for additional BMPs and other controls when dissolved arsenic concentrations in early warning wells exceed their trigger levels but are still below 8 µg/L (i.e., the arsenic warning limit set at 80% of the drinking water standard). The results of the evaluation and recommendations for proposed action will be provided to the agencies for approval in the form of a brief memo or email. Final determination of mitigation action will be done by EPA in consultation with the State.

To focus the evaluation process, the general measures that will likely be included in the contingency analysis and their expected applicability are summarized separately below for preventing potable use of groundwater with arsenic concentrations over 10 µg/L and for reducing groundwater dissolved arsenic concentrations to below trigger levels.

Contingency plans for reducing dissolved arsenic concentrations to below trigger levels are further divided into the primary RA activities that could impact groundwater quality.

6.2 Contingency Plan for Exceedance of 10 µg/L Dissolved Arsenic Concentration at Drinking Water Supply Wells

Mitigative measures that will be considered in the event arsenic concentrations above 10 µg/L are confirmed in a private or small public water supply system well and when RA activities or other ongoing loading from the MRSOU (applicable to newly discovered domestic wells with arsenic concentrations >10 µg/L) are believed to be a potential cause of the exceedance include:

1. Immediate notification of the affected well user followed by drilling a replacement well in an unimpacted portion of the alluvial aquifer and connecting the affected water user to the new well (note: this alternative may also include providing replacement water in bottles [with delivery scheduled at the convenience of the water user] or installation of a point of use water treatment system until the new well is connected);
2. Immediate notification of the affected well user followed by connecting the affected water user to an alternate existing water supply system such as the Milltown Water Users' Association system (note: this alternative may also include providing replacement water in bottles [with delivery scheduled at the convenience of the water user] or installation of a point of use water treatment system until the user is connected to the alternate system); or
3. If the exceedance is expected to be of relatively short duration, immediate notification of the affected well user followed by providing replacement water in bottles [with delivery scheduled at the convenience of the water user] or installation of a point of use water treatment system until the affected well's arsenic concentrations drops back below 10 µg/L dissolved arsenic concentration.

Final determination of the mitigative measure to be implemented for drinking water supply wells that exceed 10 µg/L will be done by EPA in consultation with the State and Missoula City-County Health Department.

If the exceedance occurs in one of Mountain Water Company's existing drinking water supply wells then the anticipated contingency action will be to notify the Mountain Water Company of the exceedance so they can take appropriate actions under their contingency plan (e.g., switching supply wells in use at the time) to prevent potable use of groundwater with arsenic concentrations over 10 µg/L assuming Mountain Water Company is able to make reasonable operational modifications. EPA, in consultation with the State, will determine if reasonable operational modifications are possible.

As shown on Figure 1, in addition to evaluating the above options for preventing potable use of groundwater with arsenic concentrations over 10 µg/L, an exceedance of drinking water standards at identified public health wells may also trigger evaluation of additional BMPs or other controls to reduce RA-related dissolved arsenic loading to groundwater. The options that may be considered for reducing dissolved arsenic concentrations over time at the affected public health wells are similar to those that may be evaluated in the event arsenic concentration trigger levels are exceeded at early warning wells. These options, grouped by the specific RA activities that could potentially impact groundwater quality, are discussed in Sections 6.3 through 6.6.

6.3 Contingency Plan for Exceeding Dissolved Arsenic Trigger Levels at Early Warning Well Related to Reservoir Drawdown

Monitoring of downstream surface water quality during previous drawdowns has shown little or no increase in downstream dissolved arsenic concentrations compared to background loading coming from upstream. This data suggests it is unlikely that sediment scour associated with reservoir drawdown will increase the dissolved arsenic concentrations in downstream surface water sufficiently to result in significantly increasing adjacent groundwater dissolved arsenic concentrations through river leakage. However, despite this should dissolved arsenic concentrations in early warning wells located adjacent to the downstream CFR increase above their trigger levels and this increase be correlated to increasing surface water arsenic concentrations associated with reservoir drawdown scour then one practical additional measure that could be taken to mitigate drawdown-related water quality impacts is to reduce the rate or total amount of drawdown. Note that if surface water dissolved arsenic concentrations at the downstream CFR above Missoula station increased above 8 µg/L due to reservoir drawdown then evaluation of changing drawdown rate or amount would already be required under the Contingency Plan for Exceedance of Downstream Surface Water Quality Standards/Warning Limits (Envirocon, 2006b) and therefore a separate analysis under this contingency plan would not be needed.

Evaluation of changing the rate or amount of drawdown would only be practical during Stages 1 and 2 drawdowns since the Stage 3 drawdown will be achieved by breaching cofferdams. The specifics of how adjustments to reservoir drawdown could be implemented are presented in Envirocon, 2006b and will therefore not be repeated here.

Raising reservoir water levels and/or slowing the rate of drawdown during Stages 1 and 2 drawdowns may be somewhat effective in addressing drawdown-related increases in downstream arsenic concentrations. However, raising reservoir water levels could potentially have significant effects on the ability to complete the required Stages 1 and 2 work in a safe and timely manner or could result in other environmental impacts that offset any benefit from scour reduction. For example raising water levels during Stage 1 could re-saturate sediment in SAA I potentially resulting in additional discharge of dissolved metals and arsenic to the river from sediment dewatering. Therefore, the decision by EPA, in consultation with the State, on whether or not to modify reservoir drawdown in response to a drawdown related exceedance of surface water quality warning limits will consider the following factors:

- if RA activities are only a relatively minor contributor to the exceedance;
- if the exceedance is above trigger levels but below the 8 µg/L;

- if the drawdown modification could potentially slow production rates sufficiently to jeopardize the ability to meet the critical seasonal milestones of completing all Stage 1 work by October and all Stage 2 work by March;

- if the reduction in dissolved arsenic concentrations in the downstream surface water expected from the drawdown modification are likely to be offset by increased arsenic release from other sources caused by having to work under higher reservoir water level conditions (e.g., increased loading from sediment dewatering); and

- if the drawdown modification could result in increased potential for failure of key infrastructure (e.g., reduced stability of constructed berms or cofferdams) or other risks to workers, the environment or the public.

6.4 Contingency Plan for Exceeding Dissolved Arsenic Trigger Levels at Early Warning Well Related to Discharge of Sediment Dewatering Water

As discussed in Section 5.2, exceedance of groundwater arsenic trigger levels associated with discharge of water from SAA I sediment dewatering (generated via pumping from wells or excavations or from collected stockpile drainage) may be identifiable by occurring in wells located adjacent to downstream CFR when, or immediately after, surface water dissolved arsenic concentrations are elevated due to discharge of dewatering water. Associating an increase in downstream surface water dissolved arsenic concentrations to discharge of sediment dewatering water may be possible by comparing discharge contaminant loads (determined based on measured discharge sample concentrations and flow rates) versus incremental loads at the CFR above Missoula station (i.e., sample concentrations and flow rates at this station adjusted to remove loads measured at upstream stations). Results for water samples collected during a previous sediment dewatering pump test conducted in SAA I (see Table D-4 in DSR #2, Envirocon, 2004c) show that the water generated from sediment dewatering is likely to have neutral pH, be relatively low in TSS and dissolved metals but potentially have elevated dissolved arsenic concentrations in the 200 to 400 µg/L range. However, even assuming the high end of the arsenic concentration range and conservative total pumping rates for sediment dewatering along the bypass channel alignment of 15 cubic feet per second (cfs), the discharge is expected to increase in-stream concentrations by a maximum of 1 µg/L after mixing with river water. Therefore, discharge of water from SAA I sediment dewatering using wells is unlikely to increase downstream surface water arsenic concentrations sufficiently to result in significant increases in adjacent groundwater. However, should this unlikely event occur, the following potential mitigative measures will be evaluated for implementation:

- reduce well pumping rates, and hence arsenic discharge loads; or

- treat pumped water prior to discharge to reduce arsenic concentrations, and hence arsenic discharge loads.

Note that if surface water dissolved arsenic concentrations at the downstream CFR above Missoula station increased above 8 µg/L due to sediment dewatering discharge then evaluation of the above mitigative measures would already be required under Envirocon 2006b and therefore a separate analysis under this contingency plan may not be needed.

Various treatment methods are available to reduce dissolved arsenic concentrations with the preferred option dependent on flow rates, influent concentrations and removal efficiencies required. Given the uncertainties on these parameters at this point in the design process, the specific approach for water treatment as a contingency will be developed as part of the pending Stage 1C bypass channel design rather than included in this contingency plan. However, given the relatively high costs of treating discharge water it is unlikely to be considered a cost-effective method for indirectly addressing increases in downstream groundwater arsenic concentrations particularly if the early warning well exceedance is above trigger levels but below 8 µg/L.

6.5 Contingency Plan for Exceeding Dissolved Arsenic Trigger Levels at Early Warning Well Related to Increased Arsenic Flux into Underlying Aquifer at MRSOU Site

The flux of dissolved arsenic from the MRSOU reservoir sediments to the local aquifer, which is currently occurring at a rate estimated to be between 2 and 20 pounds per day, was identified as the main source of the existing arsenic plume beneath Milltown (ARCO, 1995). A primary purpose of the RA sediment and dam removal work is to reduce this dissolved arsenic flux sufficiently to restore the local aquifer water quality over time. The proposed RA work should reduce arsenic flux to the aquifer by:

1. Removal of the more contaminated "source" sediment from the site;

2. Changes in geochemical environment within the reservoir that is currently favoring release of dissolved arsenic from the sediment to sediment pore water; and

3. Reduction in hydraulic head in the reservoir sediments (via reservoir drawdown and/or active pumping from wells or excavations) that is currently driving the sediment pore water flow downward into the alluvial aquifer.

Because of the time it will take to flush the existing arsenic out of the aquifer, full cleanup of the aquifer is not anticipated to be achieved while the RA is ongoing. However, for the three reasons listed above the RA work is anticipated to gradually reduce the flux of dissolved arsenic from the site into the local aquifer as the source sediments are progressively dewatered and removed. Therefore a gradual reduction, rather than an increase, in dissolved arsenic concentrations in wells within, and immediately downgradient, of the existing MRSOU plume is anticipated during the RA. However, although unlikely, it is possible that the disturbance involved with RA construction could temporarily result in increases in loading to the alluvial aquifer from increased infiltration in localized areas or geochemical changes associated with water table elevation variations that increase, rather than decrease, arsenic mobility (note: as identified in bullet 2 above a gradual drawdown of the water table elevation within the reservoir sediments is anticipated to reduce dissolved arsenic mobility as the more oxidizing environment favors adsorption of dissolved arsenic onto iron oxyhydroxides but if the water table subsequently rises again it is possible to temporarily increase dissolved arsenic as the adsorbed arsenic is released in a more reducing environment).

If a temporary increase in loading to the alluvial aquifer were to occur and result in exceedance of trigger levels in downgradient early warning wells it may be possible to identify its likely cause based on timing (i.e., whether it occurs after significant variations in water table elevations at the site or after significant grading, water containment pond construction or other surface disturbance work that could increase infiltration). Assuming the likely cause is determined to be variation in water table levels then evaluation of options to limit variations in drawdown levels (which may itself have been generated in response to contingency measures to address drawdown-related impacts to downstream surface water quality) could be evaluated. Based on our understanding of the geochemistry of arsenic release from the sediments it is likely that limiting upward fluctuations in established drawdown levels would be more effective in addressing this contingency than limiting downward fluctuations. However, upward fluctuations in drawdown levels that are driven by higher flow conditions are beyond the ability to control under the current dam configuration.

Assuming the likely cause of an identified increase in loading from the site to the local alluvial aquifer is determined to be increased infiltration of water that has elevated arsenic concentrations to start with (e.g., drainage from sediment stockpiles) or becomes elevated in arsenic as it passes through contaminated sediments then the following additional BMPs and other controls may be evaluated for implementation:

- enhance run-on/runoff controls around stockpiles and other disturbed areas containing contaminated material (e.g., install or raise containment berms or increase ditch capacity);

- reduce the amount of contaminated disturbed area exposed at any one time;

- limit the rate of infiltration in disturbed areas (e.g., by grading, cover placement and/or revegetation); and

- increase the rate of sediment dewatering to reduce the downward hydraulic head from the sediments into the underlying aquifer.

Consistent with the other contingency plans, if the early warning well exceedance driving the need for a BMP and other controls evaluation is above trigger levels but below the 8 μg/L then greater weight may be given to schedule, production rate and cost impacts of implementing any of the above potential additional BMPs and other controls.

6.6 Contingency Plan for Exceeding Dissolved Arsenic Trigger Levels at Early Warning Well Related to Changes in Groundwater Flow Paths

Groundwater modeling completed to predict how RA dam and sediment removal work would affect groundwater flow (see "Preliminary Groundwater Modeling to Estimate the Effects of Dam and Sediment Removal on the Alluvial Aquifer in Milltown, Montana", Clark Fork Coalition, 2003) predicted a minor change in flow direction could occur, mainly shifting from north to northwest within the reservoir area and slightly south in the area north of the dam. It is unlikely that the predicted shift in flow paths from the RA project area would be sufficient to result in impacting currently unimpacted wells. If this were to occur and result in exceeding dissolved arsenic trigger levels at previously unimpacted early warning wells then modifying the rate of drawdown could be considered as a potential measure to temporarily address a reservoir drawdown driven change in flow paths. However, ultimately the reservoir will be eliminated with removal of the dam and so any attempt to prevent changes in groundwater flow paths would be temporary and likely relatively ineffective. Therefore, although modifying the rate or amount of drawdown could be evaluated as a possible BMP, it is unlikely to be selected as a practical option.

7.0 REFERENCES

ARCO, 1995, “Milltown Reservoir Sediments Operable Unit, Final Draft Remedial Investigation Report”, prepared by Titan Environmental Corp., February.

Clark Fork Coalition, 2003, “Preliminary Groundwater Modeling to Estimate the Effects of Dam and Sediment Removal on the Alluvial Aquifer in Milltown, Montana”.

Envirocon, 2004a, “Final Technical Memorandum Milltown Reservoir Dry Removal Scour Evaluation”, May.

Envirocon, 2004b, “Draft Technical Memorandum, Pore Water Release and Sediment Consolidation During Area I and Dam Removal Evaluation”, August.

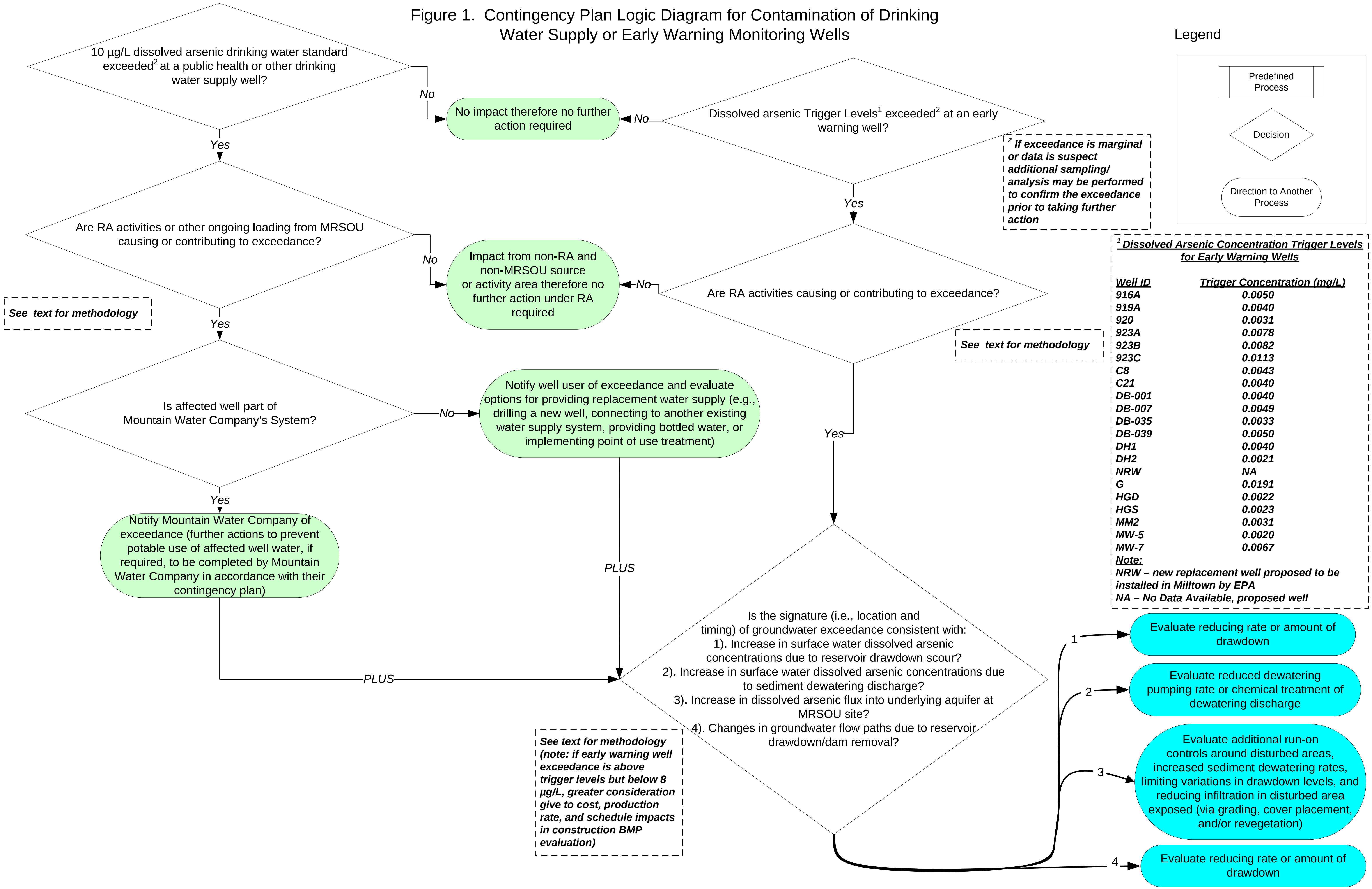
Envirocon, 2004c, “Draft Remedial Design Data Summary Report #2 Covering July 2004 through September 2004 Field Activities, Milltown Reservoir Sediment Site”, November.

Envirocon, 2006a, “Remedial Action Monitoring Plan, Milltown Reservoir Sediments Site”, May.

Envirocon, 2006b, “Contingency Plan for Exceedance of Downstream Surface Water Quality Standards/Warning Limits”, pending.

FIGURES

Figure 1. Contingency Plan Logic Diagram for Contamination of Drinking Water Supply or Early Warning Monitoring Wells



[1] Dissolved Arsenic Concentration Trigger Levels for Early Warning Wells

Well ID	***Trigger Concentration (mg/L)***
916A	***0.0050***
919A	***0.0040***
920	***0.0031***
923A	***0.0078***
923B	***0.0082***
923C	***0.0113***
C8	***0.0043***
C21	***0.0040***
DB-001	***0.0040***
DB-007	***0.0049***
DB-035	***0.0033***
DB-039	***0.0050***
DH1	***0.0040***
DH2	***0.0021***
NRW	***NA***
G	***0.0191***
HGD	***0.0022***
HGS	***0.0023***
MM2	***0.0031***
MW-5	***0.0020***
MW-7	***0.0067***

Note:
NRW – new replacement well proposed to be installed in Milltown by EPA
NA – No Data Available, proposed well