

Appendix C
Biomonitoring

1.0 Purpose and Scope

This appendix presents the biomonitoring approach for Operable Unit (OU) III to determine if likely ecological receptors have the potential to be affected adversely by contamination resulting from site remediation. The major constituent of concern for the biomonitoring effect is selenium, which displayed increasing concentrations in ground water and surface water samples during completion of surface cleanup activities. In addition to selenium, monitoring results of additional contaminants of concern (COCs) will be reviewed and compared to data in the remedial investigation to determine if their inclusion in future biomonitoring analysis is warranted. This decision will be made by the Biological Technical Assistance Group, which consists of the U.S. Fish and Wildlife Service (USFWS), the U.S. Environmental Protection Agency (EPA), the Utah Department of Environmental Quality (UDEQ), and the U.S. Department of Energy (DOE).

The main objective of the biomonitoring is to determine if selenium levels are present in environmental media at concentrations that could cause adverse effects on environmental receptors. As part of site remediation efforts, three "backwater" wetland areas were created on the former millsite adjacent to Montezuma Creek to attract wildlife to this area, which is planned for use as a park. Concerns are that increased selenium discharging to the surface along Montezuma Creek could accumulate in sediments to levels that may be harmful to wetland wildlife, including waterfowl that could nest in the area, as well as other species.

A multi-level sampling approach will be taken, with increasingly rigorous sampling requirements as simpler measures indicate. The simplest sampling requirements will apply unless results exceed established trigger levels that indicate more complex sampling is warranted. Updated wildlife surveys will be included as part of the baseline sampling effort. The most simplistic level of sampling will require sampling and analysis of surface water and sediment. Results of those analyses will determine the need for additional biota sampling. If the contaminant concentrations in surface water or sediment samples exceed established threshold values as described in Section 2.0, macroinvertebrate sampling will be required in addition to continued sediment and surface water sampling. If concentrations of selenium from analysis of macroinvertebrates exceed a threshold value (as discussed in Section 3.0), sampling of eggs from nesting birds will be required. Bird eggs would be examined for evidence of embryo deformity as well as undergo analysis for selenium content. This tiered approach prevents the unnecessary destruction of fauna of higher levels. If updated wildlife surveys for the area (see Section 4.0) result in the determination that other media (e.g., vegetation) represent likely exposure pathways, sampling of additional media can be added to the monitoring plan in the future. The need for sampling of additional media will be determined by the Biological Technical Assistance Group.

2.0 Collocated Surface Water and Sediment Sampling

In addition to the routine, semi-annual surface water sampling described in this section, annual collocated surface water and sediment sampling will take place in Wetlands 1, 2, and 3 and in the downstream sediment pond (Figure C-1). A stratified random sampling approach has been determined as the most appropriate and will provide the most representative data. It is anticipated that at least three strata will be identified at each wetland area based on the physical characteristics that exist at the time of sampling. One stratum will be located at the inflow for each area, where sediment is most likely to drop out because of changes in water velocity. Another possible stratum may be the low point (bottom) of each pond, and a third may be the

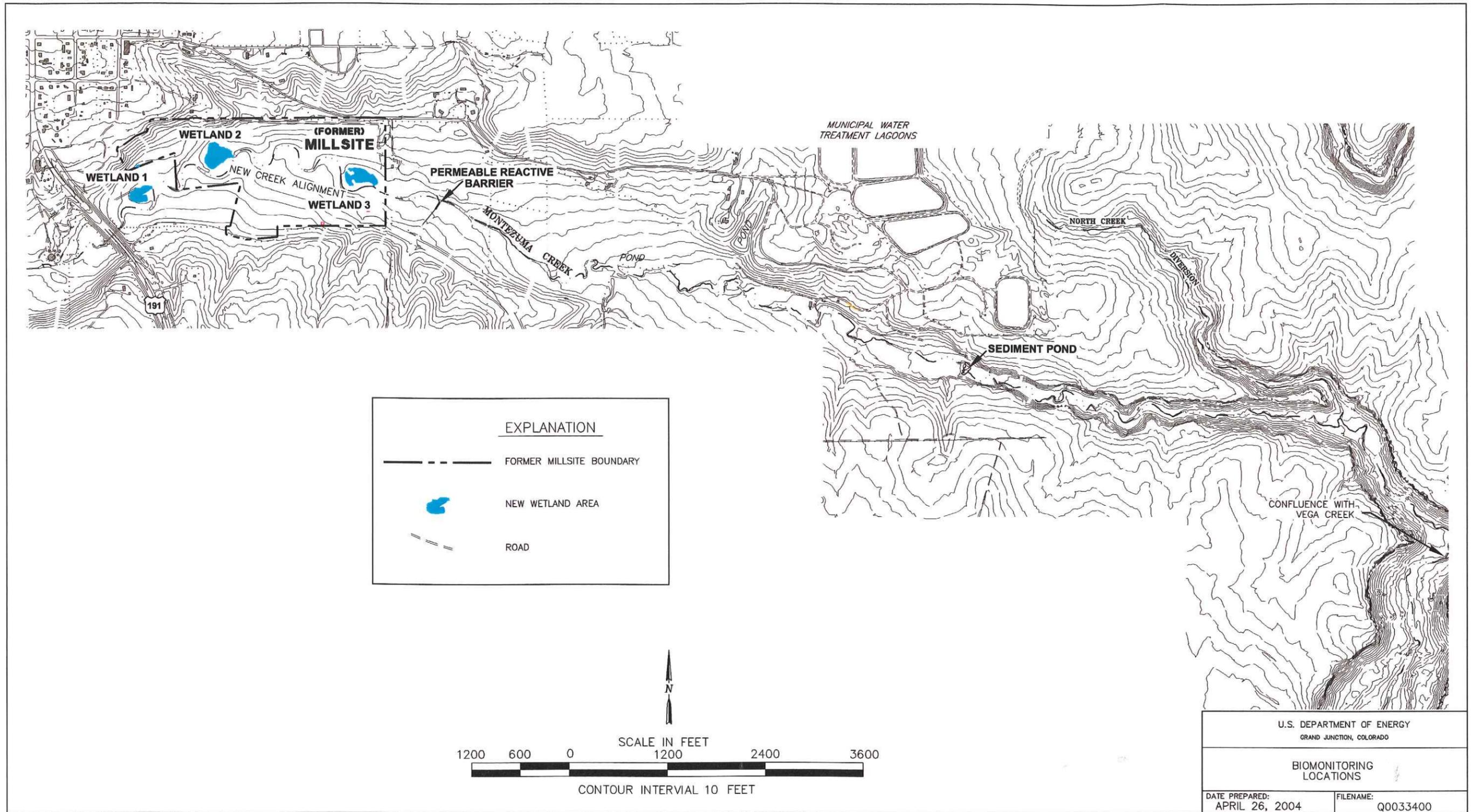
bank areas where bird nesting is most likely. The Biological Technical Assistance Group will assist in designing the specific sampling approach, including strata identification and determination of the required numbers of samples.

Two surface water samples will be collected from each stratum prior to sediment sampling. Surface water sampling will take place only if water is flowing or ponded. Samples will be collected, filtered, and preserved in the field according to standard procedures and shipped to the laboratory for selenium analysis.

Appropriate sampling of other media will be performed for each stratum to evaluate the potential for bioaccumulation of selenium in receptors identified through the wildlife survey. Random subsamples of sediment should be collected and composited to provide a sample representative of that stratum. Composite sediment samples from each stratum will be submitted for laboratory analysis. Results will enable evaluation of variability within and between strata. Sediment should be collected from the upper 3 inches of the surface, which is the most likely area of selenium accumulation from surface water and the depth to which potential receptors will most likely be exposed.

Whole sediment samples will be digested for subsequent analysis. EPA Method 3051 (nitric acid microwave) is the digestion method to be used. This is not a complete digestion, but the method should extract any adsorbed or soluble forms of selenium. The analytical results should provide a conservative estimate of the amount of bioavailable selenium in the sediments (NAS 2003).

If the average total recoverable surface water concentration of selenium for a given stratum exceeds 5 micrograms per liter ($\mu\text{g/L}$) or average selenium sediment concentrations exceeds 4 milligrams per kilogram (mg/kg), macroinvertebrate sampling of that stratum will be required, as described in Section 3.0. Because recent analytical results of surface water samples have exceeded the 5 $\mu\text{g/L}$ threshold, macroinvertebrate sampling will be conducted during the second year of biomonitoring (see schedule in Section 6.0).



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Figure C-1. Biomonitoring Locations

3.0 Macroinvertebrate Sampling

Macroinvertebrate sampling will be conducted in the second year of biomonitoring and during subsequent years, as warranted. During the initial biomonitoring sampling event when sampling strata are delineated, locations for macroinvertebrate sampling will also be determined. It is anticipated that one Hester-Dendy Multiple-Plate sampler will be placed in each strata at that time for subsequent macroinvertebrate sampling, if required. The American Society for Testing and Materials (ASTM) Standard E-1469-92 will be followed for sampler placement and sampling (see Appendix A for description of sampling procedure). Hester-Dendy samplers will yield water-column macroinvertebrates. In addition, a sediment grab sample will be collected with an Ekman Grab Sampler (ASTM Method D 4343; see Appendix A for description of sampling procedure) at the same location to obtain a sample of macroinvertebrates inhabiting soft sediments. Invertebrates from each location will be composited. ASTM invertebrate sampling procedures recommend a minimum of three replicate analyses from each sampling location. Composites will be split into three samples if enough sample material is recovered. Samples will be submitted to a laboratory for selenium analysis. If concentrations of selenium in macroinvertebrate tissue for any stratum exceed 7 mg/kg (<http://sacramento.fws.gov/ec/GBP/Table1.htm>), the Biological Technical Assistance Group will be consulted to determine the need for sampling of avian eggs. If egg sampling is required, the sampling and analysis approach will be determined at that time.

4.0 Wildlife Surveys

Surface conditions at the site have changed significantly since the last wildlife surveys were conducted in conjunction with the remedial investigation for the site. Species that were the subject of previous surveys included spotted bat (state sensitive species), northern goshawk (state sensitive), peregrine falcon (previously endangered), and the southwestern willow flycatcher (endangered). No sensitive or endangered species were identified at the site during previous surveys, though potential habitat does exist in the area. The last wildlife surveys were completed during the 1995 and 1996 field seasons. A new survey of the site vicinity is planned because of the changed nature of the site, and the disruption and restoration activities that have occurred. The same sensitive and endangered species identified in previous surveys will be targeted in particular, but other wildlife using the area will also be noted to enable selection of the most appropriate ecological receptors and media for estimation of potential site risks.

5.0 Biomonitoring Duration

It is anticipated that biomonitoring will only be required for the near term until it can be determined whether or not the wetland areas are accumulating selenium to a degree that may be harmful to ecological receptors. If no consistent increases in selenium are observed in water or sediment and if biota concentrations remain below trigger levels (if biota sampling is required) for 3 consecutive years, biomonitoring can be discontinued. If, however, biota sampling results indicate that selenium is present at concentrations that are having a negative impact on ecological receptors, some type of corrective action will be necessary (e.g., dredging wetlands, relocating wetlands, etc.). The appropriate type of corrective action will be determined in consultation with the Biological Technical Assistance Group.

6.0 Schedule

Table C-1 contains a schedule of biomonitoring activities.

Table C-1. Schedule of Biomonitoring Activities

Biomonitoring Task	Fiscal Year 2004	Fiscal Year 2005	Fiscal Year 2006	Out Years
Soil/sediment/surface water sampling	X	X	X	X
Wildlife survey		X		
Macroinvertebrate sampling		X	T	T
Other media (TBD)			T	T

TBD=to be determined by the Biological Technical Assistance Group.
T= only if trigger level exceeded.