7.0 INTERACTIONS BETWEEN MEDIA

7.1 OVERVIEW

Some monitoring is performed to characterize interactions between the various environmental media. Possible interactions are presented in Table 7-1, which represents a conceptual model of integrated monitoring at RFETS. Some significant interactions that require decision making and data are presented below.

Table 7-1 Interactions Between Media, Significance at RFETS, and Monitoring to Evaluate Interactions

Interactions Between Media	Significance at RFETS	Monitoring to Evaluate Interactions
Surface Water to Ecology	Potentially significant; surface water flow and contamination could impact local ecology. However, the local ecology has remained healthy during a variety of climatic and flow conditions. RFETS research, published in the literature, indicates that this is not a major pathway for actinides.	Data from existing RFETS-wide surface water monitoring may be used to assess potential ecological impacts. The ecological monitoring program is also designed to detect ecological changes and assess general ecological health. In addition, project-specific evaluations are conducted to assess potential impacts.
Surface Water to Groundwater	Potentially significant. Contaminants that are typically insoluble (such as Pu and Am) are not prone to move from surface water to groundwater. However, more soluble contaminants (such as U) are transported from surface water to groundwater.	Paired surface water and groundwater data sets must be analyzed to assess where and for what constituents the surface water to groundwater pathway is significant. Additional aseptic well samples, where special precautions are taken to prevent sample contamination from surface soils, may be required for groundwater actinide analysis.
Surface Water to Air	Not significant; surface water quality will not significantly impact air quality (i.e., cause exceedances of air quality standards).	Significant impacts on air or water quality will be detected by existing DOE, CDPHE, and project-specific monitoring.

Interactions Between Media	Significance at RFETS	Monitoring to Evaluate Interactions
Surface Water to Soil	Potentially significant; water in drainages and ponds will not significantly increase contaminant concentrations in soil; however, runoff could spread contaminants on surface soils and increase sediment concentrations.	Soil monitoring is conducted to determine the impacts of surface water runoff and the extent of required soil removal before, during, and after individual remediation projects. Results of the actinide migration studies will be used to determine whether existing soil monitoring needs to be modified or expanded.
Groundwater to Surface Water	Significant; most of RFETS groundwater flows into RFETS surface water drainages.	Existing surface water monitoring may detect impacts from a limited suite of groundwater contaminants. Data from groundwater monitoring (RFETS-wide and project-specific) is also used to assess and predict potential surface water impacts.
Groundwater to Ecology	Potentially significant; contaminated groundwater could indirectly impact ecological resources, as well as reduce groundwater flow.	Data from existing RFETS-wide groundwater monitoring may be used to assess and predict potential ecological impacts. The ecological monitoring program is also designed to detect ecological changes.
Groundwater to Air	Not significant; groundwater will not directly affect air quality.	Existing air quality monitoring will detect air quality degradation, and existing groundwater monitoring will detect groundwater contamination that could impact surface water quality.
Groundwater to Soil	Not significant; groundwater contaminants appear in surface water but are not likely to contaminate surface soils.	Results of the actinide migration studies will be used to determine whether existing soil monitoring needs to be modified or expanded.
Air to Soil	Potentially significant; point source and fugitive emission sources could deposit contaminants on soil.	Soil monitoring is conducted to determine the impacts of air emissions and disposition and the extent of required soil removal before, during, and after individual remediation projects.

Interactions Between Media	Significance at RFETS	Monitoring to Evaluate Interactions
		Results of the actinide migration studies will be used to determine whether existing soil monitoring needs to be modified or expanded. Also, significant impacts on air quality will be detected by existing DOE, CDPHE, and project monitoring.
Air to Ecology	Potentially significant; point source and fugitive emissions could deposit contaminants on ecological resources.	The ecological monitoring program is designed to detect ecological changes. Also, significant impacts on air quality will be detected by existing DOE, CDPHE, and project-specific monitoring.
Air to Surface Water	Potentially significant; point source and fugitive emission sources could degrade surface water quality.	Surface water monitoring (Site-wide and project-specific) will detect increases in contaminant concentrations. Also, significant impacts on air quality will be detected by existing DOE, CDPHE, and project-specific air monitoring.
Air to Groundwater	Not significant; contaminants in air will not directly impact groundwater quality.	Groundwater monitoring will track groundwater contamination, and air quality monitoring (Site-wide and project-specific) will detect degradation of air quality that could impact other media.
Soil to Surface Water	Significant; contaminants in soils are transported to surface water via runoff and surface water quality is degraded.	Site-wide and project-specific surface water monitoring will detect increases in contaminant concentrations. Soil monitoring is also conducted to determine the impacts of runoff and the extent of required soil removal before, during, and after individual remediation projects. Results of the actinide migration studies will be used to determine whether existing soil monitoring

Interactions Between Media	Significance at RFETS	Monitoring to Evaluate Interactions
		needs to be modified or expanded.
Soil to Ecology	Could be significant; contaminated soils could adversely impact local ecology.	The ecological monitoring program is designed to detect ecological changes. Results of the actinide migration studies also will be used to determine whether existing soil monitoring needs to be modified or expanded.
Soil to Air	Significant; contaminants in surface soil are resuspended and air quality is affected.	Significant impacts on air quality will be detected by existing DOE, CDPHE, and project-specific monitoring. Results of the actinide migration studies also will be used to determine whether existing soil monitoring needs to be modified or expanded.
Soil to Groundwater	Significant; contaminants migrate from surface and subsurface soils to groundwater via percolation.	The existing groundwater well network is designed to detect increases in contaminant concentrations in groundwater. Results of the actinide migration studies also will be used to determine whether existing soil monitoring needs to be modified or expanded.

7.2 WATER AND ECOLOGICAL HEALTH

As indicated in Table 7-1, there are interactions between surface water, groundwater, and plants and animals at RFETS. There are concerns that changes in water flow into and out of RFETS could impact significant habitat and species of concern located both on-Site and downstream from RFETS (e.g., the Preble's mouse at RFETS and whooping cranes in Nebraska). For example, aggregate mining activities at the west end of RFETS may alter surface water flowing onto RFETS and could impact species of concern on-Site and downstream. In fact, water is one of the key abiotic components impacting some of the significant habitats.

Site-specific relationships between water availability and ecological health, and groundwater and surface water interactions are not currently well understood. One of the primary goals of the ongoing Site Water Balance activity is to improve the understanding of interactions. The Site Water Balance will develop a hydrologic design basis for RFETS closure activities. The objectives of the Site Water Balance are to provide RFETS with a management tool to:

1. Evaluate how water hydrology is likely to change from present to final configuration;

2. Predict surface water impacts from groundwater for present and final configuration;
3. Provide data to support decisions for final IA configuration to protect surface water quality (cap and cover design and land recontouring);
4. Provide information for the comprehensive risk assessment and the Final CAD/ROD; and
5. Provide information to guide the development of the wetlands conversion project.

7.3 BUFFER ZONE HYDROLOGIC MONITORING

Some monitoring is performed to characterize interactions between the various environmental media. Possible interactions are presented in Table 7-1, which represents a conceptual model of integrated monitoring at RFETS. Some significant interactions that require decision making and data are presented below.

As indicated in Table 7-1, there are interactions between surface water, air, groundwater, and the plants and animals of RFETS.[39] As discussed in Section 7.2, changes in flow into and out of RFETS could impact habitat and species of concern both onsite and downstream. RFETS closure activities (e.g., closure of the B995 wastewater treatment plant and modification of the Interceptor Trench System) could also significantly alter drainage and flow patterns. Should the availability or quality of water be affected by upgradient off-Site activities or upgradient on-Site activities, significant habitats could be adversely affected.

In consideration of these potential impacts, watershed-level information is collected regarding water availability in the Buffer Zone. Current flow monitoring in the Buffer Zone, in addition to that performed under RFCA, is shown in Table 7-2. The flow data are collected at 15-minute intervals, downloaded, and compiled monthly. However, DQOs for this monitoring have not yet been developed, and data evaluation to assess ecological impacts has not yet been initiated. Site-specific relationships between water availability and ecological health are not yet known. Therefore, additional data, currently not collected, could be required (e.g., accurate information on purchased water, data on exfiltration and infiltration of underground pipes, additional water-quality parameters, and data on alluvial flow through the Buffer Zone habitats of concern).

Table 7-2 Buffer Zone Hydrologic Monitoring Locations

Station Identifiers	Locations	Monitoring in Addition to Flow
GS01	Woman Creek/Indiana Street	RFCA and possible nutrient load monitoring; precipitation
GS02	Mower Reservoir/Indiana Street	
GS03	Walnut Creek/Indiana Street	RFCA and possible nutrient load monitoring; precipitation
GS04	Rock Creek at Highway 128	Precipitation

[39] This table taken directly from the IMP.

Station Identifiers	Locations	Monitoring in Addition to Flow
GS05	North Woman Creek at west boundary	Precipitation
GS06	South Woman Creek at west boundary	
SW134	Rock Creek at west boundary (Gravel Pit)	(four samples per year - quarterly)
GS16	Antelope Springs	
SW118	North Access Road	RFCA Source Location

Data Types, Frequency, and Collection Protocols

Buffer Zone hydrologic monitoring (see Figure 7-1, Tables 7-3, 7-4, and 7-5) will be performed only as represented by GS01-GS06, GS16, SW118, and SW134.

Sampling at Buffer Zone stations is performed by collecting storm-event, rising-limb, flow-paced composites.

Table 7-3 Buffer Zone Hydrologic Field Data Collection: Parameters and Frequency

Station	Parameter	
	Discharge	Precipitation
GS01	15-min continuous	5-min continuous
GS02	15-min continuous	NA
GS03	15-min continuous	5-min continuous
GS04	15-min continuous	5-min continuous
GS05	15-min continuous	5-min continuous
GS06	15-min continuous	NA
GS16	15-min continuous	5-min continuous; to be installed
SW118	15-min continuous	5-min continuous
SW134	15-min continuous	NA

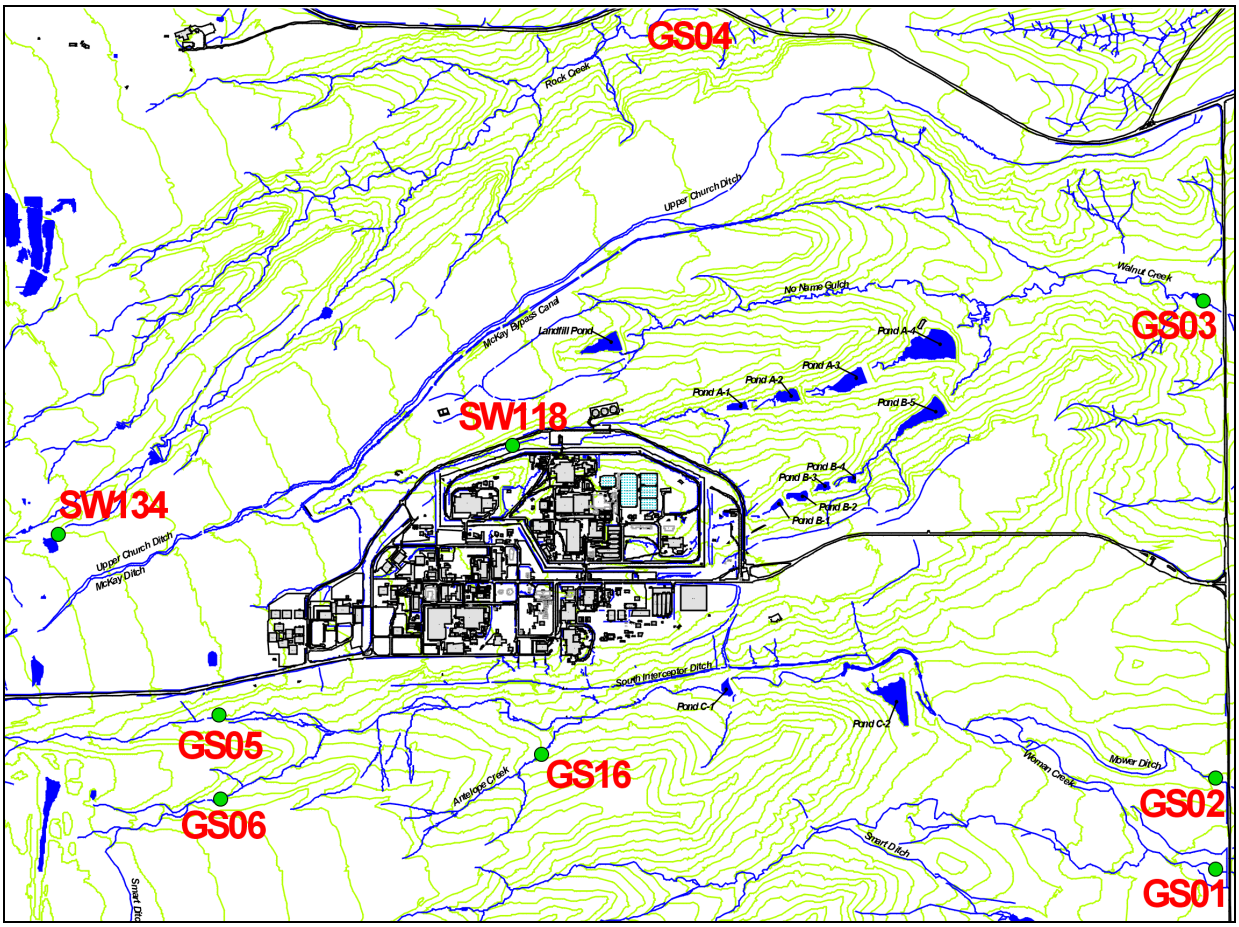

Figure 7-1 Map Showing Buffer Zone Hydrologic Monitoring Locations

Table 7-4 Buffer Zone Hydrologic Sample Collection Protocols

Station	Frequency	Type
GS01	Quarterly with an additional TSS in spring	Storm-event, flow-paced composites
GS02	Quarterly with an additional TSS in spring	Storm-event, flow-paced composites
GS03	Quarterly with an additional TSS in spring	Storm-event, flow-paced composites
GS04	Quarterly with an additional TSS in spring	Storm-event, flow-paced composites
GS05	Quarterly with an additional TSS in spring	Storm-event, flow-paced composites
GS06	Quarterly with an additional TSS in spring	Storm-event, flow-paced composites

Station	Frequency	Type
GS16	NA	NA
SW118	NA	NA
SW134	Quarterly	Storm-event, flow-paced composites

Table 7-5 Buffer Zone Hydrologic Analytical Targets (Analyses per Year)

ID Code	TSS	Sediment/Sand	Ca,Mg,Na,K,Cl,F,SO_4,HCO_3
GS01	5	4	4
GS02	5	4	4
GS03	5	4	4
GS04	5	4	4
GS05	5	4	4
GS06	5	4	4
SW134	4	4	4

7.3.1 DATA ANALYSIS

Although no routine data evaluations are required, the following preliminary decision rules have been proposed:

IF The seasonal average or yearly average water availability or quality entering Rock Creek, Walnut Creek, or Woman Creek drainages diminishes below baseline due to off-Site activities,

THEN RFETS will notify Jefferson County and USFWS to determine what actions, if any, should be taken to restore availability or quality to historical levels.

IF Activities occurring within RFETS boundaries result in a depletion of the seasonal or yearly average natural flow greater than the historic baseline, or at rates that are determined to have a negative impact on downstream habitats or individual species,

THEN RFETS will determine what management actions should be taken to ameliorate this problem.

IF Significant changes to alluvial groundwater availability in a wetlands habitat are determined,

THEN Notify parties of potential impacts to the wetlands habitat and continue groundwater and ecological monitoring.

IF A proposed action could adversely affect a listed species or its critical habitat,

THEN RFETS will consult with the USFWS.

Secondary Data Uses Could Include:

- Determining the impact of mining on Rock Creek water quality and availability;
- Interpreting potential causes of declines in the valued habitats onsite;
- Supporting water management planning;
- Evaluating cumulative impacts of actions (on and offsite);
- Validating any predicted impacts of the selected alternative to downstream resources; and
- Supporting RFETS's biological assessment and the USFWS biological opinion.