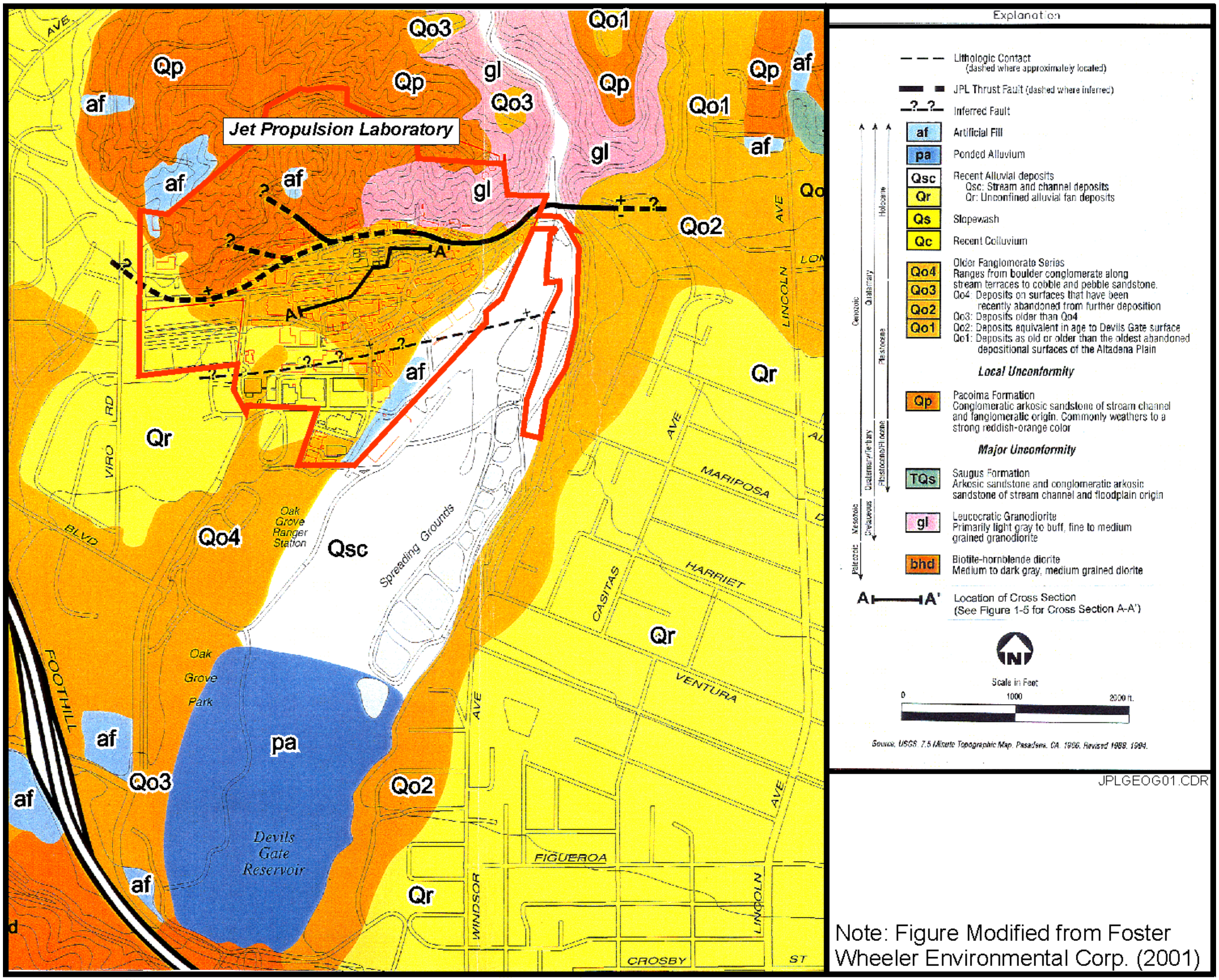


Figure E-4. Geologic Map of the JPL and Surrounding Area

E.3.5.2 Groundwater

The San Gabriel Valley contains distinct groundwater basins, including the Raymond Basin, where JPL is located (see Figure E-3). The Raymond Basin is bordered on the north by the San Gabriel Mountains, on the west by the San Rafael Hills, and on the south and east by the Raymond Fault. The Raymond Basin provides an important source of potable groundwater for many communities in the area around JPL, including Pasadena, La Cañada Flintridge , San Marino, Sierra Madre, Altadena, Alhambra, and Arcadia.

North of the JPL Thrust Fault (see Figure E-4), groundwater primarily occurs in joints and fractures in the bedrock. Because the bedrock is of low porosity, it is considered non-water-bearing. South of the JPL Thrust Fault, groundwater occurs in alluvial deposits.

The aquifer below JPL consists of four layers that are separated by noncontiguous, low-permeability silt layers (see Figure E-5). Layer 1 consists of the upper 75 to 100 ft of saturated alluvium. Layer 2 underlies Layer 1 and is about 150 to 200 ft thick. Layer 3 is about 200 to 300 ft thick and generally overlies crystalline basement rock beneath JPL. Layer 4 occurs only at the far eastern end of JPL, is about 150 ft thick, and rests on crystalline basement rocks.

Depth to groundwater at JPL ranges from 22 ft bgs to 270 ft bgs. This wide range of depth to water is attributed to steep topography in the northern part of the site and to seasonal groundwater recharge. The depth to groundwater under most of the JPL complex averages approximately 200 ft.

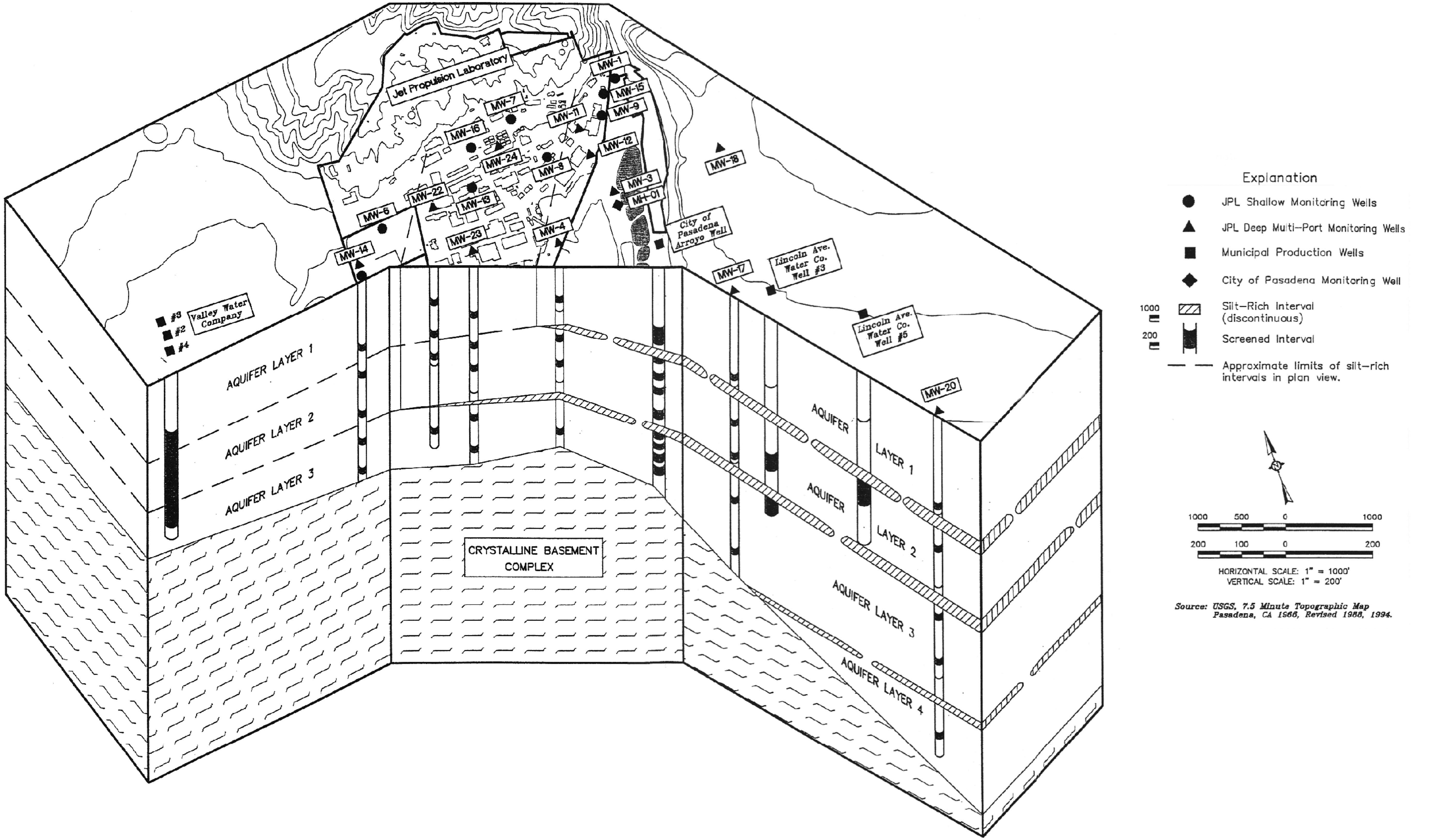
E.3.6 Natural and Ecological Resources

JPL is located along the northern edge of the San Gabriel Valley in the central part of Los Angeles County. The San Gabriel Valley is bounded to the north by the San Gabriel Mountains, which consist of relatively steep, rocky ridges with numerous canyons. The northernmost part of JPL consists of Gould Mesa, a flat-topped, southern promontory of the San Gabriel Mountains that rises 300 ft above the main JPL complex. Chaparral covers the convex slopes of the mesa in this part of JPL as well as the upland banks of the Arroyo Seco, east of JPL.

The Arroyo Seco, which borders the east side of JPL, is about 1,000 ft wide. It contains mostly riparian and desert wash habitat, interspersed with chaparral. The Arroyo Seco Creek intermittently flows through the Arroyo Seco wash. The Arroyo Seco collects runoff from the north, east, and west. Several groundwater recharge ponds are located on the east side of the Arroyo Seco and west of the extended parking area (see Figure E-2). Groundwater beneath the Arroyo Seco is a current source of drinking water.

Riparian areas are located directly northeast and east of the JPL along the Arroyo Seco Creek. Riparian trees are thicker at the drain outfalls on the eastern boundary of JPL, where runoff from landscaped areas and pavement is year-round. However, there are no forest resources at JPL.

The predominant habitat type at JPL is urbanized landscape, with paved roads, parking lots, and buildings. Vegetation used in landscaping includes native and nonnative plant species.



NOTE: GRAPHIC PREPARED BY FOSTER WHEELER ENVIRONMENTAL CORPORATION (2001).

JPLAXO01.CDR

Figure E-5. Conceptual Model of JPL Aquifer Layers

Species of special concern that potentially occur in the vicinity of JPL include the southwestern arroyo toad, the southwestern pond turtle, the San Diego horned lizard, the peregrine falcon, the bank swallow, the western yellow-billed cuckoo, and the least Bell's vireo. These species were identified using the California Department of Fish and Game Natural Diversity Database (California Department of Fish and Game, 1995) and the California Native Plant Society's list of rare, threatened, or endangered plant species (Skinner and Paulik, 1994). However, none of these species have been identified at the JPL site. If necessary consultation under Section 7 of the Endangered Species Act will be accomplished directly with the U.S. Fish and Wildlife Service.

E.3.7 Archaeological and Cultural Resources

NASA has an obligation to determine if any building, structure, or object listed or eligible to be listed on the National Register of Historic Places would be affected by the OU-2 remedial activities. It also has the obligation to determine whether any historical or archaeological data could be destroyed through alteration of terrain as a result of implementation of the selected remedial action.

It is unlikely that property with historic, architectural, archaeological, or cultural value, located within the vicinity of JPL, will be impacted by the selected remedial action. However, a historical, archaeological, architectural, and cultural resource review of surrounding and on-facility property will be conducted prior to implementation if remedial actions involve intrusive groundwork.

E.4: NEPA VALUES ASSESSMENT OF PROPOSED ACTION AND ALTERNATIVES

The results of soil vapor sampling conducted at JPL (FWEC, 1999) revealed the presence of VOCs in the vadose zone at levels that may impact groundwater above drinking water standards. These chemicals have the potential to migrate to groundwater, thus causing further groundwater impact. Therefore, the RAO was established to prevent, to the extent practicable, further migration of VOCs at potential levels of concern from the vadose zone to groundwater to protect an existing drinking water source. Two alternatives, the NFA alternative and SVE, were identified to address the RAO.

Under the NFA alternative, no remediation of OU-2 would be planned except that which occurs naturally due to chemical/biological degradation, dispersion, advection, and sorption. The NFA alternative would have no further impacts on the environment except those from VOCs in the vadose zone that could potentially impact groundwater. Ecology would not be disturbed, but VOCs in the vadose zone might act as a source of further groundwater contamination and may not provide long-term protection of the environment.

Under the selected alternative, SVE would be used to remediate vadose zone soil at JPL OU-2. SVE would be conducted to remove VOCs from the subsurface, and SVE systems would operate until the performance objectives are achieved.

Air emissions from SVE would be limited to possible dust generation during well installation and discharge of treated vapors extracted from the subsurface. The dust generation during well installation would be minimal and occur over a short duration; therefore, these emissions are expected to have negligible impacts on local air quality. The VOCs in the extracted vapor will be removed by an aboveground treatment system in accordance with state and local ARARs. These ARARs ensure protection of human health and the environment.

SVE system installation and operation would also result in negligible impacts because the system is in situ (i.e., removal of vegetation and grading would be minimal). Any vegetation removed or species temporarily displaced would have the potential to recolonize the area following completion of the remediation. However, given the small size of the SVE system above ground, the net impact to wildlife species would be negligible.

Solid waste, in the form of spent carbon from the vapor treatment system, would be transported and treated off site. Thus, implementation of the selected alternative would have negligible impacts and, during operation, would be protective of human health and the environment.

In addition, because the SVE process permanently removes VOCs from the vadose zone, the potential for further groundwater contamination is significantly reduced. After remediation is completed, residual VOCs would not be expected to further impact groundwater. Thus, long-term protection and reliability are provided to the environment.

This section evaluates the two remedial alternatives for OU-2, including the NFA alternative and the selected alternative (i.e., SVE), according to their potential effects on the environment.

E.4.1 Socioeconomic Impacts

Installation of an SVE system at OU-2 is expected to employ a maximum of five people on a part-time, temporary basis. Operation and maintenance of the system is expected to employ fewer than two people full time. These numbers are small compared to the total present employment at JPL (approximately 5,175), as well as employment at local businesses and industries in the surrounding area.

The workforce needed to implement the selected alternative would be derived from the ranks of subcontractor companies. No measurable impact on the local economy would be expected. Thus, direct and indirect socioeconomic impacts of the remediation of OU-2 using the selected alternative are expected to be negligible.

The NFA alternative would have no direct socioeconomic effects on JPL or the surrounding area. However, because no action would be taken under the NFA alternative to protect the beneficial uses of the groundwater at JPL, potential indirect socioeconomic effects could accrue to JPL and the surrounding area due to the degradation of groundwater quality.

E.4.2 Transportation Impacts

Three major freeways serve the Pasadena, Altadena, and La Cañada Flintridge communities (see Figure E-3). The Pasadena Freeway (California Route 110) connects Pasadena to Los Angeles. The Foothill Freeway (Interstate 210) links communities to the north and east of Pasadena. The Ventura Freeway (U.S. Route 134) leads to Ventura County and beyond.

Remediation of OU-2 at JPL using the selected alternative would create a very small, short-term increase in traffic flow to and from the site as a result of the movement of equipment and supplies. However, based on current traffic volume associated with the 5,175 JPL employees and various activities, the increased traffic associated with remediation efforts under the selected alternative would be negligible.

Most of the traffic on and around JPL is associated with morning and evening rush hours, 7:00 to 9:00 a.m. and 4:00 to 6:00 p.m. Most of the traffic associated with the movement of equipment and supplies for the selected alternative would not be present at those peak periods of traffic flow. Further, all truck traffic associated with implementation of the selected alternative would be during daylight hours, which would further reduce the potential for accidents. Similarly, removal and transport of spent carbon waste during daylight, non-rush hours are expected to have a negligible impact over the entire course of treatment.

The NFA alternative would have no effects on transportation at JPL or in the surrounding area.

E.4.3 Natural and Ecological Resources

Groundwater beneath the JPL is a current source of drinking water. The selected alternative for OU-2, on-facility vadose zone soil at JPL, considers the soil-to-groundwater migration pathway and requires the remedial action to be protective of beneficial uses of the groundwater. Thus, the selected alternative is expected to have a beneficial effect on groundwater near JPL.

No threatened or endangered species have been identified at the JPL site.

The areal extent of VOCs in soil and the proposed area for installation and operation of SVE are located within the main JPL complex in previously disturbed and developed areas. These areas contain no wetlands and provide minimum wildlife habitat. The minimal land disturbance caused by installation of an SVE system is expected to have negligible impacts on vegetation and wildlife.

There is no floodplain or wetland involvement in the remediation of OU-2; therefore, a floodplains/wetlands assessment is not required.

Under the NFA alternative, no action would be taken to protect the beneficial uses of the groundwater at JPL. Thus, the NFA alternative would have no effects on natural or ecological resources at JPL or in the surrounding area.

E.4.4 Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, directs federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations.

As part of the RI (FWEC, 1999), NASA conducted a human health risk assessment (HHRA) to determine the need for action to protect human health. The HHRA assessed cancer and noncancer risks associated with human exposure to surface soils, which represents the only direct human exposure route at OU-2. Conservative assumptions with respect to VOCs and other chemical concentrations in soil vapor, exposure parameters, and toxicity ensured that the calculated risks were protective of human health. Exposure parameters included both commercial and residential land use scenarios, and risks were assessed for on-facility human receptors.

The results of the HHRA showed that the risks associated with exposure to vadose zone soil are negligible and are within regulatory thresholds. In addition, results indicated that VOCs detected in soil vapor samples do not cause unacceptable risks to humans.

The risks from implementation of the SVE treatment technology are low. Therefore, NASA expects little to no adverse human health impacts from implementation of the selected alternative to occur in any off-facility community, including minority and low-income communities.

E.4.5 Irreversible and Irretrievable Commitment of Resources

The commitment of a resource is considered irreversible if primary or secondary impacts of the remedial action limit future options for the use of the resource. Under the selected action, SVE would be conducted to remove VOCs from vadose zone soil at JPL. The primary objective of SVE would be to reduce the potential for further groundwater impacts. Thus, under the selected action, there would be no irreversible commitment of resources. Rather, groundwater would be recovered as a resource under this action.

The commitment of a resource is considered irretrievable if the action uses or consumes the resource during the course of implementation. Again, under the selected action, SVE would be conducted to remove VOCs from vadose zone soil and reduce the potential for further groundwater impacts. This action would lead to potential recovery of the groundwater resource. Thus, under the selected action, there would be no irretrievable commitment of resources.

E.4.6 Cost-Benefit Analysis

Costs associated with the selected action, SVE, were evaluated in detail in the Final FS Report (FWEC, 2000). Capital costs associated with SVE include installation of up to five extraction wells and five off-gas treatment systems. Operating and maintenance costs include operation and maintenance of the SVE systems and implementation of a soil vapor monitoring program. Total present worth cost for the selected action is estimated to be $3,735,000.

NASA and the regulatory authorities agree that the costs associated with SVE are justified because the selected action reduces and removes VOCs from vadose zone soil at JPL and reduces the potential for further groundwater impacts. Thus, the vadose zone soil resource at JPL is recovered, and the groundwater beneath JPL is protected, as required under both the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR Section 300.430(e)(2)(B)) and State of California regulations for the beneficial use of groundwater, including groundwater used as a source of drinking water.

E.5: CUMULATIVE IMPACTS

As described above, minimal environmental impacts are expected from the proposed implementation of the selected action. In particular, the selected action would have no adverse impacts on threatened or endangered species, cultural resources, floodplains, or wetlands. NASA expects no adverse human health impacts from the CERCLA action to occur in any off-facility community, including minority and low-income communities. Under the selected action, increases in JPL traffic would be minimal and consist of transportation of SVE equipment and supplies to and from the JPL site, resulting in insignificant transportation impacts. There would be no measurable impact on the local economy as a result of the selected action, and, thus, no socioeconomic impacts are anticipated. Also, under the selected alternative, there would be no irreversible and irretrievable commitment of resources and the cost of remediation is justified to protect the existing source of drinking water.

NASA has examined the potential cumulative environmental impacts of the selected action in addition to other past, present, and reasonably foreseeable future actions at the site. NASA has initiated cleanup activities to address VOC- and perchlorate-impacted groundwater both on facility (OU-1) and off facility (OU-3). Remedial activities have been and will continue to be conducted in accordance with all federal, state, and local regulations. Also, research and development related to robotic exploration of the solar system, remote sensing, astrophysics, and planetary science is performed at JPL. These activities are conducted in controlled settings in accordance with applicable regulations. NASA does not anticipate any cumulative environmental impacts from the activities conducted at JPL and remedial activities at OU-2. Rather, the remediation of OU-2, using SVE, would have a positive impact in preventing further negative impacts to the groundwater resource.

E.6: AGENCIES AND PERSONS CONTACTED

During the preparation of the RI (FWEC, 1999) and the FS (FWEC, 2000) for OU-2, NASA consulted with and received comments and recommendations from the Cal-EPA DTSC; RWQCB, Los Angeles Region; the EPA, Region IX; the U.S. Fish and Wildlife Service; and the Raymond Basin Management Board. In addition, the Naval Facilities Engineering Command (NAVFAC) is also providing technical assistance to NASA on cleanup decisions at JPL.

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