US Environmental
Protection
Agency

Aerial Photography Helps Assess Septic Systems

The Clean Water Act and its predecessor legislation have authorized the funding of sewage collection and treatment facilities. When implementing this legislation in areas serviced by septic systems, EPA has recognized the need to document the condition of these systems since failures may lead to water quality problems and health concerns. Unfortunately, available field survey methods have technical limitations, and public records are usually incomplete. Therefore, researchers at the EPA's National Exposure Research Laboratory's Environmental Sciences Division (ESD), through its Environmental Photographic Interpretation Center (EPIC), in Reston, Virginia and Las Vegas, NV, have developed aerial photographic techniques to help identify and document septic system performance.

The primary characteristics of septic system failures are rapidly growing or damaged vegetation, unusual soil moisture, and surface effluent. These signs are the result of upward and/or lateral movement of partially treated or untreated waste water near the soil surface and may indicate potential water quality problems. Typically, as the septic effluent moves upward and approaches the surface, the high source of nutrients in the effluent can cause enhanced growth in the vegetation directly above the disposal drain field. As it reach-

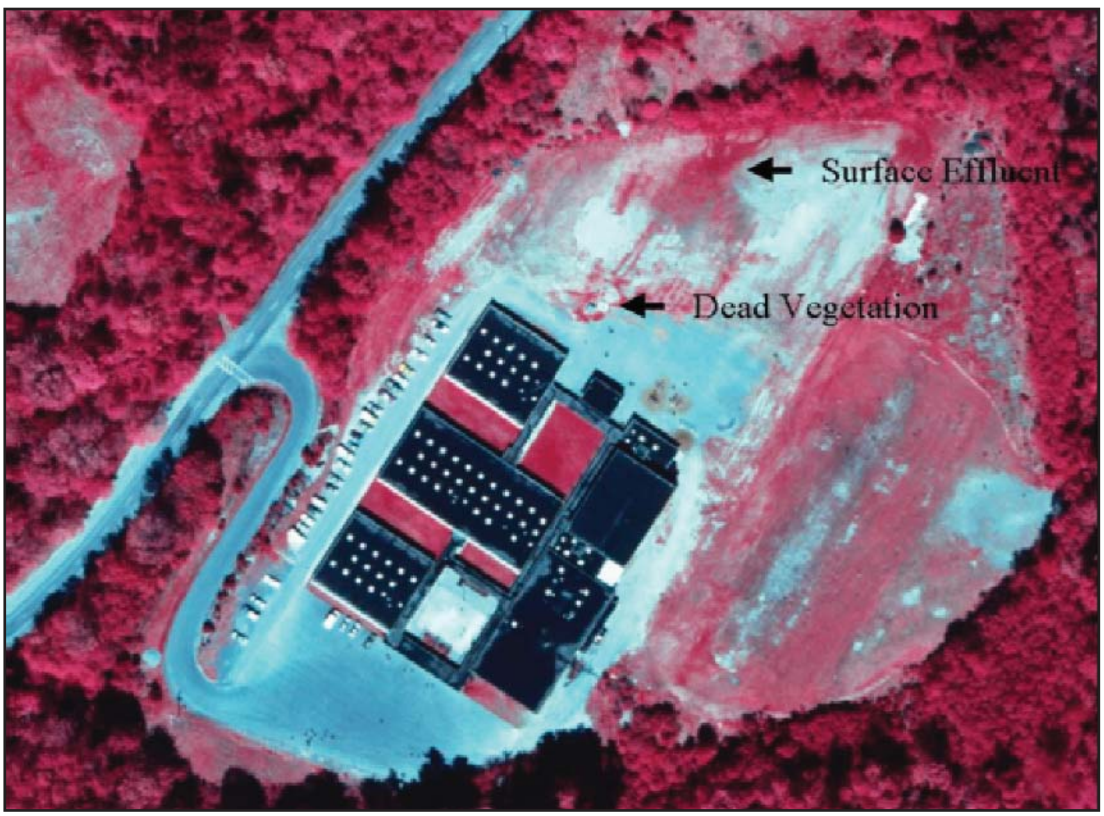

Figure 1. Surface failure. *False color infrared (CIR) aerial photographs are very valuable for showing vegetation in shades of red and pink, and any stresses associated with the vegetation which result in a change in their photographic "signature". False color infrared is also useful for showing differences in soil moisture content and the presence of standing water on the ground surface. Surface failure of a septic system in this image is characterized by dead vegetation and the presence of surface effluent. CIR records near or reflective infrared energy, not thermal emissions or temperature and should not be confused with thermal infrared*

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es the surface, the over-abundance of nutrients, coupled with an imbalance in the air-water ratio, causes the vegetation to be stressed until it eventually dies. Finally, the effluent surfaces and either stands stationary or flows downhill, depending on the topography, often causing the same growth-stress-death pattern as it moves.

Before beginning an aerial survey, EPIC researchers review available publications for information on soil types, water resources, geology, and climate and consult local regulations concerning the size and characteristics of the septic systems. This information helps to choose the proper seasonal conditions for obtaining the most useful photographic information. For example, the aerial imagery should be collected during leaf-off conditions and during the seasonally high water table which coincides with when most failures occur. This background information gives the imagery analyst insights into the type and rate of septic system failures that the analyst may expect to see.

An area under study is photographed using both standard color and color infrared film at a scale of 1:8,000. This scale provides the necessary resolution quality and still provides enough area coverage to make the method cost-effective. The color infrared imagery is the primary source for interpretation because of its ability to detect subtle changes in vegetative growth patterns. Standard color photography is used primarily for comparison purposes.

The analyst uses high-powered optics and stereoscopy, which gives the appearance of depth, to examine each housing lot in the study area for signs of unusual vegetative growth, plant foliage distress, and excessive soil moisture levels. The growth-stress-death vegetative patterns associated with the upward and/or lateral movement of septic system effluent appear different from the surrounding vegetation on both standard color and color infrared photography.

Aerial photographs taken with color infrared film show the failure pattern, or "signature", of a septic system as a deep red outlining of the subsurface drain-line absorption area. The outline is often accompanied by one or more deep red plumes in the downhill direction. Dark gray or black spots on the infrared photo show surfacing effluent and may be surrounded by pale gray or tan spots showing the stressed or dead vegetation. Figure 1 shows the classic example of septic system failure, characterized by dead vegetation and the presence of surface effluent. This condition may represent an immediate health problem.

Problems identified on the photos, however, are characteristic only of overt failures occurring at the time of overflight. All failures in a specific area may not be clearly displayed since some occur only during certain conditions.

Secondary and False Signs

The analyst can also identify secondary indications of septic system failures. Small ditches or trenches constructed by homeowners to remove the effluent from failing systems, small hoses or pipes to reroute wash water from an overloaded system, and coverings of an impervious material, such as clay, may indicate a failing system. Figure 2 shows some of the secondary signs.

The experienced analyst can discriminate among the similar signatures of vegetative growth and stress caused by different phenomena such as manure piles, compost heaps, animal droppings, and feedlot runoff. A small spring or leaky hose can produce a plume effect and surface effluent, and a small garden plot can appear to be an absorption field. Figure 3 shows a false signature. The analyst should recognize these false signatures. A field check of a portion of each study area assures accuracy of the technique.

Report Preparation

The information obtained from interpretation is annotated on overlays to U.S. Geological Survey maps or on photographs of the study area. Land use information, an explanation of the technique, and results of the preliminary environmental analysis can also be included in the report. Photo enlargements can be produced for use at public meetings.

Additional support provided by aerial photographic analysis includes dwelling unit counts, historical analysis of demographic trends, audits of construction progress, and identification of possible areas for land application of waste water from secondary treatment plants.

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Figure 2. Secondary signatures. *This false color infrared photo shows the common practice of covering a failing absorption field and rerouting wash water through small ditches.*

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Figure 3. False signature. *On this natural color aerial photograph the vegetative growth and stress pattern behind this building appears to be a large, seasonally failing septic system. It is actually vegetation stress caused by athletic activity.*

For further information contact: Environmental Photographic Interpretation Center
US Environmental Protection Agency, 12201 Sunrise Valley Drive, 555 National Center, Reston, VA 20192
(703) 648-4288, FAX (703) 648-4290

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