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Planning for Closure of the Logan City/Cache County Landfill and Surrounding Landscape

Kristofor Lee Kvarfordt
Utah State University

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Planning for Closure of the Logan City/Cache County Landfill and Surrounding Landscape

Kristofor Lee Kvarfordt

Utah State University
PLANNING FOR CLOSURE OF THE LOGAN CITY/CACHE COUNTY LANDFILL
AND SURROUNDING LANDSCAPE

by

Kristofor Lee Kvarfordt

A thesis submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF LANDSCAPE ARCHITECTURE

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2009
ABSTRACT

Planning for Closure of the Logan City/Cache County Landfill and Surrounding Landscape

by

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Utah State University, 2009

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Planning for landfill closure requires in-depth analysis into many operational, environmental, and social factors. Ideally, the planning process should resolve as many of the technical, social, and aesthetic requirements as possible by systematically addressing the various elements that influence the final design. This research identified the significant issues related to planning for the end use of the current Logan landfill (approximately 100 acres) after it reaches capacity in 18-20 years and the associated lagoons (460 acres) and wetlands (396 acres). The current closure plan calls for simply recontouring the landfill to stabilize the slopes, then revegetating. The location of the site has serious implications for environmental impact yet offers positive opportunities for consideration of alternative end uses.

This research includes a professional visual resource analysis of the landfill for specific future time periods. The study follows generally accepted procedures to
complete a visual analysis of the current proposed landfill closure plan and selected
potential alternative end uses. Based on the research analysis and results reported here,
the following conclusions are supported:

- The Logan landfill will reach full capacity in less than 20 years
- There is a need to plan for the appropriate end use of this facility
- There is an excellent landfill planning process appropriate to this need
- Several alternative end uses have been implemented on landfills nationally and
  internationally -- several of these are suitable for the Logan landfill
- There is a visually preferable alternative (the Environmental Education Center, or EEC)
  to the currently planned end use
- The EEC, with associated facilities (i.e. sewage lagoons, effluent polishing wetland,
  constructed and proposed mitigation wetlands, Cutler reservoir), presents a highly
  desirable alternative to the currently planned end use
ACKNOWLEDGMENTS

I wish to express my deepest gratitude to the following for their support and assistance in this research:

• Professor John C. Ellsworth, FASLA, department of Landscape Architecture and Environmental Planning, USU
• Mr. Issa A. Hamud, P.E., Logan City Director of Environmental Health
• Office of the Utah State University Vice-President for Research
• Members of the Logan Landfill Technical Advisory Committee
• Dr. Ryan DuPont, Head, department of Civil and Environmental Engineering, USU
• Mr. David Bell, extension landscape architect, USU
• Mr. Glen Busch, Planner, Bear River Association of Governments
• Mr. Lyle Shakespear, GIS specialist, Logan City GIS department
• Ms. Michelle Mechem, Sr. Planner, Logan City community development department
• Mr. Josh Runhaar, Director of Development Service, Cache County Corporation

Kristofor L. Kvarfordt, ASLA
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May 11, 2009
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CHAPTER 1
INTRODUCTION

Project Background and Historical Context

Cache Valley, on the border of the Rocky Mountain and the Great Basin physiographic provinces, is renowned for its scenic beauty. The Cache County Chamber of Commerce proudly states, “Residents and visitors enjoy an unequaled and varied quality of life.” Many residents of the county live here because of the abundance of scenic opportunities and outdoor recreation areas, both of which contribute to this “unequaled” quality of life (Cache Chamber of Commerce 2005; see Figure 1.1 and 1.2).

However, as the county grows many of these opportunities may be threatened by landscape change, including urban development. Former Utah State University President Kermit Hall stated, “Cache Valley is a maturing and growing metropolitan region and it can’t escape both the benefits and limitations that areas associated with growth and

Figure 1.1. Counties of Utah.
change naturally experience” (Riggs 2004).

One of the limitations cities face as they continue to grow is managing solid waste. All solid waste facilities have a capacity that will eventually be reached. The citizens of Logan and Cache County now face this challenge and need to understand the impacts associated with landfill closure.

Planning for landfill closure requires in depth analysis into many operational, environmental, and social factors. The planning process should resolve as many of the technical, social, and aesthetic requirements as possible by systematically addressing the various elements that influence the final design. These include landform, restoration profile, end use, project phasing, and interim landscape management measures (U.K. Environment Agency 2004).
Relevance of This Research

This research will identify the significant issues related to planning for the end use of the current Logan landfill (approximately 100 acres) after it reaches capacity in 18-20 years, and the associated lagoons (460 acres) and wetlands (396 acres), hereafter referred to collectively as “the Site.” This landfill has been in operation since the 1960s and serves a total of 19 cities and towns throughout Cache County (see Figure 1.3).

Figure 1.3. Project area/community proximity.
Figure 1.4. Project area.
Currently it is managed by the City of Logan and is scheduled to reach capacity in 18-20 years (Hamud 2005). Continued growth and development in Cache Valley further threatens the longevity of the landfill. Much of this expected growth pressure is being exerted on the western areas of the city, in proximity both physically and visually to the landfill. According to a planning document accepted as an amendment to the General Plan on December 17, 1997, the landfill may reach capacity as early as 2016 (City of Logan, Utah 1997). In this amendment, the visibility of the closed landfill is of primary concern and has been identified in the General Plan as “prominent in views from surrounding areas” with an outlook of becoming “highly visible” when closed (City of Logan, Utah 1997). Currently, the crest of the landfill sits approximately 80 feet above the natural grade, 4590 feet above sea level during pre-landfill conditions (Hamud 2005). At capacity the landfill is proposed to reach a height of 160’ above the natural grade after being capped and re-contoured (ibid.).

The current closure plan calls for simply re-contouring the landfill to stabilize the slopes, then revegetating. The location of the site has serious implications for environmental impact yet offers positive opportunities for consideration of alternative end uses. Logan City will continue to grow and expand during this time period and beyond. The citizens of Logan and Cache County will have an increased need for alternative land uses that have been successfully provided on former landfills, such as provision of open space (Johnson 1996), passive and active recreation (Logsdon 1989), wildlife habitat conservation and observation (Meade 1992), biodiversity (Young 1993; Young 1994), community resource and environmental education centers (Logsdon 1989; Krinke 2002), and others which might be suited for the nearly 1000 acres of the site (see...
This research includes a professional visual resource analysis of the landfill for specific future time periods. The study follows generally accepted procedures to complete a visual analysis of the current proposed landfill closure plan and selected potential alternative end uses. This process will establish a highly informed and understandable set of tools for the City of Logan to use as guidance for continued planning and design of the landfill.

**Goal and Objectives of This Research**

The goal of this research is twofold: to assist the city of Logan and Cache County in identifying a planning process specific to landfill end-use planning that is appropriate and useful for application to the current landfill, and to identify appropriate and feasible alternative end uses for the existing landfill and the associated constructed wetlands and sewage lagoons. This study emphasized visual resources assessment implications for potential end uses for the landfill, the constructed wetlands adjacent to the landfill on the west and the existing sewage lagoons to the north. A series of research objectives was established:

- Identify significant issues related to end-use planning for landfill, constructed wetlands, and sewage lagoons, with emphasis on visual (scenic) resources
- Identify an appropriate process for landfill end-use planning
- Conduct a basic GIS-based site inventory and analysis, with specific and detailed emphasis on expert visual resources assessment
• Identify up to three appropriate alternative end uses for the site
• Specify basic design criteria for the alternative end uses identified
• Designate one (or more) preferred alternative end use(s)
• Develop a timeline for implementation of the identified landfill end-use planning process

Significance

As mentioned, closure of the Logan City/Cache County landfill is anticipated in 18-20 years. The current landfill closure plan calls for capping, regrading and revegetation. The crest of the landfill would be twice its current height above natural grade at final capping and revegetation. There is concern within current planning documentation that this finished height will be “highly visible” from surrounding areas (City of Logan, Utah 1997). Therefore, it is imperative that a thorough visual resource analysis of the landfill site be completed and other end-use alternatives studied. This analysis will provide clear and understandable information to help guide future planning efforts for the Logan City/Cache County landfill.
Portions of this literature review have been referenced from *Site Suitability Analysis for an Intermountain Solid Waste Facility* (Campo 1996). This study was completed using the most current GIS technology at the time and was a very well structured analysis of existing land uses and environmental resources. The author wishes to recognize this contribution by Mr. Campo as an exemplary typology and foundational reference of the analysis completed herein.

*Landfill Siting*

Bringing new landfill sites into services is a difficult process. Finding a suitable site requires meeting many economic, environmental and social demands (Lee and Jones 1991; Lane and McDonald 1983). Although landfills are a necessity for our society few people want them sited near their place of residence. The “not in my back yard” (NIMBY) attitude is prevalent.

The Resource Conservation and Recovery Act of 1976 (RCRA) set federal standards for resource recovery, hazardous waste, and solid waste management. Its goal was to create market conditions to promote environmental protection by requiring those who benefit "from the functions that create the waste to pay the cost of its disposal" (Robinson 1986, 10). In a 1993 report, it was estimated that more than 60% of Utah landfills (100 out of 164) would close due to stricter RCRA-based Subtitle D landfill
regulations implemented in October 1993 (Repa 1993). According to a 1996 update report by the National Solid Waste Management Association, Utah had 63 landfills in service (Repa and Blakey 1996).

Landfill Challenges and Success Stories

Landfills in service can have a negative impact on surrounding communities. Odor problems and groundwater pollution are two major issues. Odor problems caused the shutdown of three mixed waste composting facilities in 1991 and 1992 (Segall and Redd 1994). A National Solid Waste Management Association survey (NSWMA 1989) shows that between 1981 and 1988, the percent of people who felt groundwater pollution was a serious problem rose from 28% to 54%.

However, research reveals that long-range planning and sound design can turn landfills into amenities for nearby local communities. At the Fresh Kills landfill on Staten Island, New York, the New York City Department of Sanitation, with a landscape architect as the project director, successfully completed a five-year restoration demonstration project. An oak-scrub forest and grass/shrubland were restored on a closed section of the landfill and early succession stages of revegetation were established. This helped to preserve the local gene pool and add to the ecological biodiversity of the area (Young 1993; Young 1994).

In San Diego, the Miramar landfill is an excellent example of environmental management. Restoration of the disturbed area has brought back wildlife and native plants. Controlled burns were used to aid revegetation. Wetlands make the facility
appear like a nature preserve (Meade 1992). In Lawrence, Kansas, a 210-acre landfill was turned into a wildlife and recreation area, with much of the work being done by students during the summer.

At the Acmar landfill near Birmingham, Alabama, managers inform the oversight committee regarding all landfill happenings, both good and bad. They support the local community through charitable food donations, scholarships, and books donated to the local Head Start Program (Thompson 1993). This professional attitude and community involvement has made this landfill a success.

In Belleville, Michigan, the local landfill is a community resource center. Landfill methane gas is providing enough electric power for 1,800 homes. An onsite hydroponics greenhouse grows vegetables that are sold to distributors who sell retail produce to some of the finest restaurants in the Midwest (Logsdon 1989). The landfill near Riverview, Michigan was turned into a ski hill. Surrounding property values have increased. Methane gas from the landfill produces enough electricity for 10,000 homes on a continuing basis. The area serves as a recreational park and an active landfill at the same time, a true community resource (Logsdon 1989).

In Lake County, Illinois, the Countryside Landfill demonstrates the value of teamwork between government, landfill owners, and landscape architects. Under previous owners, the landfill had twice been denied expansion permits. The new owners, USA Waste Service, Inc., contacted the landscape architecture firm Peter Walker William Johnson and Partners (PWWJ) for assistance. PWWJ developed a plan and worked with all concerned parties to blend the landfill in with the surrounding areas and allow it to function as an open space connector between two nearby greenways. The plan was
accepted by all parties as well as by the local community. Expansion permits were granted in 1994 (Johnson 1996).

More non-conventional proposals have come from the 606 Studio at California State Polytechnic University in Pomona. One of the projects was called the Institute for Regenerative Studies, located at the Spadra landfill of the Los Angeles Sanitation District. By recycling and self-sufficient living off the land, Lyle aims to show how Los Angeles County could eliminate the need for landfills (Thompson 1991).

Landfill End-Use Planning

Cities around the world have capped landfills that have reached the end of their useful life and no longer have the capacity to handle more solid waste. As these landfills close, the potential for reuse of the landscape for other activities is realized. Some appropriate uses identified by the U.S. EPA and the U.K. Environment Agency include open green space, agriculture, nature conservation, recreation, woodland restoration, and light construction (Brunner and Keller 1972; U.K. Environment Agency 2004). Many factors come into consideration when determining appropriate end uses for reclaimed landfill sites, and in order to successfully reclaim these facilities, planners should know what the proposed use will be before they begin the work (Brunner and Keller 1972). Some end uses under inquiry in this study include wildlife habitat restoration, open space, passive recreation, active recreation, environmental education, industrial (with limitations), alternative energy generation, large-scale land art and combinations of these various uses. Expert visual resource analysis will be used in this study to help inform the
planning process and to help identify appropriate end uses for the Logan City/Cache County landfill.

**Visual Resource Analysis**

Numerous systems exist for the analysis of visual resources. Many of these systems reside within federal government agencies due to mandates outlined in the National Environmental Policy Act of 1969 (NEPA) (U.S. Congress 1970). However, relatively few local jurisdictions are required to analyze the visual impacts of proposed projects. In the landscape, a visual resource refers to the “consistently definable appearance of the landscape and may be described by the measurable visual elements; topography, water, vegetation, sky, human/animals, structures and the pattern of interacting among these elements” (Smardon, Palmer, and Felleman 1986). Several systems for analyzing visual resources have been developed by federal government agencies, regional jurisdictions, and private practitioners. NEPA set in place a requirement for all projects that receive federal funding to undergo an environmental analysis. Because of this, some federal agencies have developed systems for land inventory that include the assessment of visual resources. The USDI Bureau of Land Management Visual Resource Management (VRM) system identifies landscape visual resources and uses ranking and other systems to evaluate these resources and changes to them. From this initial identification and evaluation, various management classes are established and incorporated into resource management plans (U.S.D.I. 1986). These systems, methods and objectives are intended to assist planners and designers in
protecting and managing visual resources for specific projects on large-scale landscapes and therefore are applicable to this research. Furthermore, these systems establish a set of tools to evaluate visual impacts of proposed projects by following a series of steps.

The BLM VRM system “provides a means: to identify visual values; to establish objectives through the RMP [Resource Management Plan] process for managing these values; and to provide timely inputs into proposed surface disturbing projects to ensure that these objectives are met” (U.S.D.I. 1986). The steps in this process include:

1. Describe characteristic landscape
2. Scenic quality evaluation (H-M-L)
3. Sensitivity level analysis
4. Establish distance zones
5. Designate visual resource classes and objectives
6. Project-specific contrast rating
7. Obtain project description
8. Identify VRM objectives
9. Select key observation points (KOPs)
10. Prepare visual simulations
11. Complete the contrast rating (Form, Line, Color, Texture, Scale, Spatial Characteristics)

Some components of the US Department of Transportation Visual Impact Assessment for Highway Projects system have application for landfill end-use planning
for landfills located in the viewshed of highway travelers (U.S. DOT 1981). The
following steps are often used for conducting a visual analysis with this system:

1. Define the visual environment
2. Identify key views
3. Analyze existing visual resources, viewers, and viewer response
4. Depict the visual appearance of project alternatives
5. Assess the visual impacts of project alternatives
6. Determine ways to mitigate adverse visual impacts

The continued application of visual analysis methods has resulted in the
development of many tools that can aid in the examination of visual impacts. Visual
simulation is one tool that has been widely used in depicting and examining the visual
appearance of project alternatives. Visual simulations can range from hand-rendered
illustrations to highly realistic modified photos and computer models. Visual simulations
can be used as a design tool, an analytical tool, an informational device, or as
that visual simulations "provide hard basis for making evaluations, which is
advantageous where objective evaluation is critical in conflict situations, or where project
alternatives need to be systematically compared." Visual simulations give planners and
designers the opportunity to examine the outcome of proposed designs at various points
in time and in context with the surrounding landscape. For example, the Gregory Canyon
landfill in Pala, California made use of visual simulations to study impacts associated
with the proposed landfill and to help identify appropriate slopes, vegetation, massing,
and placement of structures (Hanna 1999).
Viewshed and visibility mapping are also valuable tools in conducting a visual resource analysis. Sophisticated geographic information system (GIS) computer technology combined with digital elevation model (DEM) data can be used to show areas of the landscape visible from a point, area, or corridor. This technique has been used successfully in many studies, including Medina’s analysis (2002) of alternative landfill sites for Cache County and for several projects described in Hanna’s book (1999).

Summary

Landfill closure and end-use planning involve complex and significant issues of concern to the public and the agencies that manage these operations. Good planning and design, including the careful exploration of alternatives and attention to the management of visual resources, is critical to achieving success in landfill closure planning and management.
CHAPTER 3
METHODOLOGY

Major Elements

The methodology of this research included five major elements:

1. Research and identification of an appropriate landfill planning process
2. Identification and basic feasibility assessment of alternative end uses
3. GIS data-based site inventory and analysis
4. Visual analysis of current closure plan and preferred end use
5. Development of timetable for landfill closure and preferred end-use planning

Research and Identification of an Appropriate Landfill Planning Process

Literature review revealed a dearth of case studies and published planning processes specific to landfill end-use planning. Although there are many proven methods and systems for land planning (community, regional, etc.), few are designed for specific land uses such as landfill siting and closure (one notable exception being surface mine planning, for which there are many case studies and planning processes).

The process found to be most specific to landfill planning, comprehensive, and accepted for integration into the procedures of a major planning agency is *Capping and Restoration of Landfills: Annex E: Designing the Restoration Scheme* 2004. This process
was designed for the UK Environment Agency by a private consulting firm, SLR Consulting, in England (see Appendix A). Briefly, the strength of this process lies in its attention to the value of multidisciplinary teams, a strong and intricately detailed design process, and requirement for careful study of a variety of potential end uses and their design criteria. The researchers believe this is the most appropriate landfill end-use planning process for the Logan City/Cache County landfill.

Identification and Basic Feasibility Assessment of Alternative End Uses

The identification of potential alternative end uses resulted from literature review (see previous discussion) and interviews with experts. Potential end uses discovered through literature review to have been successfully implemented on other landfills were then discussed with the experts as to their potential for the Logan City/Cache County landfill. These included the following:

- residential housing
- industrial methane gas harvesting
- open space
- passive recreation
- active recreation
- land art (large-scale)
- land art (temporary installations)
- wildlife habitat establishment/conservation/observation
- mitigation wetlands (as proposed for development along 1000 West)
community environmental education center

The team of experts consulted included Mr. Issa Hamud, P.E., director of Environmental Health, Logan City; Dr. Ryan DuPont, head of Civil and Environmental Engineering at Utah State University; John C. Ellsworth, FASLA, professor of Landscape Architecture and Environmental Planning at Utah State University; and David Bell, Extension landscape architect at Utah State University. In summary, the following recommendations were reached by consensus of the team.

Residential housing: Unsuitable for this end use due to the instability of the material for foundation construction (differential settling), and a perceived reluctance on the part of the community to accept this type of use.

Industrial methane gas harvesting: Unsuitable for this end use due to the landfill’s relatively small size and therefore low economically viability. The required monitoring of methane gas may prove otherwise, but for now, this end use is not recommended.

Demonstration harvesting for environmental education is suitable.

Open space: Suitable for this end use due to its location on the periphery of the rapidly growing west side of town where the need for open space is likely to increase over time and the minimal construction challenges.

Passive recreation: Suitable for this end use for the same reasons as “open space” (above).

Active recreation: Suitable for this end use for the same reasons as “open space” (above).

Land art (large-scale): Suitable for this end use for the same reasons as “open space” (above).
Land art (temporary installations): Suitable for this end use for the same reasons as "open space" (above).

Wildlife habitat establishment/conservation/observation: Suitable for this end use for the same reasons as "open space" (above) and the potential of the site to support carefully designed floral and faunal communities.

Mitigation wetlands: Suitable for this end use for the same reasons as wildlife habitat establishment/conservation/observation (above).

Community environmental education center: Suitable for this end use for the same reasons as "open space" (above), provided that structures are designed with minimal foundation bearing capacity requirements.

Combination of the above: This could include two or more of: open space, active/passive recreation, land art (large-scale and temporary), wildlife habitat establishment/conservation/observation, mitigation wetlands, and community environmental education center.

Preferred Alternative End Use

Careful analysis of the site (including not only the landfill, constructed wetlands, and sewage lagoons, but also potential mitigation wetlands, existing effluent polishing wetland (EPW), and existing railroad grade near the lagoons) reveals a unique potential for the environmental education center (EEC) to incorporate most, if not all, of the uses listed under "combination of the above." With the additional consideration of the existing Cutler reservoir, a comprehensive and multifaceted environmental education
center complex is envisioned. A detailed description of the potential advantages of the EEC can be found in Chapter V. The best functional relationships of such a complex were determined through the development of an "Ideal Schematic Diagram" (see Figure 3.1). After the basic design criteria for each element of the complex are determined, a "Site-Related Conceptual Plan" can be developed (see Chapter V).
Figure 3.1. Ideal schematic diagram.
Several area government agencies were contacted in order to gather existing mapped data of the natural, cultural, and political resources of the study area. These included Logan City community development department, Logan City GIS department, Bear River Association of Governments, Cache County, State of Utah Automated Geographic Reference Center, and Utah State University. The following digital data was included:

- Digital elevation model data at 10-meter resolution
- NED elevation data set
- Aerial photography (grayscale and color; Cache County)
- High-resolution aerial photography for the site
- Vegetation for Cache County
- Logan City and Cache County parcel information
- City political boundaries
- Water bodies; streams and rivers, for Cache County
- City of Logan road centerlines
- Logan City future development map (analog not digital)
- Topography of Logan City at 2’ contour interval
- Logan City grid dataset at 1 meter
- Building footprints – Logan City and unincorporated county to west
- Canals in Logan City
- City limits for all incorporated areas in Cache County
• Floodplains for Cache County (Federal Emergency Management Agency)
• Liquefaction for Cache County
• Wetlands for Cache County
• Water table for Logan City
• Aerial imagery from the NAIP (National Agriculture Imagery Program)
• Annexation boundaries for Logan City
• Rivers for Cache County
• Sewer mains and laterals for Logan City
• Water mains and laterals for Logan City

The data were used for two purposes: first, to determine the areas of the valley from which the landfill could be seen at different points in time and at different heights (viewshed/visibility mapping); and second, to determine if there were any obvious factors limiting the development of the preferred alternative end use (EEC). A base map of the project area, including the locations of the various EEC elements, was also generated.

A series of viewshed/visibility maps were generated of the county (see Appendix B; further discussion in Chapter 4). The viewshed/visibility maps make it possible to identify areas currently visible from the landfill (e.g. homes, workplaces, travel corridors, etc.), and similar areas at future times when the landfill crest is higher. These maps also assisted the researchers in identifying key observation points (KOPs).
Visual Resource Analysis

Although the preferred planning process (U.K. Environment Agency 2004) recognizes the importance of a thorough visual analysis in landfill end-use planning, no specific approach is designated. The Bureau of Land Management (BLM) Visual Resource Management program, designed to address specific projects on large-scale landscapes, can be applied to landfill end-use planning. The Federal Highway Administration (FHWA) Visual Impact Assessment Procedures for Highway Projects is also useful given the close proximity of the various EEC elements to US Highway 30. Therefore, a “hybrid” visual analysis process was developed, incorporating the most salient and applicable aspects of these two visual resource analysis systems. This “hybrid” process is described in greater detail in the next chapter.

Establish a Timeline for Existing Landfill Closure and Preferred End-Use Design and Planning

Using the preferred landfill end-use planning process identified above (UK Environment Agency 2004), the major tasks associated with landfill end-use planning were scheduled for a reasonable period of time in the future. A schedule of recommended actions is given in Chapter 5.
CHAPTER 4
VISUAL ANALYSIS

Hybrid Visual Analysis Process

The visual analysis process implemented in this study is a hybrid of the BLM Visual Resource Management system and the FHWA Visual Impact Assessment Procedures for Highways system. There are eight steps in this process:

1. Describe and inventory the existing visual environment (characteristic landscape)
2. Analyze existing visual resources
3. Analyze viewshed/visibility of landfill at various future heights from points, areas, and corridors in the County
4. Establish key observation points
5. Depict visual appearance of proposed end uses (visual simulations)
6. Assess and compare visual contrast of proposed end uses
7. Determine degree of acceptable visual change (tipping point)
8. Confirm/deny higher visual acceptability of preferred end uses

Height and Time Reference Standards
Used in This Research

- Existing height currently, above natural grade (approximate): 80’ (24.4 meters)
- Full height above natural grade, as projected under current closure plan: 160’ (48.8 meters)
• Interim heights as percentages of current closure plan projected full height (for closure study purposes in this research):

  50% of projected full height: 80' (24.4 meters) (current baseline)
  60% of projected full height: 96' (29.3 meters)
  75% of projected full height: 120' (36.6 meters)
  100% of projected full height: 160' (48.8 meters)

**Anticipated Influence of Recycling and Solid Waste Minimization**

With increased reliance on recycling and other solid waste-minimization techniques in conjunction with the proposed transfer station and application of the latest techniques for conserving landfill storage space, the following relationships of landfill height to time are assumed:

• 50% height – current condition
• 60% height – 5-10 years
• 75% height – 10-15 years
• 100% height – 15+ years

**Visual Change “Tipping Point” Standard**

This research employed the “contrast rating” analysis method common to many visual resource analysis processes, most notably the USDI Bureau of Land Management Visual Resource Management program. This analysis utilizes photo-realistic visual
simulations (developed from KOPs, identified and established through field investigations by professional experts) to evaluate the degree of visual contrast and change between existing characteristic landscape and proposed future conditions in terms of changes in form, line, color, texture, scale, and spatial characteristics. In this research, the novel concept of visual change “tipping point” (Ellsworth 2005) was used to indicate the point in time when the cumulative visual contrast / change of these six factors would likely become unacceptable. Avoidance of this visual change tipping point, by stopping the proposed activity prior to that point in time or with visual mitigation such as adopting another future condition plan, becomes the goal of the visual resource management of the area.

*Step 1: Describe and Inventory the Existing Visual Environment (Characteristic Landscape)*

Study Area in General

Cache Valley, Utah is located in northern Utah and southeast Idaho approximately 80 miles northeast of Salt Lake City and 20 miles from the Idaho-Utah border. It is approximately 60 miles long and 15 miles wide. It is on the edge of the Rocky Mountain and Great Basin physiographic provinces. Cache Valley abounds in natural scenic beauty and outdoor recreation opportunities.

The elevations of the valley floor to the old Lake Bonneville benches ranges from about 4,400 to 4,700 feet above sea level. The land area of Cache County is 1,173.07 square miles (1,164.52 land; 8.56 water) and of Logan City is 16.78 square miles. The valley is bordered by the Bear River mountain range on the east and the Wellsville range
on the west. The highest point is Naomi Peak at 9,980 feet and the lowest community is Mendon City at 4,435 feet. The area has a four-season climate with cold winters. Cache County’s normal maximum temperature is 59.9 F, minimum is 32.9 F. Normal annual precipitation is 16.58 inches, and normal snowfall is 25.4 inches. The 2003 population of Logan was 45,626 and Cache County’s population was 98,176 (Logan Library 2005).

Characteristic Landscape Description

Cache Valley’s characteristic landscape was described and inventoried according to BLM VRM guidelines:

“The character of a landscape is the overall impression created by its unique combination of visual features (such as land, vegetation, water, and structures) as seen in terms of form, line, color, and texture. The visual arrangement of land including rock forms, water and vegetation is referred to as the characteristic landscape. It is the abundance and variety of these elements viewed in terms of the forms, lines, colors, and textures present in the landscape that create diversity.” (USDI BLM n.d.).

The overall visual impression of Cache Valley is a broad, well-contained high mountain valley surrounded by abrupt and impressive mountains. The valley floor appears relatively flat when observed from locations within it (observer inferior to normal), however, the slope downhill from the mountain benches becomes visually apparent when observed from those benches or higher points on the mountainsides and crests.

Landform

The view of the land is large scale and dramatic overall, yet intimate when seen from lower elevation positions. There is a great diversity of landform (‘flat’ valley floor to gently sloping benches to steep mountain sides). The line of the land is most strongly
represented in the distinct horizons of the high mountain crests, ridges, and valleys.

Color in the land can be seen in areas of disturbance (such as sand and gravel mining operations), exposed rock and cliffs, and soil along stream banks. Texture in the land ranges from fine to coarse, or from sand to jagged cliffs.

Vegetation

The vegetation form varies from low, rolling grasslands and agricultural areas to pockets of natural and human-introduced shrub and scrublands, to a wide variety of forms of trees (individual and in associations). Vegetation expresses line in the vertical, diagonal, and horizontal branching patterns (shrubs and trees), as well as continuous lines of associations of vegetation, especially trees, along streams, fences, borders of agricultural areas, and community streets. Color of vegetation is highly variable and seasonal, expressed in grasses, groundcovers, shrubs, and trees. Few colors are not represented. Texture of vegetation is also highly variable and seasonal, expressed in all vegetative types, and ranges from fine to coarse.

Water

Form of water is most prominently expressed as streams and rivers, some reservoirs, and wetlands both natural and human-made (the most visually impressive being Cutler reservoir in the lower elevations of the valley floor). Line is exhibited by water in streams, reservoir edges and shorelines, and the intricate, discontinuous, and indistinct lines of wetland edges. Color of water is highly variable (and seasonal especially during winter freeze), ranging from deep blues to greens to near whites when
the sun is reflecting from it. Texture of the water is also highly variable, from smooth-as-glass reservoir surfaces to cascading rapids on some area rivers.

Structures - Buildings

Structures in Cache Valley are most apparent in the towns and cities, but also in the rural countryside areas. Buildings in towns are, for the most part, one or two stories (there are very few buildings over three stories, with the tallest in downtown Logan being only four stories, and another building at nine stories on the USU campus). The forms of buildings, therefore, tend to be low and horizontal or “blocky.” Buildings in the more rural areas are almost exclusively single story with a few two-story homes. Building lines are generally horizontal and vertical, with few diagonals. There is a range of colors, although white, browns, tans, and reds (brick) are most common. Textures are generally fine to medium.

Structures – Other

Other notable structures include roads and highways, fence lines, and utility lines. The forms of these structures range from low and horizontal (roads) to tall and slender (fence and utility lines). Line expression is horizontal, diagonal, curving, and intersecting for roads, and vertical, short to tall, and distinct for fence and utility lines (the actual cables of utility “lines” are horizontal to curving). The most common colors of these structures are gray and black (road surfaces), browns and grays (fence lines), and gray to silver (utility lines). Textures are considered fine when assessed for individual roads, fence lines, or utility lines, and can be medium to coarse when fence lines or utility lines are viewed as continuous lines of elements in the landscape.
Scale and Spatial Character

Special and unique visual features include the pleasing spatial proportions and sense of enclosure created by the relationship of the valley width to mountain ranges' heights, abrupt and steep mountainsides, and visual diversity and complexity within an overall appearance of geographic orderliness (see Figure 4.1). There is a clear and easily understood sense of scale, with views of the entire geographic extent due to the ability to see the valley essentially “all at once” from almost any point in the valley, on the benches, or from the mountains. These scale and spatial characteristics of Cache Valley are critical to its visual character, uniqueness, and extremely high degree of visual cohesiveness, integrity, intactness, vividness, unity, and resulting outstanding scenic

Figure 4.1. Cache Valley visual complexity spectrum.
beauty (cf. USDOT 1981 for definitions). This arrangement of the land, water, vegetation, and human use (urban, suburban, rural, countryside) is visually stunning yet intimately sublime. Cache Valley is, as novelist Thomas Wolfe said, "the most lovely and enchanted valley I have ever seen, a valley that makes all that has gone before fade as nothing." (Utah State University nd).

*Step 2: Analyze Existing Visual Resources*

In the BLM VRM process, this step organizes and analyzes the visual elements of the landscape based upon the BLM rating criteria and scoring system in order to determine visual resource inventory and management classes. This step also establishes the viewer visual sensitivity levels for the visual resources of the landscape, considered very important in evaluation of proposed alternatives (Smardon, Palmer, and Felleman 1986).

The VRM process uses three factors in the analysis of the existing visual resources: distance zones (foreground FG, middleground MG, background BG); viewer sensitivity levels (high, medium, low based on viewer characteristics such as number of viewers, frequency of view, length of time viewed, viewer position in the landscape, and others); and scenic quality (high, medium, or low based on the evaluation of seven factors: landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modifications). This evaluation is necessary when a large-scale landscape may be subject to unpredictable changes in the visual resources from one or many specific projects, especially when the specific location may be flexible.
For this research, with the project site in place, some modifications to this step in the VRM process are in order. The viewing distance zones are all present (FG, MG, BG). Expert field observation and inspection of the site from near and far points within Cache Valley determined that the border between FG and MG zones is generally difficult to distinguish in the visual perception of the viewer, therefore these two distance zones (FG, MG) were combined in the analysis. Foreground/middleground are considered to be from zero to three-to-five miles, with background continuing to the visible horizon. Viewer sensitivity levels are most often determined by expert analysis of existing information, often gleaned from public meetings, published reports, and general consensus as expressed by local opinion expressed in publications, marketing materials, etc. (e.g. Utah State University nd). Based on such sources, the viewer sensitivity level for Cache Valley is determined to be high. The scenic quality evaluation is based on the overall appearance of the characteristic landscape of Cache Valley (as described above). Therefore, the scenic quality rating is considered high.

*Step 3: Analyze Viewshed/Visibility of Landfill at Various Future Heights from Points, Areas, and Corridors in the County*

This analysis utilizes sophisticated GIS mapping technology to reveal, in plan view, landscape points and areas visible from specific locations, and vice versa specific locations visible from landscape points and areas. For the purposes of this study, the mapping process identified surrounding lands visible from future landfill elevations for specific elevations above natural grade:
• 50% of projected closure height: 80' (24.4 meters) (currently; this study’s baseline)
• 60% of projected closure height: 96' (29.3 meters)
• 75% of projected closure height: 120’ (36.6 meters)
• 100% of projected closure height: 160’ (48.8 meters)

Therefore, people occupying these visible lands can also see the landfill, at the elevation specified, from those lands and thereby determine if they would see the landfill in the future from their home, workplace, travel route or other location. Results of this mapping analysis applied to the existing landfill site indicate only minor differences in visible extent of the surrounding Cache Valley landscape as the projected final height increases from 60% to 75% to 100% closure height. (Note: the 10-meter DEM data used, although considered relatively high resolution in these kinds of studies, does not result in exact mapping when there are moderate variations in final closure heights as in this research.)

Also, the digital elevation models do not account for vegetation, a potentially limiting factor in determining visibility. Therefore, this mapping is of limited value in the determination of the visual change tipping point because there is limited differentiation of “visible” versus “not visible” areas surrounding the landfill. Greater differentiation of these areas of visibility would have meant greater value could be ascribed to observer characteristics (described above) as factors in determining the visual change tipping point. The establishment of KOPs as described below was a more valuable visibility analysis factor than the viewshed/visibility mapping. However, the viewshed/visibility mapping analysis is highly valuable and useful for:
• identifying currently visible areas (homes, workplaces, travel corridors, etc.)
• identifying future visible areas (homes, workplaces, travel corridors, etc.) (cf. Logan City’s future land-use map)

• assisting the researchers in the selection of KOPs

• correlating with observer distance (designating radiating distance “rings”)

Step 4: Establish Key Observation Points

Key observation points are those points in the landscape that are the most useful in conducting a visual resource analysis of a specific proposed project or landscape change. KOPs for this project were selected based on numbers of viewers, frequency of view, length of view, location of view along popular travel corridors, and gathering places (i.e. the USU campus, Logan LDS Temple, others). Twenty-six initial KOPs were identified (#s 1-26), occupied, and field checked, and photographs were taken of the landfill from each. Seventeen were considered FG/MG (#s 3, 4, 5, 8, 9, 10, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25) while nine were considered background (#s 1, 2, 6, 7, 11, 12, 13, 14, 26). Nine of the 26 were selected for “massing studies” involving sophisticated and highly accurate computer graphic wire-frame renditions of the mass of the landfill at future points in time (#s 4, 5, 9, 13, 15, 17, 19, 20, 24; see Appendix C). Four of these ten (#s 17, 19, 20, 24) were determined to be valuable for further analysis including photo-realistic visual simulation and contrast rating (see below).
Step 5: Depict Visual Appearance of Proposed End Uses (Visual Simulations)

Visual simulations are a common and widely used tool for representing future landscape change in a fashion understandable to anyone (Ellsworth 2001; Ellsworth, Medina, and Hamud 2005; Medina 2002; Sheppard 1989). The visual simulations for this research (see Appendix D) were carefully developed from four of the established KOPs (#s 17, 19, 20, 24) and represented four periods in time and associated heights (see step 3 above and discussion below). Three were panoramic (displayed more of the landscape than visible from an observer’s normal, non-scanning perspective) while one was normal non-scanning perspective (#20).

Once the KOPs were established, the visual simulation process involved two steps: first, initial site photography of existing conditions and of other sites where similar end uses have been completed; and second, the computer-assisted alteration of the images to produce visual simulations. Initial site photography involved capturing several digital images from the four selected KOPs, as well as many images of Cache Valley landscapes, to capture appropriate visual examples of landform, vegetation, water, and structures for use in the completion of the visual simulations. Images from each KOP and area landscapes were taken within a two-day time period (October 2 and 3, 2004) at midday in order to minimize the effects of seasonal change and shadows variance. Accurate and complete notes were recorded on all field photography.

The series of visual simulations were created from each KOP using a combination of computer software, including @Last Software® SketchUp ®, Autodesk ® Land
Development Desktop ® 2005, Arc GIS ® 8.0, and Adobe Photoshop ® CS. Each
series of visual simulations depicted the landfill at closure as currently planned, and the
preferred alternative end use (EEC), at three preclosure time periods (60%, 75%, 100% of
planned final height, see #3 above). Standard methods were applied and documented to
achieve a high degree of visual simulation accuracy and eliminate bias.

Step 6: Assess and Compare Visual Change,
Including Contrast of Proposed End Uses

After completion of the visual simulations, expert analysis was applied to each of
the two end uses for the heights specified through the use of a four-step analysis: first, the
BLM VRM “contrast rating” system worksheets; second, professional analysis of any
change in scale; third, professional analysis of any change in spatial character; and
finally, professional analysis of the combined effect of these three factors in relationship
to the visual change tipping point. Based on the characteristic landscape description of
Cache Valley, scale and spatial characteristics were considered of equal importance as
VRM contrast rating. Therefore, the determination of whether or not the visual change
tipping point was reached (as well as when and for which of the two end uses studied)
was made based on equal professional consideration of these three factors.

VRM Contrast Ratings

The VRM contrast ratings facilitated effective evaluation of the level of contrast
(none, weak, moderate, strong) from the existing landscape to the proposed end uses by
analyzing certain criteria (landform, vegetation/water, structures) in terms of form, line,
color, and texture. The researchers, acting as a team, applied the contrast rating analysis to the photographic images of the existing condition and to the visual simulation (from each KOP; see Appendix E), an accepted and standard practice in BLM VRM contrast rating (USDI BLM nd). It should be noted that all four KOPs were within the FG/MG distance zones.

Planned End Use Contrast Rating Analysis
Results Within the Foreground/
Middleground Distance Zones

- Noticeable but acceptable visual contrast at 60% of closure height
- Significant and unacceptable visual contrast at 75% of closure height
- Dominant and unacceptable visual contrast at 100% of closure height

EEC Alternative End Use Contrast Rating Analysis
Results Within the Foreground/
Middleground Distance Zones

- Weak but acceptable visual contrast at 60% of closure height
- Noticeable but acceptable visual contrast at 75% of closure height
- Visually prominent but acceptable visual contrast at 100% of closure height

Scale

Scale can be defined as the relationship of an object to its surroundings (U.S.D.I. BLM 1986) and should not be confused with size (the unchanging dimensions of an object or area in terms of form and mass). The analysis of scale was determined based on the researchers’ evaluation of the change in the perceived relationship of observer to landfill as the landfill height and mass increases over time. The major concern regarding
“scale” on the landfill project is whether or not the change in scale will result in the observer perceiving the increased landfill heights as too “large” (or, “out of scale”) in relationship to observer position on the broad and relatively flat Cache Valley floor.

Planned End Use Scale Analysis Results Within the Foreground/Middleground Distance Zones

- Noticeable but acceptable change in scale at 60% of closure height
- Significant and unacceptable change in scale at 75% of closure height
- Dominant and unacceptable change in scale at 100% of closure height

Planned End Use Scale Analysis Results Within the Background Distance Zone

- Weak but acceptable change in scale at 60% of closure height
- Noticeable but acceptable change in scale at 75% of closure height
- Noticeable and unacceptable change in scale at 100% of closure height

EEC Alternative End Use Scale Analysis Results Within the Foreground/Middleground Distance Zones

- Weak but acceptable change in scale at 60% of closure height
- Noticeable but acceptable change in scale at 75% of closure height
- Significant and unacceptable change in scale at 100% of closure height

EEC Alternative End Use Scale Analysis Results Within the Background Distance Zone

- Not noticeable and acceptable change in scale at 60% of closure height
• Somewhat noticeable but acceptable change in scale at 75% of closure height

Spatial Characteristics

Spatial characteristics are expressed in the visual perception and interpretation of the horizontal and vertical spaces contained within a landscape by its landform, vegetation, water, and structures (see description of Cache Valley characteristic landscape above). Several factors contribute to landscape spatial character including extent, degree of containment, as well as definition, orientation, flow, and enclosure (Booth 1983). The analysis of spatial characteristics was determined based on the researchers’ evaluation of the change in these factors as the landfill height and mass increases over time. The major spatial character concerns on the landfill project are: first, the extent to which the landfill will obscure views of the surrounding mountains to travelers on the adjacent roads and highways; and second (and related) whether or not the change in spatial character will result in the degradation of the observer’s visually perceived understanding of his or her position in the landscape in relationship to the broad Cache Valley landscape, which is visible from almost everywhere in the valley (see discussion of viewshed/visibility mapping above).

Planned End Use Spatial Characteristics Analysis
Result Within the Foreground/
Middleground Distance Zones

• Noticeable but acceptable change in spatial character at 60% of closure height

• Significant and unacceptable change in spatial character at 75% of closure height

• Significant and unacceptable change in spatial character at 100% of closure height
Planned End Use Spatial Characteristics Analysis Result Within the Background Distance Zone

- Weak but acceptable change in spatial character at 60% of closure height
- Noticeable but acceptable change in spatial character at 75% of closure height
- Noticeable but acceptable change in spatial character at 100% of closure height

EEC Alternative End Use Spatial Characteristics Analysis Results Within the Foreground/Middleground Distance Zones

- Weak but acceptable change in scale at 60% of closure height
- Noticeable but acceptable change in scale at 75% of closure height
- Significant and unacceptable change in scale at 100% of closure height

EEC Alternative End Use Spatial Characteristics Analysis Results Within the Background Distance Zone

- Not noticeable and acceptable change in scale at 60% of closure height
- Somewhat noticeable but acceptable change in scale at 75% of closure height
- Noticeable but acceptable change in scale at 100% of closure height

Step 7: Determine Degree of Acceptable Visual Change Tipping Point for Each Alternative End Use

As mentioned, the three factors of VRM contrast rating, change in scale, and change in spatial character were considered equally in determining acceptable visual change (tipping point). Additionally, FG/MG distance zones were considered more visually sensitive than the BG zone. Therefore, FG/MG results were given more weight
when similar to the BG results. The results of the aforementioned analysis can be
summarized as follows:

Planned End Use Visual Change Tipping Point Analysis Results

- Visual contrast: unacceptable at 60% height
- Scale change: unacceptable at 75% height
- Spatial character change: unacceptable at 75% height
- Visual change tipping point for the planned end use is between 60% and 75% of
  proposed full closure height.

EEC Alternative End Use Visual Change Tipping Point Analysis Results

- Visual contrast: acceptable at 100% height
- Scale change: unacceptable at 100% height
- Spatial character change: unacceptable at 100% height
- Visual change tipping point for the EEC alternative end use is between 75% and 100%
  of proposed full closure height

*Step 8: Confirm/Deny Higher Visual Acceptability of Preferred End Use*

The comparison of the existing closure plan and the Environmental Education
Center alternative end use has been performed to determine the level of acceptability of
the Preferred End Use. The Environmental Education Center is significantly more
visually acceptable in all analysis categories and at all heights than the currently
planned end use and therefore confirms the acceptability of the Environmental Education
Center as the Preferred End Use.
CHAPTER 5
CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Based on the research analysis and results reported here, the following conclusions are supported:

• The Logan landfill will reach full capacity, as planned, in less than 20 years
• There is a need to plan for the appropriate end use of this facility
• There is an excellent landfill planning process appropriate to this need
• Several alternative end uses have been implemented on landfills nationally and internationally – several of these are suitable for the Logan landfill
• There is a visually preferable alternative (the Environmental Education Center) to the currently planned end use
• The EEC, with surrounding facilities, presents additional highly desirable opportunity to the currently planned end use

Recommendations

Based on the research conclusions stated above, the following recommendations are set forth.

Recommendation #1

Accept and prepare to implement the planning and design process (with modifications) identified in this research (i.e., “designing the restoration scheme”) (U.K.
Environment Agency 2004). Literature review and analysis suggests this planning and design process (see attached), with some modifications for local conditions, would serve Logan City and Cache County well in planning for closure of the existing sanitary solid-waste landfill. The major steps in the process are enumerated in recommendation #6 below.

Recommendation #2

Abandon the currently planned end use (basic, pyramidal landform 160’ above natural grade, with uniform slopes and minimum revegetation): the visual change tipping point occurs between 60% and 75% of proposed full closure height (160’). Therefore, the current plan to proceed with operations to 160’ above natural grade presents unacceptable visual change and should be abandoned. An alternative to recommendation #2 is to implement current closure plan (in terms of basic landform, slope gradients, and revegetation) before landfill height reaches 60% of projected final height (estimated in five to ten years, see above).

Recommendation #3

Adopt the “Environmental Education Center,” described herein as the preferred end use. Develop the preferred alternative end use described as the Environmental Education Center (EEC): the visual change tipping point occurs between 75% and 100% of proposed full closure height (160’). Compared to the planned end use, this alternative delays reaching the visual change tipping point to 10-15 years (75% height or 120’; 40’ higher than current); and with careful design, possibly extends the delay to more than 15 years (100% height or 160’; 80’ higher than current). The most significant advantages to
selecting the environmental education center complex as the preferred end use include
the following:

• Economically feasible especially in terms of initial investment (low)
• Few construction challenges with low bearing capacity requirement structures
• Flexible design: trails, structures, interpretive and art exhibits easily and inexpensively changed
• Uses can be maintained while methane gas monitoring is underway (indeed, this monitoring can be a subject of interpretation)
• Addresses general concern of local residents for open space on the west side of Logan City
• Proximity to existing landscapes with environmental education potential (EPW, Cutler reservoir, existing railroad grade)
• Great diversity of wildlife, especially avian, in close proximity
• Visual prominence of the landfill, unavoidable regardless of end use, can be an advantage in “identifying” the EEC to city and county residents as well as visitors
• Visual prominence of the EEC would constitute a positive and significant “gateway experience” for travelers approaching Logan from the west on highway 30
• The potential to “tie in” with the city recreation master plan as well as Cutler reservoir presents an opportunity for a synergistic increase in the environmental education and recreation potential of all components of the EEC
• The current landfill siting process of finding a new site post-closure of the existing facility has made the public more aware of solid waste management and related environmental issues therefore the EEC would capitalize on this
The EEC would facilitate and support:

- education about, and interpretation of natural systems and related human management activities in the study area
- active and passive recreation
- wildlife habitat establishment/conservation/observation
- temporary art installations
- methane gas monitoring (required) and demonstration harvesting (educational)

The key factor to the success of the environmental education center concept is to visually and physically link the various facilities that would comprise the EEC through the use of designated trail, rail, and vehicular systems (including trail interpretive stations and exhibits), wildlife viewing stations, maps and other information materials, and other means. The various linked facilities include:

- landfill
- constructed wetlands
- mitigation wetlands
- sewage lagoons
- effluent polishing wetlands
- existing rail, pedestrian, bicycle, and vehicular travel routes
- Cutler reservoir recreation opportunities (canoe trails, bird watching, etc.)
- other hiking, biking, cross-country skiing trails opportunities
- city recreation master plan recommendations

Perhaps the greatest opportunity to forming and reinforcing this visual and physical link in the minds and “cognitive maps” of the citizens and visitors is careful
placement of pavilion-style observation and interpretation structures (two are recommended) just below the two highest points of the redesigned EEC landfill. The opportunities for panoramic views of Cache Valley and the various facilities comprising the EEC would be unique from the middle of Cache Valley.

Another strong potential is providing a discovery educational experience, especially for young visitors. This can take many forms, such as twists and turns in interpretive trails that reveal then conceal interesting or informative features, and spontaneous experience of wildlife and their habitat. This spontaneous use by young people has been found to be a very important aspect of early childhood experience (Yang 2004). These discovery experiences can be educational and intriguing for adults as well. For example, it would be possible to construct cut-away views at different elevations through the landfill, exhibiting the deposition of years of solid waste, its decomposition (or lack thereof), as well as provide a history lesson in the materials used by previous generations.

Studies related to the designation of greenways in Cache Valley have been conducted by the USU department of Landscape Architecture and Environmental Planning graduate program, and the Bear River Association of Governments has additional pertinent information. These resources should be thoroughly understood and additional research conducted. A landmark study on the visual resources of Cutler reservoir and associated wetlands will prove highly valuable to the planning of the EEC (Ellsworth 1982).

Given its more natural appearance, as well as the easily recognizable social and cultural values associated with it (education, recreation, personal and environmental
health), the Environmental Education Center should raise significantly fewer NIMBY objections than the currently planned end use. It also has potential as an intriguing and attractive gateway entry for travelers approaching Logan from the west on U.S. highway 30. A successfully designed and implemented EEC may provide the additional benefit of alleviating the some citizens’ anxiety about the end use of the new landfill. An alternative to recommendation #3 is to implement the EEC preferred alternative end use as described above as soon as possible (prior to 75% closure height), thereby assuring avoidance of the visual change tipping point, and providing the benefits of the EEC to citizens and visitors sooner.

*Basic Design Criteria for the EEC*

**General**

Slopes 3-30%; vary soil depths above cap for various vegetation within general soil depth guidelines of 60-90 cm or below freeze/thaw line (grasses - shallowest, shrubs - moderate, trees - deepest); cluster vegetation by natural associations; compose clusters with vegetation of various heights (lower protect taller from windthrow) yet with similar root depth requirements; specify species attractive to wildlife. Mow and prune woody plants to decrease root depth which allows for thinner soils; establish vegetative cover initially to provide erosion control and soil stabilization and proper medium for plant establishment (include legumes and nitrogen fixers); select appropriate plants (drought tolerance, low fertility demand, shallow root systems, pollution tolerance, high adaptability, and regional suitability) to lower maintenance costs; plan the design to allow for natural succession of floral and faunal communities in the future. Design landform to
Site-Related Conceptual Plan

Figure 5.1. Site-related conceptual plan.
reflect and mimic contours and forms of characteristic Cache Valley landscapes. Take
guidance on trails, interpretive displays, and built structures such as pavilions from the
US Forest “Built Environment Image Guide” (USDA Forest Service 2001) and similar
sources.

Pedestrian and Bicycle Routes

The EEC would incorporate a series of interpretive trails (pedestrian and bicycle)
with signs and displays, and opportunities for passive and light active recreation. Parking
would be provided at reasonable locations, as would accommodation for a solid waste
transfer station and recycling operation. The constructed wetlands, sewage lagoons,
EPW, and Cutler reservoir could be physically connected to the landfill by the pedestrian
and bicycling trails. These routes could also be tied into the City of Logan recreation
master plan system.

Wildlife Habitat Establishment/Conservation/Observation

Implement landscape ecology principles of patches, corridors, edges, and matrices
and avoid habitat fragmentation; install perching stations for birds; encourage
colonization by designing new habitat linking areas (patches, corridors) such as the
constructed and mitigation wetlands, Cutler Reservoir and the urban edge on the east side
of the landfill (encourage plant diversity to enhance and facilitate this process).

Sewage Lagoons

Provide wildlife viewing station/tower as has been proposed by Audubon; provide
perching stations for birds; provide learning/interpretive stations to explain: the role of the lagoons in the sewage treatment process and the importance for environmental health, alternative technologies, useful predicted lifetime of existing facility, and relationship to EPW; design to link with areas such as the constructed and mitigation wetlands, Cutler Reservoir and the urban edge on the east side of the landfill (encourage plant diversity to enhance and facilitate this process).

**Effluent Polishing Wetland (EPW)**

Provide wildlife viewing stations and areas as proposed by Audubon; provide perching stations for birds; provide learning/interpretation stations to explain: the role of the EPW in the sewage treatment process, alternative technologies, useful predicted lifetime of existing facility, and relationship to the lagoons; design to link with areas such as the constructed and mitigation wetlands, Cutler Reservoir and the urban edge on the east side of the landfill (encourage plant diversity to enhance and facilitate this process).

**Constructed Wetlands**

Provide wildlife viewing stations in conjunction with mitigation wetlands as proposed by Audubon; establish perching stations for birds; design for water retention (storm water and surface runoff); design to link with areas such as the constructed and mitigation wetlands, Cutler Reservoir and the urban edge on the east side of the landfill (encourage plant diversity to enhance and facilitate this process).
Existing Railroad Grade

Develop this as a linking corridor between sewage lagoons and EPW, to the extent possible and reasonable; consultation should take place with Cache County, Bear River Association of Governments, and other interested parties regarding eligibility for “rails to trails” or similar funding opportunities.

Recommendation #4

Close the existing landfill as soon as possible in order to minimize visual contrast as well as avoid the visual change tipping point. Assuming one or more of recommendations #2 and #3 (including alternates) are followed, closure of the existing landfill as soon as possible will facilitate said recommendation(s) and further assure avoidance of the visual change tipping point. This recommendation should be considered an enhancement to any of those recommendations.

Recommendation #5

Seek funding for the design, planning, and implementation of the Environmental Education Center (EEC). Establishing an EEC as described may be unique in the history of landfill rehabilitation design and planning. Literature search has revealed no examples of landfills converted to an “Environmental Education Center” complex incorporating ancillary facilities and opportunities such as those enumerated here. This could be a strong selling point for development funds.
There are federal, regional, state, and local funding sources for such an effort, most notably the US Environmental Protection Agency. It is strongly recommended research on funding opportunities begin as soon as possible.

Recommendation #6

Implement the following “action items” (incorporates major steps in UK process, see Recommendation #1 above):

- Present results of this study to Logan City Environmental Health department and TAC
- Present results of this study to the mayor
- Present results of this study to the Public and/or other interested parties
- Begin seeking funding for EEC design, planning, and implementation
- Continue seeking funding for EEC design, planning, and implementation
- Continue the landfill planning process (listed here are the major steps in the UK process, see recommendation #1 above), with goal of closing the existing facility prior to reaching the visual change tipping point or earlier if possible:
  - Assemble the multi-disciplinary design team:
    - Landscape architecture
    - Civil and geotechnical engineering
    - Hydrogeology and hydrology
    - Soil science
    - Gas and leachate engineering
    - Ecology
    - Acoustic Engineering
Sanitary Solid Waste Management

Gather base information required for the restoration design:

- Topographical survey. This should extend well beyond the site boundaries to allow for landform integration, (aerial survey techniques may reduce access problems). Photographs, both from the air and the ground, will assist in the interpretation of survey and map data

- Planning policy or Development Plan context

- Details of the category of waste which the site is to be designed to receive

- Access and services information

- Information from the Site Assessment process, particularly visual analysis

Continue seeking funding for EEC design, planning, and implementation

Proceed with the design process (continuation of major steps in UK process)

- Landform

- Restoration profile

- After-use

- Detailed design

- Phasing

- Interim landscape measures

Open the Environmental Education Center, including the following facilities:

- Landfill

- Constructed wetlands

- Mitigation wetlands

- Sewage lagoons
• Effluent polishing wetlands

• Existing railroad grade and other travel corridors

• Designate links to area recreation (Cutler reservoir, city recreation plan)
REFERENCES


APPENDIX A

Designing the Restoration Scheme
(U.K. Environment Agency 2004)
ANNEX E: DESIGNING THE RESTORATION SCHEME

Introduction

E1 This Annex is of particular relevance to the designer and emphasises the importance of a *multi-disciplinary team* in ensuring a holistic approach to restoration design.

E2 The Annex is not intended to give a *prescriptive* approach, but rather to demonstrate the wide range of factors, which influence restoration design. The designer should use these ideas to balance the requirements of the chosen after use with those of the engineered landfill.

E3 The advice contained in this Annex is relevant to the restoration design of new sites, and also closed or existing landfills where the design requires up-dating because of changing local needs or site conditions.

Assembling the Design Team

E4 The restoration design process requires input from many different professional backgrounds. The core design team skills may include:

- Landscape architecture;
- Civil and geotechnical engineering;
- Hydrogeology and hydrology;
- Soil science;
- Gas and leachate engineering;
- Ecology;
- Acoustic engineering.

The operator may have these skills in-house or may engage specialist consultants.

E5 The operator must also consider whether the Construction Design and Management (CDM) Regulations (1994) apply, in which case a Planning Supervisor (as defined under those Regulations) should be appointed. This could be a suitably qualified member of the project team, who would be given those responsibilities *at the design stage*. The Planning Supervisor would co-ordinate all health and safety issues through design, construction, restoration and aftercare.
The members of the project team should liaise to produce a design which integrates the engineering systems, landform and after-use to achieve:

- Effective pollution control;
- The most appropriate after-use and restoration design;
- Integration of the technical and aesthetic needs of the site.

Base Information Required for the Restoration Design

Before the design process commences it is essential that the following base information is reviewed by the design team:

- Topographical survey. This should extend well beyond the site boundaries to allow for landform integration, (aerial survey techniques may reduce access problems). Photographs, both from the air and the ground, will assist in the interpretation of survey and map data;
- Planning policy or Development Plan context;
- Details of the category of waste which the site is to be designed to receive;
- Access and services information;
- Information from the Site Assessment process, which will have been largely generated as a result of the PPC and planning application processes, (see Annex A).

The Design Process

The restoration design should be prepared by an experienced professional, usually a landscape architect, who will need to consult carefully with the rest of the design team and perhaps also with stakeholders such as statutory authorities. The design process is often iterative; a number of concepts and drafts are generally produced by the designer or landscape architect, which are then considered and amended by the rest of the team having regard to their own areas of specialisation. As a result of this process a consolidated, final draft is evolved.

Manual design of the proposed base and restoration contours and calculation of the effect of design changes on landfill volume and engineering materials requirements are laborious and may be inaccurate. There are several computer aided design (CAD) software packages that allow the input of three-dimensional survey data, the generation of new contours and the rapid and accurate calculation of cut and fill volumes. These packages also allow the generation of cross sections, as well as terrain models that can be used as the basis for photomontages and Zone of Visual Influence (ZVI) studies. Proposed landforms can thus be rigorously assessed throughout the design process to
determine the overall degree of visibility, the potential effects at specific viewpoints and the total landfill void.

E10 The design process should resolve all of the technical, social and aesthetic requirements of the proposed landfill by applying a wide range of design factors to a number of design elements. Design factors are all of the operational, environmental and social requirements which have arisen from the site assessment process (see Annex A). Design elements are the main aspects of the restoration design that can be altered to take account of these factors. These include:

- Landform;
- Restoration profile;
- After-use;
- Detailed design;
- Phasing; and
- Interim landscape measures

E11 Tables E1 and E2, below, summarise the types of factors which typically arise from the site assessment process, and the elements which would need to be designed to accommodate these factors. Further details on the range of design options available for each element are provided in the following paragraphs.

Landform

E12 The designer of the restoration scheme should balance the requirement for an economic void space with planning requirements such as minimisation of potential landscape and visual impacts.

E13 The key factors affecting the amount of landfill void space that a site can provide are:

- The physical constraints, such as the size and shape of an existing redundant quarry;
- The shape of the final landform, defined largely by the capping design (see Annex B), the stability risk assessment (part of the PPC application, see Annex A), the landscape and visual assessment, and the proposed after-use;
- The profile of the base of the developed site, which is often defined by geological, geotechnical or hydrogeological considerations and/or considerations of materials balance.

E14 These factors may be varied to manipulate the void space and impact of the site. For instance, a target void space may be achieved, particularly in landraising schemes, by excavating the base of the landfill and using the material around the perimeter to screen the operational area. This may be visually more acceptable than raising the height of the finished site or increasing the gradients of side
<table>
<thead>
<tr>
<th>PLANNING/ENVIRONMENTAL ASSESSMENT TOPIC</th>
<th>RESTORATION DESIGN FACTORS ARISING FROM THIS TOPIC</th>
<th>ELEMENTS OF THE RESTORATION DESIGN THAT WOULD BE AFFECTED BY THESE DESIGN FACTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning Policy and History</td>
<td>• Local Design Guidelines and Countryside Policies • National planning policies (e.g. PPGs) • Planning history of the site</td>
<td>• Restoration landform • After-use • Detailed Design</td>
</tr>
<tr>
<td>Geology, Hydrogeology and Hydrology</td>
<td>• Distribution of surface water features and floodplains in relation to the site • Nature of the underlying rock (e.g. pH, permeability, faults and other natural weaknesses) • Requirements for surface water management • Typical geomorphology of the area • Geological designations (e.g. SSSIs)</td>
<td>• Restoration landform • After-use • Detailed Design</td>
</tr>
<tr>
<td>Landscape and Visual Assessment</td>
<td>• Landscape character of the site and its setting • Location of most sensitive viewpoints and potential magnitude of visual impact at each viewpoint • Landscape designations (e.g. AONBs)</td>
<td>• Restoration landform • After-use • Detailed design • Phasing of restoration • Interim landscape measures</td>
</tr>
<tr>
<td>Ecology</td>
<td>• Habitats and protected species within and adjacent to the site • Local and national Biodiversity Action Plan (BAP) targets • Location of ecological designations (e.g. SACs, SPAs, SSSIs)</td>
<td>• After-use • Detailed design • Phasing of restoration • Interim landscape measures</td>
</tr>
<tr>
<td>Traffic and Rights of Way</td>
<td>• Predicted traffic flows • Need (or otherwise) for junction and/or other road improvements • Access arrangements for the site • Location of public rights of way</td>
<td>• Detailed design • Interim landscape measures</td>
</tr>
<tr>
<td>Agriculture and Soils</td>
<td>• Agricultural Land Classification of the site and its context • Quality and quantity of available soils on the site • Economic viability of farm units in the locality</td>
<td>• Landform • Restoration profile • After-use</td>
</tr>
</tbody>
</table>
| Archaeology and Cultural Heritage | • Location of scheduled monuments, listed buildings, conservation areas  
|                               | • History of the site and its context | • Phasing of restoration  
|                               |                                      | • Interim landscape measures  
| Noise                        | • Location of noise sensitive properties and background noise levels | • Phasing of restoration  
|                             |                                      | • Interim landscape measures  
| Air quality                  | • Location of potential sensitive receptors, background air quality levels and meteorological conditions | • Phasing of restoration  
|                             |                                      | • Interim landscape measures  
| Litter and vectors           | • Location of potential sensitive receptors, assessment of potential risks | • Phasing of restoration  
|                             |                                      | • Interim landscape measures |
### TABLE E2: DESIGN FACTORS ARISING FROM PPC PERMIT APPLICATION PROCESS

<table>
<thead>
<tr>
<th>ASSESSMENT TOPIC</th>
<th>RESTORATION DESIGN FACTOR ARISING FROM THIS TOPIC</th>
<th>ELEMENTS OF THE RESTORATION DESIGN THAT WOULD BE AFFECTED BY THESE DESIGN FACTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Setting and Installation Design (ESID)</td>
<td>• Characterisation of waste to be received&lt;br&gt;• Capping design&lt;br&gt;• Provisions for leachate management and monitoring&lt;br&gt;• Provisions for groundwater management&lt;br&gt;• Provisions for landfill gas management and monitoring</td>
<td>• Landform&lt;br&gt;• Restoration profile&lt;br&gt;• After-use&lt;br&gt;• Detailed design&lt;br&gt;• Phasing of restoration&lt;br&gt;• Interim landscape measures</td>
</tr>
<tr>
<td>Hydrogeological Risk Assessment</td>
<td>• Capping design&lt;br&gt;• Requirements for leachate extraction and monitoring</td>
<td>• Landform&lt;br&gt;• Restoration profile&lt;br&gt;• Detailed design</td>
</tr>
<tr>
<td>Stability Risk Assessment</td>
<td>• Restrictions on restoration slope gradients</td>
<td>• Landform</td>
</tr>
<tr>
<td>Landfill Gas Risk Assessment</td>
<td>• Requirements for gas extraction and monitoring</td>
<td>• Restoration profile&lt;br&gt;• Detailed design</td>
</tr>
<tr>
<td>Habitats Risk Assessment</td>
<td>• Location and nature of designations near to the site</td>
<td>• After-use&lt;br&gt;• Detailed design&lt;br&gt;• Phasing of restoration&lt;br&gt;• Interim landscape measures</td>
</tr>
<tr>
<td>Nuisance and Health Risk Assessment</td>
<td>• Locations of potentially sensitive receptors and assessment of potential risks</td>
<td>• Phasing of restoration&lt;br&gt;• Interim landscape measures</td>
</tr>
</tbody>
</table>
slopes. The suitability of this approach will be determined by the local hydrogeological and geotechnical conditions as deepening a site may lead to intersection of a water bearing horizon or the potential of basal heave from groundwater in that horizon.

E15 The designer should recognise that a site which is to take biodegradable wastes will settle as the waste decomposes. In order to achieve the desired final landform the site must be over-tipped. Surcharged or pre-settlement contours, which take account of settlement, must therefore be calculated in order to achieve the final required landform.¹

E16 The designer should pay great attention to the appearance of the final landform, which must also suit the proposed after-use and should also assess the visual impact of the pre-settlement landform which will be greater than that of the settled landform. Final contours of landraise sites may be a very sensitive issue, since the restoration landform will stand proud of the surrounding topography. The following guidelines are relevant:

• In rural areas the site should be appropriate in the context of the surrounding landscape, with slope gradients which harmonise with local landforms or other features;

• In urban areas the landform may not need to conform to the surrounding landform but should enhance the area and not look incongruous;

• The site may be deliberately designed to give visual stimulation in a flat landscape, with careful consideration of the height and scale of the new landform;

• In undulating or hilly landscapes steeper slopes can be formed which can look natural;

• Slope gradients should be varied, (where this is appropriate in the local context) both in terms of the long profile of the slope and across the flanks of the landfill;

• The new landform may have more than one summit, or a ridge landform, for a more natural appearance but careful consideration of drainage patterns from such landforms needs to be considered to avoid ponding on the cap surface.

E17 With the exception of sites which will take only inert wastes, the designer should avoid complex landforms because they can lead to:

¹ See ENVIRONMENT AGENCY “Technical Guidance on the Design, Construction and Operation of Non-Hazardous and Inert Landfills” (in Draft) for more detail on calculating settlement.
• Operational and engineering problems;
• Increased costs of landfilling, gas control and drainage;
• Constraints on aftercare activities requiring the use of agricultural equipment;

Slope Gradients

E18 When designing slopes (including temporary acoustic or screen bunds), operators should seek the advice of geotechnical engineers regarding the stability of the slopes, taking into account the materials to be used and the hydrological and hydrogeological environment. Consideration of risks attached to the site during construction, restoration and aftercare should include identification of appropriate after-uses on steeply sloping areas which are potentially dangerous to cultivate and maintain.

E19 The designer should observe certain maximum and minimum slope gradients, related to drainage and after-use, which are given in Table E3, below.

E20 The designer should seek to attain a minimum post-settlement gradient of 1 in 25 on sites which may be subject to differential settlement. In localities with high rainfall and slowly permeable soils the minimum post settlement gradient may need to be increased to 1 in 15 to ensure satisfactory drainage subject to the advice of a hydrologist. Even in flat landscapes the final landform should be designed to these slope gradients, if possible, to:

• Ensure that landfill gas collection pipes have sufficient gradient to drain condensate;
• Lessen the frequency of remedial action to landfill gas and drainage pipework systems;
• Encourage natural drainage from the restored landform, allowing for some differential settlement;

The visual effects of differential settlement will be less noticeable on undulating or sloping sites than on relatively flat sites.
TABLE E3: SLOPES OF LAND IN RELATION TO USE*

<table>
<thead>
<tr>
<th>Gradient</th>
<th>Significance for Land use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 in 3</td>
<td>Maximum gradient for safe cultivations using most wheeled agricultural equipment. Maximum gradient for amenity woodland planting.</td>
</tr>
<tr>
<td>1 in 5</td>
<td>Maximum gradient for agricultural and managed amenity grassland (MAFF).</td>
</tr>
<tr>
<td>1 in 8</td>
<td>Maximum gradient for arable agricultural land grades 1, 2 and 3a (MAFF).</td>
</tr>
<tr>
<td>1 in 10</td>
<td>Maximum gradient which will not generally need erosion control measures. Minimum preferred gradient for woodland planting unless soil is freely draining (Forestry Commission).</td>
</tr>
<tr>
<td>1 in 15</td>
<td>Preferred minimum post settlement gradient for high rainfall areas and slowly permeable soils.</td>
</tr>
<tr>
<td>1 in 25</td>
<td>Minimum post settlement gradient on sites subject to differential settlement.</td>
</tr>
</tbody>
</table>

*See also MPG7, Reclamation of Mineral Workings

E21 When considering steep slopes the designer must take the following factors into account:

- After-use requirements (see table E3), especially where agricultural after-use is proposed.
- Measures for erosion control, particularly on slopes steeper than 1 in 10.
- Physical properties of available materials - steep slopes may not be possible with wastes other than excavation materials because of potential instability and problems of effectively capping the site; the maximum recommended slope for domestic, commercial and industrial wastes is 1 in 4².
- If an artificial membrane capping system is to be used, this may lead to soil instability on steep slopes.

E22 The use of tracked machinery is recommended on slopes steeper than 1 in 3 or 1 in 4 unless it is possible for tractors and mounted or trailed equipment to work safely up and down and not turn or traverse across the slope. The designer should use these slopes for trees and shrubs, rather than agriculture or managed amenity

Unless they fulfil a particular landscape design objective, slopes steeper than 1 in 3 should be avoided because they:

- Are likely to be unstable unless specialist engineering measures are adopted;
- Often appear unnatural;
- Are difficult to cultivate and seed; and
- Are difficult and costly to maintain.

On all slopes, the stability of the slope and soil covering must be considered in the design, and appropriate solutions adopted. Specialist techniques, which may include the use of geotextiles, will be necessary to establish vegetation on some very steep slopes.

Restoration Profile

E23 The restoration profile, i.e. the soils and other materials that are placed on top of the cap, should be considered as an integral part of the operational landfill, the design of which will affect not only the after-use of the site but also the movement of gas, water and leachate within and around the waste.

E24 As explained in the Core Document, Paragraph 7 of Schedule 2 to the Regulations contains guidelines for surface sealing (i.e. capping) of hazardous and non-hazardous landfills. These guidelines state that 1 metre of "top soil" should be placed over a 0.5 metre deep drainage layer. However, the Regulations make it clear that these are guidelines, and that the depth and nature of these layers can be varied depending upon a risk assessment.

E25 Annex F describes the hydrological attributes of restoration soils, and indicates how water levels within the soil vary according the nature of the soils, the degree of compaction, the location of the site, slope gradient and the nature of the surface cover (e.g. woodland as opposed to grassland). These factors will, therefore, influence the amount of precipitation that permeates to the cap and, in turn, help to determine the quantity of leachate that is produced by the waste within the landfill.

E26 Annex F also explains how the depth of restoration materials should be varied in accordance with the chosen after-use. For example, research by Dobson and Moffat (1993, 1997) has shown that where trees are to be planted as part of the after-use, a total restoration profile of 1 metre over a geosynthetic cap will be sufficient to allow for root growth and to prevent windthrow. A

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minimum depth of 1.5 metres is recommended over clay caps. By contrast, it may be possible to use much thinner restoration layers for after-uses such as low-productivity agricultural land or species rich meadows. In these circumstances the thickness of the restoration soil profile should be determined by reference to the need to protect the integrity of the cap and associated pollution control systems. Accordingly, care should be taken to allow sufficient clearance over the gas collection pipework and/or the cap for any cultivations which are envisaged.

The nature of restoration materials should also be closely matched to the requirements of the chosen after-use, (see Annex F). Not all after-uses require the use of topsoil. Furthermore, most ecological after-uses benefit from the use of a low fertility substrate.

When designing the restoration profile it is essential that the designer takes account of the materials that are available on site. As part of the site assessment process (see Appendices A and F) these materials should have been categorised and quantified. It may be necessary to import suitable materials and/or ameliorants to augment and improve the restoration profile or to manufacture such materials on site (e.g. by composting of suitable wastes).

After-Use

The range of after-use options for restored landfills includes:

- Agriculture;
- Nature conservation;
- Recreation;
- Woodland;

Built development is unlikely to be a suitable afteruse other than in exceptional cases, dependant upon the nature and history of waste deposition.

On many sites a combination of different after-uses often results in a more attractive and useful final result. The opportunities and constraints of each after-use option are described in Table E4, below.

Selecting the after-use is based on a range of factors. The initial choice may be based on development plan land use policies or the landowner's requirements. The final choice may be influenced by the results of the assessment work described in Annex A.
The developer may wish to review the proposed after-use envisaged by an old planning permission if it is no longer considered appropriate in the light of:

- changed priorities for land use in the area; and

- the inherent potential or constraints of the site (for example waste types, final contours and available soil).

Any changes in the after-use on an existing permission must be discussed and agreed with the waste planning and waste regulatory authorities and the landowner and may need a new planning permission and permit.

As Table E2 illustrates, after use can be influenced by a range of factors derived from the site assessment process. However, the main factors which will influence the choice of after-use design are:

- Character and quantity of available soils;
- Type of waste and associated operational constraints;
- Size, location and access;
- The Development Plan;
- Aspirations of local residents, interest groups and other stakeholders;
- Scheme economics; and
- Long-term management requirements.

Soils

At certain sites, such as old quarries, the choice of after-use may largely depend upon the quantities of soils or soil making materials which remain, and the cost and availability of suitable soils and soil making materials which can be imported or manufactured on site. However, where on-site soils are scarce, importing soils after landfilling operations have ceased in order to achieve a certain restoration soils profile may extend the period of disturbance to local residents and a less demanding soil specification may be appropriate in these circumstances.

The site characteristics, and in particular the availability and quality of soils for restoration, are important in the choice of after-use for restored landfills. Difficulties in landfill restoration leading to unsuccessful attempts to comply with planning conditions have often been due to the lack of suitable restoration materials existing on site. Where small amounts of nutrient-poor materials are available, it is often advisable to create diverse new habitats rather than areas of low grade agriculture.
TABLE E4: OPPORTUNITIES AND CONSTRAINTS OF DIFFERENT END-USES

<table>
<thead>
<tr>
<th>POTENTIAL AFTER-USE</th>
<th>OPPORTUNITIES</th>
<th>CONSTRAINTS</th>
</tr>
</thead>
</table>
| AGRICULTURE         | • Where the proposed landfill or landfill extension requires the disturbance of existing best and most versatile land, DEFRA will require replacement of a comparable amount of the same quality of land in the restoration scheme.  
• Agricultural restoration is often the after-use which is most compatible with the surrounding landscape.  
• Agricultural restoration provides the opportunity of providing an income to the operator/landlord after restoration.  
• The site can be restored to different standards of agricultural production depending on the characteristics of the site and the restoration materials. Whilst landfills which disturb virgin agricultural land should generally be restored to a standard equivalent to that occurring before development commenced, older sites, which may have significant deficiencies in soils and soil making materials, may be able to be restored to low productivity grassland or willow coppice.  
• Few people object to agricultural land in a rural context | • There may be considerable cost implications of agricultural after-use. Replaced soils need to be carefully cultivated and may need the addition of ameliorants over a period of many years to re-gain their previous fertility. Many sites may also require field drainage and/or mole drainage to ensure that soils do not become waterlogged.  
• The designer and operator should evaluate proposals for agricultural restoration in the light of current and anticipated demand for restored agricultural land within the locality.  
• The available soil resources may constrain the ability to restore to agricultural land. Where resources are limited, these should be concentrated to achieve satisfactory standards of restoration on part of the site whilst the rest of the site is restored for non-agricultural uses.  
• Landfill sites restored to agriculture on the edge of conurbations may be prone to damage to fences, disturbance to stock and unauthorised access.  
• Isolated locations may make sites an unattractive, or uneconomic, proposition for agricultural after-use.  
• The impact of settlement, landfill gas and leachate control systems is potentially greater on agricultural after-uses, particularly arable and productive grassland, than on other after-uses. |
<table>
<thead>
<tr>
<th>NATURE CONSERVATION</th>
<th>RECREATION AND AMENITY</th>
<th>WOODLAND</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The Development Plan, local nature conservation strategies, local and national BAP targets and local Community Woodlands, (if applicable), will all encourage the establishment of natural habitats.</td>
<td>• The creation of some natural habitats may be constrained by the nature of the available restoration materials.</td>
<td>• The Forestry Authority provides grants for establishing and managing woodland for timber production, amenity, recreation and wildlife.</td>
</tr>
<tr>
<td>• Nature conservation after-uses are often compatible with other after-uses such as woodland and agriculture.</td>
<td>• Where the site is isolated from existing nature conservation interest, it may take a considerable period of time before target species or habitats establish.</td>
<td>• A minimum depth of 1.5 metres of restoration materials over a clay cap (and one metre over a plastic cap) is recommended before tree planting can take place, (see Annex F).</td>
</tr>
<tr>
<td>• Nature conservation after-uses often receive considerable support and interest from the public, who will be inclined to see it as beneficial.</td>
<td>• Low potential for income from nature conservation after-uses.</td>
<td>• If the site is to be restored to commercial forestry, there are more constraints on the restoration design, for example the pattern of the planting design, the selected species or the gradients of the site.</td>
</tr>
<tr>
<td>• Although nutrient-poor soils may restrict the potential of other restoration options, they may be a positive attribute for nature conservation purposes.</td>
<td>• Some nature conservation after-uses may require management over a long period of time to ensure that the desired habitats have successfully established, (for example heathland). Long term management agreements or Section 106/ Section 50 agreements may, therefore, be required by the Waste Planning Authority.</td>
<td></td>
</tr>
</tbody>
</table>
Type of Waste and Associated Operational Constraints

E36 The type of waste which the site is to accept will also influence the choice of after-use. A site that is to take largely inert wastes may be capable of a wide range of after-uses at a relatively early stage following cessation of waste acceptance. Conversely, a site that is to accept biodegradable wastes, especially a deep site, will probably be less suitable for some after-uses (such as arable agriculture).

E37 The proposed after-use can be affected by the density of wells and connecting pipework required for the collection of landfill gas and leachate. For instance, gas extraction wells, which are essential for the operation of landfills that accept biodegradable waste, may be spaced at relatively close centres (less than forty metres), depending upon the nature of the waste. Where such dense groupings of wells occur, it may be impractical to return the site to high grade agricultural land, as much of the land will be difficult to cultivate with standard farm machinery.

Size, Location and Access

E38 The chosen after-use should be appropriate in the context of land-uses surrounding the site. For example:

- The type of agricultural after-use (arable or grassland) will, to some extent, depend on the farming regimes in the surrounding area;
- A site in an urban location is likely to be more suitable for woodland and amenity use than for agriculture;

E39 Size and access may also influence the choice of after-use. For example a small site is unlikely to be attractive for an agricultural after-use unless it can be combined with an adjacent holding.

The Development Plan

E40 National planning policy guidelines and development plan policies provide a framework for development, changes to land use and conservation. Selected after-uses should normally accord with policies in the development plan such as:

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4 Development Plan policies consist of Structure Plans and Subject Local Plans (such as Minerals and/or Waste Local Plans) prepared by the County Council, and Local Plans prepared by the District Council. In Unitary Authorities, the Structure and Local Plan policies are normally amalgamated in the Unitary Development Plan (UDP), although these authorities may have separate Subject Local Plans for historical reasons. The relationship of guidance and plans concerning waste matters is explained within PPG23.
• The establishment of nature conservation areas;
• The need to safeguard best and most versatile agricultural land;
• The promotion of recreational or open space uses; and
• The development of woodland.

In addition, the WPA may use the pre-application discussions (see Section 3 of the core document) to give advice about:

• Emerging policies and land use strategies;
• Its preference for a given after-use on an individual site (District Councils also have a role in determining the after-use. In addition, after-uses such as recreational uses will require planning permission from the District Council);
• The need to secure a beneficial after-use and the technical feasibility of achieving this for different after-use options.

Aspirations of Local Residents and Interest Groups

Local groups and stakeholders which may have an interest in the choice of after-use of the site include adjacent land owners, the local community and local interest groups such as the Rambler's Association and county wildlife trusts. These bodies will generally be consulted by the WPA before planning permission is granted, but the operator may be advised to consult these parties before finalising the proposals for the site, particularly where ecological or recreational and amenity after-uses are proposed.

Scheme Economics

Scheme economics are dependent upon:

• The costs of land, site development and environmental protection, including monitoring;
• The revenue from incoming waste and resulting products, e.g. gas utilisation and re-sale value of treated wastes;
• The costs of restoration and aftercare; and
• The income from the after-use.

The operator should fund the costs of restoration and aftercare from the income generated throughout the life of the site as required by the Landfill Regulations.
The choice of after-use may affect scheme economics, both in terms of the costs of restoration and aftercare and after-use income. After-use income may come from the sale of agricultural crops and commercial woodland products, and rents from grazing land and some recreational pursuits. It will assist in funding ongoing long term after-use management, but should not be relied upon as the sole source of funding.

**Long-Term Management of the Site**

The long-term management of the site is an important consideration in choosing the intended after-use. Historically, most sites have been restored to agriculture and long-term management has usually passed to the farmer/landowner after a period of statutory agricultural aftercare. However, responsibility for maintenance of the landfill cap and all of the associated pollution control mechanisms, in the post-closure management period rests with the permit or licence holder. Accordingly, there need to be arrangements between the landfill operator and those responsible for the after-use of the site to ensure that environmental protection is treated as being imperative throughout the pre-surrender period. When reviewing the after-use options the operator should take account of whether, and how, each after-use can be maintained and who would be responsible for such maintenance.

**Detailed Design**

Detailed aspects of the restoration scheme that should be resolved as part of the design process could include, but should not necessarily be limited to, the following:

- Operational considerations;
- Surface water management measures;
- Barriers (*e.g.* fencing or bunds);
- Planting and seeding; and
- Public access

**Operational Considerations**

The key design considerations for engineering systems are as follows;

- The protection of the:
  - Capping layer (details on the design of capping layers is included within Technical Annex B).
• Leachate and landfill gas management systems (details on the engineering of landfill gas and leachate management systems is included in separate technical guidance).  

• Fixed monitoring points for leachate and landfill gas quality and permanent ground markers for settlement monitoring.

• The long-term requirements for the stabilisation of the waste;

• The long-term screening of the operational site compounds and fixed plant - gas engines and flares, leachate treatment plant, garages and workshops;

• Operational compound and site facilities; and

• Site security, fences, gates and protection against vandalism.

Tables E5 to E8 summarise the design considerations for engineering systems that relate specifically to restoration and aftercare of landfills.

On new sites, the design team's objective should be to integrate and co-ordinate the design of engineering systems and landscape and after-use design through collaboration and careful planning.

**TABLE E5: DESIGN CONSIDERATIONS RELATING TO THE OPERATIONAL COMPOUND AND SITE ENTRANCE**

<table>
<thead>
<tr>
<th>ENGINEERING SYSTEM</th>
<th>MAIN ELEMENTS</th>
<th>DESIGN CONSIDERATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational Compound and Facilities</td>
<td>Site office, car parking, workshop, toilets, weighbridge, wheelwash. operational compound</td>
<td>Consider timescale for facilities; in some cases site office and car parking can be used as a visitor centre after restoration, in which case the whole area can be permanently landscaped. Alternatively, these facilities may need to be removed as soon as the landfill is completed, in which case a more temporary form of screening may be required.</td>
</tr>
</tbody>
</table>
| Site Entrance                       | Signage, road access, gates. Possibly lorry lay by or sheeting bays.         | Careful design of the site entrance provides a positive statement to the public about how the carefully the site is managed. Entrance landscaping should fit in with the landscape design of the whole site, and plants to be used at the site entrance should be carefully selected. The following should be taken into account:  
  • Ornamental species often look incongruous and do not thrive in the harsh environment of the site entrance  
  • Thorny shrubs collect windblown litter |

5 ENVIRONMENT AGENCY "Technical Guidance on the Design, Construction and Operation of Non-Hazardous and Inert Landfills" (in Draft)
which is difficult to remove, and becomes unsightly

- Plants which are close to the roadway may suffer damage from vehicle wheels.
TABLE E6: DESIGN CONSIDERATIONS RELATING TO CAPPING LAYERS AND SETTLEMENT

<table>
<thead>
<tr>
<th>ENGINEERING SYSTEM</th>
<th>MAIN ELEMENTS</th>
<th>DESIGN CONSIDERATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capping Layer</td>
<td>Mineral or geosynthetic caps (geomembranes, geosynthetic clay liners) overlain by a protection/drainage layer (of naturally occurring and/or geosynthetic materials)</td>
<td>Maximum gradients to be determined by geotechnical engineer and only gradual changes in gradient. Minimum gradients of 1 in 25 to facilitate surface water run-off. Minimum settled soil depth of 1m, 1.5m in tree areas on clay caps, to prevent damage and desiccation (see Annex F for soil requirements for plant growth).</td>
</tr>
<tr>
<td>Settlement of the Fill</td>
<td>Degree of settlement depends upon nature of waste, in particular biodegradable or inert. Initial settlement occurs mainly because of the physical rearrangement of the waste after it is first placed in the landfill. Later settlement mainly results from biochemical degradation of the waste, which in turn leads to further settlement. Inert wastes will be affected less than hazardous or non-hazardous sites in this respect. Typical settlement rates vary greatly depending upon the nature of the waste, depth of the landfill and density of the waste. Settlement rates of 15-25% or more are normal, and should be allowed for in non-hazardous waste landfill sites, with the majority of this settlement normally occurring within the first five years.</td>
<td>For biodegradable waste landfill sites, considerable settlement may occur in the first few years after closure. Consequently, there may be a requirement to re-install or repair the gas and leachate collection systems within this period. Operators should therefore consider the need for Interim Restoration where this may protect the structure of particularly high grade agricultural soils, (see Annex D) Restoration gradients should be steeper than 1:25 (1:15 in areas of high rainfall) to ensure that the effects of differential settlement do not impede the drainage of the restored cap. Surcharge, i.e. additional waste above the levels of the post-settlement contours, is required to allow for settlement. Surcharge values of 15 to 25% are typical to achieve the required post-settlement contours.</td>
</tr>
</tbody>
</table>
TABLE E7: DESIGN CONSIDERATIONS RELATING TO THE MANAGEMENT OF LANDFILL GAS

<table>
<thead>
<tr>
<th>Engineering System</th>
<th>Main Elements</th>
<th>Design Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas Compound</td>
<td>Gas flares, which may be temporary or permanent, and may vary in height between 5 metres and 10 metres. In addition, there may be containerised generators, which may be between three and four metres in height. Elements within the gas compound would be constructed on a concrete slab, and the entire compound would need to be securely fenced, with a gate for vehicle access.</td>
<td>Agree compound size and location with landfill gas specialists at the design stage and integrate the compound in the landscape design. The location of the gas compound should be selected with regard to the following:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Technical constraints, such as gas flow and the pipe network, which are dependent upon the finished gradients for good performance.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Whether the compound will be used for power generation (location of electricity grid connection or energy user) or flaring (visual impact) or both.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Access for service and construction vehicles, power supply and other services.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Proximity of sensitive receptors, such as residential or recreational areas, which may be affected by visual impact or noise.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Include mounding and planting for visual and noise screening in the design of the compound for long-term screening and integration into the post-closure landscape and after-use.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Screening mound slopes should not be too steep to make maintenance difficult or to bring vegetation too close to the flare, or gas engine radiator units.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The compound should not be located in an area where trees would be affected by the heat from the flare stack. Choose lower growing shrubs for more effective screening.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ensure security against vandalism and risk to health and safety.</td>
</tr>
<tr>
<td>Gas Monitoring Boreholes</td>
<td>Boreholes typically located outside of waste deposits, around site perimeter although there will often be gas monitoring wells within the waste in addition to extraction wells. Well heads trend to be 200mm diameter units extending up to 1 metre above ground level</td>
<td>Where practical, locate at the perimeter of the landfilled area, along field boundaries and in non-agricultural areas.</td>
</tr>
<tr>
<td>Gas Control System</td>
<td>Pipework on top of the cap, linked into wells running vertically through the landfill and outcropping at the restoration surface. Well heads tend to contain pipework connections and condensation boxes, and are typically around 1 metre square and located close to the well head. Pipes feed towards a single main (or series of mains) which feed towards the gas compound. Spacing of wells will vary considerably according to the nature of the waste, but is typically at an average grid of 40 to 50 metres.</td>
<td>Where possible, co-ordinate the gas system design with the landscape and restoration design. Consider non-agricultural after-uses, or include non-agricultural areas such as wide hedgerows, access tracks, shelter belts, woodland and nature conservation areas. Integrate these features with the gas control system. Locate horizontal pipework above capping layer with collection mains in stable (non-filled) ground if possible. Locate wells along field boundaries and in non-agricultural areas wherever possible. Select gas system with design features which are most appropriate to the proposed after-use; • Lay pipes to falls and dewatering points • Lay pipework so that plant and machinery can run over it without causing damage • In arable after-use lay pipes in 300mm layer of soil forming material above capping layer • Lay pipes below depth of field drainage systems with the top of the gas pipe 1 m below finished surface. On older sites the active extraction system may be installed on part of the site only, in response to the need for gas migration control; such a system may need to be extended or modified; • As the site is completed; • As later phases of landfilling begin to produce gas; or • To convert passive vents to an active extraction system. If carried out during or after the aftercare period these works are likely to cause severe impact on aftercare and after-use.</td>
</tr>
</tbody>
</table>
TABLE E8: DESIGN CONSIDERATIONS RELATING TO THE MANAGEMENT OF LEACHATE

<table>
<thead>
<tr>
<th>Engineering System</th>
<th>Main Elements</th>
<th>Design Considerations</th>
</tr>
</thead>
</table>
| Leachate Collection System | Vertical or side slope leachate extraction and monitoring points, comprising manhole rings and/or polyethylene/polypropylene pipes. Generally have manhole capping unit or headwell arrangement. | The influence of the leachate treatment system upon restoration and aftercare is generally less extensive than that exerted by the gas control system as:  
  - There are fewer features above the cap or at the surface, and the leachate collection pipework does not commonly spread over the whole surface of the finished site;  
  - There may be some flexibility in the location and frequency of the leachate monitoring points and associated manholes  
Where possible, co-ordinate location of collection sumps and pumping manholes with field boundaries, along access tracks and in areas which will not be intensively managed for agriculture or recreation wherever possible. |
| Leachate Treatment Compound | Leachate holding lagoons or treatment facility. Often incorporate complex network of pipework and chambers, and may have mechanical and electrical storage buildings. Site should be securely fenced with provision for vehicular access. The units within the leachate compound may not be as high as those in the gas compound: modular systems may be only 2.5 - 3 metres high. Some systems require the use of taller equipment and, unless they can be set partially below ground to reduce their impact, their use should be carefully considered in visually sensitive areas. | Combine with gas compound if possible to simplify screening design.  
Screen with mounding and shrub planting.  
Ensure suitable access and manoeuvring space for road tankers if necessary or likely in the future.  
Ensure security against vandalism and risk to health and safety.  
The design of screen mounding should take account of the possibility of using biotechnology (such as reed or Miscanthus beds) as a final treatment before leachate is discharged to stream. The leachate treatment and gas control equipment may be located in the same compound to simplify screening and planting arrangements. |
Surface Water Management Measures

E50 The hydrological assessments carried out as part of the PPC and/or planning application processes should include a quantification of the total volumes of surface water run-off that should be expected for a given rainfall event. Typically, these volumes are calculated on the basis of a 1 in 100 year return period, with an additional 20% to account for global warming.

E51 The restoration scheme should include suitable measures to accommodate these anticipated surface water flows. Flood water attenuation ponds should be included as part of the scheme, to minimise the potential risk of flooding downstream of the site. Cut-off ditches, swales and/or French drains will need to be included to direct surface water to these ponds. In high grade agricultural restoration, it may be necessary to implement a field drainage scheme, so that water is transported rapidly from the surface of the soil, via a piped drainage system to the balancing pond.

E52 If the restoration design includes steep slopes, it will be necessary to consider the potential risk of erosion to these areas by surface water run-off. Cut-off ditches or French drains at the top and bottom of these slopes may be necessary. In addition, it may be advisable to reinforce the surface of the slope itself with an appropriate geotextile.

E53 The Agency will expect runoff from the site, during the construction, operation and restoration phases, to be of the same quantity and quality as the "green field" run off rate for the site. This means that surface water will need to be treated prior to discharge, perhaps with a series of settlement and attenuation lagoons or reed beds.

E54 Surface water management features offer excellent opportunities for the creation of diverse ecological habitats within the restoration scheme. For example, water bodies can be excavated to form irregular shapes with gently shelving margins which may allow the establishment of marginal species.

Barriers

E55 Barriers, such as hedgerows, dry stone walls or fences often define the way in which the restoration scheme will be used and also contribute to the character of the overall design.

E56 Spaces should be defined by enclosures so that each space is a suitable size and shape for its proposed after-use. Agricultural fields should generally be of a similar size and shape to those outside of the site, although in areas of agricultural intensification, where many hedgerows have been breached or lost altogether, the restoration scheme may provide an opportunity to provide smaller fields, similar to those found immediately after the Enclosure Act was implemented (or even pre-Enclosure Act in some cases).
Barriers should be designed according to their proposed function. For example, if it is proposed that a field shall hold livestock as part of the after-use, then it would be necessary to specify a stock-proof barrier; for example, a hedgerow augmented by a stock-proof wire fence in the first few years following restoration. Where screening is required, such as around an environmental management compound, it may be necessary to combine a hedgerow with a hedgebank or bund.

Barriers should also be designed in accordance with the vernacular style. The ways in which hedgerows, dry stone walls and hedge banks are constructed varies considerably from region to region, and designers should research these local styles before applying them to the restoration scheme.

**Planting and Seeding**

Restoration schemes will often include large areas of new woodland and/or grass seeding. The species which are used to create these areas, and the way in which planting and seeding is carried out, should be both appropriate to the proposed after-use and appropriate in the local context.

For amenity and ecologically-based schemes, the chosen species should be appropriate in the local context and should ideally be from local stock, to preserve local genetic identity. In these cases, use of non-native plant material in the restoration scheme should be avoided where practically possible.

The spacing of tree or shrub planting (planting “centres”) can be varied according to soils, gradients and after-use. For example, on steeper or more exposed slopes it may be advisable to decrease planting centres to 1.5m or even 1m to provide a better microclimate for plant growth in the years immediately following planting. Conversely, planting centres could extend to 2.5m or even 3m on high grade soils on suitable terrain.

Similarly, the specified density of grass seeding should also be influenced by the proposed after-use. Agricultural grasslands are typically seeded at much higher rates (e.g. 25 to 35g per square metre) than species-rich grasslands (which could be as low as 1g per square metre).

For both planting and seeding, it is often desirable from an ecological perspective to create an open matrix of vegetation that then allows local species to regenerate naturally on the site, since this preserves local genetic identity. Thus, for grasslands, it may be possible to specify a low density sward which allows local wildflowers to colonise. This will, however, necessitate management to both reduce weed colonisation and introduce desirable species (perhaps through the addition of green hay, for example).

Planting and seeding technique should also be varied to take account of local conditions. For example, in poor soils and on steep slopes, it may be beneficial to specify pit planting of trees and shrubs, as opposed to notch planting.
Exposed sites may also benefit from the use of tree shelters, which promote plant growth in the establishment phase and also reduce the potential for damage by rabbits. For seeding, agricultural grasslands will require intensive cultivation to achieve a suitable tilth, whereas species-rich grasslands may benefit from variations in soil conditions since these may increase the diversity of the habitat.

E65 Specifications of plants should be in accordance with the format used by the National Plant Specification\(^8\), to ensure that the correct species, age, size and root condition are received on site. All plant handling should be in accordance with the CPSE’s guidelines\(^9\).

**Public Access**

E66 At the outset, the design team must consider the degree to which public access is to be allowed or encouraged. If access is to be allowed, the designer will need to define which parts of the site will be accessible. In general, it is advisable to reduce the potential for access to the environmental management compound for health and safety reasons. However, controlled public access to the restored landfill itself may be both possible and desirable, as long as this does not conflict with the post-closure management of the site.

E67 Public access should be controlled by a combination of barriers and signage and interpretation. Appropriate surfaces should be provided for, and appropriate to, the intensity of usage that is anticipated at the site.

**Phasing**

E68 Restoration phasing provides an opportunity to gradually reduce environmental impacts throughout the operational life of the site. The development of sites can also be phased so that the potential for environmental impact at sensitive receptors can be greatly reduced.

E69 Where possible, landfill sites should be restored progressively. This process allows newly restored areas to mature whilst other parts of the site continue landfill operations. This may have particular benefits where it has been necessary to provide new habitat for certain flora or fauna.

E70 The direction of filling within the landfill void should take account of the findings of the site assessment (see Annex A), particularly the visual, noise and air quality assessments. For example, it may be possible to create a screening feature out of inert material, or the first phase of filling, close to a potentially sensitive receptor, behind which all future operations could take place. In this case, filling operations would then progress away from the receptor so that the majority of plant movements would be shielded by both the intervening waste.

**Interim Landscape Measures**
The restoration design may also need to incorporate some temporary landscape measures to mitigate potential environmental impacts. These could include soils storage bunds, screen bunds (acoustic and/or visual) and temporary ecological mitigation measures. Where bunds are used as temporary mitigation measures, the restoration design should aim to remove these features where practically possible, since they are likely to be anomalous in the context of local landforms.

In some landfill restoration schemes, particularly restoration to high grade arable land on non-hazardous biodegradable waste landfill sites, it may be advisable to stockpile the majority of topsoils for the first few years after closure. The site would then be subject to interim restoration, where a thin layer of topsoil and the underlying subsoil are restored to a temporary use whilst the majority of settlement at the site takes place and the highest proportion of maintenance to the engineering systems is carried out. The topsoils can then be replaced when the site is more stable and less likely to be subject to disturbance by post closure management operations. This process can help to ensure that the structure of soils is not compromised by excessive tracking.
APPENDIX B

Visibility Maps
Notes: Map shows the calculated visibility for the landfill at the indicated closure height. Each color ring represents a one-mile distance. The landfill is not visible from areas without color within the five-mile radius.

25 Meter (82') Visibility Analysis
Not to Scale
Note: Map shows the calculated visibility for the landfill at the indicated closure height. Each color ring represents a one-mile distance. The landfill is not visible from areas without color, within the five-mile radius.

30 Meter (98') Visibility Analysis

Not to Scale
Note: Map shows the calculated visibility for the landfill at the indicated closure height. Each colored ring represents a one-mile distance. The landfill is not visible from areas without color, within the five-mile radius.

35 Meter (115') Visibility Analysis
Not to Scale
Notes: Map shows the calculated visibility for the landfill at the indicated closure height. Each coloring represents a one-mile distance. The landfill is not visible from areas without color, within the five-mile radius.

50 Meter (164') Visibility Analysis
Not to Scale
APPENDIX C

“Massing” Studies
KOP 4 Existing Condition

KOP 4 Massing
APPENDIX D

Visual Simulations
Landfill Current Closure Plan

KOP Location:

Highway 30 and 1900 West

Existing Condition

60% Final Height - Current Closure Plan
Landfill Current Closure Plan

KOP Location:
Highway 30 and 1900 West

75% Final Height - Current Closure Plan

100% Final Height - Current Closure Plan
Environmental Education Center

KOP Location:

Highway 30 and 1900 West

Existing Condition

60% Final Height - Environmental Education Center
Environmental Education Center

KOP Location:
Highway 30 and 1900 West

75% Final Height - Environmental Education Center

100% Final Height - Environmental Education Center
Current Closure Plan

KOP Location:
1225 West 200 North

Existing Condition

60% Final Height - Current Closure Plan
Current Closure Plan

KOP Location:
1225 West 200 North

75% Final Height - Current Closure Plan

100% Final Height - Current Closure Plan
Environmental Education Center

KOP Location:

1225 West 200 North

Existing Condition

60% Final Height - Environmental Education Center
Environmental Education Center

KOP Location:
1225 West 200 North

75% Final Height - Environmental Education Center

100% Final Height - Environmental Education Center
Current Closure Plan

KOP Location:
450 North 1000 West

Existing Condition

60% Final Height - Current Closure Plan

75% Final Height - Current Closure Plan

100% Final Height - Current Closure Plan
Environmental Education Center

KOP Location:
450 North 1000 West

Existing Condition

60% Final Height - Env. Education Center

75% Final Height - Env. Education Center

100% Final Height - Env. Education Center
Current Closure Plan

KOP Location:
1250 West 600 South

Existing Condition

60% Final Height - Current Closure Plan
Current Closure Plan

KOP Location:
1250 West 600 South

75% Final Height - Current Closure Plan

100% Final Height - Current Closure Plan
KOP Location:
1250 West 600 South

Existing Condition

60% Final Height - Environmental Education Center
Environmental Education Center

KOP Location:
1250 West 600 South

75% Final Height - Environmental Education Center

100% Final Height - Environmental Education Center
APPENDIX E

Contrast Rating Worksheets
### SECTION A. PROJECT INFORMATION

1. Project Name
   Logan City/Cache County Landfill

2. Key Observation Point
   Hwy 30 and 1900 West - Existing Condition

3. VRM Class
   None

4. Location
   Township
   Range
   Section

5. Location Sketch
   See Visual Simulation

### SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

<table>
<thead>
<tr>
<th>1. LAND/WATER</th>
<th>2. VEGETATION</th>
<th>3. STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>FG/MG: distinct, flat, regular</td>
<td>FG/MG: diverse, low and flat (seasonal), other vegetation clumping on north aspect</td>
<td>FG/MG: roads: smooth, solid, regular, wide, tan, light brown; buildings: indistinct, small (far middle ground)</td>
</tr>
<tr>
<td>FG/MG: flat, straight, simple</td>
<td>FG/MG: trees: undulating, irregular; agriculture/ROW: straight, regular, angular; buildings: indistinct, small (far middle ground)</td>
<td></td>
</tr>
<tr>
<td>FG/MG: N/A obscured by vegetation</td>
<td>FG/MG: tan, light to dark variation, warm</td>
<td>FG/MG: roads: medium gray, warm, subtle; utilities/fence: discontinuous, vertical, tall, bright; buildings: smooth, repulsive, spotlight</td>
</tr>
</tbody>
</table>

### SECTION C. PROPOSED ACTIVITY DESCRIPTION

<table>
<thead>
<tr>
<th>1. LAND/WATER</th>
<th>2. VEGETATION</th>
<th>3. STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>FG/MG: landfill: definite, rough irregular dome, obscures background mountain</td>
<td>FG/MG: landfill: smooth, medium, clumped, patchy, low (seasonal)</td>
<td>FG/MG: No change</td>
</tr>
<tr>
<td>FG/MG: landfill: slightly diagonal to high point, horizontal at top vegetation and disturbance edges</td>
<td>FG/MG: landfill: smooth, medium, clumped, patchy, low (seasonal)</td>
<td>FG/MG: No change</td>
</tr>
<tr>
<td>FG/MG: landfill tan, light to dark variation, warm</td>
<td>FG/MG: landfill: smooth, medium, clumped, patchy, low (seasonal)</td>
<td>FG/MG: No change</td>
</tr>
<tr>
<td>FG/MG: landfill: fine to medium</td>
<td>FG/MG: landfill: discontinuous</td>
<td>FG/MG: No change</td>
</tr>
</tbody>
</table>

### SECTION D. CONTRAST RATING

| 2. Does project design meet visual resource management objectives? | Yes | No |
| (Explain on reverse side) |

| 3. Additional mitigating measures recommended | Yes | No |

Evaluator's Names
Kristofor L. Kvarfordt
John C. Ellsworth
Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

SECTION A. PROJECT INFORMATION

1. Project Name
   Logan City/Cache County Landfill

2. Key Observation Point
   Hwy 30 and 1900 West - 60% CC

3. VRM Class

4. Location
   Township 12N
   Range 1E
   Section 31

5. Location Sketch
   See Visual Simulation

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

1. LAND/WATER
   - FG/MG: distinct, flat, regular
   - BG: dominant, bold horizon, moderately jagged, steep, severely dissected

2. VEGETATION
   - FG/MG: diverse, low and flat (seasonal)
   - BG: indistinct, coalesce, climbing on north aspect, other vegetation clumping throughout

3. STRUCTURES
   - FG/MG: trees: undulating, irregular, agriculture/ROW: intersecting, angular, tapering
   - BG: distinct edge on ridgelines, apparent grooves to trees

SECTION C. PROPOSED ACTIVITY DESCRIPTION

1. LAND/WATER
   - FG/MG: landfill: definite, uniform, (fattened dome, mass)
   - BG: noticeable obscures background mountains

2. VEGETATION
   - FG/MG: landfill: arcing profile, horizontal along vegetation and disturbance edges
   - BG: clear, distinct, gray/blue, brown/tan/red (seasonal)

3. STRUCTURES
   - FG/MG: landfill: clumped, patchy, low (seasonal)
   - BG: gray to dark slate, tan, red/yellow/orange (seasonal)

SECTION D. CONTRAST RATING

1. DEGREE OF CONTRAST
   - LAND/WATER
     - Strong
     - Moderate
     - Weak
   - VEGETATION
     - Strong
     - Moderate
     - Weak
   - STRUCTURES
     - Strong
     - Moderate
     - Weak

2. Does project design meet visual resource management objectives? ☐ Yes ☐ No
   (Explain on reverse side)

3. Additional mitigating measures recommended
   ☐ Yes ☐ No

Evaluator's Names
Kristofor L. Kvarfordt
John C. Ellsworth
VISUAL CONTRAST RATING WORKSHEET

SECTION A. PROJECT INFORMATION

1. Project Name
   Logan City/Cache County Landfill

2. Key Observation Point
   Hwy 30 and 1900 West - 60% EEC

3. VRM Class

4. Location
   Township 12N
   Range 1E
   Section 31

5. Location Sketch
   See Visual Simulation

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

<table>
<thead>
<tr>
<th>1. LAND/WATER</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Form</td>
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</tr>
<tr>
<td>FG/MG: distinct, flat, regular</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>FG/MG: diverse, low and flat (seasonal), bold: indistinct, conifers clumping on north aspect, other vegetation clumping throughout</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FG/MG: trees: undulating, irregular; agriculture/ROW: intersecting, angular, tapering</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FG/MG: trees: dark green (seasonal); agriculture/ROW: vivid green</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FG/MG: trees: medium, clumped, agriculture/ROW: fine to medium, smooth, uniform</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FG/MG: roads: smooth, uniform, stippled; agriculture/ROW: smooth, repetitive; buildings: smooth walls, somewhat contrasty</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1. LAND/WATER</th>
<th>2. VEGETATION</th>
<th>3. STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line</td>
<td>Line</td>
<td>Line</td>
</tr>
<tr>
<td>FG/MG: flat, straight, simple</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>FG/MG: trees: undulating, irregular; agriculture/ROW: intersecting, angular, tapering</td>
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<td>FG/MG: trees: medium, clumped, agriculture/ROW: fine to medium, smooth, uniform</td>
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<td>FG/MG: roads: smooth, uniform, stippled; agriculture/ROW: smooth, repetitive; buildings: smooth walls, somewhat contrasty</td>
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<thead>
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</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Color</td>
<td>Color</td>
</tr>
<tr>
<td>FG/MG: N/A obscured by vegetation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>FG/MG: trees: undulating, irregular; agriculture/ROW: intersecting, angular, tapering</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FG/MG: trees: dark green (seasonal); agriculture/ROW: vivid green</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FG/MG: trees: medium, clumped, agriculture/ROW: fine to medium, smooth, uniform</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FG/MG: roads: smooth, uniform, stippled; agriculture/ROW: smooth, repetitive; buildings: smooth walls, somewhat contrasty</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1. LAND/WATER</th>
<th>2. VEGETATION</th>
<th>3. STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tone</td>
<td>Tone</td>
<td>Tone</td>
</tr>
<tr>
<td>FG/MG: smooth</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>FG/MG: trees: undulating, irregular; agriculture/ROW: intersecting, angular, tapering</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FG/MG: trees: dark green (seasonal); agriculture/ROW: vivid green</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FG/MG: trees: medium, clumped, agriculture/ROW: fine to medium, smooth, uniform</td>
<td></td>
</tr>
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<td>FG/MG: roads: smooth, uniform, stippled; agriculture/ROW: smooth, repetitive; buildings: smooth walls, somewhat contrasty</td>
<td></td>
</tr>
</tbody>
</table>

SECTION C. PROPOSED ACTIVITY DESCRIPTION

<table>
<thead>
<tr>
<th>1. LAND/WATER</th>
<th>2. VEGETATION</th>
<th>3. STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form</td>
<td>Form</td>
<td>Form</td>
</tr>
<tr>
<td>FG/MG: landfill: definite, undulating, mass slightly obscures background mountains</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>FG/MG: landfill: clumped, patchy, scattered, varied shape and size</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FG/MG: landfill: indistinct, triangular, appropriate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FG/MG: landfill: varied, moderately jagged profile</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FG/MG: landfill: indistinct, curving to a peak</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FG/MG: landfill: mostly obscured by vegetation, tall, warm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FG/MG: landfill: indistinct, dark brown</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FG/MG: landfill: indistinct, dark brown</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FG/MG: landfill: indistinct, dark brown</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FG/MG: landfill: indistinct, dark brown</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FG/MG: landfill: indistinct, dark brown</td>
<td></td>
</tr>
</tbody>
</table>

SECTION D. CONTRAST RATING □ SHORT TERM □ LONG TERM

1. DEGREE OF CONTRAST

<table>
<thead>
<tr>
<th>FEATURES</th>
<th>LAND/WATER BODY (1)</th>
<th>VEGETATION (2)</th>
<th>STRUCTURES (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>Moderate</td>
<td>Weak</td>
<td>None</td>
</tr>
<tr>
<td>Strong</td>
<td>Moderate</td>
<td>Weak</td>
<td>None</td>
</tr>
<tr>
<td>Strong</td>
<td>Moderate</td>
<td>Weak</td>
<td>None</td>
</tr>
</tbody>
</table>

2. Does project design meet visual resource management objectives? □ Yes □ No
   (Explain on reverse side)

3. Additional mitigating measures recommended
   □ Yes □ No

Evaluator’s Names
Kristolof L. Kvarfordt
John C. Ellsworth
### SECTION A. PROJECT INFORMATION

1. **Project Name**  
   Logan City/Cache County Landfill

2. **Key Observation Point**  
   Hwy 30 and 1900 West - 75% CC

3. **VRM Class**

4. **Location**  
   Township 12N  
   Range 1E  
   Section 31

5. **Location Sketch**  
   See Visual Simulation

### SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

#### 1. LAND/WATER

<table>
<thead>
<tr>
<th>FORM</th>
<th>LINE</th>
<th>COLOR</th>
<th>TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>FG/MG: distinct, flat, regular</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BG: dominant, bold horizon, moderately jagged, steep, severely dissected</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 2. VEGETATION

<table>
<thead>
<tr>
<th>FORM</th>
<th>LINE</th>
<th>COLOR</th>
<th>TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>FG/MG: diverse, low and flat (seasonal),</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BG: indistinct, scattered clumps, uniform,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>other vegetation clumping throughout</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 3. STRUCTURES

<table>
<thead>
<tr>
<th>FORM</th>
<th>LINE</th>
<th>COLOR</th>
<th>TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>FG/MG: bold, continuous, simple</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BG: bold irregular, angular, vertical to diagonal, rugged, long, slightly interrupted by landfill profile</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### SECTION C. PROPOSED ACTIVITY DESCRIPTION

#### 1. LAND/WATER

<table>
<thead>
<tr>
<th>FORM</th>
<th>LINE</th>
<th>COLOR</th>
<th>TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>FG/MG: landfill: definite, uniform, flattened dome, mass</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BG: definitely obscures background mountains</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 2. VEGETATION

<table>
<thead>
<tr>
<th>FORM</th>
<th>LINE</th>
<th>COLOR</th>
<th>TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>FG/MG: landfill: clumped, patchy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BG: landfill: clumped, patchy</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 3. STRUCTURES

<table>
<thead>
<tr>
<th>FORM</th>
<th>LINE</th>
<th>COLOR</th>
<th>TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>FG/MG: No change</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### SECTION D. CONTRAST RATING

2. Does project design meet visual resource management objectives?  
   ☐ Yes ☐ No  
   (Explain on reverse side)

3. Additional mitigating measures recommended  
   ☐ Yes ☐ No

---

**Evaluator's Names**  
Kristofor L. Kvarfordt  
John C. Ellsworth
UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

SECTION A. PROJECT INFORMATION

1. Project Name
   Logan City/Cache County Landfill

2. Key Observation Point
   Hwy 30 and 1900 West - 75% EEC

3. VRM Class

4. Location
   Township 12N
   Range 1E
   Section 31

5. Location Sketch
   See Visual Simulation

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

1. LAND/WATER
   Form: distinct, flat, regular
   Line: N/A
   Color: N/A
   Texture: N/A

2. VEGETATION
   Form: diverse, low and flat (seasonal)
   Line: indistinct, uniform
   Color: N/A
   Texture: N/A

3. STRUCTURES
   Form: bold, straight, wide
   Line: horizontal, straight, simple
   Color: N/A
   Texture: N/A

SECTION C. PROPOSED ACTIVITY DESCRIPTION

1. LAND/WATER
   Form: landfill: definite, undulating
   Line: N/A
   Color: N/A
   Texture: N/A

2. VEGETATION
   Form: landfill: clumped, patchy
   Line: flat
   Color: N/A
   Texture: N/A

3. STRUCTURES
   Form: landfill: indistinct
   Line: N/A
   Color: N/A
   Texture: N/A

SECTION D. CONTRAST RATING

<table>
<thead>
<tr>
<th>DEGREE OF CONTRAST</th>
<th>FEATURES</th>
<th>LAND/WATER BODY</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>Moderate</td>
<td>Weak</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Weak</td>
<td>Moderate</td>
<td>Weak</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>None</td>
<td>Strong</td>
<td>Moderate</td>
<td>Weak</td>
<td>None</td>
</tr>
<tr>
<td>None</td>
<td>Moderate</td>
<td>Weak</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

2. Does project design meet visual resource management objectives? 
   □ Yes  □ No

3. Additional mitigating measures recommended
   □ Yes  □ No

Evaluator's Names
Kristofor L. Kvarfordt
John C. Ellsworth
### Section A. Project Information

1. **Project Name**
   - Logan City/Cache County Landfill

2. **Key Observation Point**
   - Hwy 30 and 1900 West - 100%CC

3. **VRM Class**
   - 31

### Section B. Characteristic Landscape Description

<table>
<thead>
<tr>
<th>Form</th>
<th>Line</th>
<th>Color</th>
<th>Texture</th>
<th>FG/MG:</th>
<th>FG/MG:</th>
<th>FG/MG:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>distinct, flat,</td>
<td>flat, straight,</td>
<td>trees: dark green (seasonal)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>regular</td>
<td>simple</td>
<td>agriculture/ROW: void green</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>B/G: dominant,</td>
<td>B/G: bold angular,</td>
<td>B/G: landfill: clumped, patchy, low (seasonal)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>bold tenion, moderately jagged, steep, severity dissected</td>
<td>vertical to diagonal, rugged, long, slightly interrupted by landfill profile</td>
<td>B/G: landfill: strong horizontal along disturbance face (different vegetation types)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>B/G: distinct edge on ridgelines, apparent grass to crevices</td>
<td>B/G: landfill: reds and tans (seasonal)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>B/G: landfill: tan, light to dark variation, warm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>B/G: landfill: fine to medium</td>
</tr>
</tbody>
</table>

### Section C. Proposed Activity Description

<table>
<thead>
<tr>
<th>Form</th>
<th>Line</th>
<th>Color</th>
<th>Texture</th>
<th>FG/MG:</th>
<th>FG/MG:</th>
<th>FG/MG:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>distinct, flat,</td>
<td>flat, straight,</td>
<td>trees: medium, clumped, agriculture/ROW: fine to medium, smooth, uniform</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>regular</td>
<td>simple</td>
<td>B/G: smooth to medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>B/G: dominant,</td>
<td>B/G: bold angular,</td>
<td>B/G: landfill: more apparent, discontinuous, fine to medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>bold tenion, moderately jagged, steep, severity dissected</td>
<td>vertical to diagonal, rugged, long, slightly interrupted by landfill profile</td>
<td>B/G: landfill: strong horizontal along disturbance face (different vegetation types)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>B/G: distinct edge on ridgelines, apparent grass to crevices</td>
<td>B/G: landfill: tan, light to dark variation, warm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>B/G: landfill: fine to medium</td>
</tr>
</tbody>
</table>

### Section D. Contrast Rating

1. **Degree of Contrast**
   - Strong
   - Moderate
   - Weak

2. **Dealing with Visual Resource Management Objectives?**
   - Yes
   - No

3. **Additional Mitigating Measures Recommended**
   - Yes
   - No

**Evaluator's Names**
- Kristofor L. Kvarfordt
- John C. Ellsworth
# UNITED STATES DEPARTMENT OF THE INTERIOR
## BUREAU OF LAND MANAGEMENT

### VISUAL CONTRAST RATING WORKSHEET

#### SECTION A. PROJECT INFORMATION

1. **Project Name**
   - Logan City/Cache County Landfill

2. **Key Observation Point**
   - Hwy 30 and 1900 West - 100% EEC

3. **VRM Class**

4. **Location**
   - Township: 12N
   - Range: 1E
   - Section: 31

5. **Location Sketch**
   - See Visual Simulation

#### SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

<table>
<thead>
<tr>
<th>FORM</th>
<th>LINE</th>
<th>COLOR</th>
<th>TEXTURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>FG/MG: distinct, flat, regular</td>
<td>FG/MG: flat, straight, simple</td>
<td>FG/MG: dark green (seasonal)</td>
<td>FG/MG: smooth</td>
</tr>
<tr>
<td>BG: dominant, bold horizon, moderately jagged, steep, severely dissected</td>
<td>BG: bold irregular, angular, vertical to diagonal, rugged, long, slightly interrupted by landfill profile</td>
<td>BG: landfills, moderate, jagged profile</td>
<td>BG: varied, moderately jagged profile</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LG/WATER</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>FG/MG: landfill: definite, undulating, mass noticeably obscures background mountains, slopes mimic background mountains</td>
<td>FG/MG: landfill: clumped, patchy, scattered, varied shape and size</td>
<td>FG/MG: landfill: indistinct, triangular, appropriate</td>
</tr>
<tr>
<td>FG/MG: landfill: undulating profile, multiple high points, mimics background mountains</td>
<td>FG/MG: landfill: varied, moderately jagged profile</td>
<td>FG/MG: landfill: indistinct, running to a peak</td>
</tr>
<tr>
<td>FG/MG: landfill: mostly obscured by vegetation, ten, warm</td>
<td>FG/MG: landfill: red/yellows, sage green and fangs (seasonal)</td>
<td>FG/MG: landfill: indistinct, dark brown</td>
</tr>
<tr>
<td>FG/MG: landfill: fine to medium</td>
<td>FG/MG: landfill: continuous, fine to medium, clumped</td>
<td>FG/MG: landfill: indistinct</td>
</tr>
</tbody>
</table>

#### SECTION C. PROPOSED ACTIVITY DESCRIPTION

<table>
<thead>
<tr>
<th>FORM</th>
<th>LINE</th>
<th>COLOR</th>
<th>TEXTURE</th>
</tr>
</thead>
<tbody>
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<td>FG/MG: landfill: clumped, patchy, scattered, varied shape and size</td>
<td>FG/MG: landfill: indistinct, triangular, appropriate</td>
<td></td>
</tr>
<tr>
<td>FG/MG: landfill: undulating profile, multiple high points, mimics background mountains</td>
<td>FG/MG: landfill: varied, moderately jagged profile</td>
<td>FG/MG: landfill: indistinct, running to a peak</td>
<td></td>
</tr>
<tr>
<td>FG/MG: landfill: mostly obscured by vegetation, ten, warm</td>
<td>FG/MG: landfill: red/yellows, sage green and fangs (seasonal)</td>
<td>FG/MG: landfill: indistinct, dark brown</td>
<td></td>
</tr>
<tr>
<td>FG/MG: landfill: fine to medium</td>
<td>FG/MG: landfill: continuous, fine to medium, clumped</td>
<td>FG/MG: landfill: indistinct</td>
<td></td>
</tr>
</tbody>
</table>

#### SECTION D. CONTRAST RATING

1. **Degree of Contrast**

<table>
<thead>
<tr>
<th>LAND/WATER BODY</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Moderate</td>
<td>Strong</td>
<td>Moderate</td>
</tr>
<tr>
<td>Weak</td>
<td>Weak</td>
<td>None</td>
</tr>
</tbody>
</table>

2. **Does project design meet visual resource management objectives?**
   - Yes
   - No

(Explain on reverse side)

3. **Additional mitigating measures recommended**
   - Yes
   - No

---

**Evaluator's Names**

Kristofo L. Kvarfordt
John C. Ellsworth
**UNITED STATES DEPARTMENT OF THE INTERIOR**  
**BUREAU OF LAND MANAGEMENT**

**VISUAL CONTRAST RATING WORKSHEET**

**SECTION A. PROJECT INFORMATION**

1. **Project Name**  
   Logan City/Cache County Landfill

2. **Key Observation Point**  
   1225 West 200 North- Existing Condition

3. **VRM Class**

4. **Location**  
   Township 12N  
   Range 1E  
   Section 31

5. **Location Sketch**  
   See Visual Simulation

**SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION**

<table>
<thead>
<tr>
<th>LAND/WATER</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
</table>
| **FORM**   | FG/MG: distinct, flat, regular, slightly sloping  
             BG: prominent, bold horizon, moderately jagged, steep | FG/MG: diverse, low and flat (seasonal)  
             BG: indistinct, clumping on north aspect | FG/MG: roads: smooth, solid, regular, bold, wide,  
                                                   large, bold lines, buildings: definite, geometric, low  
                                                   BG: N/A |
| **LINE**   | FG/MG: partially obscured by vegetation  
             BG: bold irregular, angular, rugged, long (vertical) | FG/MG: trees: undulating, broken, prominent  
             BG: distinct edge on ridges, mostly not apparent  
             trees: vertical, straight, buildings: horizontal,  
             straight, simple  
             BG: N/A |
| **COLOR**  | FG/MG: partially obscured by vegetation, tan to brown  
             BG: mixed (diluted), grayblue, brownfaunated (seasonal) | FG/MG: trees: dark green (seasonal), agriculture/ROW:  
             green, reds and tans (seasonal)  
             BG: mixed, indistinct, gray to dark slate, tan,  
             red/orange (seasonal) | FG/MG: roads: medium gray, warm, subtle  
                                           utilities/fence: dark brown to gray subtle  
                                           buildings: high contrast, white sides dark roofs,  
                                           glare  
                                           BG: N/A |
| **TEXTURE** | FG/MG: smooth to moderate  
             BG: ridged, vertically striated, contrasty, rough, aridized | FG/MG: trees: medium, clumped, agriculture/ROW: fine  
             to medium, smooth, uniform  
             BG: mixed, indistinct, smooth | FG/MG: roads: smooth, uniform, stippled  
                                           utilities/fence: smooth walls and roofs,  
                                           stables, sequential  
                                           BG: N/A |

**SECTION C. PROPOSED ACTIVITY DESCRIPTION**

<table>
<thead>
<tr>
<th>LAND/WATER</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
</table>
| **FORM**   | FG/MG: landfill: apparent, smooth, flattened mound | FG/MG: landfill: diverse, low and flat (seasonal),  
                                                   moderate blocky, amorphous clumps | FG/MG: No change |
| **LINE**   | FG/MG: landfill: somewhat indistinct, undulating | FG/MG: landfill: varied | FG/MG: No change |
| **COLOR**  | FG/MG: landfill: tan (subtle), warm | FG/MG: landfill: dark reds to tan (seasonal) | FG/MG: No change |
| **TEXTURE** | FG/MG: landfill: smooth | FG/MG: landfill: fine to medium | FG/MG: No change |

**SECTION D. CONTRAST RATING**  

<table>
<thead>
<tr>
<th>DEGREE OF CONTRAST</th>
<th>LAND/WATER BODY (1)</th>
<th>VEGETATION (2)</th>
<th>STRUCTURES (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>Moderate</td>
<td>Weak</td>
<td>None</td>
</tr>
<tr>
<td>Form</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Line</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Color</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Texture</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

2. Does project design meet visual resource management objectives?  
   - [ ] Yes  
   - [x] No  
   (Explain on reverse side)

3. Additional mitigating measures recommended  
   - [ ] Yes  
   - [x] No

**Evaluator's Names**  
Kristofor L. Kvarfordt  
John C. Ellsworth
## UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

### VISUAL CONTRAST RATING WORKSHEET

#### SECTION A. PROJECT INFORMATION

1. **Project Name**
   Logan City/Cache County Landfill

2. **Key Observation Point**
   1225 West 200 North - 60% CC

3. **VRM Class**

#### SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

<table>
<thead>
<tr>
<th>1. LAND/WATER</th>
<th>2. VEGETATION</th>
<th>3. STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>FORM</td>
<td>FG/MG: distinct, flat, regular; slightly sloping</td>
<td>FG/MG: diverse, low and flat (seasonal)</td>
</tr>
<tr>
<td>LINE</td>
<td>BG: prominent, bold horizon, moderately jagged, steep</td>
<td></td>
</tr>
<tr>
<td>COLOR</td>
<td>FG/MG: partially obscured by vegetation</td>
<td>FG/MG: trees; undulating, broken, prominent</td>
</tr>
<tr>
<td></td>
<td>flat, straight, simple</td>
<td>agriculture/ROW: horizontal, parallel, straight along edges</td>
</tr>
<tr>
<td>TIDE</td>
<td>BG: bold irregular, angular, rugged, long (vertical)</td>
<td>BG: distinct edge on ridgelines, mostly not apparent grass to treeline</td>
</tr>
</tbody>
</table>

#### SECTION C. PROPOSED ACTIVITY DESCRIPTION

<table>
<thead>
<tr>
<th>1. LAND/WATER</th>
<th>2. VEGETATION</th>
<th>3. STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>FORM</td>
<td>FG/MG: landfill; definite, smooth, flattened mound</td>
<td></td>
</tr>
<tr>
<td>LINE</td>
<td>FG/MG: landfill; 30% diagonal transitioning to horizontal</td>
<td></td>
</tr>
<tr>
<td>COLOR</td>
<td>FG/MG: landfill; tan (subtle), warm</td>
<td></td>
</tr>
<tr>
<td>TIDE</td>
<td>FG/MG: landfill; smooth</td>
<td></td>
</tr>
</tbody>
</table>

#### SECTION D. CONTRAST RATING

<table>
<thead>
<tr>
<th>DEGREE OF CONTRAST</th>
<th>LAND/WATER (1)</th>
<th>VEGETATION (2)</th>
<th>STRUCTURES (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>Moderate</td>
<td>Weak</td>
<td>None</td>
</tr>
<tr>
<td>Moderate</td>
<td>Weak</td>
<td>Moderate</td>
<td>None</td>
</tr>
<tr>
<td>Weak</td>
<td>None</td>
<td>Strong</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

1. Does project design meet visual resource management objectives? **Yes** **No**

2. Additional mitigating measures recommended **Yes** **No**

Evaluator's Names
Kristofor L. Kvarfordt
John C. Ellisworth
Form 8400-4  
(September 1985)

UNITED STATES  
DEPARTMENT OF THE INTERIOR  
BUREAU OF LAND MANAGEMENT  

VISUAL CONTRAST RATING WORKSHEET  

Date: June 15, 2005  
District: Cache County  
Resource Area:  
Activity (program): Landfill Closure  

SECTION A. PROJECT INFORMATION  

1. Project Name  
   Logan City/Cache County Landfill  

4. Location  
   Township: 12N  
   Range: 1E  

5. Location Sketch  
   See Visual Simulation  

2. Key Observation Point  
   1225 West 200 North - 60% EEC  

3. VRM Class  

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION  

<table>
<thead>
<tr>
<th>FORM</th>
<th>FG/MG: distinct, flat, regular, slightly sloping</th>
<th>BG: prominent, bold horizon, moderately jagged, steep</th>
</tr>
</thead>
<tbody>
<tr>
<td>LINE</td>
<td>FG/MG: par polyline by vegetation flat, straight, simple</td>
<td>BG: bold irregular, angular, rough, long (vertical)</td>
</tr>
<tr>
<td>COLOR</td>
<td>FG/MG: partially obscured by vegetation, tan to brown</td>
<td>BG: muted (distal), gray, blue, brown, tan (seasonal)</td>
</tr>
<tr>
<td>TEXTURE</td>
<td>FG/MG: smooth to moderate</td>
<td>BG: ridged, vertically striated, contrasty, rough, ordered</td>
</tr>
</tbody>
</table>

SECTION C. PROPOSED ACTIVITY DESCRIPTION  

<table>
<thead>
<tr>
<th>FORM</th>
<th>FG/MG: landfill: noticeably visible, slightly undulating, mounding form</th>
<th>BG: smooth, continuous, varied, fine to medium, patchy</th>
</tr>
</thead>
<tbody>
<tr>
<td>LINE</td>
<td>FG/MG: landfill: noticeably visible, undulating profile</td>
<td>BG: smooth, continuous, varied, fine to medium, patchy</td>
</tr>
<tr>
<td>COLOR</td>
<td>FG/MG: landfill: partially obscured by vegetation, tan</td>
<td>BG: smooth, continuous, varied, fine to medium, patchy</td>
</tr>
<tr>
<td>TEXTURE</td>
<td>FG/MG: landfill: smooth</td>
<td>BG: smooth, continuous, varied, fine to medium, patchy</td>
</tr>
</tbody>
</table>

SECTION D. CONTRAST RATING  

1. DEGREE OF CONTRAST  

<table>
<thead>
<tr>
<th>LAND/WATER BODY</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>Moderate</td>
<td>Weak</td>
</tr>
</tbody>
</table>

2. Does project design meet visual resource management objectives?  
   [ ] Yes  [ ] No  
   (Explain on reverse side)  

3. Additional mitigating measures recommended  
   [ ] Yes  [ ] No  

Evaluator’s Names  
Kristofor L. Kvarfordt  
John C. Ellsworth
#### SECTION A. PROJECT INFORMATION

1. **Project Name**
   Logan City/Cache County Landfill

2. **Key Observation Point**
   1225 West 200 North - 75% CC

3. **VRM Class**

<table>
<thead>
<tr>
<th>4. Location</th>
<th>5. Location Sketch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Township</td>
<td>12N</td>
</tr>
<tr>
<td>Range</td>
<td>1E</td>
</tr>
<tr>
<td>Section</td>
<td>31</td>
</tr>
</tbody>
</table>

**Cache County**

**VISUAL CONTRAST RATING WORKSHEET**

#### SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

<table>
<thead>
<tr>
<th>LAND/WATER</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FORM</strong></td>
<td><strong>COLOR</strong></td>
<td><strong>TEXTURE</strong></td>
</tr>
<tr>
<td>FG/MG: distinct, flat, regular; slightly sloping</td>
<td>FG/MG: partially obscured by vegetation, tan to brown</td>
<td>FG/MG: smooth to moderate</td>
</tr>
<tr>
<td>BG: prominent, bold horizon, moderately jagged, steep</td>
<td>BG: bold, irregular, angular, rugged, long (vertical)</td>
<td>BG: ridged, vertically stratified, contrasty, rough, ordered</td>
</tr>
</tbody>
</table>

#### SECTION C. PROPOSED ACTIVITY DESCRIPTION

<table>
<thead>
<tr>
<th>LAND/WATER</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FORM</strong></td>
<td><strong>COLOR</strong></td>
<td><strong>TEXTURE</strong></td>
</tr>
<tr>
<td>BG: prominent long arc</td>
<td>BG: subdued, earthy; uncommon</td>
<td>BG: continuous with subtle variation, definite</td>
</tr>
</tbody>
</table>

#### SECTION D. CONTRAST RATING

- **SHORT TERM**
- **LONG TERM**

<table>
<thead>
<tr>
<th>FEATURES</th>
<th>LAND/WATER BODY</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DEGREE OF CONTRAST</strong></td>
<td>Spring</td>
<td>Moderate</td>
<td>Weak</td>
</tr>
</tbody>
</table>

**ELEMENTS**

- **Form**
  - X
- **Line**
  - X
- **Color**
  - X
- **Texture**
  - X

2. Does project design meet visual resource management objectives? [ ] Yes [ ] No

(Explain on reverse side)

3. Additional mitigating measures recommended

[ ] Yes [ ] No

**Evaluator’s Names**

Kristofo L. Kvarfordt
John C. Ellisworth
**SECTION A. PROJECT INFORMATION**

1. **Project Name**
   Logan City/Cache County Landfill

2. **Key Observation Point**
   1225 West 200 North - 75% EEC

**SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION**

<table>
<thead>
<tr>
<th>LAND/WATER</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>FG/MG: trees, understory, broken, prominent</td>
<td>trees: medium, clumped, light green</td>
<td>trees: medium, clumped, light green</td>
</tr>
<tr>
<td>BG: medium gray, warm, subtle</td>
<td>BG: medium gray, warm, subtle</td>
<td>BG: medium gray, warm, subtle</td>
</tr>
<tr>
<td>FG/MG: partially obscured by vegetation, tan to brown</td>
<td>FG/MG: partially obscured by vegetation, tan to brown</td>
<td>FG/MG: partially obscured by vegetation, tan to brown</td>
</tr>
<tr>
<td>FG/MG: smooth to moderate</td>
<td>FG/MG: smooth to moderate</td>
<td>FG/MG: smooth to moderate</td>
</tr>
</tbody>
</table>

**SECTION C. PROPOSED ACTIVITY DESCRIPTION**

<table>
<thead>
<tr>
<th>LAND/WATER</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>FG/MG: landfill: noticeably visible, slightly undulating, mound</td>
<td>FG/MG: landfill: clumping trees and shrubs, varied forms</td>
<td>FG/MG: landfill: continuous but varied, fine to medium, pointed</td>
</tr>
<tr>
<td>FG/MG: landfill: noticeably visible, slightly undulating, mound</td>
<td>FG/MG: landfill: clumping trees and shrubs, varied forms</td>
<td>FG/MG: landfill: continuous but varied, fine to medium, pointed</td>
</tr>
<tr>
<td>FG/MG: landfill: noticeably visible, slightly undulating, mound</td>
<td>FG/MG: landfill: clumping trees and shrubs, varied forms</td>
<td>FG/MG: landfill: continuous but varied, fine to medium, pointed</td>
</tr>
</tbody>
</table>

**SECTION D. CONTRAST RATING**

<table>
<thead>
<tr>
<th>ELEMENTS</th>
<th>LAND/WATER BODY</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Line</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Color</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Texture</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

1. Does project design meet visual resource management objectives? [ ] Yes [ ] No
(Explain on reverse side)

2. Additional mitigating measures recommended: [ ] Yes [ ] No

Evaluator's Names
Kristofor L. Kvarfordt
John C. Ellsworth
**SECTION A. PROJECT INFORMATION**

1. **Project Name**: Logan City/Cache County Landfill

2. **Key Observation Point**: 1225 West 200 North - 100% CC

3. **VRM Class**: See Visual Simulation

4. **Location**
   - **Township**: 12N
   - **Range**: 1E
   - **Section**: 31

**SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION**

<table>
<thead>
<tr>
<th>FORM</th>
<th>LAND/WATER</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIG/MG: distinct, flat, regular, slightly sloping</td>
<td>FIG/MG: diverse, low and flat (seasonal)</td>
<td>FIG/MG: roads: solid, regular, bold, wide, tapered; utilitarian: straight; buildings: horizontal, simple; natural: N/A</td>
<td></td>
</tr>
<tr>
<td>BG: prominent, bold horizon, moderately jagged, steep</td>
<td>BG: indistinct, clumping on north aspect</td>
<td>BG: N/A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LINE</th>
<th>LAND/WATER</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIG/MG: partially obscured by vegetation, flat, straight, simple</td>
<td>FIG/MG: trees: indistinct, broken, prominent agriculture/ROW: horizontal, parallel, straight along edges</td>
<td>FIG/MG: roads: solid, straight, receding, simple, continuous; utilitarian: vertical, straight; buildings: horizontal, simple; natural: N/A</td>
<td></td>
</tr>
<tr>
<td>BG: bold irregular, angular, rugged, long (vertical)</td>
<td>BG: indistinct edge on ridgelines, mostly not apparent grass to baseline</td>
<td>BG: N/A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COLOR</th>
<th>LAND/WATER</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIG/MG: partially obscured by vegetation, tan to brown</td>
<td>FIG/MG: trees: dark green (seasonal) agriculture/ROW: vivid green, reds and tans (seasonal)</td>
<td>FIG/MG: roads: medium gray, warm, subtle; utilitarian: dark brown to gray subtle; buildings: high contrast, while sides dark roofs, glare</td>
<td>BG: muted, indistinct, gray to dark state, tan, red/orange (seasonal)</td>
</tr>
<tr>
<td>BG: muted (distant), grayblue, brown/orange (seasonal)</td>
<td>BG: muted, indistinct, gray to dark state, tan, red/orange (seasonal)</td>
<td>BG: N/A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TEXTURE</th>
<th>LAND/WATER</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIG/MG: smooth to moderate</td>
<td>FIG/MG: trees: medium, clumped, agriculture/ROW: fine to-medium, smooth, uniform</td>
<td>FIG/MG: roads: smooth, uniform, stippled; utilitarian: smooth, repetitive; buildings: smooth walls and roofs, stagers, somewhat contrasty</td>
<td>BG: rugged, vertically striated, rough, ordered; natural: N/A</td>
</tr>
<tr>
<td>BG: ridged, vertically striated, contrasty, rough, ordered</td>
<td>BG: muted, indistinct, smooth</td>
<td>BG: N/A</td>
<td></td>
</tr>
</tbody>
</table>

**SECTION C. PROPOSED ACTIVITY DESCRIPTION**

<table>
<thead>
<tr>
<th>FORM</th>
<th>LAND/WATER</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIG/MG: landfill: distinct, smooth, pyramidal, prominent high point</td>
<td>FIG/MG: landfill: diverse, low and flat (seasonal), moderate to-blowy, amorphous chumps</td>
<td>FIG/MG: No change</td>
<td></td>
</tr>
<tr>
<td>BG: prominent, bold horizon, moderately jagged, steep</td>
<td>BG: indistinct, clumping on north aspect</td>
<td>BG: N/A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LINE</th>
<th>LAND/WATER</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIG/MG: landfill: 30% diagonal transitioning to peak, prominent long arc</td>
<td>FIG/MG: landfill: varied</td>
<td>FIG/MG: No change</td>
<td></td>
</tr>
<tr>
<td>BG: prominent, bold horizon, moderately jagged, steep</td>
<td>BG: indistinct, clumping on north aspect</td>
<td>BG: N/A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COLOR</th>
<th>LAND/WATER</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIG/MG: landfill: tan (subtle), warm</td>
<td>FIG/MG: landfill: tan to sage green (seasonal)</td>
<td>FIG/MG: No change</td>
<td></td>
</tr>
<tr>
<td>BG: muted, indistinct, gray to dark state, tan, red/orange (seasonal)</td>
<td>BG: muted, indistinct, gray to dark state, tan, red/orange (seasonal)</td>
<td>BG: N/A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TEXTURE</th>
<th>LAND/WATER</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIG/MG: landfill: smooth</td>
<td>FIG/MG: landfill: continuous with subtle variation, definite</td>
<td>FIG/MG: No change</td>
<td></td>
</tr>
<tr>
<td>BG: rugged, vertically striated, rough, ordered</td>
<td>BG: muted, indistinct, smooth</td>
<td>BG: N/A</td>
<td></td>
</tr>
</tbody>
</table>

**SECTION D. CONTRAST RATING**

1. **DEGREE OF CONTRAST**

<table>
<thead>
<tr>
<th>ELEMENTS</th>
<th>LAND/WATER BODY (1)</th>
<th>VEGETATION (2)</th>
<th>STRUCTURES (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Line</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Color</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Texture</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

2. **SHORT TERM**

- Does project design meet visual resource management objectives? [ ] Yes [ ] No

(Explain on reverse side)

3. **LONG TERM**

- Additional mitigating measures recommended? [ ] Yes [ ] No

**Evaluator's Names**

Kristofor L. Kvarfordt

John C. Ellsworth
### SECTION A. PROJECT INFORMATION

1. **Project Name**: Logan City/Cache County Landfill
   - **Location**: Township 12N, Range 1E, Section 31

2. **Key Observation Point**: 1225 West 200 North - 100% EEC

3. **VRM Class**: See Visual Simulation

4. **Location**: Date June 15, 2005

### SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

<table>
<thead>
<tr>
<th>FORM</th>
<th>LFMG:</th>
<th>Natural</th>
<th>MODIFIED</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>LINE</td>
<td>F/G/M/G:</td>
<td>distinct, flat, regular, slightly sloping</td>
<td>prominent, bold horizon, moderately jagged, steep</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BG:</td>
<td>prominent, bold horizon, moderately jagged, steep</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COLOR</td>
<td>F/G/M/G:</td>
<td>partially obscured by vegetation</td>
<td>trees: undulating, broken, prominent</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BG:</td>
<td>trees: undulating, broken, prominent</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIDE</td>
<td>F/G/M/G:</td>
<td>smooth to moderate</td>
<td>ridge, vertically striated, contrasty, rough, ordered</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### SECTION C. PROPOSED ACTIVITY DESCRIPTION

<table>
<thead>
<tr>
<th>FORM</th>
<th>LFMG:</th>
<th>Natural</th>
<th>MODIFIED</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>LINE</td>
<td>F/G/M/G:</td>
<td>landfill: definitely visible, slightly undulating, mounding form, prominent high point</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BG:</td>
<td>landfill: definitely visible, slightly undulating, mounding form, prominent high point</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COLOR</td>
<td>F/G/M/G:</td>
<td>landfill: partially obscured by vegetation, tan to brown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BG:</td>
<td>landfill: partially obscured by vegetation, tan to brown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIDE</td>
<td>F/G/M/G:</td>
<td>landfill: smooth</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### SECTION D. CONTRAST RATING

<table>
<thead>
<tr>
<th>FEATURES</th>
<th>LAND/WATER BODY</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strong</td>
<td>Moderate</td>
<td>Weak</td>
</tr>
<tr>
<td>FORM</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>LINE</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>COLOR</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>TEXTURE</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>
UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

SECTION A. PROJECT INFORMATION
1. Project Name
   Logan City/Cache County Landfill
2. Key Observation Point
   1250 West 600 South - Existing Condition
3. VRM Class

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

<table>
<thead>
<tr>
<th>LAND/WATER</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>FG/MG: distinct, flat, regular, horizontal</td>
<td>FG/MG: trees: rounded form, clump, distinct, simple, strip, horizontal; agriculture/ROW: fat, distinct, solid, simple</td>
<td>FG/MG: roads: distinct, smooth, solid, regular, horizontal; utilities/fence: vertical, narrow, tall/short; buildings: definite, geometric, regular, low</td>
</tr>
<tr>
<td>BG: definite horizon, modularity jaggard</td>
<td>BG: indistinct, not apparent</td>
<td>BG: indistinct, mostly not apparent grass to treeline</td>
</tr>
<tr>
<td>LINE</td>
<td>COLOR</td>
<td>TEXTURE</td>
</tr>
<tr>
<td>FG/MG: horizontal, straight, simple, parallel</td>
<td>FG/MG: N/A; obscured by vegetation</td>
<td>FG/MG: smooth</td>
</tr>
<tr>
<td>FG/MG: trees: undulating, broken, prominent agriculture/ROW: horizontal, parallel, straight</td>
<td>BG: indistinct, mostly not apparent grass to treeline</td>
<td></td>
</tr>
<tr>
<td>BG: bold irregular; angular, rugged, long</td>
<td>BG: muted, indistinct, gray, tan, red/orange (seasonal)</td>
<td>BG: smooth, uniform, smooth</td>
</tr>
<tr>
<td>FG/MG: N/A; obscured by vegetation</td>
<td>FG/MG: trees: dark green (seasonal) agriculture/ROW: wispy green (seasonal)</td>
<td>FG/MG: roads: smooth, uniform, shaded, utilities/fence: smooth, continuous; buildings: smooth walls, medium roofs, ordered, contrasty</td>
</tr>
<tr>
<td>BG: indistinct, mostly not apparent grass to treeline</td>
<td>BG: muted, indistinct, gray, tan, red/orange (seasonal)</td>
<td>BG: N/A</td>
</tr>
<tr>
<td>FG/MG: trees: medium, clumped, directional agriculture/ROW: fine to medium, smooth, uniform</td>
<td>FG/MG: trees: medium, clumped, directional agriculture/ROW: fine to medium, smooth, uniform</td>
<td></td>
</tr>
<tr>
<td>BG: muted, indistinct, smooth</td>
<td>BG: muted, indistinct, smooth</td>
<td></td>
</tr>
<tr>
<td>FG/MG: smooth</td>
<td>BG: muted, indistinct, smooth</td>
<td></td>
</tr>
<tr>
<td>BG: smooth, uniform, smooth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEXTURE</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SECTION C. PROPOSED ACTIVITY DESCRIPTION

<table>
<thead>
<tr>
<th>LAND/WATER</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>FG/MG: landfill: indistinct, slightly rounded, slightly domed</td>
<td>FG/MG: landfill: indistinct</td>
<td>FG/MG: No change</td>
</tr>
<tr>
<td>FG/MG: landfill: horizontal, slightly wrong, simple</td>
<td>FG/MG: landfill: indistinct</td>
<td>FG/MG: No change</td>
</tr>
<tr>
<td>FG/MG: landfill: tan (subtle), warm</td>
<td>FG/MG: landfill: redlight tan to brown (seasonal)</td>
<td>FG/MG: No change</td>
</tr>
<tr>
<td>FG/MG: landfill: smooth</td>
<td>FG/MG: landfill: fine, uneven</td>
<td>FG/MG: No change</td>
</tr>
</tbody>
</table>

SECTION D. CONTRAST RATING

1. DEGREE OF CONTRAST
   | LAND/WATER BODY | VEGETATION | STRUCTURES |
   | Strong | Moderate | Weak | Strong | Moderate | Weak | Strong | Moderate | Weak | None |
   | Form | X | X | X | Line | X | X | X | Color | X | X |
   | Texture | X | X | X |

2. Does project design meet visual resource management objectives?  □ Yes □ No (Explain on reverse side)

3. Additional mitigating measures recommended
   □ Yes □ No

Evaluator's Names
Kristofor L. Kvarfordt
John C. Ellsworth
SECTION A. PROJECT INFORMATION

1. Project Name
Logan City/Cache County Landfill

2. Key Observation Point
1250 South 600 West - 60% CC

3. VRM Class

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

1. LAND/WATER
   FG/MG: distinct, flat, regular, horizontal
   BG: default horizon, moderately jagged

2. VEGETATION
   FG/MG: trees, rounded form, clustered, distinct, simple, strip, horizontal, agriculture/ROW: flat, defined, solid, simple
   BG: indistinct, not apparent

3. STRUCTURES
   FG/MG: roads: distinct, smooth, solid, regular, horizontal; utilities/fence: vertical, narrow, tall, bright; buildings: definite, geometric, regular, low
   BG: N/A

SECTION C. PROPOSED ACTIVITY DESCRIPTION

1. LAND/WATER
   FG/MG: landfill: indistinct, slightly rounded, slightly domed

2. VEGETATION
   FG/MG: landfill: indistinct
   BG: N/A

3. STRUCTURES
   FG/MG: landfill: indistinct
   BG: N/A

SECTION D. CONTRAST RATING

1. DEGREE OF CONTRAST
   LAND/WATER
   VEGETATION
   STRUCTURES
   (1) (2) (3)

2. Does project design meet visual resource management objectives?
   □ Yes □ No
   (Explain on reverse side)

3. Additional mitigating measures recommended
   □ Yes □ No

Evaluator's Names
Kristofor L. Kvarfordt
John C. Ellsworth
Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

SECTION A. PROJECT INFORMATION

1. Project Name
Logan City/Cache County Landfill

2. Key Observation Point
1250 West 600 South - 60% EEC

3. VRM Class

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

<table>
<thead>
<tr>
<th>1. LAND/WATER</th>
<th>2. VEGETATION</th>
<th>3. STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>BG: definite horizon, moderately jagged</td>
<td>BG: distinct, simple, single, horizontal, vertical, narrow, tall, short, buildings: distinct, geometrical, regular, low</td>
<td></td>
</tr>
<tr>
<td>BG: bold irregular, angular, ragged, long</td>
<td>BG: distinct, single, horizontal, vertical, narrow, tall, short, buildings: distinct, geometrical, regular, low</td>
<td></td>
</tr>
<tr>
<td>FG/MG: N/A: obscured by vegetation</td>
<td>FG/MG: trees: dark green (seasonal) agriculture/ROW: vivid green (seasonal)</td>
<td>FG/MG: roads: medium gray, warm, subtle</td>
</tr>
<tr>
<td>BG: muted (distant), grayblue, brown (seasonal)</td>
<td>BG: muted, indistinct, gray, tan, red/orange (seasonal)</td>
<td>BG: muted, indistinct, gray, tan, red/orange (seasonal)</td>
</tr>
<tr>
<td>BG: smooth to medium, ordered</td>
<td>BG: smooth, uniform, striped, vertical, fence, smooth, consistent, buildings: smooth walls, medium roofs, ordered, contrasty</td>
<td></td>
</tr>
</tbody>
</table>

SECTION C. PROPOSED ACTIVITY DESCRIPTION

<table>
<thead>
<tr>
<th>1. LAND/WATER</th>
<th>2. VEGETATION</th>
<th>3. STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>FG/MG: landfill: obscured with vegetation</td>
<td>FG/MG: landfill: brown to tan, red, green (seasonal)</td>
<td>FG/MG: landfill pavilion: indistinct, brown</td>
</tr>
</tbody>
</table>

SECTION D. CONTRAST RATING

1. DEGREE OF CONTRAST

<table>
<thead>
<tr>
<th>FEATURES</th>
<th>LAND/WATER</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strong</td>
<td>Moderate</td>
<td>Weak</td>
</tr>
<tr>
<td></td>
<td>Strong</td>
<td>Moderate</td>
<td>Weak</td>
</tr>
<tr>
<td></td>
<td>Strong</td>
<td>Moderate</td>
<td>Weak</td>
</tr>
<tr>
<td></td>
<td>Strong</td>
<td>Moderate</td>
<td>Weak</td>
</tr>
</tbody>
</table>

2. Does project design meet visual resource management objectives? [ ] Yes [ ] No
(Explain on reverse side)

3. Additional mitigating measures recommended
[ ] Yes [ ] No

Evaluator's Names
Kristofor L. Kvarfordt
John C. Ellsworth

Date: June 15, 2005
District: Cache County
Resource Area
Activity (program): Landfill Closure
# Visual Contrast Rating Worksheet

## Section A. Project Information

1. **Project Name**  
   Logan City/Cache County Landfill

2. **Key Observation Point**  
   1250 West 600 South - 75% CC

3. **VRM Class**  
   __________

4. **Location**  
   Township 12N  
   Range 1E  
   Section 31

5. **Location Sketch**  
   See Visual Simulation

## Section B. Characteristic Landscape Description

1. **Land/Water**
   - FG/MG: distinct, flat, regular, horizontal  
     - BG: definite horizon, moderately jagged  

2. **Vegetation**
   - FG/MG: trees: rounded form, clustered, simple, strip, horizontal, agricultural/ROW: flat, definite, solid, simple  
     - BG: indistinct, not apparent  

3. **Structures**
   - FG/MG: landfill: elevated, definitely apparent but subtle  
     - BG: N/A

## Section C. Proposed Activity Description

1. **Land/Water**
   - FG/MG: landfill: definite form, somewhat rounded, somewhat domed  

2. **Vegetation**
   - FG/MG: trees: medium, pointed, directional, agricultural/ROW: light green (seasonal)  
     - BG: indistinct, gray, tan, red/orange (seasonal)  

3. **Structures**
   - FG/MG: more apparent, fine, even

## Section D. Contrast Rating

1. **Degree of Contrast**
   - **LAND/WATER BODY**  
     - Strong, Moderate, Weak  
   - **VEGETATION**  
     - Strong, Moderate, Weak  
   - **STRUCTURES**  
     - Strong, Moderate, Weak

2. **Does Project Design Meet Visual Resource Management Objectives?**  
   □ Yes □ No  
   (Explain on reverse side)

3. **Additional Mitigating Measures Recommended**  
   □ Yes □ No

### Evaluator's Names
- Kristofor L. Kvarfordt  
- John C. Ellsworth
**SECTION A. PROJECT INFORMATION**

1. **Project Name**
   Logan City/Cache County Landfill

4. **Location**
   Township: 12N
   Range: 1E
   Section: 31

5. **Location Sketch**
   See Visual Simulation

**SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION**

1. **LAND/WATER**
   FG/MG: distinct, flat, regular, horizontal
   BG: definite horizon, moderately jagged

2. **VEGETATION**
   FG/MG: trees: rounded form, dispersed, distinct, simple, strip, horizontal; agriculture/ROW: flat, definite, solid, simple
   BG: indistinct, not apparent

3. **STRUCTURES**
   FG/MG: roads: distinct, smooth, solid, regular, horizontal; utilities/fence: vertical, narrow, tall/stall, buildings: definite, geometrical, regular, low
   BG: N/A

**SECTION C. PROPOSED ACTIVITY DESCRIPTION**

1. **LAND/WATER**
   FG/MG: landfill: apparent, slightly domed
   BG: landfill: apparent forms, clumped and varied

2. **VEGETATION**
   FG/MG: trees: dark green (seasonal) agriculture/ROW: green (seasonal)
   BG: mound, indistinct, gray, tan, red/tan (seasonal)

3. **STRUCTURES**
   FG/MG: roads: medium gray, warm, subtle; utilities/fence: dark brown to gray subtle; buildings: high contrast, white sides dark roofs, glare
   BG: N/A

**SECTION D. CONTRAST RATING**

1. **DEGREE OF CONTRAST**

<table>
<thead>
<tr>
<th>LAND/WATER BODY</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>Moderate</td>
<td>Weak</td>
</tr>
<tr>
<td>Moderate</td>
<td>Strong</td>
<td>Moderate</td>
</tr>
<tr>
<td>Weak</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

2. **FEATURES**

<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>LAND/WATER</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Line</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Color</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Texture</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

3. **Does project design meet visual resource management objectives?**
   □ Yes □ No

(Explain on reverse side)

3. **Additional mitigating measures recommended**
   □ Yes □ No

Evaluator's Names
Kristofor L. Kvarfordt
John C. Ellsworth
**SECTION A. PROJECT INFORMATION**

1. **Project Name**
   - Logan City/Cache County Landfill

2. **Key Observation Point**
   - 1250 West 600 South - 100% CC

3. **VRM Class**
   - ...

4. **Location**
   - Township: 12N
   - Range: 1E
   - Section: 31

5. **Location Sketch**
   - See Visual Simulation

**SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION**

<table>
<thead>
<tr>
<th>FORM</th>
<th>FG/MG: distinct, flat, regular, horizontal</th>
<th>BG: definite horizon, moderately jagged</th>
</tr>
</thead>
<tbody>
<tr>
<td>LINE</td>
<td>FG/MG: horizontal, straight, simple, parallel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BG: bold irregular, angular, rugged, long</td>
<td></td>
</tr>
<tr>
<td>COLOR</td>
<td>FG/MG: N/A; obscured by vegetation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BG: muted (distant), greyblue, brownish (seasonal)</td>
<td></td>
</tr>
<tr>
<td>TEXTURE</td>
<td>FG/MG: smooth</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BG: smooth to medium, ordered</td>
<td></td>
</tr>
</tbody>
</table>

**SECTION C. PROPOSED ACTIVITY DESCRIPTION**

<table>
<thead>
<tr>
<th>FIG/MG: landfill: prominent form, slightly pyramidal</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIG/MG: landfill: elevated, definitely apparent but subtle forms</td>
</tr>
<tr>
<td>FIG/MG: landfill: bold curving profile</td>
</tr>
<tr>
<td>FIG/MG: landfill: partially obscured by vegetation, tan (dullish), warm</td>
</tr>
<tr>
<td>FIG/MG: landfill: smooth</td>
</tr>
</tbody>
</table>

**SECTION D. CONTRAST RATING**

<table>
<thead>
<tr>
<th>DEGREE OF CONTRAST</th>
<th>LAND/WATER BODY (1)</th>
<th>VEGETATION (2)</th>
<th>STRUCTURES (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>Moderate</td>
<td>Weak</td>
<td>None</td>
</tr>
<tr>
<td>Moderate</td>
<td>Strong</td>
<td>Weak</td>
<td>None</td>
</tr>
<tr>
<td>Weak</td>
<td>None</td>
<td>Strong</td>
<td>Weak</td>
</tr>
<tr>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

**CONTRAST RATING**

<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>Long Term</th>
<th>Short Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Line</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Color</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Texture</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

2. Does project design meet visual resource management objectives?  
   - Yes [X]  No [ ]

(Explain on reverse side)

3. Additional mitigating measures recommended  
   - Yes [X]  No [ ]

**Evaluator's Names**

Kristofor L. Kvarfordt  
John C. Ellsworth
SECTION A. PROJECT INFORMATION

1. Project Name
   Logan City/Cache County Landfill

2. Key Observation Point
   1250 West 600 South - 100% EEC

3. VRM Class
   31

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

<table>
<thead>
<tr>
<th>FORM</th>
<th>LINE</th>
<th>COLOR</th>
<th>TEXTURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>FG/MG: distinct, flat, regular, horizontal</td>
<td>BG: definite horizon, moderately jagged</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FG/MG: horizontal, straight, simple, parallel</td>
<td>BG: bold irregular, angular, rugged</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FG/MG: N/A; obscured by vegetation</td>
<td>BG: muted (distant), gray, brown/tan (seasonal)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FG/MG: smooth</td>
<td>BG: smooth to medium, ordered</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SECTION C. PROPOSED ACTIVITY DESCRIPTION

<table>
<thead>
<tr>
<th>FORM</th>
<th>LINE</th>
<th>COLOR</th>
<th>TEXTURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>FG/MG: landfill: apparent profile, interrupts background horizon line</td>
<td>FG/MG: landfill: indistinct, irregular</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FG/MG: landfill: partially obscured by vegetation, tan (subtle), warm</td>
<td>FG/MG: landfill: brown to tan, red, green (seasonal)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FG/MG: landfill: smooth</td>
<td>FG/MG: landfill: fine to medium, uneven</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SECTION D. CONTRAST RATING

1. DEGREE OF CONTRAST

<table>
<thead>
<tr>
<th>LANDE/WATER BODY (1)</th>
<th>VEGETATION (2)</th>
<th>STRUCTURES (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>Moderate</td>
<td>Weak</td>
</tr>
</tbody>
</table>

2. Does project design meet visual resource management objectives? □ Yes □ No

3. Additional mitigating measures recommended
   □ Yes □ No

Evaluator's Names
Kristofor L. Kvarfordt
John C. Ellsworth
**SECTION A. PROJECT INFORMATION**

1. **Project Name**
   Logan City/Cache County Landfill

2. **Key Observation Point**
   450 North 1000 West - Existing Condition

3. **VRM Class**

4. **Location**
   Township 12N
   Range 1E
   Section 31

5. **Location Sketch**
   See Visual Simulation

**SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>FG/MG: flat, regular, partially obscured by structures, low</td>
<td>FG/MG: variegated, clumped forms, moundy, pyramidal, separate</td>
<td>FG/MG: roads: smooth, solid, regular, bold, wide, taper; utilities: prominent, vertical, tall; buildings: distinct, horizontal rectangle</td>
</tr>
<tr>
<td>BG: dominant, bold horizon, moderately jagged, stress, severely dissected</td>
<td>BG: distinct edge on riprap, apparent grass to tree line</td>
<td>BG: N/A</td>
</tr>
<tr>
<td>FG/MG: intersecting angles, partially obscured by structures and vegetation</td>
<td>FG/MG: vertical and horizontal, diagonal, branching apparent</td>
<td>FG/MG: roads: bold, straight, zig zag, disjointed; utilities: vertical, straight; buildings: horizontal, straight, bold</td>
</tr>
<tr>
<td>BG: bold irregular, angular, vertical, to diagonal, jagged</td>
<td>BG: distinct edge on riprap, apparent grass to tree line</td>
<td>BG: N/A</td>
</tr>
<tr>
<td>FG/MG: N/A; obscured by structures and vegetation</td>
<td>FG/MG: trees and shrubs: light, medium, dark green, red, brown to dark brown; ROW: sandy loam (seasonal); BG: gray to dark slate, tan, red/yellow/orange (seasonal)</td>
<td>FG/MG: roads: medium gray, warm; utilities: brown to dark brown; buildings: moderate contrast, greys, tan, brown</td>
</tr>
<tr>
<td>BG: distinct, gray/blue, brown/tan (seasonal)</td>
<td>BG: gray to dark slate, tan, red/yellow/orange (seasonal)</td>
<td>BG: N/A</td>
</tr>
<tr>
<td>FG/MG: smooth to medium</td>
<td>FG/MG: trees and shrubs: medium to coarse, clumped; ROW: medium</td>
<td>FG/MG: roads: smooth, uniform, stippled; utilities: smooth, unpaved; buildings: smooth walls</td>
</tr>
<tr>
<td>BG: gentle, vertically and diagonally striated, contrasty, rough, ordered</td>
<td>BG: smooth to medium</td>
<td>BG: N/A</td>
</tr>
</tbody>
</table>

**SECTION C. PROPOSED ACTIVITY DESCRIPTION**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>FG/MG: landfill: partially visible, low, indistinct</td>
<td>FG/MG: landfill: elevated, apparent but indistinct</td>
<td>FG/MG: No change</td>
</tr>
<tr>
<td>FG/MG: landfill: obscured, horizontal, profile broken by structures and vegetation</td>
<td>FG/MG: landfill: apparent but indistinct</td>
<td>FG/MG: No change</td>
</tr>
<tr>
<td>FG/MG: landfill: partially obscured, fan, warm</td>
<td>FG/MG: landfill: yellowishbrown (seasonal)</td>
<td>FG/MG: No change</td>
</tr>
<tr>
<td>FG/MG: landfill: smooth</td>
<td>FG/MG: landfill: line, unseen where visible</td>
<td>FG/MG: No change</td>
</tr>
</tbody>
</table>

**SECTION D. CONTRAST RATING [ ] SHORT TERM [X] LONG TERM**

1. **DEGREE OF CONTRAST**

<table>
<thead>
<tr>
<th>FEATURES</th>
<th>1. LAND/WATER BODY (1)</th>
<th>2. VEGETATION (2)</th>
<th>3. STRUCTURES (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strong</strong></td>
<td>Moderate</td>
<td>Weak</td>
<td>Moderate</td>
</tr>
<tr>
<td><strong>Moderate</strong></td>
<td>Moderate</td>
<td>Weak</td>
<td>Moderate</td>
</tr>
<tr>
<td><strong>Weak</strong></td>
<td>None</td>
<td>Weak</td>
<td>None</td>
</tr>
</tbody>
</table>

2. **Does project design meet visual resource management objectives?**  
   [ ] Yes  [X] No  
   (Explain on reverse side)

3. **Additional mitigating measures recommended**  
   [ ] Yes  [ ] No

**Evaluator's Names**  
Kristofer L. Kvarfordt  
John C. Ellsworth
**UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT**

**VISUAL CONTRAST RATING WORKSHEET**

**SECTION A. PROJECT INFORMATION**

1. **Project Name**
   Logan City/Cache County Landfill

2. **Key Observation Point**
   450 North 1000 West - 50% CC

3. **VRM Class**

**SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION**

<table>
<thead>
<tr>
<th>FORM</th>
<th>1. LAND/WATER</th>
<th>2. VEGETATION</th>
<th>3. STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>FG/MG: flat, regular, partially obscured by structures, low</td>
<td>FG/MG: varied, clumped forms, rounded, pyramidal, separate</td>
<td>BG: dominant, bold horizon, moderately jagged, steep, severely dissected</td>
<td></td>
</tr>
<tr>
<td>FG/MG: intersecting angles, partially obscured by structures and vegetation</td>
<td>FG/MG: varied, vertical and horizontal, diagonal, branching apparent</td>
<td>BG: indistinct, buildings: horizontal, straight, bold</td>
<td></td>
</tr>
<tr>
<td>FG/MG: N/A, obscured by structures and vegetation</td>
<td>BG: distinct, gray/blue, brownish/tan (seasonal)</td>
<td>BG: indistinct, buildings: horizontal, straight, bold</td>
<td></td>
</tr>
<tr>
<td>FG/MG: smooth to medium</td>
<td>BG: ridged, vertically and diagonally striated, contrast, rough, ordered</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SECTION C. PROPOSED ACTIVITY DESCRIPTION**

<table>
<thead>
<tr>
<th>FORM</th>
<th>1. LAND/WATER</th>
<th>2. VEGETATION</th>
<th>3. STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>FG/MG: landfill: noticeably visible, low, distinct flat form</td>
<td>FG/MG: landfill: elevated, noticeably apparent</td>
<td>FG/MG: No change</td>
<td></td>
</tr>
<tr>
<td>FG/MG: landfill: definitely visible, horizontal, profile broken by structures and vegetation</td>
<td>FG/MG: landfill: noticeably apparent</td>
<td>FG/MG: No change</td>
<td></td>
</tr>
<tr>
<td>FG/MG: landfill: partially obscured, tan, warm</td>
<td>FG/MG: landfill: yellow/tan, sage green (seasonal)</td>
<td>FG/MG: No change</td>
<td></td>
</tr>
<tr>
<td>FG/MG: landfill: smooth</td>
<td>FG/MG: landfill: fine, uniform, even</td>
<td>FG/MG: No change</td>
<td></td>
</tr>
</tbody>
</table>

**SECTION D. CONTRAST RATING**

<table>
<thead>
<tr>
<th>FEATURES</th>
<th>LAND/WATER</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEGREE OF CONTRAST</td>
<td>BODY (1)</td>
<td>VEGETATION (2)</td>
<td>STRUCTURES (3)</td>
</tr>
<tr>
<td>Strong</td>
<td>Moderate</td>
<td>Weak</td>
<td>None</td>
</tr>
<tr>
<td>Form</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Line</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Color</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Texture</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

1. Does project design meet visual resource management objectives? **☐ Yes ☐ No**
   (Explain on reverse side)

2. Additional mitigating measures recommended **☐ Yes ☐ No**
   (Explain on reverse side)

**Evaluator's Names**

Kristofer L. Kvarfordt
John C. Ellsworth
**SECTION A. PROJECT INFORMATION**

1. **Project Name**
   Logan City/Cache County Landfill

2. **Key Observation Point**
   450 North 1000 West - 60% EEC

3. **VRM Class**

**SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION**

<table>
<thead>
<tr>
<th>FG/MG</th>
<th>Land/Water</th>
<th>Vegetation</th>
<th>Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>F/G/MG: flat, regular, partially obscured by structures, low B/G: dominant, bold, horizontal, moderately jagged, steep, severely dissected</td>
<td>F/G/MG: varied, clumped forms, rounded, pyramidal, separate B/G: indistinct, continuous clumping on north aspect, other vegetation clumping throughout</td>
<td>F/G/MG: roads: smooth, solid, regular, bold, wide, layered, utilities: prominent, vertical, tall, buildings: distinct, horizontal retrace B/G: N/A</td>
<td></td>
</tr>
<tr>
<td>F/G/MG: intersecting angles, partially obscured by structures and vegetation B/G: bold, irregular, angular, vertical to diagonal, rugged, long, toe of slope obscured by structures</td>
<td>F/G/MG: varied, vertical and horizontal, diagonal, branching apparent B/G: distinct edge on ridgelines, apparent grass to tree line</td>
<td>F/G/MG: roads: bold, straight, zig zag, disjointed; utilities: vertical, straight; buildings: horizontal, straight, B/G: N/A</td>
<td></td>
</tr>
<tr>
<td>F/G/MG: N/A; obscured by structures and vegetation B/G: distinct, gray, blue, brown/tan/lred (seasonal)</td>
<td>F/G/MG: trees and shrubs: light/medium dark green, red, seasonal; ROW: tan/yellows (seasonal); B/G: gray to dark slate, tan, red/yellow/orange (seasonal)</td>
<td>F/G/MG: roads: medium gray, warm; utilities: brown to dark brown; buildings: moderate contrast, gray, tan, turquoise B/G: N/A</td>
<td></td>
</tr>
</tbody>
</table>

**SECTION C. PROPOSED ACTIVITY DESCRIPTION**

<table>
<thead>
<tr>
<th>FG/MG</th>
<th>Land/Water</th>
<th>Vegetation</th>
<th>Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>F/G/MG: landfill: noticeably visible, low, indistinct, slightly undulating</td>
<td>F/G/MG: landfill: elevated, noticeably apparent, varied</td>
<td>F/G/MG: No change</td>
<td></td>
</tr>
<tr>
<td>F/G/MG: landfill: noticeably visible, undulating, profile broken by structures and vegetation</td>
<td>F/G/MG: landfill: noticeably apparent, soft, subtle</td>
<td>F/G/MG: No change</td>
<td></td>
</tr>
<tr>
<td>F/G/MG: landfill: N/A; obscured by vegetation</td>
<td>F/G/MG: landfill: tan, sage green, red/yellows/oranges (seasonal)</td>
<td>F/G/MG: No change</td>
<td></td>
</tr>
<tr>
<td>F/G/MG: landfill: smooth</td>
<td>F/G/MG: landfill: line to medium grain, sparse density, uneven</td>
<td>F/G/MG: No change</td>
<td></td>
</tr>
</tbody>
</table>

**SECTION D. CONTRAST RATING**

<table>
<thead>
<tr>
<th>DEGREE OF CONTRAST</th>
<th>LAND/WATER BODY</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>Moderate</td>
<td>Weak</td>
<td>None</td>
</tr>
<tr>
<td>Moderate</td>
<td>Strong</td>
<td>Moderate</td>
<td>Weak</td>
</tr>
<tr>
<td>Weak</td>
<td>None</td>
<td>Strong</td>
<td>Moderate</td>
</tr>
<tr>
<td>None</td>
<td>Weak</td>
<td>None</td>
<td>Strong</td>
</tr>
</tbody>
</table>

2. Does project design meet visual resource management objectives? Yes [ ] No [x] (Explain on reverse side)

3. Additional mitigating measures recommended? Yes [x] No [ ]

**Evaluator's Names**
Kristofor L. Kvarfordt
John C. Ellsworth
### SECTION A. PROJECT INFORMATION

1. **Project Name**  
   Logan City/Cache County Landfill

2. **Key Observation Point**  
   450 North 1000 West - 75% CC

3. **VRM Class**

4. **Location**  
   Township 12N  
   Range 1E  
   Section 31

5. **Location Sketch**  
   See Visual Simulation

### SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

<table>
<thead>
<tr>
<th>FORM</th>
<th>LAND/WATER</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>FG/MI: Rat, regular, partially obscured by structures, low</td>
<td>FG/MI: varied, clumped forms, rounded, pyramidal, separate</td>
<td>FG/MI: varied, vertical and horizontal, diagonal, branching apparent</td>
<td></td>
</tr>
<tr>
<td>LINE</td>
<td>Bg: bold irregular, angular, vertical to diagonal, rugged, low, line of slope obscured by structures</td>
<td>Bg: distinct edge on ridgelines, apparent grass to treeline</td>
<td></td>
</tr>
<tr>
<td>COLOR</td>
<td>FG/MI: N/A, obscured by structures and vegetation</td>
<td>FG/MI: trees and shrubs: light green, dark green, red, seasonal</td>
<td></td>
</tr>
<tr>
<td>TEXTURE</td>
<td>FG/MI: smooth to medium</td>
<td>FG/MI: trees and shrubs: medium to coarse, clumped; ROW: medium</td>
<td>FG/MI: No change</td>
</tr>
</tbody>
</table>

### SECTION C. PROPOSED ACTIVITY DESCRIPTION

<table>
<thead>
<tr>
<th>FORM</th>
<th>LAND/WATER</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>FG/MI: Landfill: definitely visible, distinct doming form</td>
<td>FG/MI: Landfill: elevated, noticeably apparent, uniform</td>
<td>FG/MI: No change</td>
<td></td>
</tr>
<tr>
<td>LINE</td>
<td>FG/MI: Landfill: partially obscured, tan, warm</td>
<td>FG/MI: Landfill: noticeably apparent</td>
<td>FG/MI: No change</td>
</tr>
<tr>
<td>COLOR</td>
<td>FG/MI: Landfill: smooth</td>
<td>FG/MI: Landfill: yellowish, sage green (seasonal)</td>
<td>FG/MI: No change</td>
</tr>
<tr>
<td>TEXTURE</td>
<td>FG/MI: Landfill: smooth</td>
<td>FG/MI: Landfill: line, uniform, even</td>
<td>FG/MI: No change</td>
</tr>
</tbody>
</table>

### SECTION D. CONTRAST RATING

<table>
<thead>
<tr>
<th>DEGREE OF CONTRAST</th>
<th>LAND/WATER BODY (1)</th>
<th>VEGETATION (2)</th>
<th>STRUCTURES (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>Moderate</td>
<td>Weak</td>
<td>None</td>
</tr>
<tr>
<td>Strong</td>
<td>Moderate</td>
<td>Weak</td>
<td>None</td>
</tr>
<tr>
<td>Strong</td>
<td>Moderate</td>
<td>Weak</td>
<td>None</td>
</tr>
</tbody>
</table>

2. Does project design meet visual resource management objectives?  
   - [ ] Yes  
   - [x] No  
   (Explain on reverse side)

3. Additional mitigating measures recommended  
   - [ ] Yes  
   - [ ] No

Evaluator’s Names  
Kristofer L. Kvarfordt  
John C. Ellsworth
**SECTION A. PROJECT INFORMATION**

1. **Project Name**  
   Logan City/Cache County Landfill

2. **Key Observation Point**  
   450 North 1000 West - 75% EEC

3. **VRM Class**
   31

4. **Location**
   Township  12N
   Range  1E
   Section  31

5. **Location Sketch**  
   See Visual Simulation

**SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION**

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>LAND/WATER</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FORM</strong></td>
<td>flat, regular, partially obscured by structures, low</td>
<td>varied, clumped forms, rounded, pyramidal, separate</td>
<td>roads: smooth, solid, regular, bold, wide, layered; utilities: prominent, vertical, tall; buildings: distinct, horizontal rectangle</td>
</tr>
<tr>
<td><strong>LINE</strong></td>
<td>intersecting angles, partially obscured by structures and vegetation</td>
<td>varied, vertical and horizontal, diagonal</td>
<td>roads: bold, straight, zig zag, disjointed; utilities: vertical, straight, buildings: horizontal, straight</td>
</tr>
<tr>
<td><strong>COLOR</strong></td>
<td>N/A: obscured by structures and vegetation</td>
<td>trees and shrubs: light/mid dark green, red (seasonal); ROW: tans/blondes (seasonal)</td>
<td>roads: medium-gray, warm; utilities: brown to dark brown; buildings: moderate contrast, grays, tan, topoline</td>
</tr>
<tr>
<td><strong>TEXTURE</strong></td>
<td>smooth to medium</td>
<td>trees and shrubs: medium to coarse, clumped</td>
<td>roads: smooth, uniform, stippled; utilities: smooth, repitious; buildings: smooth walls</td>
</tr>
</tbody>
</table>

**SECTION C. PROPOSED ACTIVITY DESCRIPTION**

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>LAND/WATER</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FORM</strong></td>
<td>landfill: definitely visible, low, distinct, slightly undulating</td>
<td>landfill: elevated, noticeably apparent, varied</td>
<td>landfill: indistinct</td>
</tr>
<tr>
<td><strong>LINE</strong></td>
<td>landfill: noticeably visible, undulating, profile broken by structures</td>
<td>landfill: noticeably apparent, soft, subtle</td>
<td>landfill: indistinct</td>
</tr>
<tr>
<td><strong>COLOR</strong></td>
<td>N/A: obscured by vegetation</td>
<td>landfill: tan, sage green, reds/yellows/oranges (seasonal)</td>
<td>landfill: dark brown, indistinct</td>
</tr>
<tr>
<td><strong>TEXTURE</strong></td>
<td>landfill: smooth</td>
<td>landfill: fine to medium grain, sparse density, uneven</td>
<td>landfill: indistinct</td>
</tr>
</tbody>
</table>

**SECTION D. CONTRAST RATING**

- **Short Term**
- **Long Term**

<table>
<thead>
<tr>
<th>DEGREE OF CONTRAST</th>
<th>LAND/WATER BODY</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate</td>
<td>Weak</td>
<td>None</td>
<td>Strong</td>
</tr>
<tr>
<td>Form</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Line</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Color</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Texture</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

2. Does project design meet visual resource management objectives?  
   [ ] Yes  [ ] No
   (Explain on reverse side)

3. Additional mitigating measures recommended  
   [ ] Yes  [ ] No

**Evaluator's Names**  
Kristofer L. Kvarfordt  
John C. Ellsworth
### SECTION A. PROJECT INFORMATION

1. **Project Name**  
   Logan City/Cache County Landfill

2. **Key Observation Point**  
   450 North 1000 West - 100% CC

3. **VRM Class**  
   31

4. **Location**  
   Township 12N

5. **Location Sketch**  
   See Visual Simulation

### SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

#### 1. LAND/WATER

| FORM | FG/MG: flat, regular, partially obscured by structures, low BG: dominant, bold fountain, moderately jagged, steep, severely dissected |
| LINE | FG/MG: intersecting angles, partially obscured by structures and vegetation BG: bold irregular, angular, vertical to diagonal/rugged, steep, toe of slope obscured by structures |
| COLOR | FG/MG: N/A; obscured by structures and vegetation BG: distinct, grayish brown, brown (seasonal) |
| TIDE | FG/MG: smooth to medium |

#### 2. VEGETATION

| FG/MG: varied, clumped forms, rounded, pyramidal, serene |
| BG: indistinct, conifers clumping on north aspect, other vegetation clumping throughout |
| FG/MG: varied, vertical and horizontal, diagonal, branching apparent |
| BG: distinct edge on ridgelines, apparent grass to treeline |
| FG/MG: trees and shrubs: light to dark green, red (seasonal) | ROW: tans / yellows (seasonal); vegetation clumping throughout |
| BG: bold irregular, angular, vertical to diagonal/rugged, steep, rugged |
| COLOR | FG/MG: trees and shrubs: medium to coarse, clumped; FG/MG: roads: smooth, uniform, stippled; utilities: smooth walls |

#### 3. STRUCTURES

| FG/MG: landfill: prominent, bold doming form |
| BG: elevated, significantly apparent, uniform |
| FG/MG: landfill: elevated, significantly apparent, uniform |
| FG/MG: landfill: slightly visible, horizontally arcing,profile broken by structures |
| FG/MG: landfill: yellowish, sage green (seasonal) |
| FG/MG: landfill: smooth |

### SECTION C. PROPOSED ACTIVITY DESCRIPTION

#### 1. LAND/WATER

| FG/MG: landfill: prominent, bold doming form |
| BG: elevated, significantly apparent, uniform |
| FG/MG: landfill: elevated, significantly apparent, uniform |
| FG/MG: landfill: slightly visible, horizontally arcing, profile broken by structures |
| FG/MG: landfill: yellowish, sage green (seasonal) |
| FG/MG: landfill: smooth |

#### 2. VEGETATION

| FG/MG: trees and shrubs: medium to coarse, clumped; ROW: medium |
| BG: smooth to medium |

#### 3. STRUCTURES

| FG/MG: landfill: more apparent, fine, uniform, even |

### SECTION D. CONTRAST RATING

1. **DEGREE OF CONTRAST**

<table>
<thead>
<tr>
<th>FEATURES</th>
<th>LAND/WATER (1)</th>
<th>VEGETATION (2)</th>
<th>STRUCTURES (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEGREE</td>
<td>Strong</td>
<td>Moderate</td>
<td>Weak</td>
</tr>
<tr>
<td>FORM</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Line</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Color</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Texture</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

2. **Does project design meet visual resource management objectives?**  
   - Yes  
   - No  
   (Explain on reverse side)

3. **Additional mitigating measures recommended**  
   - Yes  
   - No

**Evaluator’s Names**  
Kristofor L. Kvarfordt  
John C. Ellsworth
Form H400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

SECTION A. PROJECT INFORMATION

1. Project Name
   Logan City/Cache County Landfill

2. Key Observation Point
   450 North 1000 West - 100% EEC

3. VRM Class

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

<table>
<thead>
<tr>
<th>LAND/WATER</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
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<tbody>
<tr>
<td>FG/MG: flat, regular, partially obscured by structures, low</td>
<td>FG/MG: varied, clumped forms, rounded, pyramidal, separate</td>
<td>FG/MG: roads: smooth, solid, regular, bold, wide, tapered; utilities: prominent, vertical, tall; buildings: distinct, horizontal rectangle</td>
</tr>
<tr>
<td>BG: dominant, bold horizon, moderately jagged, steep, severely dissected</td>
<td>BG: indistinct, confuses clumping on north aspect, other vegetation clumping throughout</td>
<td>BG: N/A</td>
</tr>
<tr>
<td>FG/MG: intersecting angles, partially obscured by structures and vegetation</td>
<td>FG/MG: varied, vertical and horizontal, diagonal, branching apparent</td>
<td>FG/MG: roads: bold, straight, zig zag, disjointed; utilities: vertical, straight; buildings: horizontal, straight, BG: N/A</td>
</tr>
<tr>
<td>BG: bold triangular, angular, vertical to diagonal, ragged, long, line of slope obscured by structures</td>
<td>BG: distinct edge on ridgelines, apparent grass to treeline</td>
<td></td>
</tr>
<tr>
<td>FG/MG: N/A, obscured by structures and vegetation</td>
<td>FG/MG: trees and shrubs: light/medium/dark green, red (seasonal)</td>
<td>FG/MG: roads: medium gray, warm; utilities: brown to dark brown; buildings: moderate contrast, grey, tan, brown</td>
</tr>
<tr>
<td>BG: distinct, grey/blue, brown/tan/red (seasonal)</td>
<td>BG: gray to dark slate, tan, red/yellow/orange (seasonal)</td>
<td>BG: N/A</td>
</tr>
<tr>
<td>THE TONE</td>
<td>THE TONE</td>
<td>THE TONE</td>
</tr>
<tr>
<td>FG/MG: smooth to medium</td>
<td>FG/MG: trees and shrubs: medium to coarse, clumped; ROW: medium</td>
<td>FG/MG: roads: smooth, uniform, stippled; utilities: smooth, repetitive; buildings: smooth walls</td>
</tr>
<tr>
<td>BG: indistinct</td>
<td>BG: smooth to medium</td>
<td>BG: N/A</td>
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SECTION C. PROPOSED ACTIVITY DESCRIPTION

<table>
<thead>
<tr>
<th>LAND/WATER</th>
<th>VEGETATION</th>
<th>STRUCTURES</th>
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</thead>
<tbody>
<tr>
<td>BG: landfill: significantly visible, undulating, profile broken by structures</td>
<td>BG: landfill: definitely apparent, soft, subtle</td>
<td>BG: landfill: indistinct</td>
</tr>
<tr>
<td>FG/MG: landfill: N/A, obscured by vegetation</td>
<td>BG: landfill: tan, sage green, red/yellow/orange (seasonal)</td>
<td>BG: landfill: dark brown, indistinct</td>
</tr>
<tr>
<td>THE TONE</td>
<td>THE TONE</td>
<td>THE TONE</td>
</tr>
</tbody>
</table>

SECTION D. CONTRAST RATING [ ] SHORT TERM [X] LONG TERM

1. DEGREE OF CONTRAST

   | LAND/WATER BODY (1) | VEGETATION (2) | STRUCTURES (3) |
   | Strong | Moderate | Weak | Strong | Moderate | Weak | Strong | Moderate | Weak | None |
   | Form | X | X | X | | | | | |
   | Line | X | X | X | | | | | |
   | Color | X | X | X | | | | | |
   | Texture | X | X | X | | | | | |

2. Does project design meet visual resource management objectives? [ ] Yes [ ] No
   (Explain on reverse side)

3. Additional mitigating measures recommended
   [ ] Yes [ ] No

Evaluator's Names

Kristofor L. Kvarfordt
John C. Ellsworth

Date: June 15, 2005
District: Cache County
Resource Area: Landfill Closure