

INTRODUCTION

Site Description

The Cedar Hills Regional Landfill is located near Maple Valley, Washington, approximately 25 miles east of Seattle. King County owns the landfill, which disposes solid waste from all of King County outside of the City of Seattle. Currently, the landfill accepts approximately 3,500 tons per day of municipal solid waste. The site encompasses 940 acres, with 452 acres of interior permitted waste fill area. A 1,000-foot-wide buffer with native Northwest vegetation is located around all sides. Waste filling began in an unlined area of the site in the 1960s. In 1985, King County constructed the first composite-lined expansion area with leachate collection. The construction of the area was well ahead of landfill lining and leachate collection requirements imposed by the RCRA Subtitle D regulations of 1991. King County Solid Waste Division (KCSWD) personnel operate the landfill and all of its environmental control systems, including the landfill gas collection system.

Focus on Prevention

The maintenance program for equipment, facilities, roads, and environmental control systems at the Cedar Hills Regional Landfill is based on the concept of preventive maintenance: fixing things before they break. Not only does this save ratepayer money in the long run, but preventive maintenance ensures that problems do not get out of control and result in unplanned releases to the environment. KCSWD operations have found that it pays to spend about two-thirds of its efforts on preventive maintenance, and about one-third on monitoring and adjusting the system. The landfill operates in a very wet part of the world, which in general causes physical changes in the landfill to occur more rapidly than in a drier climate. For this reason, it is imperative that operations be pro-active.

DESIGN AND CONSTRUCTION

Award Criteria:

- *Discussion of siting, site preparation and design, construction techniques, site soils, hydrology/geology and their suitability for a landfill.*
- *Discussion of merits of the site preparation and design for environmental protection, demonstrating that it is “state of the art” sanitary landfill*
- *Overall planning and end-use planning*

Designs Guided by Site Development Plan

Progressive development of successive expansion cells and closure of completed cells are done in accordance with an overall site development plan prepared originally by King County in 1987 and modified in 1998. All environmental control systems (gas, stormwater, leachate control), access roads, borrow areas, stockpile areas, and so forth, are budgeted, designed, and constructed in accordance with the site development plan. The plan is reviewed and updated periodically to coincide with the development of a new refuse cell to respond to changing regulations, new technology, changes in projections of waste generation and disposal, and other factors.

Phased Design and Construction

The development of the Cedar Hills Regional Landfill has been planned as a series of large expansion areas, or cells, each designed to provide several years of filling capacity. Surface water runoff is uniquely managed at the site. The layout of the landfill is designed so that surface water runoff from landfill areas that have received final or interim final covers drain to four permanent detention ponds. An additional temporary stormwater detention pond is also constructed with the development of each new cell.

Figure 1 shows the progressive development of Cedar Hills Regional Landfill cells, planned out to site final closure when it reaches capacity. Figure 2 shows the lining system installed in the most recent landfill cell areas.

Surface Water Runoff and Leachate Drainage

To ensure separation of potentially contaminated surface runoff from the clean component, runoff from active cell areas are routed to lined contaminated stormwater lagoons for temporary detention. Leachate flows by gravity from north to south. Leachate piping from each successive cell is connected to the cell ahead of it in sequence. Pretreatment is provided on-site for the leachate and the contaminated stormwater flow component in two aeration lagoons prior to transmission to an offsite publicly owned wastewater treatment plant.

Lift Sequencing Plans Integrated with Cell Designs

For each new cell of the landfill that is developed, King County prepares a lift sequencing plan that shows the disposal operators how to place lifts in the landfill, including the

elevations of each lift, lift thicknesses, and lift surface slopes (see Figure 3). Operations personnel then use rotating laser levels to carefully control the placement of waste to meet the surfaces depicted in the operational filling plans. This process results in interior and exterior landfill cell slopes that drain water effectively, preventing local inundation that could otherwise clog gas collectors and overload leachate collection pipes. The process also guides the placement of horizontal gas collectors to prevent them from acting as conduits for leachate flow into the gas header pipes. The cell filling plan for each area is typically contracted to the engineering consultant designing the cell configuration, bottom lining, and leachate drainage system to ensure consistency with applicable regulatory and engineering design standards. These include compliance with slope stability, liner thickness, liner materials, landfill gas, leachate, surface water, and erosion control system design requirements.

Lining and Cover Systems

Composite lining systems (geomembrane over low-permeability soils) have been used since 1985. Figure 4 shows typical cross-sections of the lining system installed in the most recent landfill cell areas. Final cover is installed in stages as a landfill cell is brought up to final grade, rather than waiting for the entire cell to be brought to final grade. Figure 5 shows a typical cross-section of final cover installed in the most recent closure phases. Figure 6 shows a typical berm placed on final cover.

Leachate, Gas and Stormwater Control Systems

See the next section, Environmental Controls.

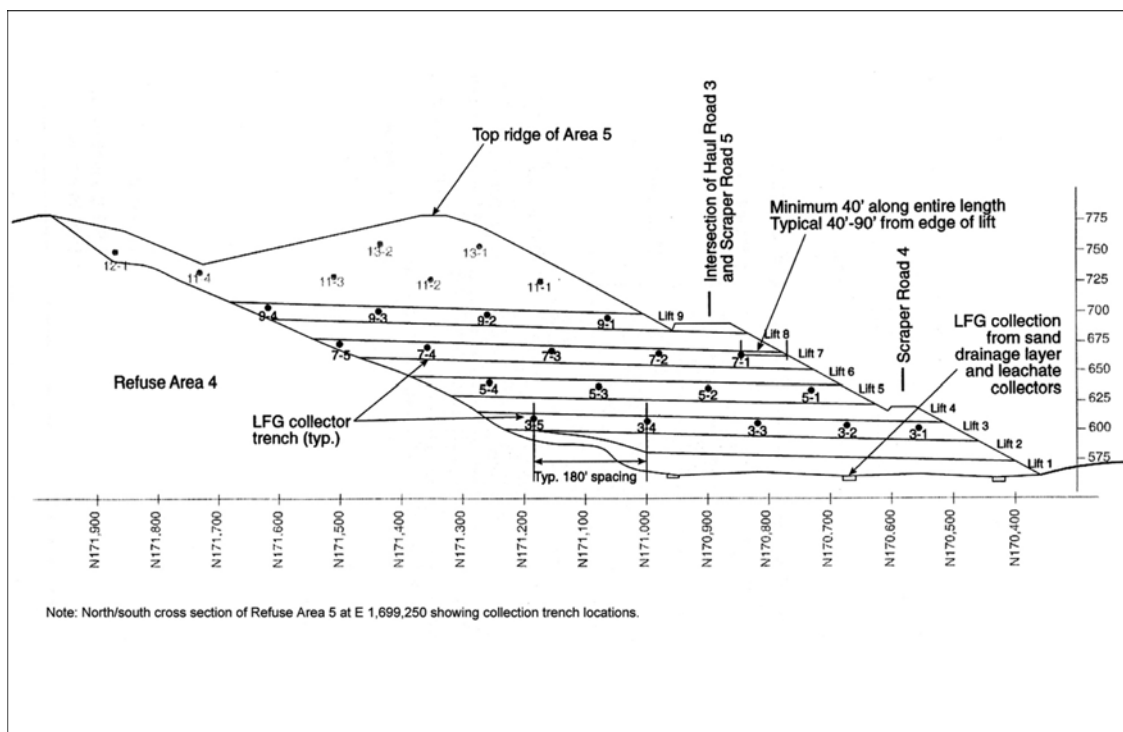


Figure 3. Cross-Section of Operational Filling Plan Area 5

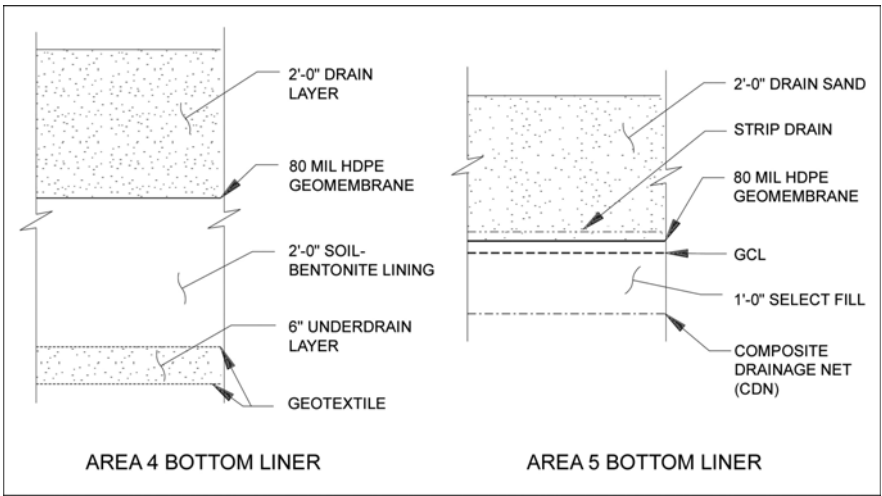


Figure 4. Typical Cross-Section of Lining System

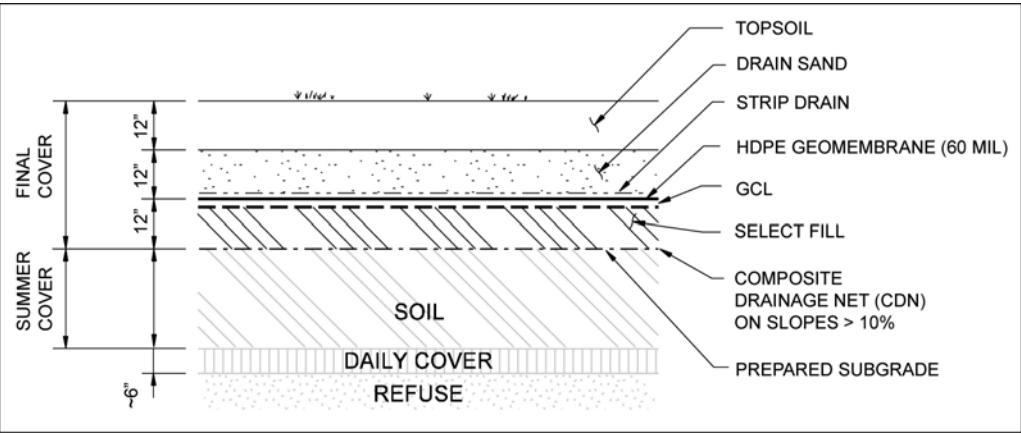


Figure 5. Typical Cross-Section of Final Cover

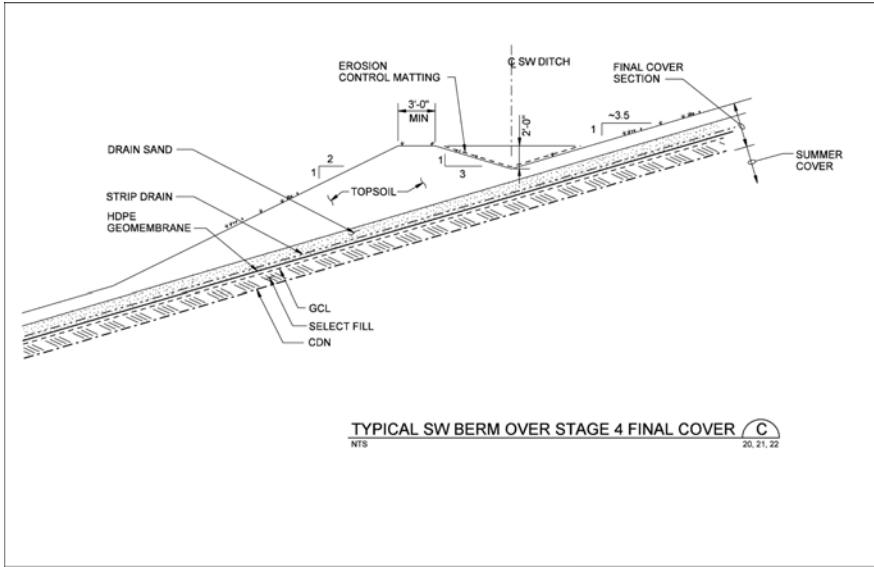


Figure 6. Typical Berm Over Final Cover

ENVIRONMENTAL CONTROLS

Award Criteria:

- *Discussion of groundwater, leachate monitoring; collection and treatment methods employed; quantities produced/collected; materials used for environmental protection (liners, filter layers, etc.). Photographs/schematics included as necessary.*
- *Overall impact of the program on human health, environmental quality and resource conservation.*
- *Compatibility with the environment.*

History of Environmental Protection as First and Absolute Priority

Beginning in the early 1980s, environmental protection was established as a priority at the Cedar Hills Regional Landfill. King County understood the importance of taking all reasonable precautions to prevent groundwater contamination and effective measures were taken to reduce or eliminate the impacts of past practices on groundwater quality. An example is the improvements made to the “Central Pit,” a 2.1.1-acre (final cover surface) expansion area of the Cedar Hills Regional Landfill. The improvements were designed in expectation of the requirements of WAC 173-304 promulgated in 1984 and enacted in 1986. In 1985, KCSWD constructed a composite lining system (plastic membrane underlain by low-permeability soils) in the Central Pit area. Although earlier parts of the landfill were unlined, the new area in 1985 would be closer to groundwater. Therefore, as final cover was placed over the earlier parts of the landfill, the composite lining was installed in the Central Pit. All successive expansion areas of the landfill since that time have had RCRA Subtitle-D-compliant lining.

In addition, King County was the first in the state, and among the first in the nation, to implement modern leachate collection and gas collection designs.

Over the years, King County has proactively remediated a number of issues by investing in a large number of improvement projects. What KCSWD has learned is to plan for and expect failures, to develop and implement design redundancies in expectation of failures, and to budget for replacement of components that are expected to fail. This lesson is most applicable to leachate and gas collection systems, but is also applicable to all of the landfill construction and operations, including, for example, road maintenance, stormwater management, and disposal equipment maintenance.

Landfill Monitoring and Inspection Program

KCSWD has a trained staff of 4 full-time technicians who are responsible for monitoring, inspection, and operation of the environmental control systems at the landfill.

The landfill gas system technicians have implemented an aggressive, day-to-day preventive maintenance program. Inspections occur during monitoring sessions as well as during scheduled quadrant inspections.

Visual Inspection

The landfill is divided into quarters. Landfill technicians visually inspect on a monthly basis each quarter, rotating from quarter to quarter. This inspection is an ongoing process to ensure complete inspection coverage of the landfill.

Inspectors concentrate efforts on checking for field integrity, stressed vegetation, soil cracks and differential settlement, and gas header/well alignment. The observations are recorded and documented in a preventive maintenance database.

Monitoring Sessions

The Cedar Hills Regional Landfill gas collection system has (at present) nearly 500 landfill gas collection and control stations. It consists of:

- 276 horizontal gas collectors
- 108 vertical gas collectors
- 29 migration control vertical wells
- 84 leachate control gas connections

Each control station is monitored twice a month. The gas samples are recorded using the Land Tec Gem 500 system, which samples for CH₄, O₂, CO₂, and temperature and differential pressure of flow at each sampling station. At the sampling control stations, a technician confirms the valve condition and collector line alignment.

Before and after each monitoring session, collected data is compiled and used for collection system evaluation. KCSWD has created its own custom LFG database. Before each monitoring session, well data are printed out for the selected landfill monitoring session. The data are used for a system evaluation-trending monitoring performance of each collection well. The result is an exceptions report. By taking this type of data to the field, each technician can adjust wells according to real data rather than relying on memory. The exceptions report also allows the technician to use best management practices to maintain and balance the collection field.

A network of 19 down-gradient wells and 22 up-gradient wells is used to monitor groundwater. Figure 7 shows a plan view of the well locations; Figure 8 shows typical cross-sections through the landfill and surrounding strata. KCSWD has installed more than the minimum required groundwater monitoring network in order to monitor all of the conductive strata around the landfill. Figure 9 also shows the network of gas monitoring probes around the landfill, which also contains probes in multiple potential migration strata in the vadose zone around the landfill. An aggressive approach to landfill gas control has prevented lateral gas migration. KCSWD also monitors ambient air and has a complete meteorological station at the site. The Nasal Ranger program is used to monitor odor. KCSWD hired an olfactory certification consultant (Nasal Ranger, Inc.) to train all supervisors and leads and Landfill Gas operators to recognize odors and evaluate the source and concentration levels of reported and detected odors. The Landfill Gas staff has developed a site-wide monitoring program to include daily site-wide odor observations twice a day. These observations are recorded on paper as well as in an electronic database. Trained staff also perform stormwater and leachate monitoring in accordance with regulations. All LFG monitoring records are kept in a validated database. And our preventative maintenance records are kept in paper form or



Figure 7. Monitoring Well and Staff Gage Locations

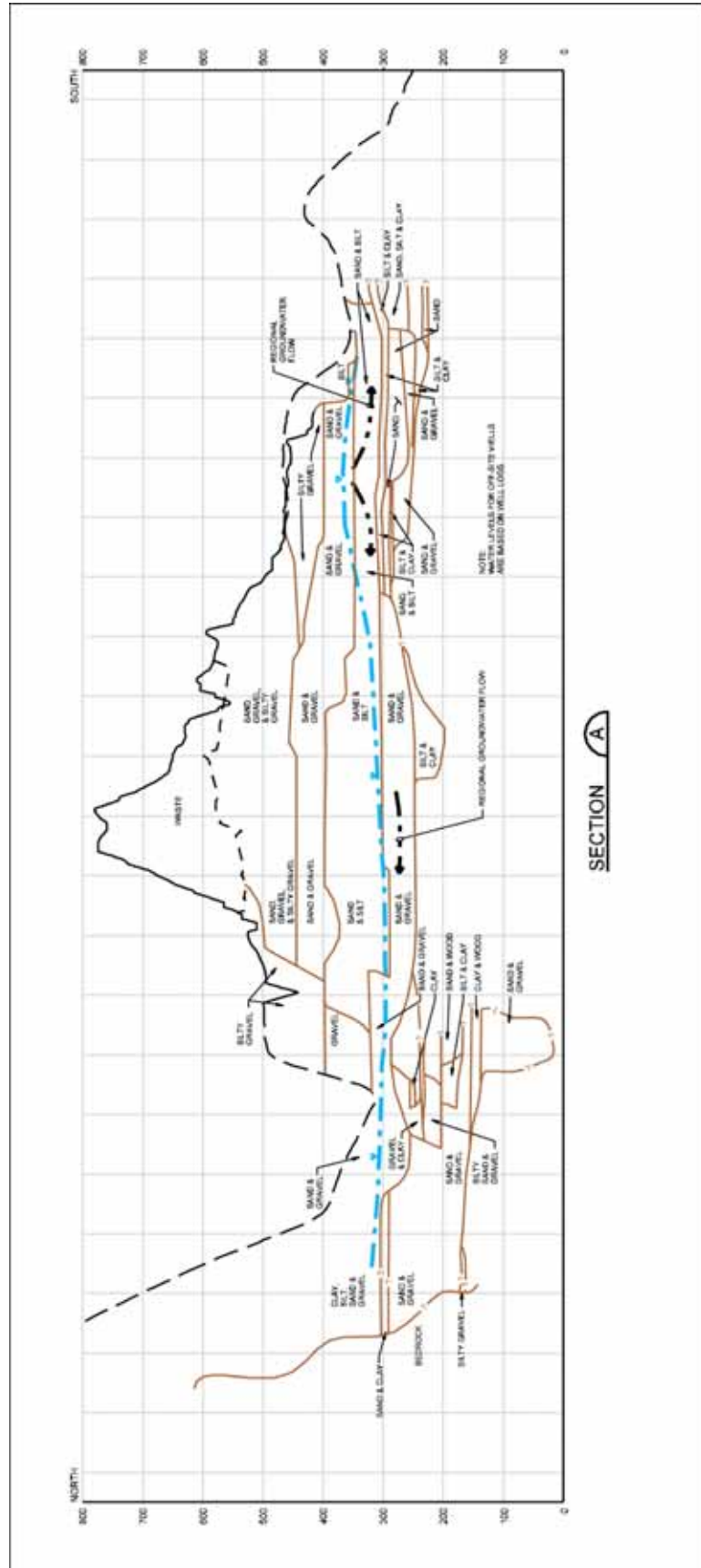


Figure 8. Cross-Sections Through Landfill and Surrounding Strata

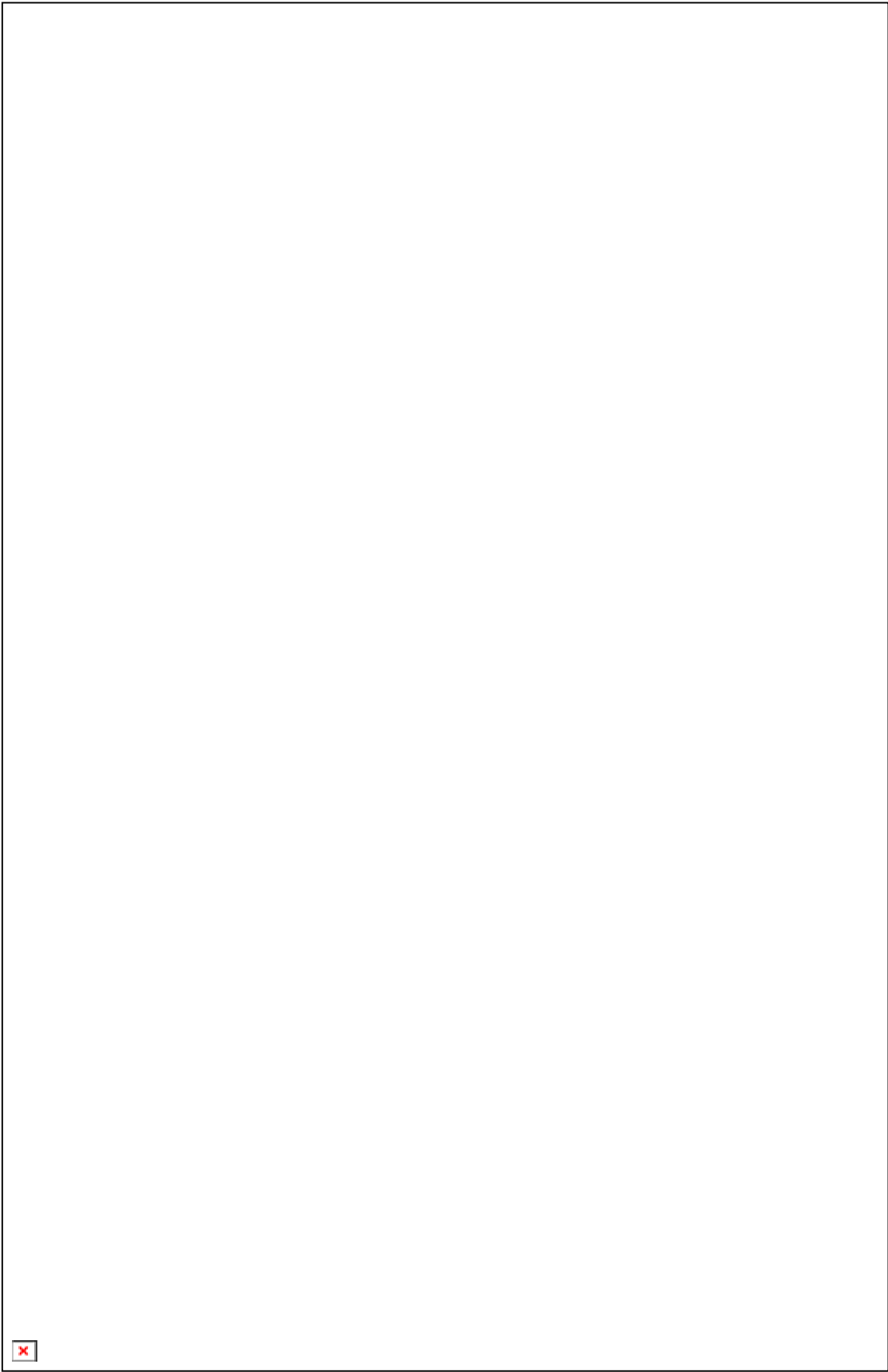


Figure 9. Locations of LFG Monitoring Probes

recorded in MAXIMO data base. MAXIMO is an asset maintenance and work tracking software application. Locations and equipment are set up in the software with related preventative maintenance schedules and tasks. The software creates preventive maintenance work orders ahead of when they are due based on these schedules. Demand work orders can also be created. For any type of work, related labor details and comments are then entered back into the system to verify work completion. KCSWD is in the process of converting all equipment and system maintenance records over to the CCG FASTER electronic database collection and tracking management system.

Stormwater Drainage and Detention System

Stormwater channels have been constructed around the entire landfill area to prevent run-on in accordance with 40CFR Part 258 and Washington State regulations. In addition, constructed on the final cover and intermediate cover areas are two networks of stormwater drainage channels. The two systems convey clean stormwater from final cover areas and “contaminated” stormwater from areas that have not yet received final cover. The latter stormwater is collected and treated as if it were leachate to prevent any contamination of the clean stormwater runoff, even though at most times the runoff from this system has minimal or no refuse contact or contaminants. An overall site stormwater plan for the final, filled landfill configuration has been prepared and used as a guide to building out the stormwater systems as the landfill cells are successively added and closed. Separate detention ponds have been sized and constructed for the “contaminated” stormwater and clean stormwater to prevent downstream carryover of silt or flows in excess of pre-development conditions. Figure 10 shows the locations of the stormwater detention basins and the major stormwater channels. Stormwater channels are lined to prevent washout and inspected after each storm event or on a monthly basis as part of an overall site preventive maintenance program.

(See additional related comments under Design and Construction.)

Landfill Gas Control System

Vertical polyvinylchloride (PVC) gas collection wells were installed in the older, unlined areas of the landfill in the mid-1980s. With the construction of the first lined landfill cell, the decision was made to install horizontal collectors in the waste as filling progressed. The horizontal collectors consist of thick-walled (Standard Dimension Ratio [SDR] 11 or thicker), 6-inch-diameter, perforated high-density polyethylene (HDPE) embedded in gravel-filled trenches. A HDPE header pipe network connects both the horizontal collectors in the newer areas and the vertical wells to a blower/flare station at the north end of the landfill site. Each wellhead, on both the vertical and horizontal wells, is equipped with a pitot tube and monitoring ports to allow measurements of flow, pressure, temperature and gas composition.

Connected to the HDPE header pipe network are all of the nearly 500 gas extraction points at the wellheads or from the horizontal collectors. The header pipe is buried in native soil or final cover and sloped in a saw-tooth pattern to condensate drains around the perimeter or shallow-buried over the landfill cover. The header network comprises two complete loops, with main perimeter headers on the east and west sides of the landfill, with an interior header running over the landfill cover, to provide gas flow pathway redundancy. The blower/flare station comprises five, identical, 75-horsepower centrifugal blowers in parallel, discharging to five, identical, enclosed, 40-foot-all flares, with piping and control systems designed to

allow any combination of blowers to discharge to any combination of flares. Cyclonic knockouts designed to remove all free water precede the blowers. The system currently collects approximately 9,500 standard cubic feet per minute (scfm) of landfill gas.

King County is working with a developer to utilize the landfill gas for energy production. Design of modifications to the existing gas collection system to provide gas to the generating plant is under way.

Figure 11 shows the overall layout of the gas collection system as of early 2005. Expansion of the system is continual, with new horizontal collectors added on top of every other 15-foot lift of waste and made operational as soon as one lift of waste is placed over them.

Leachate Collection System – All Points Accessible

Design of the leachate collection system is based on the principle that all points in the system should be accessible for inspection, cleanout, and, if necessary, repair. Cleanout extensions are provided for all leachate pipes that are accessible from the landfill surface. Leachate drains by gravity to a wet-well and pump station outside of the lining system at the south end of the landfill site. The leachate is then pumped to an on-site aeration basin for pre-treatment prior to discharge to a sewer and final treatment at a King County wastewater treatment plant 12 miles away approximately; 188 million gallons of leachate from the landfill is treated to secondary treatment standards annually. During the wettest months, January and February, the system handles an average of 1 million gallons per day; the system is designed and permitted to discharge up to a peak of 3 million gallons per day of leachate, providing a substantial safety factor. (The KCSWD wastewater discharge permit allows up to 2.4 million gallons per day discharge without prior notification and surcharge.) KCSWD owns and uses water- and explosion-proof pipe inspection cameras to inspect the condition of leachate pipes, sumps, and pump stations. The camera inspection is part of the preventive maintenance philosophy of fixing things before they break.

The overall site development plan and layout of the cell bottom drainage pattern and leachate collection system are designed to drain the leachate by gravity wherever possible. Connections are made between cells to allow the leachate from older, closed cells to drain to newer cells as the progressive build-out of the landfill occurs. Figure 12 shows the leachate and underdrain collection bottom liner system at the toe of the west slope of the landfill.

Progressive Cover Program

KCSWD has adopted a program of placing interim cover over all areas that will not have final cover immediately installed and will not be covered with additional waste lifts during wet weather months (October through May). This program reduces water infiltration into the landfill and minimizes gas emissions and air breakthrough into the gas extraction system. Final cover is placed progressively as final fill elevations are reached in each cell. Figure 13 shows a typical cross-section of the interim cover (also referred to as “summer cover” because of when the cover is typically put in place).

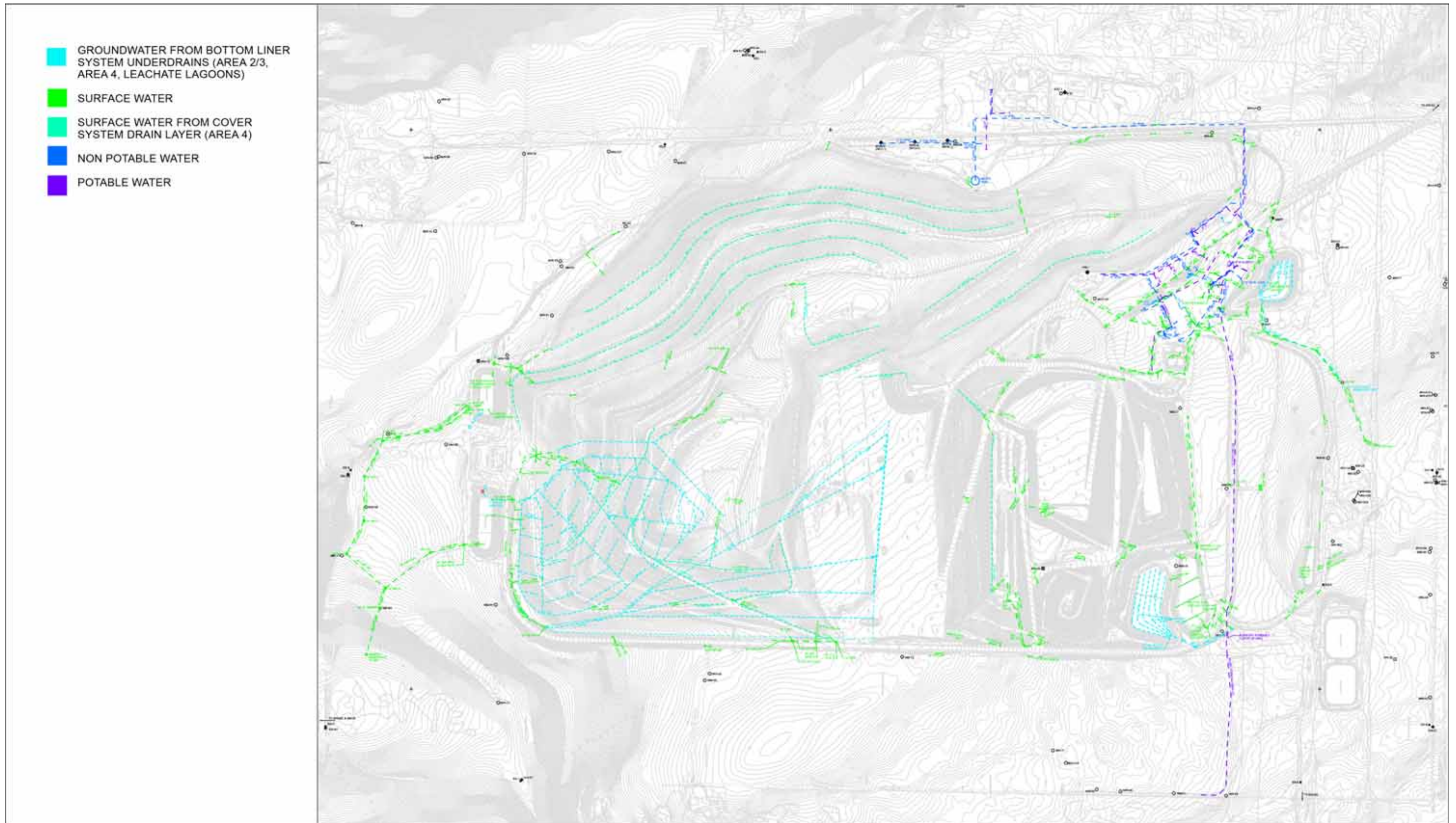


Figure 10. Groundwater and Stormwater Facilities

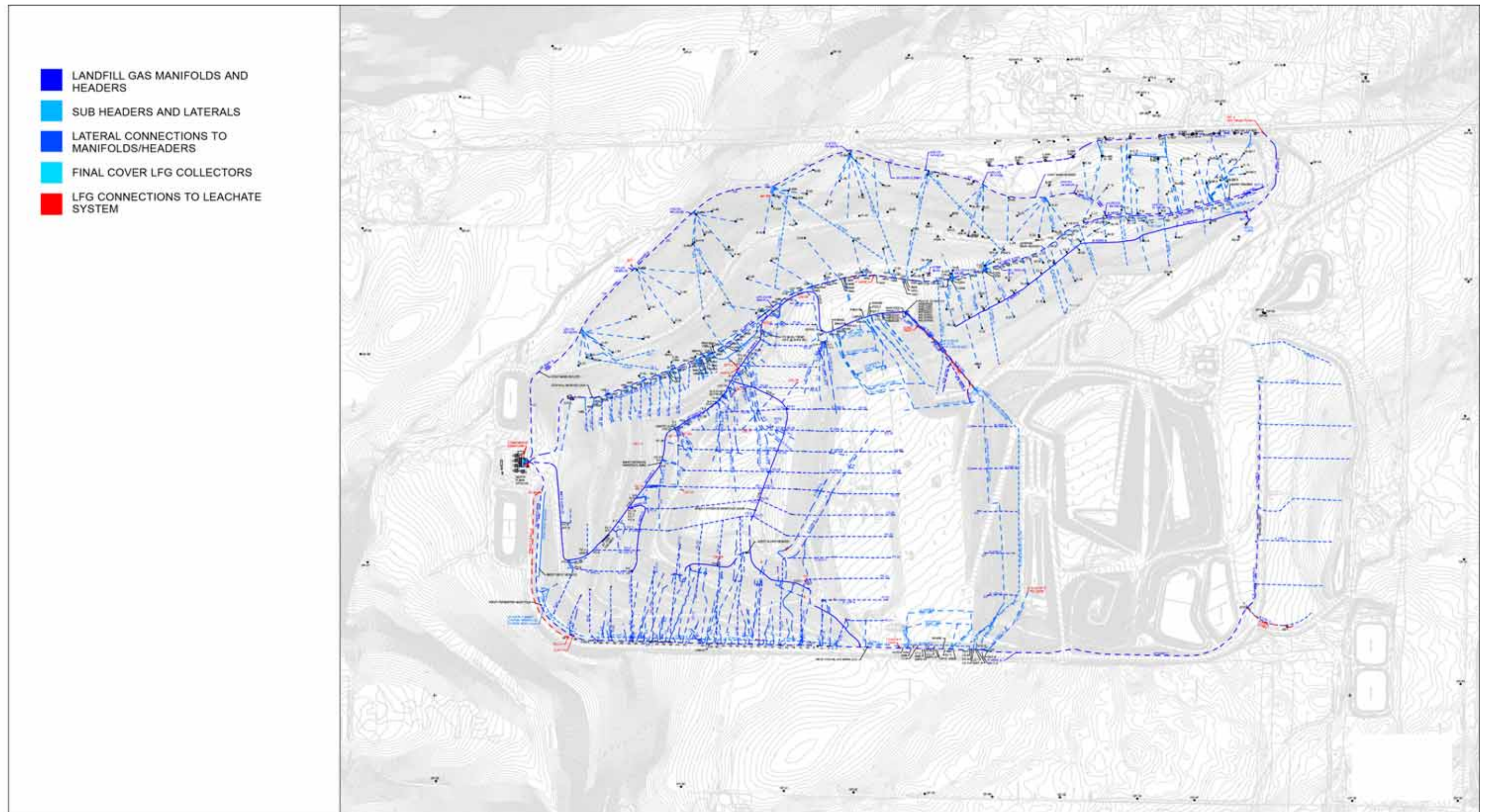


Figure 11. Landfill Gas Facilities

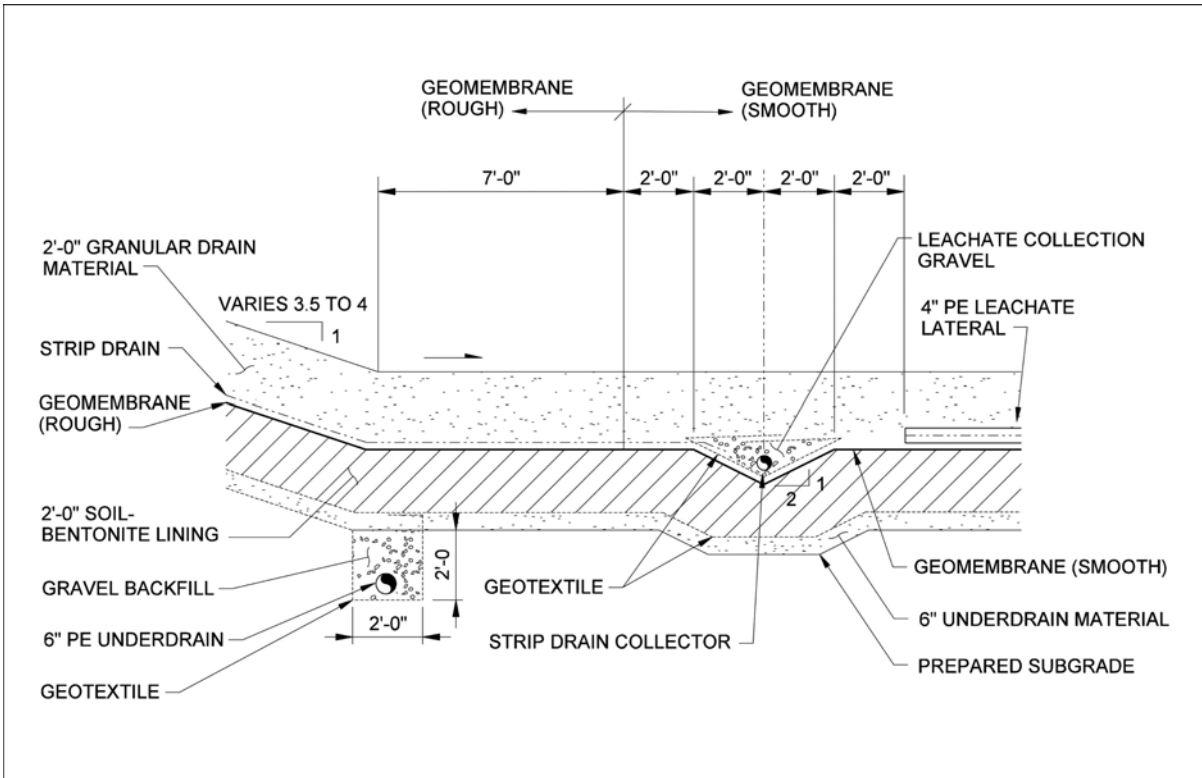


Figure 12. Leachate and Underdrain Collection System – Toe of West Slope

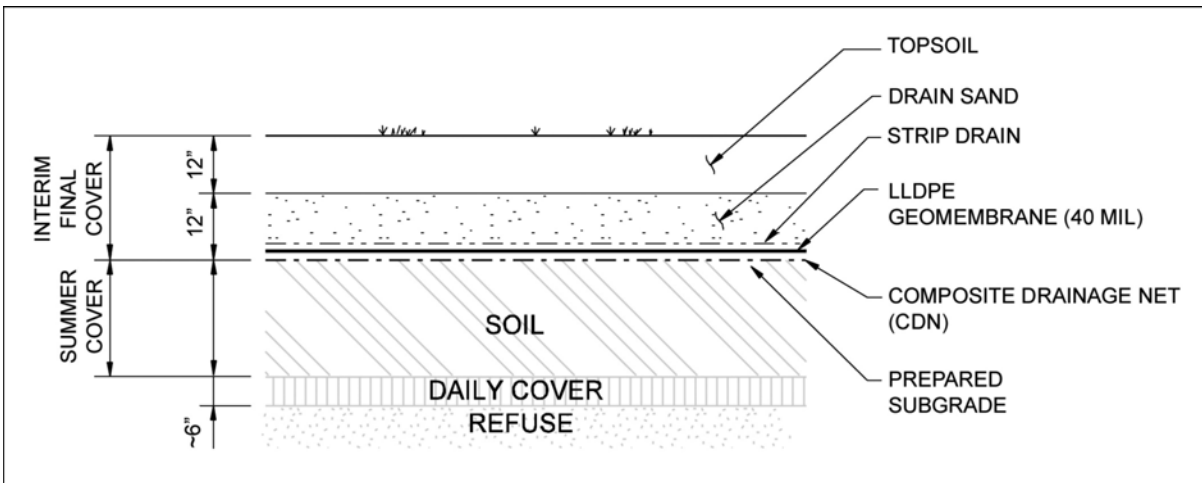


Figure 13. Typical Cross-Section of Interim Cover

REGULATORY COMPLIANCE

Award Criteria:

- *The system's role in local community's integrated solid waste management system.*
- *Details showing that the site is in environmental compliance (facilities that are not in compliance may be disqualified).*
- *Have they submitted any awards letters or facility inspection data.*

Role of Landfill in Community's Integrated Solid Waste Management Systems

The King County Solid Waste Division is responsible for regional solid waste planning for the unincorporated areas of King County and 37 of 39 County cities (less Seattle and Milton). As such, the KCSWD is responsible for the State-mandated Comprehensive Solid Waste Management Plan that is updated every 5 years, or more often as necessary. In this function, the KCSWD leads the region in developing/revising the plan through stakeholder involvement in plan development and review.

King County/KCSWD own and operate the Cedar Hills Regional Landfill, and own and operate 8 solid waste transfer stations. Nearly 1 million tons of MSW received from throughout the region are processed through the transfer stations and disposed of at the Cedar Hills Regional Landfill.

Brief Description of Applicable Regulations

King County is subject to and in compliance with the following regulations that apply to the Cedar Hills Regional Landfill:

- Federal Regulations: 40CFR Parts 258, 60, 61 and 62, subpart WWW and landfill MACT.
- State Regulations: WA Admin Code Part 351, which incorporates the requirements of 40CFR Part 258.
- Local/Regional: Puget Sound Clean Air Agency Rules I, II and III.
- Permits: The Cedar Hills Regional Landfill operates under a permit issued by the Seattle/King County Health District (SKCHD). In Washington, "jurisdictional health departments" issue and enforce solid waste facility permits in accordance with the state solid waste regulations noted above. SKCHD is such a health district. The facility's solid waste permit requires submittal of design plans and supporting engineering calculations for each expansion of the landfill within the site. The SKCHD typically requests design review by specialists in the Washington Department of Ecology (Ecology). Ecology conducts strict reviews, sometimes employing third-party engineering consultants, and has praised King County for the excellence of its landfill designs.

The Cedar Hills Regional Landfill also operates under permits issued by the Puget Sound Clean Air Agency (PSCAA) that incorporate requirements of the federal air emission and gas control requirements referenced above, as well as additional requirements. These permits include permits to construct each cell of the landfill and a Title V permit for the overall site.

Both SKCHD and PSCAA carry out regular and surprise inspections. No notices of violation have been received within the past 5 years.

A letter of recognition from the Washington State Department of Ecology can be found in the Supplemental Materials section for KCWSD and its consultants' efforts in the planning, permitting, design, and construction of the Cedar Hills Regional Landfill Area 5 cell.

PLANNING, OPERATIONS AND FINANCIAL MANAGEMENT

Award Criteria:

- *Description of operation program used to meet design and operational objectives.*
- *Estimated operating budget year.*
- *Does the facility have room to expand on and create new programs for future?*
- *Employee health and safety training, waste screening programs, etc.*

Safety

King County maintains a safe workplace for its employees. The Landfill Operations Manual details safety programs for all aspects of operation. Regular safety training is provided for all 113 KCSWD Operations staff, and safety meetings are held monthly. All staff is trained. The staff includes 41 landfill gas operations staff (disposal, gas, and water control); 62 shop/maintenance staff; and nine support staff, including one manager. The staff completes as few as 1 safety and health program element up to 17 elements (Table 1 lists the program elements). Training is administered annually, biannually, and every three years, depending upon the federal, state, or King County requirement. Training time for the program elements ranges from one-half hour up to 8 hours depending upon technical complexity. KCSWD Safety Office in-house trainers and supervisors provide the training; in some cases, contract trainers or contract vendors provide the training. KCSWD also provides personal protective equipment training in hard hat; safety glasses, goggles and safety shield; safety shoes and boots; rain gear; safety vest; puncture-resistant, leather, rubber, electrician, and non-latex surgical gloves; steel inserts for boots; and respirator.

**Table 1
Safety and Health Program Elements**

Alcohol Drug Testing Overview/CDL (KC Policy PER-15-2-(AEP)
Alternate Fuel Safety (KC Policy (G) FES 12-11 & FES 12-3 (AEP)
Asbestos Awareness (WAC 296-62-07721 (1) (2); WAC 296-65-003, 010, 012, 030)
Bloodborne Pathogens (WAC 296-62-08001)
Confined Space Permit Entry (WAC 296-62-145), 29CFR
Confined Space Awareness (WAC 296-62-145), 29CFR
Crane/hoist/lifts (WAC 296-24-23529-1, WAC 296-155-525)
Defensive Driving (KC Policy FES-12-1-2)
Electrical Safety
Fall Hazards (WAC 296-155-24507,24501,48060, 245-C1)
Fire Extinguisher Use(WAC 296-24-59213)

Table 1 (continued)
Safety and Health Program Elements

First Aid Training/CPR (WAC 296-24-060 & 296-155-120)
Flagging (WAC 296-155-305, WRD 84-8, ANSI D6-1-1988, WSCOT-M24-01HT)
Forklift (WAC 296-61-0780, WAC 296-56-6077, WRD78-25A, OSHA 1910-178)
Fuel Handling/Storage (NFPA 30-1969, 58-1969, WAC 296-24-475)
Compressed Gas Safety
Hazard Communication/MSDS (WAC 296-62-05409, 05249C) 29CFR 1910.1200
Handtool Safety
Hazardous Waste Awareness RCRA (RCRA Subtitle D 40 CFR 258.20a3)
Hearing Conservation Program (WAC 296-62-09015)
Heavy Equipment Safety
Hot Work--Welding, Cutting, Brazing
Lock-out/Tag-out (wac 296-24-110, 119, 975) (29CFR 1910.147)
Motor Vehicle Air Conditioner Service (40 cfr 82.34A Subpart B; 40 CFR 82, Subpart B, Appendix A)
Personal Protective Equipment (29CFR 1910.13)
Power Tool Safety
Refrigerant Extraction (RCW 70.94.970)
Renton Aquifer [Required for all employees who work at the Renton Transfer Station]
Respiratory Protection Program (WAC 296-62-071) (Voluntary Program)
Rim Wheel Servicing (WAC 296-24-217)
Stormwater Pollution Prevention (NPDES)
Supervisor Safety Awareness Training
Trenching, Excavation and Shoring (WAC 296-155-650)

Landfill Operations Manual

King County operates the landfill in accordance with a Plan of Operations Manual prepared specifically for the site. The first version of this document, prepared in 1987, has been recently updated. The operations manual is required reading for all landfill operations personnel. The manual covers basic operations, such as how to direct traffic for efficient and safe operations at the working face, operation of the environmental control systems, groundwater and air monitoring. A 6-volume Landfill Gas Operation and Maintenance Manual (part of the Plan of Operations Manual) is also used by operations and maintenance personnel. Figure 14 presents photographs of the manuals.

Transportation Plan – Hauling from Transfer Stations

King County-owned and –operated transfer trailers haul the majority of waste to the site. Commercial and contract haulers take most waste collected in the service area to local transfer stations owned and operated by KC. The operations of the transfer stations and the landfill are coordinated to prevent long queues from forming at the landfill. King County’s truck driver leads coordinate with the landfill operations and transfer station staff to dispatch trucks in the most effective manner.

This system of publicly owned and operated transfer stations coordinated with the operations of the regional landfill provides superior service to the community by minimizing the distance collection vehicles must travel to unload.

Density Monitoring

KCSWD has recently implemented a regular Compaction Control Program for monitoring the compaction of recently placed waste in the landfill. This is done through monthly measurement of compaction densities achieved and adjusting operating practices as necessary to ensure consistency in the resulting densities. In addition, annual evaluation of effective density is completed using aerial photogrammetric and land survey data. The tonnage placed in a defined area, as recorded at the scales and tracked to the working face, is compared to the fill volume in the defined area. The compaction results are provided to disposal equipment operators to provide feedback on performance of ongoing operating methods with a goal of optimizing landfill airspace consumption.

Working Face Control

As mentioned previously, the lift sequencing plan prepared in conjunction with the engineering design for each landfill cell governs waste lift placement. Operations personnel accomplish this by setting up a rotating laser at a location that will make the laser trace easily visible to the equipment operators. The laser traces out the top of the lift currently under construction. The laser is moved by the site surveyors as often as necessary to provide a current reference plane for the operators.

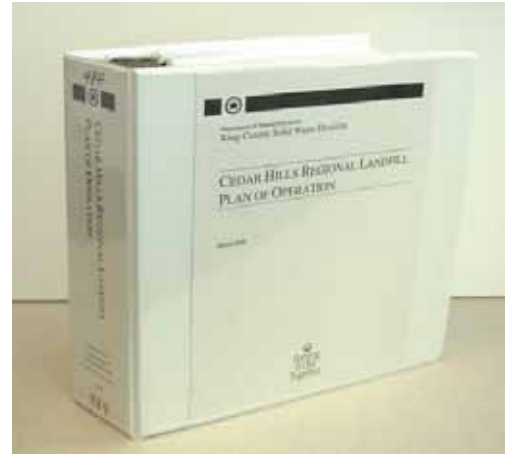


Figure 14. KCSWD Plan of Operations Manual (top) and Landfill Gas Operations and Maintenance Manual (bottom)

All Roads Paved

KCSWD applies asphalt paving to all major and heavily used roads on site. This minimizes dust emissions and road maintenance that results from erosion and rutting of unpaved roads. KCSWD has found that, on balance, the investment in asphalt pavement results in increased efficiency for road maintenance, dust control, and stormwater facility construction and maintenance.

Recycling Cover Material, Temporary Rock Surfacing and Bark

King County has recently implemented a program of removal and recycling of daily cover soil and crushed surfacing rock used to provide all-weather surfaces on the approach to the working face during the wet season. This program has resulted in significantly reducing the quantity of daily cover and crushed surfacing rock used.

This program has resulted in significantly reduced costs for daily cover excavation and stockpile as well as rock surfacing costs, more than paying for the efforts required in recycling the materials. KCSWD estimates that 2004 savings of \$100,000 annually and 10.2 thousand cubic yards of capacity have been generated as a result of this recycling.

Strong Cooperation Between Engineers and Operators

King County has learned the value of, and places a strong emphasis on, the cooperation and teamwork of planning, engineering, and operations personnel. County engineering staff and engineering consultants are required to consult with operations staff during all phases of design of each cell of the landfill as well as expansions and modifications of the environmental control systems. These cooperative relationships lead to consistency in operations, maintenance, and engineering. The end result is effective and safe operations, safe work practices, optimizing use of equipment, and producing comparable results. By consulting with the operators who have many years of hands-on experience with the existing system, the designers gain valuable, site-specific insights that are critical when incorporating the existing systems into expansions and modifications.

Financial Management and Accounting

KCSWD employs 18 accounting staff who process daily receivables, payables, and finances. The landfill is managed as part of the solid waste enterprise fund. The enterprise fund is audited regularly by the State of Washington Auditor. The division also audits itself on an ongoing basis through an internal controls program that includes cash audits at the scale houses.

Recent Efficiency Improvements

Process changes have been made in landfill operations in an effort to conserve daily cover cost through cover-dirt stockpile management. Operations staff is stripping the in-place daily cover off the existing day cell areas before placing refuses. This effort has shown a savings in stockpile dirt, provided better leachate gas control, and created more landfill capacity.

This savings will be passed on to the rate payer in the form of no rate increase until 2007, at the earliest. The last rate increase was 1999. This achievement is particularly impressive,

given the rising costs of fuel and construction steel, which are major resources used to accomplish KCSWD's mission.

In addition, improved compaction and associated landfill settlement has extended the life of the Cedar Hills landfill by two years, from 2012 until 2014. This extension will delay the County's transition to the more costly export of solid waste to a remote landfill, saving \$37 million dollars (discounted to 2005), or a savings of about \$5.00 per ton during the years 2008 to 2015. The savings is equal to \$5.2 million per year during 2008 to 2015. The \$37 million is equal to a savings of \$20.60 for each ton of solid waste that will not need to be waste exported in 2013 and 2014.

Closure Reserve Fund

As an enterprise fund, KCSWD maintains a landfill reserve fund of more than \$43 million and does not rely on the good faith and credit of the County general fund for post-closure care. This assures that the funds are in place to accomplish closure of the Cedar Hills Landfill. A specific portion of the tip fee is deposited into the Landfill Reserve Fund (LRF) for each ton disposed. The LRF includes mandatory reserves for closure and post-closure maintenance costs. Other accounts in the LRF fund new area development and associated landfill facilities.

Operating Budget

The annual operating budget of the Cedar Hills Regional Landfill is \$85 million.

UTILIZATION OF EQUIPMENT/SYSTEMS AND TECHNOLOGIES

Award Criteria:

- *Types of equipment being utilized. Detail efficiency and effectiveness of equipment.*
- *Demonstrate the routine maintenance and employee training on equipment.*

Landfill Operating Equipment

The Cedar Hills Regional Landfill has a fleet of 7 dozers, 4 compactors, and 1 water truck as well as other miscellaneous site maintenance equipment. KCSWD keeps reserve equipment maintained and “ready to roll” to prevent interruptions in working face operations. KCSWD has one piece of landfilling equipment in reserve except for KCSWD’s smaller Cats (D6). KCSWD rents smaller Cats when needed.



The Cedar Hills Regional Landfill equipment includes:

- 4 Caterpillar D9R dozers
- 1 Caterpillar D7H dozer
- 1 Caterpillar D6N dozer
- 1 Caterpillar D6R dozer
- 4 Caterpillar 627G scrapers
- 4 Aljon Landfill compactors
- 2 Caterpillar excavators 225C and a 365BL
- 1 Dynapac roller
- 1 Caterpillar 14G grader
- 1 Watertruck Peterbilt
- 2 Sweepers, Tymco and a Sterling Elgin
- 1 New Holland Lawnmower/Brushcutter
- 1 John Deere backhoe 410E
- 1 John Deere Gator
- 2 Road Sweeper Trucks

Full-Service Maintenance Shop on Site

KDSWD maintains a full-service maintenance shop at the Cedar Hills Landfill to service the landfill equipment and refuse transfer vehicles. As mentioned earlier, preventive maintenance is a strong theme and basic operating principle of the landfill operations. The compactors and dozers’ engine oil is analyzed regularly to detect unusual engine wear. Oil changes are made ahead of schedule. Dozers and compactors are steam-cleaned daily at the working face to remove grit that wears down gears, impedes equipment inspection, and cooling system efficiency.

Routine and Preventive Maintenance Program

Routine maintenance to equipment, systems and facilities are conducted using manufacturers’ suggested maintenance practices, best maintenance practice, and preventative maintenance practices developed by KCSWD.

All preventative maintenance requirements are loaded into the maintenance planning and scheduling software system CCG Faster. CCG Faster automatically creates a work order for each item of preventative maintenance, which is scheduled and assigned by the Shop Scheduling and Planning Unit. CCG Faster tracks all aspects of the maintenance, including technician, hours on task, parts, and so on. This information is rolled into CCG Faster's equipment database. This database is available to planners, schedulers, supervisors, and managers for oversight and review. The CCG Faster system is used to roll up labor and expense requirements for all work at the management level for resource planning and to review trends in efficiency. The system also issues reminders for needed work based on past patterns and inputs by operators or management.

Training and Equipment

Training on specific KCSWD equipment is provided per procurement contract by the original equipment manufacturer. Routine refresher/remedial training is provided by KCSWD subject matter experts, or by experts outside training contractors (OEM or other). Required routine refresher training, for example, forklift operations and safety, is scheduled in the training database discussed in the Safety section of this submittal.

Continuous Improvement Policy – Lessons Learned Database

KCSWD has a policy of continuous improvement in all aspects of landfill operation, especially safety. Weekly meetings are held with all operations supervisors to review lessons learned, as well as monthly meeting with division managers, senior engineering staff, and operations staff.

Using Up-To-Date Technology

KCSWD is an earlier adopter of new landfill technology where the new technology makes economic sense. The Cedar Hills landfill operations manager and supervisors keep abreast of changes through participation in SWANA training and symposiums, as well as through current literature.

One example is the Supervisory Control and Data Acquisition (SCADA) system that monitors processes at the landfill as well as at the County's transfer stations and closed landfills.

ECS Engineering, Inc., of Bothell, Washington, was responsible for the investigation, study and Master Plan preparation for the new County-wide SCADA system for the KCSWD. The project goal was to develop a SCADA system that would allow staff to monitor sites throughout the Cedar Hills Regional Landfill, remote landfills, and transfer stations for process and security alarm conditions. The Master Plan included SCADA system hardware and software options, implementation options, cost estimates comparing options, and a recommended final system configuration.

The first portion of the project included retrieving all existing County documentation on all of the sites that would be monitored. This documentation was used for onsite investigations to determine the accuracy of the documentation and the existence or absence of existing process equipment (pumps and motors) and devices (level transmitters, alarms) that needed monitoring. A task included in this phase of the project was to mark up the existing

documentation to the fullest extent possible to provide the County with accurate documentation of the existing systems.

Subsequent to the investigation, ECS Engineering worked with the County Information Technology and Communications Departments to investigate communications options to all of the sites. The plan recommended using an existing County-wide fiber optic and telephone Ethernet network for most of the locations that needed to be monitored. The remainder of the sites were provided with Ethernet radios which allowed connection of remote sites to the existing network.

The resultant system configuration recommended to the County is a programmable logic controller-based system, communication over the Ethernet network to a master SCADA computer utilizing operator interface software for data gathering, report generation, alarm generation, and graphic screens for information display. The system has new Allen-Bradley PLCs and a Graphical User Interface/Data acquisition system software. Technical Systems, Inc., was the prime contractor and SCADA system hardware supplier.

To monitor all facilities from the Cedar Hills facility, the master SCADA computer communicates with the remote facilities (transfer stations and closed land fills) over a combination of the County's existing Ethernet network, cellular telephone modem, or leased telephone line. The type of communication selected depended on the most economical (initial and life cycle) option. Specifically, at Cedar Hills all of the potable water pump, gas flares and blowers, and monitoring sensors in the leachate, storm water and gas systems are monitored by a SCADA system that transmits data to the site office through a fiber optic network installed around the landfill perimeter. This network is accessible throughout King County's Ethernet, including at offsite County offices. Figure 15 shows sample SCADA system data screens.

Other technological innovations used at Cedar Hills include:

- A rotating laser placed daily (or more often as needed) by County surveyors controls waste placement.
- New Source Performance Standards (NSPS) surface monitoring and site surveying tracked using differential global positioning system (GPS) units.
- A complete meteorological monitoring station maintained on site to correlate meteorological data with leachate, stormwater, and gas production.

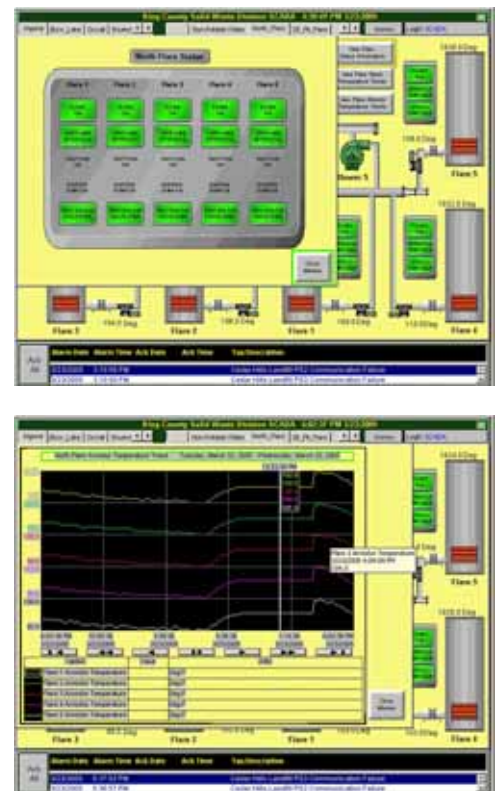


Figure 15. Sample SCADA System Data Screens – Flare Status (top), Flame Arrestor Temperature Trends (bottom)

PUBLIC ACCEPTANCE AND AESTHETICS

Award Criteria:

- *Overall appearance of site; is the facility kept neat and clean and overall appearance.*
- *Demonstrate the community of education and customer service.*
- *Discuss site landscaping and onsite facilities.*

Site is Surrounded by Hills in Northwest Forest Environment

Remote from large population centers, the landfill site is set into surrounding hills in a forested location in rural King County, approximately 25 miles from downtown Seattle. A 1/2-mile-long private road provides access to the site; the entrance is not visible from the nearest public road.



Cedar Hills Landfill is remote with private access only.

Strict 1,000-foot-wide Buffer

KCSWD maintains a 1,000-foot-wide buffer around the landfill area. King County owns and maintains all buffer area. The buffer forms a visual barrier to all nearby residents. The buffer is maintained as a pristine Northwest forest environment inhabited by wildlife. Elk, deer, and bears are common wanderers in the site buffer. American bald eagles nest in the buffer area and are commonly seen soaring around the site boundaries. Salmon are found in the streams that pass through the buffer zone.



40-foot-high gas flares with buffer zone trees in background.

Bird, Odor, Litter and Control

KCSWD uses active bird control systems that rely primarily on monofilament lines stretched from portable towers that are moved with the working face. When needed, supplementary techniques are employed, such as bird distress noises. Bird counts at the site have been drastically reduced since the mid-1980s. One full-time employee continuously picks up litter around the site. The landfill gas system controls odors, and trucks and leaving the site are checked to make certain that they are covered and not leaking. The undercarriage of the trucks are also washed. The “Nasal Ranger” system is used to conduct pro-active odor monitoring.



Regular Meetings with Neighborhood Groups

KCSWD management meets three times a year with neighborhood groups from the surrounding rural residential area. At these meetings, landfill development plans are reviewed and citizens' concerns are addressed. An example of a notice of meeting issued by KCSWD can be found in the Supplemental Materials section.



Tours on Demand

KCSWD managers and supervisors conduct frequent tours for visiting engineering professors, managers from other cities and counties and foreign countries, and King County residents and science classes. Tours are also provided for the public.

Immediate Responses to Neighbor Inquiries

KCSWD maintains a hotline staffed 24 hours a day to provide immediate response to any problem that might be reported by site neighbors. All neighbors within 3.2 miles of the landfill have been made aware of a formal complaint response plan created by King County. The response tool is discussed at each Community Relations Council (CRC) meeting. The plan commits the County to respond rapidly with specific actions and time frames. The title page of the current plan and a complaint form used to document any complaints from neighbors are included in the Supplemental Materials section. KCSWD had 15 odor complaints about the Cedar Hills Landfill in 2004, and one complaint so far in 2005 (as of March 30).

Appearance and Aesthetics

The Cedar Hills is isolated, and because the general public is not granted access, nor is the landfill visible to the public from roadways or residences, KCSWD has not invested a great deal in appearance or aesthetics. Nonetheless, the landfill is kept as neat and clean as possible. We routinely (weekly or more often, if required) sweep and wash our paved surfaces. Litter control is a daily effort, and we maintain a nearly litter-free landfill at all times. Tracking of contaminants from the landfill is strictly controlled, largely through the use of our undercarriage truck wash system. Vehicles exiting the working face must drive through the truck wash before proceeding onto public roadways. In conjunction with King County Parks Division, we have flower planters and hanging baskets in the Administration area of the landfill.



INNOVATION AND CREATIVITY

Award Criteria:

- *Innovative or unique aspects of the facility.*
- *What makes this facility different from the rest?*

KCSWD does not simply rely on current technology, but adapts and invents technology to provide continuous improvement in landfill operations. In addition to the recycling of cover material and rock for temporary roads discussed earlier, other innovations at the Cedar Hills Regional Landfill include:

Inventing New Equipment for the Landfill Gas System

King County operations staff invented an airtight expansion/contraction coupler that allows pipes to adjust to rapid slope settlement that occurs, especially in the wetter parts of the landfill. The illustrations below show a “before” scene of settlement impact on pipes before the coupler was introduced, and an “after” photo of the coupler accommodating the settlement. This innovation has a patent pending.



LFG Pipe Buckling Failure



Expansion/Contraction Coupler

SCADA System

Two key innovations were applied to the Cedar Hills project. The first innovation was the integration of existing process control systems into the new SCADA system. Existing programmable logic controllers (PLCs) of recent technology were reused with only minor hardware modifications. This allowed the existing PLCs to communicate to the new SCADA system. This innovation resulted in a considerable project cost savings by eliminating the need to replace existing hardware and the expense of reprogramming these systems. The second innovation was the use of a combination of fiber optic cable and spread spectrum radio communications to communicate between the PLCs and the master SCADA computer. This allowed for the most reliable communications system while reducing trenching.

Supplemental Materials



IRG 10.7

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

Northwest Regional Office, 3190 - 160th Ave S.E. • Bellevue, Washington 98008-5452 • (425) 649-7000

October 22, 1999

RECEIVED

OCT 26 1999

SOLID WASTE DIVISION

Mr. Rodney Hansen
King County Department of Natural Resources
Solid Waste Division
400 Yesler Way Room 600
Seattle, WA 98104-2637

Mr. Larry Kirchner
Seattle-King Co. Department of Public Health
Wells Fargo Center
999 3rd Avenue, Suite 700
Seattle, WA 98104-4099

Gentlemen:

Construction of the new North cell in Area 5 of the Cedar Hills landfill is complete and complies with all relevant plans and specifications. This new cell meets or exceeds the public health and environmental protection requirements of Chapter 173-351 WAC. To construct a landfill cell in compliance with the demanding standards of modern environmental regulatory requirements is a significant accomplishment. Now that the new cell is ready to receive waste it is appropriate to acknowledge the outstanding efforts of both your agencies to keep this project on time and under budget.

You have reason to be proud of all the staff and contracted professionals involved in this enterprise. Several individuals deserve specific mention.

- Mike Reibold, Jim Walker, and Elaine Springier of CH2M Hill should be acknowledged for their excellent design and construction support.
- The on-site engineer, Mike Spillane of Herrera Environmental Consultants, deserves complement for his construction management and quality assurance.
- This project required extraordinary permitting and regulatory oversight. Dave Hickok of Seattle King County Department of Public Health did an outstanding job coordinating this effort.

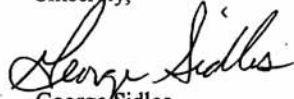


Mr. Rodney Hansen
Mr. Larry Kirchner
October 18, 1999
Page 2 of 2

- Finally, the overall project management effort of Victor Okereke of King County Solid Waste was exemplary. His drive to hold all of the project contractors accountable to exacting regulatory and engineering standards is noteworthy. His dedication to these standards while meeting the strict time and budgetary requirements of this project is meritorious.

Again, our compliments to you and your staffs for jobs well done.

Sincerely,



George Sidles
Regional Supervisor
Solid Waste and Financial Assistance Program

GS/jk/dm

cc: Cullen Stephenson, Ecology, HQ
File

NOTICE OF **MEETING TIME**

CEDAR HILLS CITIZEN REVIEW COMMITTEE PUBLIC MEETING

The next Citizen Review Committee Meeting

will be held

Wednesday, February 16, 2005

at

7:00 pm to 8:30 pm

Issaquah School District Bus Barn

805 Second Avenue SE, Issaquah
(across the street from Issaquah High School)

For more information regarding this notice, please contact:

Annette Mentzer
King County Solid Waste Division
(206) 296-0465 or
annette.mentzer@metrokc.gov

DEPARTMENT OF NATURAL RESOURCES
KING COUNTY SOLID WASTE DIVISION

**CEDAR HILLS
REGIONAL LANDFILL
ODOR, FUGITIVE DUST
OR NUISANCE
COMPLAINT RESPONSE
PLAN**

PREPARED BY:

ENGINEERING SERVICES SECTION

JANUARY 12, 2000

VOO/2000/COMPLAINT RESPONSE PLAN

KING COUNTY SOLID WASTE DIVISION
COMPLAINT COMMENT FORM

Complaint handled by: First Name: _____ Last Name: _____
Date: _____ Time rec'd: _____

Type of Comment: Internal (employee): External (public):
(check all that apply) Written: Verbal:
Odor report line: CCF:
Telephone call: Agency (PSCAA)

Complainant Info:

First Name: _____ Last Name: _____
Address: _____
City: _____ Zip Code: _____
Home phone: _____ Work phone: _____

Comment: _____

Did complainant decline an informational bulletin? (Y/N) : _____
If no, Date informational bulletin was sent: (MM/DD/YY): _____

Complaint Investigation

Investigated by:
First Name: _____ Last Name: _____

Date Investigation Started: _____ Date Investigation Ended: _____
Time Investigation Started: _____ Time Investigation Ended: _____

Results and Data: _____

Investigator: _____ Date _____ Time: _____
(signature)

Action Taken: _____
Action Completed: _____ Date: _____ Time: _____
(signature)

Supervisor: _____ Date: _____ Time: _____
(signature)

[Note to Supervisor: Please confirm that all Date and Time field have been completed to facilitate permit compliance review.]