

CEDAR HILLS REGIONAL LANDFILL 2022 ANNUAL REPORT



King County

Department of
Natural Resources and Parks
Solid Waste Division

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2022 ANNUAL REPORT

CEDAR HILLS REGIONAL LANDFILL

April 2023

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SECTION 1 - OVERVIEW

The King County Solid Waste Division (SWD) owns and operates the Cedar Hills Regional Landfill (CHRLF) in eastern King County for the disposal of municipal solid waste (MSW) generated in the county, exclusive of the cities of Seattle and Milton. It is a 920-acre site located at 16645 228th Ave. SE, off Cedar Grove Road, approximately three miles north of Maple Valley, six miles east of the City of Renton, and four miles south of the City of Issaquah. In addition to the landfill, the site contains Passage Point, a transitional housing facility; a landfill gas-to-energy facility owned and operated by Bio Energy Washington, LLC (BEW); and rights-of-way for a natural gas pipeline and numerous power transmission lines.

In 2022, waste disposal continued in refuse Area 8 after having commenced in 2019. Authorization to begin accepting waste in Area 8 was granted on July 5, 2019, by Public Health - Seattle and King County (PHSKC); a copy of their authorization letter is included in Attachment A. In addition, an Order of Approval was issued by the Puget Sound Clean Air Agency (PSCAA), dated July 2, 2019, under Notice of Construction Number 11307 authorizing SWD to begin operating Area 8.

This report includes a compilation of activity summaries and system evaluations associated with the following:

- Landfill capacity;
- Financial assurance cost estimates for closure and post-closure maintenance;
- Changes to landfill operations; and
- An environmental management program, including results from work with groundwater, stormwater, leachate, landfill gas, and odor management.

This annual report is submitted pursuant to the provisions of the Washington State Criteria for Municipal Solid Waste Landfills, Operating Criteria - Annual Reports - Washington Administrative Code (WAC) 173-351-200(11), and the Cedar Hills Regional Landfill Operating Permit, Section XII - Reporting Requirements, Part B - Annual Report and Permit Renewal Application. Municipal Solid Waste Permit PR0015736 was reissued to SWD for operation of CHRLF by PHSKC on May 7, 2019 and authorizes activity through May 7, 2029. The permit was renewed via an addendum to the original permit, per WAC 173-351-750(3), on May 5, 2022, and authorized landfill operation (retroactively) from January 1, 2022, to December 31, 2022. Copies of the permit and addendum are included in Attachment A.

SECTION 2 – CHRLF 2022 INFORMATION

A summary of CHRLF 2022 waste disposal and recycling activities is included in Appendix B: *Annual Report Municipal Solid Waste Landfill*. This form is required by Washington Department of Ecology (WDOE) for submittal of this report.

2.1 CHRLF Operational Activities

Significant operations activities that occurred at CHRLF in 2022 include the following:

- Continuation of waste disposal in Area 8 after having begun in the summer of 2019.
- Usage of approved daily cover materials to control for odor, wind litter, and nuisance vector migration.
- Pilot testing of Byers Scientific Odor Control System reduced odor complaints at the site by 83 percent year over year. This system releases a vapor that neutralizes odors emitted from Area 8. For reference, the 2022 Analysis of Odor Complaints is included in Attachment G. Based on the success of the pilot, operation of the system will continue in 2023.

2.2 CHRLF Construction and Regulatory Activities

Significant construction and regulatory activities that occurred at CHRLF in 2022 include the following:

- Construction of the Area 7 cover was completed. This included commissioning of seven new dual-phase extraction wells.
- Issuance of conditional approval from PHSKC to place waste over the Area 7/8 liner tie in.
- Completion of the installation of a new electric vehicle (EV) charging station in the parking lot north of BEW.
- Repair and maintenance of the North Flare Station (NFS) flares.
- Issuance of the CHRLF Site Development Plan Final Environmental Impact Statement (FEIS), submitted in the first half of 2022. This FEIS included numerous studies on and surrounding the landfill to account for a variety of potential environmental impacts to noise, vibration, air quality, traffic, and other environmental considerations. The preferred alternative selected from landfill development was Alternative 2.

SECTION 3 - LANDFILL CAPACITY AND DEVELOPMENT STATUS

CHRLF has capacity remaining in three Refuse Areas: 3,030,000 cubic yards in the combined Areas 5 and 6, and 4,420,703 cubic yards in Area 8, as of the November 18, 2022, aerial flyover. Area 8 has a permitted capacity of 7,840,000 cubic yards. Capacities are calculated by comparing the difference between existing landfill contours and a design surface at completion. Attachment D contains documentation for calculating capacity.

Efforts are underway to optimize the use of this remaining built capacity. This includes decreasing the amount of airspace consumed by disposal, recovering returned airspace due to settlement, and recycling efforts. The capacity available for disposal is also impacted by airspace consumed by daily soil cover over refuse and road construction in the active areas. Airspace available for disposal is increased through the use of tarps for alternative daily cover, recovery of rock used for roads, and mechanical compaction.

As the landfill ages, it settles, creating airspace that can be recovered for disposal. Settlement occurs due to consolidation and loss of mass from leachate and landfill gas (LFG) collection. As leachate and LFG are collected and removed from the landfill, additional airspace is gained. Soil surcharge (i.e., stockpiling clean soils on top of covered waste) is used to accelerate settlement. Areas 5 and 6 both currently have soils partially stockpiled over existing waste. This soil is intended for uses such as daily cover, road construction, or other on-site earthwork projects.

The table below presents current and planned capacity in cubic yards and tons by Refuse Area, as of November 18, 2022. These figures are based upon an airspace utilization of 1,600 pounds (lbs.) of refuse disposed per cubic yard (CY) of air space consumed, actual monthly tonnage disposed in 2022, and the average yearly tonnage forecasted through 2029. A conservative airspace utilization factor of 1,600 lbs./CY is based on historical densities achieved in previous areas at CHRLF. This density is also expected to be reached in Area 8 using current operational practices (compaction, daily cover usage, and rock recovery). See Attachment D for details.

Area	Remaining Capacity (cubic yards)	Remaining Capacity (tons)	Remaining Capacity (years)
8	4,420,703	3,536,562	~3.5
5 & 6	3,030,000	2,424,000	~2.5-3
Total	8,556,640	6,845,312	~7

Note: Remaining capacity based on the most recent aerial flyover of CHRLF on November 16, 2022.

The development status of the landfill is summarized in the table below. Closed Areas are Refuse Areas that have been closed in accordance with pertinent regulatory requirements and not currently scheduled to receive additional waste. The Area 5 and Area 6 Top Deck surfaces have interim covers that will be maintained until the completion of the last remaining lifts.

STATUS OF LANDFILL AREAS

Landfill Area	Area Specific Information	
Main Hill	Status	Closed
	Exposed Surface Area	84.4 acres
South Solid Waste Area	Waste was removed from this area and relocated to Area 7.	
Southeast Pit	Status	Closed
	Exposed Surface Area	9.6 acres
Central Pit	Status	Closed
	Exposed Surface Area	9.6 acres
Area 2/3	Status	Closed
	Exposed Surface Area	22.2 acres
Area 4	Status	Closed
	Exposed Surface Area	22.2 acres
Area 5	Status	Interim closure
	Final Cover Surface Area	9.2 acres
	Top Deck Interim Cover Area	31.4 acres
Area 6	Status	Interim closure
	Final Cover Surface Area	25.2 acres
	Top Deck Interim Cover Area	30.1 acres
	Volume in Place	6,800,000 cubic yards
Area 7	Status	Final Closure (Pending)
	Final Cover Surface Area	9.1 acres
	Top Deck Area	17.4 acres
	Volume in Place	8,070,000 cubic yards
Area 8	Status	Active
	Liner Footprint Area	31.4 acres
	Volume in Place (as of Nov. 16, 2022)	3,419,297 cubic yards

Note: Areas are net final cover plan view surfaces or as otherwise noted.

SECTION 4 - FINANCIAL ASSURANCE ANALYSIS

SWD maintains a Landfill Reserve Fund (LRF) account for new area development, closure, post-closure, and corrective action in accordance with WAC 173-351-600. The LRF receives monthly transfers from the SWD operating fund, which obtains about 94 percent of its revenue each year from customers paying the waste disposal fee for MSW brought into the SWD solid waste system. The transfer amount is set during the disposal rate approval process and adjusted annually. The 2022 LRF contribution was \$14.42 per ton versus the 2021 contribution of \$14.07 per ton. In addition to WAC 173-351-600 requiring the LRF to provide financial assurance for closure and post-closure care, King County Code (4A.200.390) requires the LRF to include funding for new area development costs.

The current LRF rate is based on a projected expenditures forecast, which is based on the current disposal rate. Each year SWD reassesses the following items and calculates a new LRF contribution, based on the following items:

- [a] Updated tonnage forecast;
- [b] The current interest rate set by the King County Office of Economic and Financial Analysis (OEFA);
- [c] Updated projected costs in each future year for closure, new area development, and facility improvements;
- [d] Updated assumptions for future capacity development of the site and updated post-closure maintenance estimates; and
- [e] Updated post-closure maintenance estimate.

The post-closure maintenance estimate is updated annually. The updated estimate is based on current costs for maintenance of the systems and considers whether there have been changes to the environmental control systems that would lead to changes in maintenance costs, as well as any changes to current costs of maintenance.

Based on a recommendation from the King County Auditor's Office, SWD uses the OEFA forecast for both the inflationary assumptions and likely future investment return interest rates. The current and forecasted return interest rates are included in Attachment E. The 2022 estimate is that \$4,247,849 (2022 dollars) per year will be required to maintain the landfill for 42 years. The background for this year's estimate is included in Attachment E.¹

¹ 42 years is currently estimated for the landfill to reach functional stability, a status attained after closure whereby there is little, or no settlement, leachate production, or landfill gas production and only custodial care is required, vs. the 30 years required by WAC 173-351 as a minimum for PCM.

SECTION 5 - WASTE DISPOSAL QUANTITIES

The CHRLF received 868,925 tons of municipal solid waste in 2022. Detailed information can be found in Attachment B.

SECTION 6 - SUMMARY OF 2022 GROUNDWATER, STORMWATER, LEACHATE AND LANDFILL GAS MONITORING PROGRAM AND 2023 PROPOSED ENVIRONMENTAL MONITORING PROGRAM

6.1 Summary of Groundwater Monitoring Program

Groundwater monitoring is conducted in accordance with WAC 173-351-410 and reported here in compliance with WAC 173-351-415(1). A summary of groundwater data collected during the reporting year is presented in Part 7 of Attachment F.

The Groundwater Monitoring Program is described in detail in the *Environmental Monitoring Sampling and Analysis Plan for Cedar Hills Regional Landfill (2013)* (SAP), and in Attachment F of this annual report. Thirty-two groundwater monitoring wells are monitored for groundwater elevations and geochemical sampling in the regional aquifer, and sixteen for the perched saturated zones. Twelve additional wells in the regional aquifer and thirteen additional wells in the perched zones are monitored only for groundwater elevations. Detection monitoring wells are located downgradient of, or lateral to, waste placement areas. Background characterization wells are located up-gradient of waste placement areas.

6.2 Summary of Stormwater Monitoring Program

The Stormwater Monitoring Program is described in the SAP. The goals of this program include these elements:

- Monitor the effectiveness of Best Management Practices (BMPs) per the Stormwater Pollution Prevention Plan (SWPPP) for CHRLF;
- Evaluate compliance with the Industrial Stormwater General Permit (ISGP); and
- Evaluate compliance with the Construction Stormwater General Permit (CSGP).

Stormwater discharges associated with industrial activities at CHRLF are covered by the ISGP, which establishes monitoring requirements and benchmark values for several parameters. Three discharge locations are monitored quarterly for compliance with the ISGP. Routine inspections also are conducted monthly and more frequently following certain storm events. Permit compliance monitoring locations are at N4 (north end of the landfill); GS1 (south end of the landfill); and SL3 (discharges to a conveyance/infiltration system along 228th Avenue Southeast near the entrance to the landfill).

Besides routine monitoring conducted in accordance with the ISGP, SWD maintains several contingency surface water monitoring stations. The purpose of the contingency monitoring stations is to allow additional surface water monitoring if ISGP monitoring results exceed applicable benchmarks and broader surface water monitoring is warranted.

In 2022, SWD also had continued coverage under the CSGP - permit number WAR305034 with WDOE for the remaining Area 8 development construction activities, consisting of the Areas 7/8 liner

tie-in work. This permit was transferred in its entirety on April 20, 2021, to Goodfellow Brothers, Inc. (GBI), the Areas 7/8 tie-in construction contractor. A separate SWPPP was created for the CSGP permit. Permit coverage took effect in 2017 and remained active for the duration of Area 8 development until project completion in October 2022 and permit termination in November 2022. Construction site BMPs and four CSGP monitoring locations are monitored weekly during construction activities (or within 24 hours of construction stormwater flows), or monthly during inactive periods, as allowed by the permit. The four monitoring locations are designated as follows: C-1 (northwest end of the site, downstream of the northwest siltation pond); C-2 (northeast end of the site, downstream of the north stormwater pond); C-3 (southeast part of the site, downstream of the south stormwater lagoon and upstream of the bioswale); and C-4 (southwest part of the site, downstream from the southwest siltation pond).

Copies of required stormwater reports submitted to WDOE are included in Attachment H.

6.3 Summary of Leachate Monitoring Program

SWD primarily collects two types of leachate samples at CHRLF: characterization and compliance. Leachate characterization is a critical component of the on-going groundwater contamination detection monitoring performed at the landfill. Leachate characterization also serves to assess pretreatment needs prior to discharge, and to evaluate the effectiveness of pretreatment. Characterization includes all analytes for which groundwater is analyzed, plus several analytes specifically related to wastewater characterization and treatment. Monthly characterization samples are collected at four monitoring locations: Leachate Effluent Pumping Station (LEPS), Vault 1A (which replaced the Leachate Aeration Pond Influent that was decommissioned and removed in 2018 with Area 8 construction), Pump Station 2A, and MH-46N.

Compliance samples refer to those collected to support compliance with Wastewater Discharge Permit No. 7842-03, issued by King County Industrial Waste (KCIW). Weekly compliance samples collected from LEPS are analyzed for all permit-specified parameters. Sample analyte concentrations and leachate discharge flow data are used to calculate permit analyte loadings. Compliance is determined by comparing results to allowable limits specified in the permit.

SWD calculates and reports metals mass loading values alongside their respective concentration and flow values on the KCIW Self-Monitoring Report (SMR) form. SMRs are generated monthly and submitted to KCIW. SMRs for 2022 can be found in Attachment I. SWD also submits an *Annual Facility and Sampling and Monitoring Report* to KCIW detailing sampling and analytical results for all non-permit-required sampling and analysis, such as the characterization sampling described above.

In addition to compliance sampling and reporting, SWD has been conducting an on-going investigation of characterization locations within the landfill leachate conveyance system since 2018, including historical leachate flows from Pump Station 1A, Pump Station 4, Area 5-6-7, and the seasonal flow from the contaminated stormwater (CSW) lagoon. In 2019, additional sampling locations and analytes were added to the investigation, including flows from Area 8 and BEW. Continuing investigation efforts in 2022 also included additional BEW wastewater effluent sampling.

Collaboration with the University of Washington Civil and Environmental Engineering Department that began in 2018 also continues to support these investigative efforts.

Field and analytical leachate data are included in Part 7 of Attachment F.

6.4 Summary of Landfill Gas Monitoring Program

Landfill gas (LFG) monitoring is performed in accordance with provisions of WAC 173-351-200(4). A network of LFG monitoring probes has been installed at strategic locations and elevation intervals below the ground surface to monitor the potential presence of LFG in the subsurface vadose zone outside of the footprint of the landfill refuse (see Attachment G).

According to WAC 173-351-200 (4)(a), the concentration of methane gas generated by the facility shall meet the following limits:

- The concentration of methane gas generated by the facility does not exceed 25 percent of the lower explosive limit (LEL) for methane in facility structures (excluding gas control or recovery system components);
- The concentration of methane gas does not exceed the LEL for methane (50,000 parts per million [ppm]) at the facility property boundary or beyond;
- The concentration of methane gases does not exceed one hundred ppm by volume of methane in offsite structures.

There are two categories (defined by function) of LFG probes at the CHRLF:

- Migration Monitoring Compliance Probes (Property Line)
- Interior Monitoring Probes

Migration Monitoring Compliance Probes are primarily intended to verify that methane concentrations at the property boundary do not exceed 50,000 ppm in the subsurface vadose zone. There are 36 Migration Monitoring (Compliance) Probes at CHRLF. The installation history of the LFG monitoring probes at CHRLF was described in the 2005 CHRLF Annual Report. These probes are either single or multiple completion probes installed at different depths depending on subsurface geological formation. A figure showing the location of each migration monitoring compliance probe is included in Attachment G.

Interior Monitoring Probes are used to evaluate and manage the performance of the LFG collection system with respect to LFG composition (methane, oxygen, and carbon dioxide) and vacuum radius of influence. This information is used to adjust the LFG collection and conveyance system to minimize the potential for LFG migration outside of the refuse footprint. There are 30 interior monitoring probes at CHRLF. The installation history of the LFG interior monitoring probes at CHRLF was described in the 2005 CHRLF Annual Report. The probes are either single or multiple

completion probes installed at different depths depending on subsurface geological formation. A figure showing the location of each interior monitoring probe is included in Attachment G.

Migration and interior probe monitoring are performed both quarterly (in compliance with WAC 173-351), and monthly for operational indicators. Monitoring results are included in Attachment G. Results from LFG migration monitoring for 2022 are discussed in Section 8.4 of this report.

6.5 Environmental Monitoring Program for 2023

Effective January 1, 2016, SWD implemented the SAP, as approved by PHSKC and WDOE in 2015. The SAP outlines current monitoring programs designed to comply with the requirements of Chapter 173-351 WAC and other applicable environmental regulations and permits, including wastewater discharge permits and stormwater permits. Modifications to the SAP will occur only with prior approval of PHSKC and WDOE.

SECTION 7 - SUMMARY OF LANDFILL PERSONNEL TRAINING PROGRAM

The SWD implements a landfill training program ensuring that landfill personnel comply with the certification requirements of WAC 173-300-060. Employees with valid Solid Waste Association of North America Landfill Certification as Manager of Landfill Operations (MOLO) are listed below in the table below.

MOLO Certifications

NAME	TITLE	DATE OF EXPIRATION
Cynthia Adams	Operations Supervisor	Certified through 05/12/2024
Dean Bell	Operations Supervisor	Certified through 06/22/2025
Henry Dotson	Operations Supervisor	Certified through 05/12/2024
James Gentili	Operations Supervisor	Certified through 05/12/2024
Jason Gonzales	Equipment Operators Lead	Certified through 07/15/2024
Jeff Dye	Landfill Gas Lead	Certified through 07/22/2025
Joseph Newton	Operations Supervisor	Certified through 06/22/2025
Mark Monteiro	Operations Manager	Certified through 06/08/2024
Nigel White	Special Projects Manager	Certified through 06/28/2025
Rusty Bogart	Landfill Gas Operator	Certified through 01/11/2025
Sam Medina	Equipment Operators Lead	Certified through 07/15/2024
Scott Barden	Assistant Operations Manager	Certified through 01/02/2024
Shawn Carter	Operations Supervisor	Certified through 01/02/2024
Tyler Fogelberg	Operations Supervisor	Certified through 05/12/2024

SECTION 8 - EVALUATION REPORTS

8.1 Summary of Emergency or Corrective Actions Taken in 2022

The following is a listing of emergency situations and/or corrective actions taken by SWD in 2022 to maintain compliant operation of the landfill.

8.1.1 Stormwater Corrective Action

In 2022, CHRLF did not exceed any ISGP established stormwater monitoring benchmark limits or effluent limitations. Thus, no corrective actions were necessary.

During 2022, monitoring pursuant to the Area 8 CSGP identified exceedances of the turbidity benchmark level in January at monitoring station C-4, in February at C-1, and in March at C-1. In response to turbid stormwater discharges associated with the Area 8 construction project, SWD implemented and/or directed the Area 8 contractor to implement additional temporary erosion and sediment control improvements and repairs to maintain the water quality of construction discharges and meet discharge limits. To note, the CSGP coverage was transferred in its entirety to the Area 8 contractor (GBI) in April 2021 and had sole responsibility for compliance until project completion and permit termination in the fall of 2022. Additional details regarding exceedances are contained in GBI Discharge Monitoring Reports (DMRs) in Attachment H, which are included as a courtesy and for information purposes.

8.1.2 Wastewater Discharge Permit Corrective Action

In 2022, SWD continued to investigate and develop a remedy for the Notice of Violation (NOV) received from KCIW in July 2018 for arsenic and chromium loading exceedances in wastewater discharged from CHRLF. Actions taken followed the outline provided in the Assessment of Penalty and Compliance Order issued by KCIW on December 21, 2018. KCIW issued a Revised Compliance Order dated October 29, 2019, which superseded and replaced the December 2018 Compliance Order. The Revised Compliance Order primarily modified the due-dates and reporting requirements. SWD's continuing response includes research and development of realistic engineered alternatives to reduce metals loading below permit limits using source control and/or treatment technologies.

Sampling results indicate that 2022 wastewater discharges frequently exceeded the permit limit for arsenic loading. In accordance with permit requirements, these exceedances were reported to KCIW using its 14-day report protocol, which explained the cause(s) of the exceedances, corrective actions taken to respond to the exceedances, and ensure ongoing compliance and resampling, as applicable. KCIW sent three warning letters to SWD in 2022, dated May 25, 2022, August 16, 2022, and November 28, 2022. Each warning letter described arsenic loading exceedances measured during the previous quarter (e.g., the May 25, 2022, letter described arsenic loading exceedances which occurred in the first quarter of 2022, and so forth). These warning letters required no further action by SWD.

SWD received two NOV's from KCIW in 2022. The first NOV, dated February 8, 2022, was regarding arsenic mass loading violations from the second, third, and fourth quarters of 2021. Because SWD is complying with the elements of the Revised Compliance Order mentioned above, the NOV required no further action. The second NOV, dated June 14, 2022, was regarding acceptance of the BEW landfill gas condensate and introduction in to the CHRLF leachate lagoons. Sample results indicated BEW's high concentration arsenic waste is at levels above the federal hazardous waste and state dangerous waste limits for arsenic, which is a violation of Permit 7842-03. The June NOV required a written response outlining the cause(s) of the violations and corrective action(s) taken to ensure a return to compliance. A comprehensive written response was sent to KCIW on July 13, 2022. SWD is actively working with WDOE, BEW, and KCIW in regard to determining generator status and operational and/or treatment options to resolve this issue.

No other corrective actions occurred in 2022 regarding the wastewater discharge permit.

8.1.3 PHSKC Inspection Reports and Corrective Actions

In 2022, PHSKC inspected CHRLF eight times. The only violations that were noted in the inspection reports pertained to litter. Corrective actions were taken in response to each of the violations and observations made by PHSKC, including routine and enhanced efforts for maintenance activities, such as litter collection, fence maintenance, and stormwater BMP maintenance.

8.1.4 Title V Air Operating Permit Deviation Reports

Failures to comply with requirements of Title V Air Operating Permit #10138 must be self-reported to PSCAA in the form of deviation reports. Title V deviation reports in 2022 included the following:

February 24, 2022: The Title V second semi-annual certification report was due on January 31, 2022. SWD inadvertently failed to submit the certification report on time. The reporting responsibility for this permit was reassigned the previous year, and preparation and submittal of this report was inadvertently missed amid assignment transitions.

The corrective action taken was: SWD continues to strengthen internal processes to prevent late reporting.

March 23, 2022: A fire occurred in the motor of blower #1 at the CHRLF NFS. The blower system was turned off and the fire was immediately extinguished by employees present at the time of the incident. The blower system was turned off for approximately 45 minutes, but there were no indications that excessive emissions occurred during the system shutdown. The cause of the fire was investigated and (later) corrected.

The corrective action taken was: SWD will use the manufacturer-specified type(s) of lubrication for application onto mechanical components of the blower motors. (see April 26, 2022, report below)

April 26, 2022: A smoke incident occurred in the motor of blower #2 at the CHRLF NFS. The blower system was turned off and the smoke was immediately extinguished by employees present at the time

of the incident. The blower system was not operating for approximately 30 minutes, but there were no indications that excessive emissions occurred during the system shutdown. The cause of the fire was investigated and corrected.

The corrective actions taken were: 1) SWD procured the proper grease for blower motors. 2) Damaged motors were replaced with new motors. 3) SWD thoroughly inspected all other blower motors and removed any non-manufacturer-specified lubricants and mechanical components. 4) SWD provided training to employees and improved process controls to safeguard against a recurrence.

May 23, 2022: During an inspection by the U.S. Environmental Protection Agency, three surface emission exceedances of the 500 parts per million (ppm) limit were recorded. SWD failed to recognize the requirement to respond to those exceedances in the same manner as exceedances discovered during routine monitoring. As a result, SWD failed to conduct 10-day checks at those three locations. However, 30-day checks and additional corrective actions were completed.

For the three locations, the probable cause included the following: Location 1) Area 5 has only interim cover with no geomembrane cover present. Cracking of the soil cover may have led to the exceedance. Location 2) Investigation conducted by the contractor responsible for Area 7 cover construction did not identify a probable cause. The exceedance was not detected again. Location 3) Geomembrane tear in Area 7 likely caused by elk.

The corrective actions taken were: 1) The first location was a LFG well that was backfilled with bentonite and compacted with screened embankment material. 2) The second location was investigated, and extended monitoring was conducted, but a source was not found. 3) In the third location, a tear was discovered in cover material and patched.

July 3, 5, and 12, 2022: Three methane surface emission exceedances occurred in July 2022. Cover penetration point emission exceedances were detected on the north-east side of the Main Hill Area, while a third exceedance was detected in the southeast pit area. Exceedances were also measured in the southeastern part of the landfill in Area 7. The cover penetration points – CHCOOC47 (C-47) and CHC00004 (C-04) – had methane exceedances of 700 ppm and 655 ppm, correspondingly, on July 05, 2022, and July 03, 2022, while the Area 7 exceedances had a group of five methane exceedances of more than 1,000 ppm on July 12, 2022.

The probable cause for the exceedances included a variety of sources, including leakage in the geomembrane cover, a torn LFG well boot, and a broken LFG T-fitting.

The corrective actions taken were: 1) Investigation and repairs of all points of leakage. 2) Repair of the damaged boot. 3) Repair of the broken T-fitting.

September 22, 26, and 28, 2022: Multiple methane surface emission exceedances of the 500 ppm limit were recorded. The cover penetration points – CHEGLSE2 (GL-SE2), CHE00039 (C-39), CHGL0015 (GL-15) – had methane exceedances. A group of exceedances were also measured in the Top Deck of Area 5; in the exposed liner on south side of Area 7; and, at Top Deck of Area 6 along the south edge of the slope.

The probable cause included the following for each location: 1) Cover penetrations – a broken T-connection, broken flex-hose, and missing blind flange, respectively. 2) Valve adjustments in Area 5 likely caused detections. 3) Geomembrane tears in Area 7 likely caused by elk. 4) An anchor trench for Area 6 was not installed as per design and caused the detection.

The corrective actions taken were: 1) The T-connection, flex-hose, and missing blind flange were all adjusted or repaired. 2) The valve was adjusted in Area 5. 3) Geomembrane tears were repaired in Area 7. 4) An alternative design was drafted for the anchor trench, and construction was scheduled for 2023.

December 15 and 27, 2022: Two methane surface emissions exceedances of the 500 ppm limit were recorded at the following locations. 1) Cover penetration point – CHE00061 (GL-61). 2) Exposed geomembrane liner on the south side of Area 7.

The probable cause included the following for each location: 1) PVC connections were not glued adequately. 2) Geomembrane tears in Area 7 were likely caused by elk.

The corrective actions taken were: 1) PVC connection was repaired to eliminate any leakage occurring. 2) Geomembrane tears were repaired in Area 7.

8.1.5 Independent Remedial Action

SWD is proceeding with an Independent Remedial Action in the East Perched Zone (EPZ) under the Model Toxics Control Act (MTCA) in accordance with WAC 173-340-510 and 173-340-515. SWD issued a Remedial Investigation/Feasibility Study (RI/FS) in December 2016. EPZ Phase 1 Interim Actions were completed in June 2020. Work completed included ongoing monitoring of the six new groundwater monitoring wells, as well as the additional landfill gas wells that were installed in 2018 in the EPZ. Multiple recommended EPZ Phase 2 Interim Actions have also taken place, including optimization of extraction wells and enhanced monitoring in the EPZ area. Procurement of a consultant for support with the additional recommended Phase 2 Interim Actions of the EPZ RI/FS project is currently in planning.

8.1.6 Leachate Pipeline Releases and Remedial Actions

In September and October 2020, SWD investigated the cause and location of a flow restriction in the pipeline that conveys leachate effluent from CHRLF to the King County Wastewater Treatment Division South Treatment Plant in Renton, WA. During repair, three separate leachate releases occurred from the pipeline outside the property boundary of the landfill. Immediate action was taken by SWD to halt and remedy these releases. Further evaluation and restoration work was completed by SWD in 2021, and WDOE issued “no further action” determinations for two releases in 2021 and the third release in 2022, indicating that environmental impacts from the releases had been adequately resolved.

In 2022, SWD became aware of the following releases from the leachate conveyance pipeline and collection system:

<i>Aware Date</i>	<i>Summary</i>
April 1, 2022	An unknown quantity of leachate was released near mile post 20 on the shoulder of northbound Maple Valley Highway/SR-169. Immediate actions were taken to discontinue discharge through the pipeline, report the release to WDOE (ERTS #713936), and investigate the source of the leak. SWD determined the leak was caused by a joint failure between two segments of discharge pipe, which were subsequently replaced, and the road shoulder was restored in accordance with Washington State Department of Transportation standards. SWD hired a consultant to evaluate potential environmental impacts caused by the release. This work is underway and will inform remedial actions, as appropriate.
September 19, 2022	During replacement of a leachate manhole at the CHRLF, a temporary plug for a leachate line failed, releasing ~100 gallons of leachate. The specific area is located on the west side, near the northwest corner of Area 8 and the southwest corner of Area 7. This manhole replacement was part of the Area 7/8 liner tie-in work of the Area 8 Development Project, completed in 2022. Immediate actions were taken to prevent any additional release of leachate, report the release to WDOE (ERTS #717730), and begin repairs. The plug was immediately fixed and contaminated soil was excavated. Installation of the new manhole resumed, and all connections were completed without incident. Samples also were collected from the remaining native material during the final excavation and analyzed to ensure all contaminated soil had been removed. The results of the soil removal and sampling from this release are included in Appendix I of the Contractor Quality Assurance Report for the Area 8 Development project.
December 29, 2022	An estimated 50 gallons of leachate was released on the north shoulder of Cedar Grove Road SE east of the intersection with SE Lake Francis Road. Immediate actions were taken to discontinue discharge through the pipeline, report the release to WDOE (ERTS #719864), and investigate the source of the leak. SWD determined the leak was caused by an air vacuum valve malfunction. That valve was subsequently replaced, and normal operation of the pipeline resumed. Evaluation of potential environmental impacts is underway and will inform remedial actions, as appropriate.

8.2 Evaluation of Stormwater Monitoring Data

Under the ISGP, quarterly sampling is required for the following 12 parameters: biological oxygen demand, total suspended solids, ammonia (total as N), alpha terpineol, benzoic acid, p-Cresol (4-methylphenol), phenol, zinc (total), pH, turbidity, copper (total), and oil sheen. Field and analytical stormwater data are included in Part 7 of Attachment F.

Monitoring station N4 monitors discharges to an unnamed tributary to McDonald Creek, which ultimately flows into Issaquah Creek. Monitoring station SL3 monitors discharges to a series of roadside ditches along 228th Avenue SE and Cedar Grove Road SE. While the ditches ultimately connect to the Cedar River, the underlying geology is highly porous, resulting in the infiltration of stormwater discharging from CHRLF long before it reaches the Cedar River. Monitoring station GS1 measures discharges to a designated King County wetland with palustrine forested, palustrine open water, and palustrine emergent wetland classes. The wetland does not contain key aquatic life uses.

The CHRLF also had a CSGP for the Area 8 development construction activities through October of 2022. This permit was terminated per approval from WDOE in January 2023 (see Attachment H). Four discharge points were monitored in compliance with the CSGP. These monitoring locations include: C-1, at the northwest end of the site downstream of the northwest siltation pond; C-2, at the northeast end of the site, downstream of the north stormwater pond; C-3, at the southeast part of the site, downstream of the south stormwater lagoon and upstream of the bioswale; and C-4, at the southwest part of the site, downstream from the southwest siltation pond. All CSGP monitoring points discharge into the ISGP monitoring locations.

Under the CSGP, inspections are performed in any areas disturbed by construction activities, all BMPs, and all stormwater discharge points at least once every calendar week and within 24 hours of any discharge from the site, during active construction. Monitoring is required for turbidity, and for pH levels if more than 1,000 cubic yards of concrete is poured (no monitoring for pH occurred in 2022 due to no substantive concrete construction work being completed). As referenced earlier in this report, CSGP coverage was transferred in its entirety to GBI, the Area 8 liner tie-in contractor, in April 2021. Construction activities ended in October and the last monthly DMR submitted to Ecology for this permit was for October 2022.

Exceedances for the turbidity monitoring benchmark value per the CSGP for 2022 are summarized in the table below.

**SUMMARY OF 2022 STORMWATER MONITORING DATA
THAT EXCEEDED CSGP CRITERIA (Turbidity)**

Date	Turbidity Measurement by Monitoring Location (NTUs)			
	C1	C2	C3	C4
1/11	<25 or NS	<25 or NS	<25 or NS	39.2
2/28	47.0	<25 or NS	<25 or NS	<25 or NS
3/01	44.3	<25 or NS	<25 or NS	<25 or NS

NTU = Nephelometric turbidity unit
 NS = Not Sampled

 = criteria exceeded

Field and analytical stormwater data are included in Part 7 of Attachment F.

When turbidity exceedances occurred, the effectiveness of the existing stormwater BMPs were evaluated, and modifications were made to improve erosion and sediment controls.

8.3 Evaluation of Groundwater Monitoring Data

Groundwater at the CHRLF occurs both in a regional aquifer and in perched zones. The regional aquifer flows through advance outwash and deeper deposits and is separated from the base of waste placement areas by approximately 200 feet of unsaturated sands and gravels. Perched groundwater occurs in onsite till, ice-contact deposits, and recessional outwash. No laterally or vertically extensive perched zones have been identified, leaving the regional aquifer beneath the landfill as the earliest target hydraulic pathway for groundwater contaminant detection.

Attachment F contains a detailed analysis of groundwater monitoring results. Sections 8.3.1 and 8.3.2 give a summary of the conclusions of the Annual Groundwater Monitoring Report certified in Attachment F.

8.3.1 Regional Aquifer

The regional aquifer beneath CHRLF is recharged entirely by precipitation. A local recharge area is located immediately south of the landfill within the Queen City Farms (QCF) property and is centered north of the Main Gravel Pit Lake. In general, groundwater flow in the regional aquifer is radial from the recharge area. Beneath the landfill, regional flow is to the north in the south and central portions of the landfill site. Flow direction in the northern part of the site turns northeasterly as recharge from the McDonald Creek drainage affects flow patterns. Regional aquifer flow is physically separated from the Cedar River and likely discharges to Issaquah Creek. There is no significant seasonal variation in horizontal groundwater flow paths. Horizontal gradients are influenced by infiltrating precipitation in the recharge area. Vertical hydraulic gradients are demonstrated by head differences in adjacent wells screened at different depths and related to hydraulic conductivity of the aquifer materials. A flow-path analysis has been previously completed for the site and indicates a complex flow regime in the landfill vicinity. Site hydrogeological reports and supporting documentation show that the regional aquifer is the first continuously saturated zone beneath the landfill and serves as the earliest path for detection monitoring.

A monitoring network is in place consisting of 32 regional monitoring wells located to characterize groundwater flow and to obtain representative samples for water quality characterization. Downgradient flow converges into a high-transmissivity zone, which provides critical monitoring coverage for all flow paths delineated within the potential source area.

Each year, an extensive list of chemical analytes and field parameters are sampled and analyzed at CHRLF. The results are reviewed and evaluated by a variety of graphical and statistical methods. The groundwater data analyses presented in this report describe onsite groundwater elevations, flow direction, and velocity, and summarizes the evaluation of groundwater quality to determine if chemical concentrations have changed over time or differ between well locations. This report determines whether these findings are indicative of impacts to groundwater quality by surface activities.

Upgradient groundwater quality, especially in wells nearest the southern recharge zone, is significantly affected by conditions and activities that have occurred on the adjoining QCF property. Groundwater quality results are variable and likely subject to surface activities occurring near or within the recharge zone. A significant increase in trends for multiple water quality indicator parameters began in 2011 and have continued to increase through 2022. These increases are coincident with major clearing, grading, and stockpiling activities on the QCF property that have continued over time.

As flow continues into areas beneath the landfill footprint, changes are discernible as groundwater encounters and equilibrates to different oxidation-reduction conditions, soil gas/groundwater interface conditions, and solvent/solute interactions. Flow paths under the landfill footprint and immediately downgradient of waste cells are potentially influenced by the presence of LFG and/or leachate in the unsaturated strata. Flow paths in the north landfill area are also notably higher in chloride concentrations, along with several other ionic species. The data suggest a historical input from the onsite, overlying infrastructure located north of the closed landfill area. Chloride concentrations have declined and stabilized since maximum levels were reached in 2008-2010. Dispersion along the flow path is apparent in other downgradient wells. However, trends in alkalinity and other water-quality indicator parameters suggest groundwater that has been influenced by LFG may be migrating towards the northeast outflow channel from the site. This includes increases in key total metals concentrations, including arsenic, barium, and vanadium.

Downgradient groundwater quality is also highly variable and displays temporal trends. Much as recharge effects are dampened with distance from the source, the concentrations of many analytes are attenuated by processes such as dispersion, dilution, sorption, and degradation as groundwater flows beneath the landfill. The highest concentrations of numerous water quality analytes occur in upgradient wells, including the only detections/exceedances of chlorinated volatile organic compounds (CVOCs) in the regional aquifer. Groundwater in the regional aquifer leaving the site has no exceedances of primary drinking water standards.

MW-67, a downgradient well located in the northeast portion of CHRLF, was investigated in December 2020 by SWD and a licensed hydrogeologist consultant, with the intention of redeveloping the well. During investigation, MW-67 was determined to be inadequate for groundwater monitoring due to damage to the well screen (as evidenced by filter pack sand present in the borehole), and inappropriate sizing of the well casing (diameter of the well is too small to allow redevelopment). This well is planned to be decommissioned, and a replacement well drilled adjacent to the existing wellhead in a future project. In the interim, MW-67 continues to be sampled semi-annually until a replacement well design and location is approved and can be installed.

When comparing upgradient and downgradient groundwater data at CHRLF, it is evident that the regional aquifer beneath the landfill acts as an attenuation zone for upgradient impacts, allowing a reduction in the concentration of CVOCs to occur as groundwater flows from the south property line

to the north-northeast. The most recent water quality evaluation of the QCF groundwater monitoring program is available in *Fifth Five-Year Review Report for Queen City Farms* (2018).

8.3.2 Perched Zones

Perched groundwater occurs in onsite till, ice-contact deposits, and recessional outwash. No laterally or vertically extensive perched zones have been identified. Recharge is by precipitation with possible hydraulic continuity to surface streams.

Impacts from past landfilling practices have previously been recognized in several perched zones. Site improvements and engineered facilities have been effective in reducing contaminant concentrations attributable to past practices. Declining or stable long-term trends for many contaminants are apparent in these wells.

The East Main Hill perched zone is undergoing an independent clean-up action led by SWD. Recent investigation findings for this zone are presented in the *East Perched Zones Remedial Investigation and Feasibility Study* (December 2016). A discussion of conditions in the perched zone near the former South Solid Waste Area are available in the Technical Memoranda *Results of Groundwater Sampling and Fate and Transport Analysis South Solid Waste Area Perched Zone Assessment* (April 2010).

8.3.3 Prediction Limit Exceedances

During 2022, MW-93, a cross-gradient well, reported a 3-of-3 prediction limit exceedance for total arsenic. All PL exceedances were below the Primary Federal Drinking Water Maximum Contaminant Levels and the background Puget Sound Basin Groundwater level of 0.008 mg/L (*Natural Background Groundwater Arsenic Concentrations in Washington State*, Ecology Publication No. 14-09-044). SWD is in the process of updating the permit for background threshold value (BTV) calculation for the Cedar Hills local regional area. The program was agreed to with PHSKC and Ecology in response to the previous 3-of-3 prediction limit exceedance for MW-67 in 2020. The new BTV will set a more representative background value to compare total arsenic, dissolved iron, and dissolved manganese concentrations within the Cedar Hills region.

At this time, no additional actions are underway to address the 3-of-3 prediction limit exceedances for total arsenic at MW-93. Further information can be referenced in Attachment F of this annual report.

8.4 Evaluation of Landfill Gas Monitoring Data

During 2022, no exceedance of the methane regulatory limit occurred in any of the compliance migration monitoring probes.

Methane was detected in multiple interior monitoring probes, ranging from 1 to 6 interior probes in each month of 2022 by more than five percent volume. Adjustments were made on an on-going basis in more than 300 LFG wells inside the footprint of the landfill refuse to optimize collection of LFG. These extraction wells are upgradient from the above-referenced interior monitoring probes. Adjustments were made twice a month to ensure the containment of LFG within the footprint of landfill refuse. These adjustments were successful in preventing potential migration of LFG outside of the landfill refuse footprint, as demonstrated by the methane readings in the migration monitoring probes.

Additionally, no methane was detected inside any of the CHRLF facilities or in offsite facilities (Passage Point) at concentrations above 100 ppm (4th quarter 2022 monitoring data indicated a calibration issue with the sensor).

All LFG monitoring data for 2022 for the perimeter compliance probes, interior probes, migration probes, and building monitoring are included in Attachment G.

8.5 Evaluation of Wastewater Monitoring Data and Volumes Generated

Leachate collected throughout the landfill is routed to the onsite leachate lagoons, where it mixes with other sources of wastewater at CHRLF (e.g., contaminated stormwater, grey water, sewage, and BEW process/condensate wastewater). Following aeration, the combined wastewater discharges to the King County sewerage system pursuant to a Waste Discharge Permit No. 7842-03 issued to SWD by KCIW.

8.5.1 Wastewater Volumes

The volume of wastewater discharged from the leachate aeration basins by way of the LEPS are recorded daily by SWD Operations staff. The actual leachate volume generated within the landfill is not measured directly.

The maximum allowed daily discharge volume for wastewater from CHRLF per permit 7842-03 is 2.7 million gallons per day. There were no exceedances of this permitted discharge volume in 2022.

8.5.2 Wastewater Monitoring Analytical Data

Waste Discharge Permit No. 7842-03 lists several effluent limitations and self-monitoring requirements. In 2022, wastewater monitoring analytical data indicated 19 exceedances of the total loading limit for Arsenic, which is 0.27 pounds per day.

All other results met permit-specified limits.

All wastewater and leachate monitoring analytical data is included in Attachment F. SMRs submitted to KCIW in 2022 are included in Attachment I.

8.6 Landfill Settlement

Settlement monitoring at CHRLF began in 1992, and by 2005 seven monitoring locations had been established. More stations were added in 2007, while others have been abandoned because of operational impacts, including one station that was covered with Area 8 excavation soils in the summer of 2017. There are currently eight total settlement monitoring stations. Annual settlement, which is in part dependent on refuse thickness as well as time, has historically varied in a range of zero percent to nearly four percent of total refuse thickness for different settlement monitoring locations over time. Settlement at all stations monitored in 2022 was minimal. It is anticipated that landfill settlement will continue, with older landfill areas settling at a comparatively lower rate to newer areas of disposed refuse.

SECTION 9 - ATTACHMENTS

Attachment A – Municipal Solid Waste Permit

Attachment B – Tonnage Report

Attachment C – Disposal Fees

Attachment D – Landfill Capacity Documentation

Attachment E – Financial Assurance Documentation

Attachment F – Annual Summary of Groundwater Monitoring Results

Attachment G – Landfill Gas Probe Monitoring Results

Attachment H – Stormwater Discharge Monitoring Reports

Attachment I – Wastewater Discharge Self-Monitoring Reports